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*as a strategic tool to
leapfrog the efficiency
of tax administrations*



ICT as a Strategic Tool to Leapfrog the Efficiency of Tax Administrations



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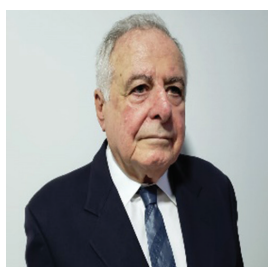
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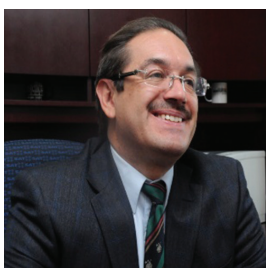
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She has over 10 years of professional experience in the corporate legal field and specialized in Mexico's legal framework for electronic invoicing and e-signature. She collaborates in national advisory committees for the regulation of information technologies. She holds a Law degree from Tec de Monterrey, Mexico. She obtained a Master's degree from UANL, is certified as ISO/IEC 27001 Lead Auditor, and is a Public Notary authorized by the Ministry of Economy of Mexico for commercial law matters since 2018.

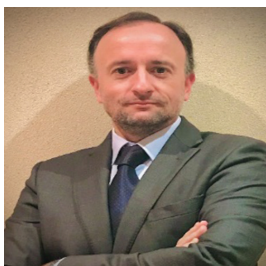
Fernando Martínez Coss



Mr. Martínez Coss is a Mexican economist, with more than 29 years of experience in tax administration and fiscal matters.

He currently collaborates with several companies, governments, and a CIAT consultant. His knowledge is based on practical experience in the conceptualization, implementation, operation and maintenance of such projects as Annual Individual Filing through electronic means, creation of the Taxpayer Assistance Model for the personal, telephone and social network assistance channels, Advanced Electronic Signature, Electronic Invoicing, Electronic Accounting, Tax Mailbox and Electronic Notification. He has been teaching law for more than 8 years through CIT.

Mario Martins Campos



Mr. Martins Campos is the Deputy General Director in charge of Information Systems at the Portuguese Tax Administration. Before assuming his current position, he was responsible for enterprise architecture at a major Portuguese financial institution.

He is an engineer and worked in the past in information systems consulting, having developed projects of innovation and digital transformation in companies of different sectors.

Wolney Martins



Mr. Martins is a Brazilian national. He holds a degree in engineering with a postgraduate degree in Computer Networks. For 20 years, he worked at SERPRO, the IT company of the Ministry of Finance of Brazil, where he held positions as an analyst, department head, director (operations, technology, and systems development) and president.

From 2003 to 2005, he worked as CIO at SEBRAE. From 2005 to 2009, he served as director of Politec, an IT services and software development provider with 5,000+ employees. From 2009 to 2013, he worked as a consultant for Jupiter Systems, in Angola. Since 2014, he has been an independent IT consultant, working in public finance and tax administration systems, crisis management, IT planning and innovation.

Oscar Nieto

Mr. Nieto is a Colombian national and systems engineer. Currently, he works as a systems architect at the Secretariat of Finance of the State of Santa Catarina in Brazil, where he has headed the implementation and evolution of SAT, one of the most recognized and award-winning tax administration systems in the country.

As a CIAT, IADB and IMF CAPTAC-DR consultant, he has conducted seminars on tax administration technology and management, as well as participated in projects for the modernization of tax and customs administrations of seven Latin American and Caribbean countries. The focus has been the development and evaluation of their information systems, as well as in the evaluation and modernization of their management models.

Christine Oyugi

Ms. Oyugi has a wealth of experience in managing Customer Experience Projects, data analysis, and developing Monitoring & Evaluation (M&E) frameworks. She has an outstanding record of accomplishments including spearheading the Customer Relationship Management project, which comprised installation, configuration, and implementation of Customer Experience Technology Solutions.

She has knowledge in identifying technology solutions in a revenue administration setting coupled with the ability to define and map project scope, specifications, project timeline, resources, and budget requirements from planning to production in both traditional and virtual business environments. She also has experience in developing process flows and mapping out the “as is” and “to be” processes for end-to-end case management.

Xavier Paz

Mr. Paz trained in Finances at PUCE (Ecuador) and also holds a Master's degree in Engineering Science from ITESM (Mexico). Other accomplishments include experiences in: Change Management Practitioner & Instructor (PROSCI); Black Belt Six Sigma (ASU); Leading for Productivity (Cornell); PMP (PMI); PM4R y APPs (BID); WWPM (IBM); and, Complex Problem Solving (Delft University). Other educational experiences include: Professor of Governance and Political Leadership (IDE); and, professor of Quality Systems and Lean Sigma in the Master's program on Operations (UDLA).

He represented the Ecuadorian Government before the IADB in the Public Service Improvement Program (2014). Mr. Paz has also been the National Head of Quality and Processes of the Ecuadorian Tax Department (SRI) from 2007 to 2012; also, the General Coordinator of the Labor Ministry from 2014 to 2015.

Roberto Pereira Stambuk

Mr. Pereira Stambuk is a Bolivian national. He holds a Bachelor's degree in Business Administration. Has been a consultant of tax information systems for 30 years (internal, customs, municipal, state taxes and social security).

He has worked in various countries including Bolivia, Brazil (States of Santa Catarina and Tocantins), Costa Rica, Ecuador, Guatemala, Honduras, Panama, Paraguay, Peru, Dominican Republic, Sao Tome and Principe and Venezuela, for international organizations such as CIAT, IADB, IMF, WB, consultancy companies as well as independently.

Vinicius Pimentel de Freitas



Mr. Pimentel de Freitas is a Brazilian national. He holds a degree in Electrical Engineering, with postgraduate degrees in Tax Law, Business Administration, and Tax Administration. He was a Tax Inspector in Brazil since 1994, and from 2008 to 2016 also Deputy Coordinator of the Brazilian National Program of Electronic Fiscal Documents (having resumed this activity in 2019).

In his current role, he conducted or oriented programs for implementing e-invoicing in over ten countries. He has taught postgraduate IT and Tax Law courses and has held several executive positions, such as National Manager in the private sector, CIO of Treasury Secretariat, and Head of International Coordination e-Invoice Programs at CIAT.

Juan F. Redondo Sánchez



Mr. Redondo Sánchez is a Spanish national. He has a degree in Law and is currently Spain's representative before CIAT and Finance Adviser at the Embassy of Spain in Panama.

He has been a State Finance Inspector and State Intervenor and Auditor. He has also held positions as Head of the Inspection Unit, Member of the Madrid Regional Administrative Economic Court, Advisory Member and Coordinator of the Cabinet of the General Director of the State Agency of Tax Administration.

Mr. Sánchez has participated in numerous international seminars, missions, and projects and in different TADAT Evaluation missions of the International Monetary Fund and Inter-American Development Bank.

Silas Santiago



Mr. Santiago is the former Executive Secretary of the Management Committee of the Micro and Small Enterprises Tax Special Regime (CGSN), located in the Ministry of Finance of Brazil. From 2007 to 2018, he headed the implementation of the "Simples Nacional" system and faced difficult challenges due to the complex Brazilian Federation. The "Simples Nacional" system unifies the registration, collection, and control of federal, state and local taxes and contributions.

From 2009 onwards, he also managed the Individual Micro-Entrepreneur (MEI) program, one of the major programs of informal business reduction worldwide. He obtained his Master's of Tax Administration and Tax Policy degree from the Institute of Fiscal Studies, in Madrid, Spain, in 2015.

Antonio Seco



Mr. Seco is a Brazilian national from Cabo Frio-RJ. He holds a degree in Electrical Engineering, with a Master of Science degree in ICT Management and a postgraduate in Tax Administration. He was a SERPRO official in the Ministry of Finance of Brazil, where he participated in the implementation of SIAFI and other public finance systems.

As an Independent Senior Consultant of the Inter-American Center of Tax Administrations (CIAT) and the Inter-American Development Bank (IADB), he led the ICT component in projects to modernize tax and public finance administrations in different countries of Latin America and has carried out multiple assistance missions in countries of Latin America, the Caribbean, and Africa. He is also a Senior External Consultant for Jupiter Systems & Solutions, in Angola.

Edmundo Spolzino

Mr. Spolzino is a Brazilian national. He holds an engineering degree and a postgraduate degree in tax law. In his professional activity, he worked as a systems analyst in the area of information technology in the financial sector.

In the Brazilian Federal Tax Administration (RFB), he worked as a Fiscal Auditor, mainly in the areas of collection, audit and management. He also held the positions of Head of the Collection Division, Deputy Head of the Audit Division, Regional Superintendent and Chief of the Major Taxpayers Division, all related to the State of São Paulo. He is currently a tax and compliance consultant.

Claudia Suárez

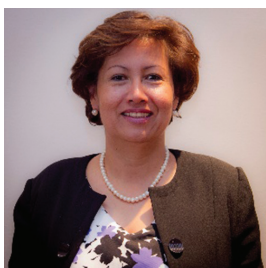
Ms. Suárez is the Peru National Superintendent of Customs and Tax Administration – SUNAT. She holds a Law degree from Pontificia Universidad Católica del Perú – PUCP. She also holds a Master's degree in Tax Consultancy ("Cum Laude") from Universidad de Navarra (Spain), a Master's degree in Finance from Universidad del Pacífico (Peru), and is a member of "Beta Gamma Sigma", an international business honor society. She also completed postgraduate studies in Leadership at SDA Bocconi Business School (Italy) and at IESE Business School (Spain).

Before taking on the leadership of the National Superintendency of Customs and Tax Administration, she was the National Deputy Superintendent of Internal Taxes at SUNAT. In the academic field, she is a tax law professor at PUCP.

Patrick Tarraf

Mr. Tarraf is a Canadian national. He is a Senior Advisor at C2D Services, Montreal, Canada. He holds a Bachelor's of Engineering degree and a Master's of Science in Administration.

Specializing in tax administration business processes and IT, he participated in over a dozen system implementations and upgrades at tax administrations in the Caribbean, Africa, Asia, Eastern Europe, and the Western Pacific. Additionally, he participated in assessments and evaluations of tax administration systems and processes at the request of several organizations including the Inter-American Development Bank (IADB) and the Inter-American Center of Tax Administrations (CIAT).

María Eugenia Torres

Ms. Torres is an Industrial Engineer of Colombian nationality. She has a postgraduate degree in Human Resources Management. During her career, she worked for 20 years in the Colombian Tax Administration (DIAN), where she contributed in different positions to the improvement of processes and systematization of the collection and recovery areas.

Ms. Torres also worked as an independent consultant for international organizations such as CIAT, IADB and IMF participating in specific missions and in projects for strengthening the tax administrations of several Latin American countries, which have been particularly focused on the diagnosis, definition, design and implementation of the information system. Likewise, she has collaborated with CIAT as a tutor of virtual training programs and in the preparation of documents published by a said organization with the cooperation of GIZ and IADB.

Ana Claudia Utumi



Ms. Utmi is a partner at Utumi Advogados. She has more than 25 years of experience in Tax Consulting and Tax Litigations, assisting corporations and families with domestic and international tax issues. She has intense academic activity with lectures, classes, seminars, and conferences. She is frequently acknowledged as one of the top tax practitioners in Brazil by different publications.

Ms. Utmi holds a Master's in Tax Law from the Catholic University of São Paulo and a Ph.D. in Tax Law from the University of São Paulo, where her thesis was on "Taxation of Non-Residents by Income Tax."

Socorro Velazquez



Mr. Velazquez is a US national. He served 30 years with the US Internal Revenue Service (IRS) in various capacities; among them were managerial positions in Collection Division field offices, Chief of Budget and Planning in the Collection Division (National Headquarters), Director of Tax Administration Advisory Services, Technical Assistance Project Manager in Turkey, and IRS Representative at the US Embassies in Chile and Mexico.

Post-retirement from IRS, he joined the CIAT organization where he served 10 years as Director of Institutional Planning and Development. In this capacity, he interacted with CIAT collaborative international organizations such as OECD, IMF, UNDP and GIZ. He holds a Bachelor's degree from the Inter-American University of Puerto Rico and graduates studies at the University of Puerto Rico School of Law and the University of Pennsylvania.

Márcio F. Verdi



Mr. Verdi is a Brazilian national and currently the Executive Secretary of the Inter-American Center of Tax Administrations. He is an economist and tax auditor from the Secretariat of Federal Revenues of Brazil (RFB).

He completed specialized studies in International Economics and Advanced Quantitative Methods at the University of Brasília (UnB). He also holds a postgraduate degree in Theory and Operation of a Modern Economy from the "Institute of Brazilian Business and Public Management Issues" of George Washington University, Washington, D.C., U.S.A.

After devoting 28 years of his career to the Brazilian government, in July 2004 he was appointed CIAT Director of Tax Economic Studies, which position he held until 2007 when he accepted the Executive Council's invitation to take over the position of CIAT Director of Operations. In January 2010 he assumed the role of the CIAT Executive Secretary.

Raul Zambrano



Mr. Zambrano was born in Quito, Ecuador. He is a Systems Engineer and currently the CIAT organization Director for Technical Assistance and Technology. He has directed international multidisciplinary teams in modernization projects carried out by CIAT in 6 countries and has participated in the improvement of processes and in the development and evaluation of information systems as a consultant of CIAT, IADB or CARTAC in over 20 tax and customs administrations.

He has conducted database, information systems and orientation toward objects management classes at Escuela Politécnica Nacional of Ecuador and Universidad San Francisco in Quito.

INTRODUCTION

It is an honor for me to be able to write the preamble of this very important book on the use of information and communication technology (ICT) in the tax administrations, within the cooperation framework between the Inter-American Center of Tax Administrations (CIAT) and the Bill & Melinda Gates Foundation.

Two years ago, CIAT began working with the Gates Foundation, in an effort to cooperate with the outstanding work carried out by this organization, mainly in the field of public health and improvement of the quality of life of the populations in the poorest regions of the world, specifically, in the African Continent.

We have discussed the pressing need that the search for minimum living conditions of the most need populations should go hand in hand with the strengthening of public policies. Likewise, we need to consider that the latter is difficult without creating strong fiscal areas in those countries, in order to arrive at the minimum necessary conditions for fiscal sustainability, especially through the structuring of tax administrations that may guarantee minimum standards of efficiency and effectiveness, in its taxation activities.

The purpose of this book called Flagship, is precisely to be a leading vessel to guide the tax administrations on how to implement information technology in its processes, thereby seeking not only the reduction of the cost of the tax transaction, which is defined as the compliance cost of the taxpayers, but also the administration's cost. Likewise, it endeavors to increase the rates of voluntary compliance with tax obligations, as well as the capacity of the treasuries to combat tax evasion and harmful tax planning.

In these current times, it is a well-known fact that a tax administration, in addition to counting on a tax legislation that may guarantee the necessary powers for fulfilling its mission, must be capable of managing huge databases. Therefore, it requires not only hardware and software, but modern solutions for becoming a “paperless” tax administration, with an effective capacity for managing complex databases and risk analysis models.

We thus know that the great change we are experiencing in tax management is the substitution of the taxpayer self-assessment system (a goal that has been pursued for decades), with the tax administration's provision of draft returns. Today, we may say that this complete turnaround in the administration's action is almost an obligation toward the citizens, given that, it is not appropriate

for the administration to continue requesting the taxpayers' data, when it has all their information, whether of internal as well as external operations. It is only a matter of time, but very soon all the countries will be providing draft pre-filled returns to their taxpayers, which will result in a significant reduction in tax litigation, as well as in the already mentioned tax transaction cost. We are aware that, in order to achieve this new standard, such technologies as electronic invoicing, block-chain, online auditing, in addition to effective information (national and international) exchange mechanisms will be imposed on the tax administrations.

Through this book we are precisely seeking to pave the way toward the modernization of the tax administrations by means of the information and communication technology. And such path is, today, significant and expanding, among the administrations with more resources, whether human or material, as compared to those that lack the knowledge as well as the necessary resources for such implementation.

Along this line, we may then classify this book as a real tool in the search for reducing inequalities of the empirical and practical knowledge, thereby contributing to the harmonization of knowledge in the nations. The solutions, models and proposals presented are always of a general nature, resulting from successful experiences, which may allow for their easy adoption by countries with varying levels of knowledge in the use of information and communication technology.

Where to start is a question that should be answered by each individual reader. If the area that needs to be improved is known, because you have serious issues or because it better relates with the strategy, a direct visit to the specific chapter would be the best road to take, whether it is the registry, returns processing, auditing, risk management, arrears collection or electronic documents. These aspects are covered in chapters 2 to 7.

Chapter 10 deals with horizontal, general-purpose, services that should give support to the full tax administration, regardless of the architecture of the system. It covers aspects that go from security to document management to business processes automation.

At the top executive level, the Peru experience presented in chapter 9 brings helpful insights to the table, while the experience from Portugal's "Administração Tributária", a very recent fusion of the internal tax administration and customs operation, should be read for those that need to interoperate to the previous system.

As a long-term vision to improve the use of information technology for the organization, Chapter 11 covers all the aspects in the fashion of a roadmap, that provides all the details. In Chapter 14, we revisit the deciding factors of both project and change management as aids to help reach the goals, if well-handled or, certainly, guarantee its failure if executed poorly.

Chapters 12 and 13 will be of interest to those officials actually running or overseeing the ICT in their organizations. The former covers the information technology options and architectures

available, in terms of hardware, storage, software, or cloud services. The second chapter deals with ICT processes, those indispensable elements to run it properly.

The potential that new technologies could bring to the tax administration is presented in Chapter 15. This chapter is not only for early adopters, but it is also a good incentive for dreamers that want to start the new disruptive trend for tax administration, not because it is in vogue, but because it really opens the potential to better services and control.

Lastly, Chapter 16 deals with the most critical part of information technology applications within the tax administration: people.

For those readers that are ready to read the entire book, the list of topics presented above is just a sampling of the variety of aspects that are going to be covered. For those readers that decide to go straight to a particular chapter and related subject, the list serves as a shortcut guide.

Márcio F. Verdi
Executive Secretary
Inter-American Center of Tax Administrations

1. WHY IMPROVE THE TAX ADMINISTRATION'S EFFICIENCY AND THE ROLE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY

1.1. Introduction

What do the prevention of malaria, the efficiency of the financial markets, access to clean water, a reliable judicial system, safety in the streets or the maintenance of the transportation infrastructures in a country have in common? Apart from the fact that they may all be considered desirable objectives; all require financing and significant collective action.

When facing these challenges, external international aid may contribute to initiate the processes or to face critical situations of extreme need. Nevertheless, because of medium- and long-term sustainable development, it is essential for each country to count on its own resources and management capacity.

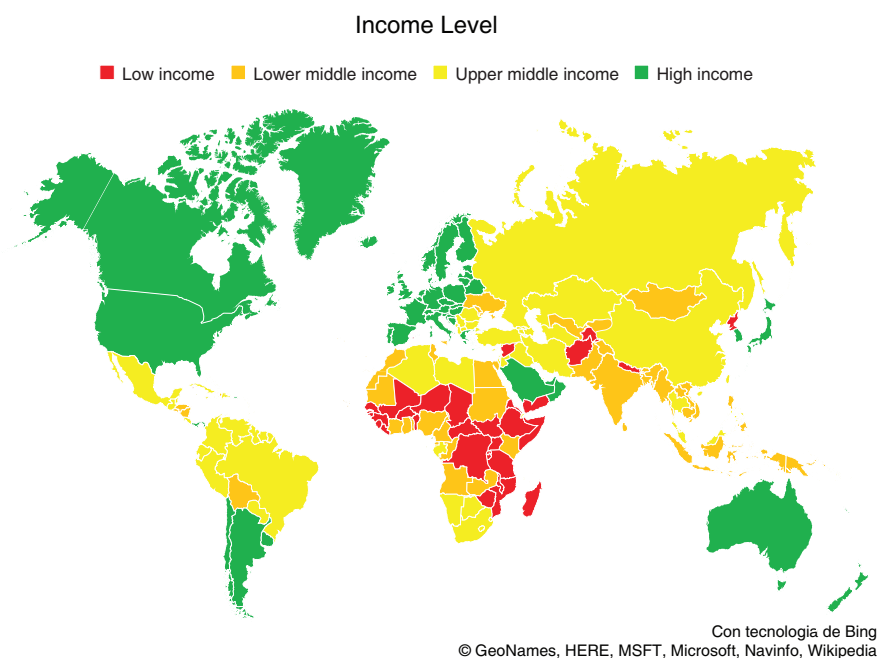
And here is where the tax administrations (TA) play their role. As highlighted by all the experts in institutionalism and the origin of the modern states, such as, for example, Francis Fukuyama in his work entitled “The Origins of Political Order”, the capacity for collecting taxes along with the rule of law, is one of the pillars of collective action. The objectives of said collective action may vary, as well as the levels of expenditures to be financed, but in any case, an efficient tax administration will be required for obtaining the necessary resources.

In other words, we could say that there is no public policy possible without a strong economic policy, there is no economic policy without a strong fiscal policy, there is no fiscal policy without a strong tax administration. In this chapter we would like to see how the use of IT could help to strengthen tax administrations and make them more efficient. (Márcio F. Verdi, CIAT)

1.2. Public resources and tax administration

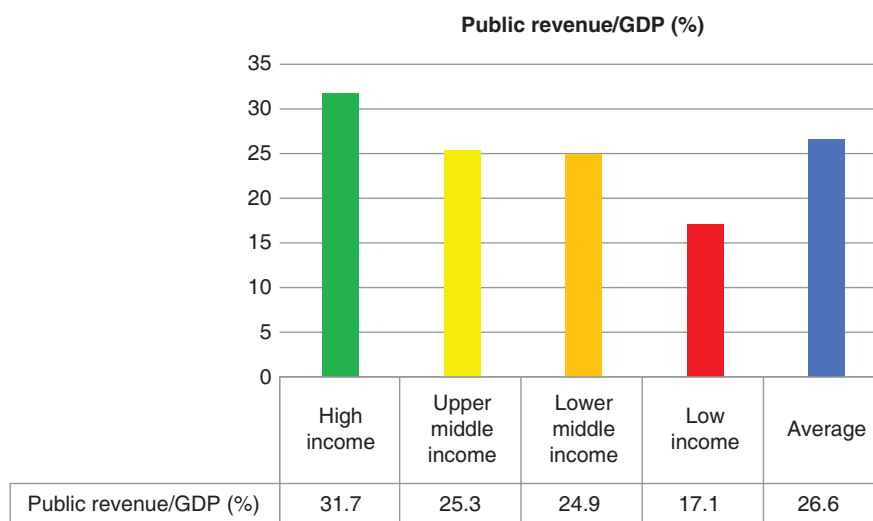
The existing inequalities of income in the world (*Figure 1.2-1*) show a high correlation with the public resources of the different countries (*Chart 1.2-1*): from a 31.7% average GDP in the high-income countries, to 17.1% in the low-income ones.

Figure 1.2-1 Income level by country 2017



Source: World Bank Open Data

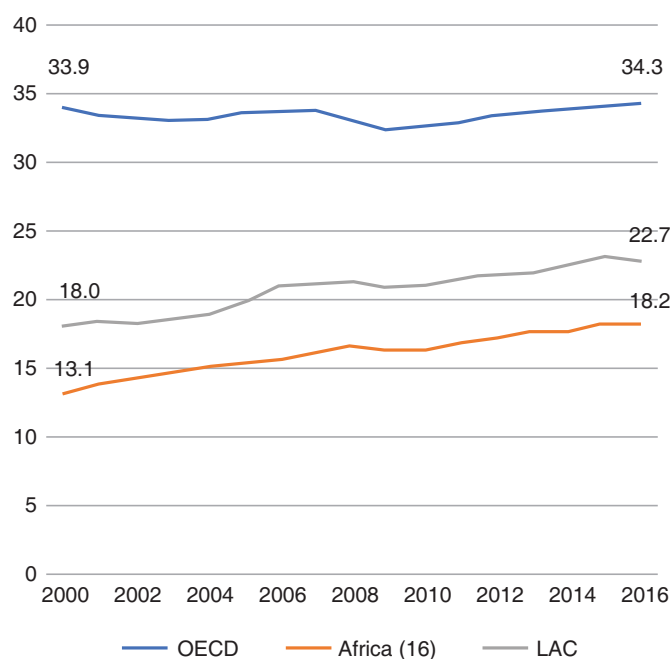
Chart 1.2-1 Public Revenue (% of GDP)



Source: World Bank Open Data

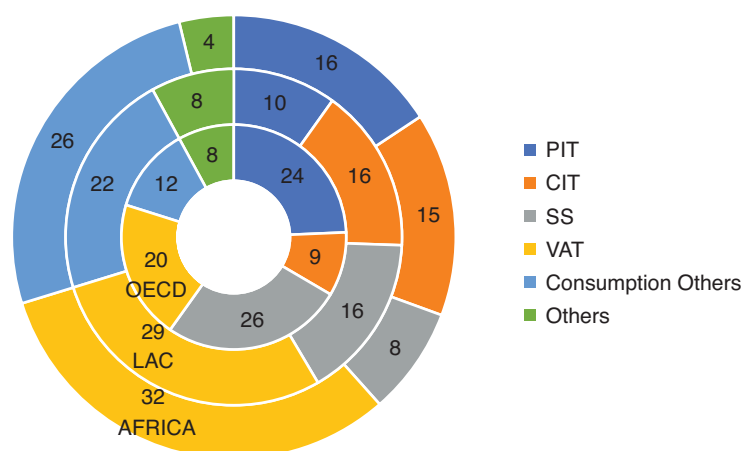
These same differences are observed in terms of tax burden, (taking into account only the tax resources and social contributions) although one may observe a certain convergence in favor of the less developed economies. In this century, (2000-2016) the tax burden has been practically stable with regards to the Organization of Economic Cooperation and Development (OECD) countries. It has remained around 34% of the GDP after overcoming the initial effects of the 2007 crisis, while it has increased in other spheres that began with more reduced levels, such as Africa (from 13.1% to 18.2%) or Latin America and the Caribbean (LAC) (from 18% to 22.7%).

Chart 1.2-2 Taxation (% of GDP)



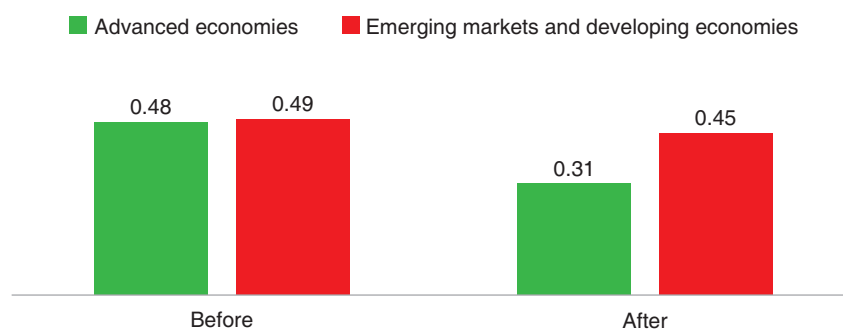
Source: Global Revenue Statistics Database, OECD

As for the structure of tax revenues, there are significant differences between the more developed countries and other regions. In the OECD, the main figures represent Social Security contributions and individual income tax (26% and 24%, respectively, of the total), while in Africa or Latin America consumption tax prevails, with a much lower contribution from direct taxes (except for Corporate Income Tax), an increasing trend in the past decades.

Chart 1.2-3 Taxation structure 2015 (% of total)

Source: Global Revenue Statistics Database, OECD

These differences in the public resource and structural levels unavoidably condition the governments' acting capacity and, in particular, their effects on the improvement of inequality. According to the International Monetary Fund (IMF) data, the starting point in inequality is similar in both the advanced and developing economies (0.48 and 0.49, respectively, in terms of the Gini indexes). However, the former ones manage to reduce the differences through taxes and public transfers by 35% (reducing the Gini index to 0.31), while the latter barely improve inequality by 8% (up to a 0.45 Gini index).

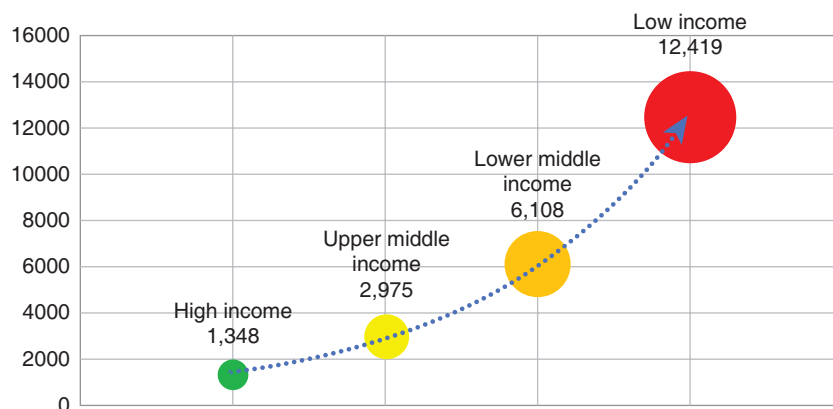
Chart 1.2-4 Inequality before and after taxes and transfer

Source: International Monetary Fund

In this scenario, the tax administrations of the less developed countries face enormous challenges for doing their work efficiently. The workload (*see Chart 1.2-5*) which they face is inversely proportional to the income level. For example, every worker in the administrations would be assigned some 1,300 persons in a high-income country, more than the double, around 3,000, in countries with an upper middle income, more than 6,000 in those of lower middle income and over 12,000 in low-income ones. All this, in spite of the fact that the tax administration budgetary effort is even

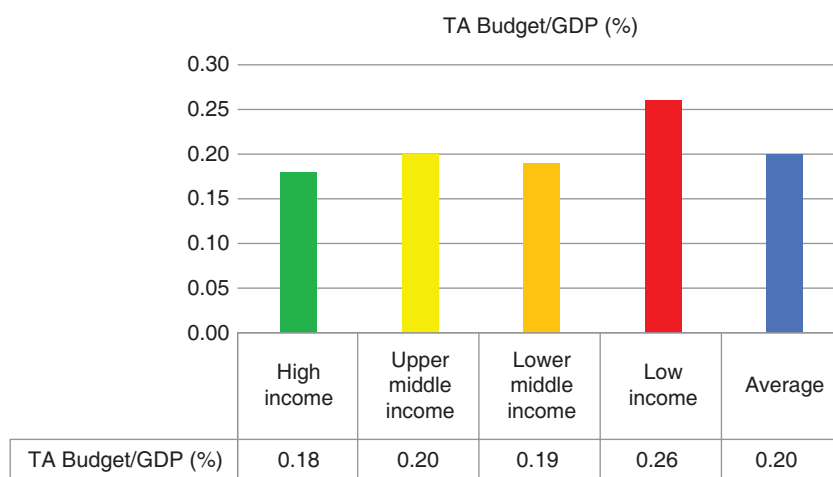
greater in the poorer countries. The budget of the administrations in high-income countries is 0.18% of GDP, as compared to 0.26% in those of low-income [Chart 1.2-6](#)).

Chart 1.2-5 Population per tax administration employee



Source: Prepared by the author with data from ISORA (2017)

Chart 1.2-6 Tax administration budget



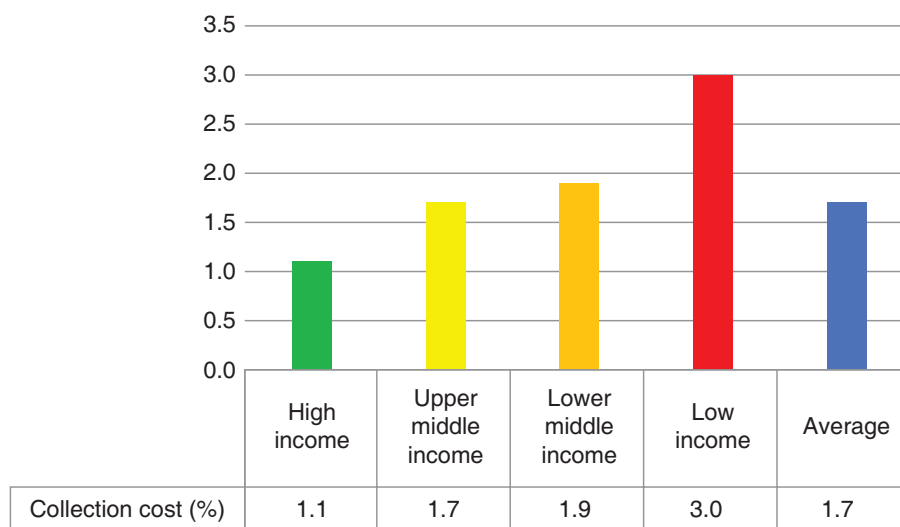
Source: Prepared by the author with data from ISORA (2017)

To all of the foregoing one must add all the other known factors that characterize the developing countries and render difficult tax administration. These are: a high level of informality; lack of basic infrastructures; insufficient recording mechanisms; lower level of bankarization; greater impact of corruption; greater dependence on primary sector and natural resources; high level of fraud; etc.

As an unavoidable result of this combination of factors, the efficiency of the administrations is much lower in the less developed countries. In spite of the inconveniences of this indicator, the cost of collection reflects this reality: every hundred monetary units collected require a one-unit

administration expense in high-income countries, as compared to a three times higher cost in those with low income ([Chart 1.2-7](#)).

Chart 1.2-7 Collection costs



Source: Prepared by the author with data from ISORA (2017)

1.3. New tax administrations and new technologies

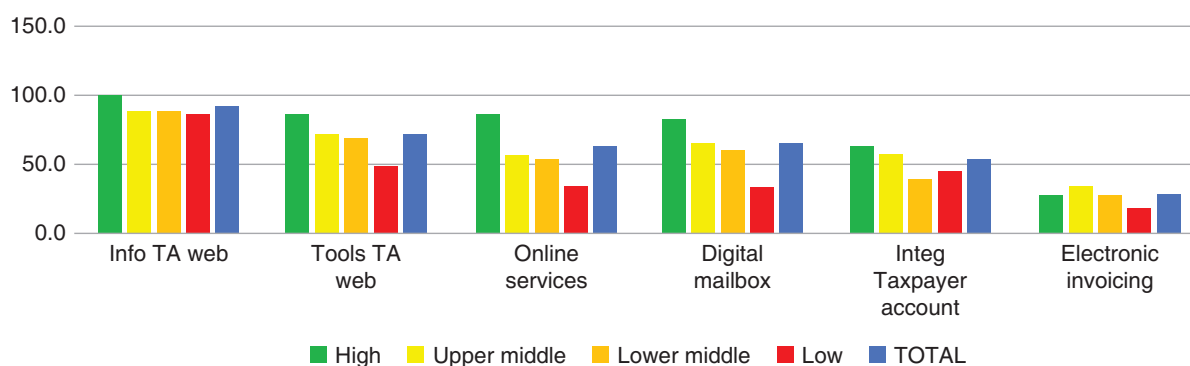
According to the described context, the tax administrations of the developing countries face enormous challenges and they cannot wait until the level of global progress in their territories may allow them to adopt the “traditional” procedures that have been applied by the most advanced countries. In order to take a qualitative leap and shorten the distances, they must directly adopt the more advanced procedures and technologies.

Some of these procedures and technologies could be: 1) Payments through mobile applications without going through the complete banking system; 2) Development of cadasters with satellite support, without waiting to count on an army of experts to visit every plot of land; 3) Establishment of electronic mailboxes rather than trusting in urban planning and mail systems that may determine the geographical location of the taxpayers; 4) Electronic invoicing instead of the capacity for demanding and controlling enormous amounts of physical documents; 5) Computerized information and taxpayer assistance systems, without waiting until having the capacity for providing assistance in physical offices. Others are certainly possible.

Such leap should be based essentially on the experience of those countries that have undergone similar situations to those of lower-income countries, which are aware of the difficulties and have had to overcome (almost) unavoidable failures in such a transition, seeking in many cases, the support of regional collaboration organizations such as CIAT.

Chart 1.3-1 shows the implementation of basic electronic services in the tax administrations in accordance with their income level. In general, there is a higher level of implementation in the richer countries. However, one may observe a large number of experiences in middle-income countries in such aspects as information, via web support tools, online services, electronic mailboxes or the implementation of integrated tax current accounts. In some areas, such as electronic invoicing, the experience of middle-income countries even exceeds that of the high-income ones, thus constituting the most appropriate point of reference for the administrations of less developed countries.

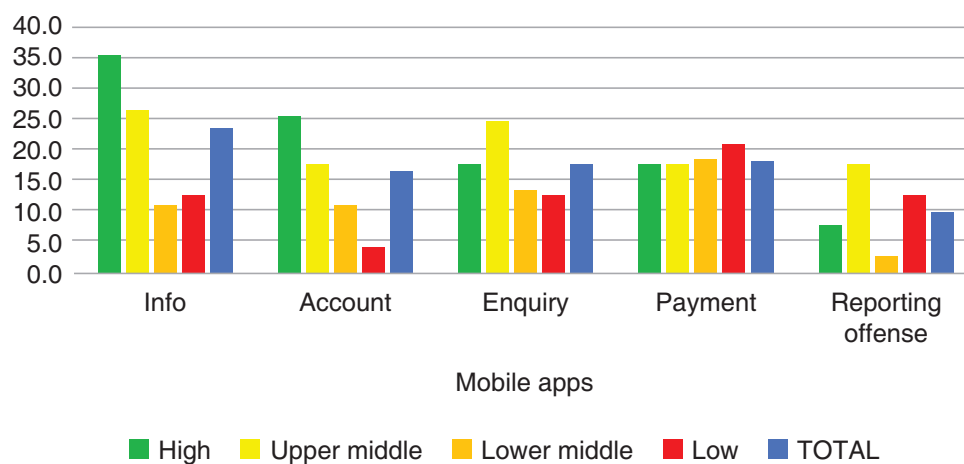
Chart 1.3-1 E-Services



Source: Prepared by the author with data from ISORA (2017)

Something similar is observed in other potentially appropriate areas for the poorer countries, such as the implementation of tax mobile applications (*Chart 1.3-2*). Herein, although the more developed countries continue to lead the information offer or consultation of the integrated current accounts, the experiences of lower-income countries surpass them in relative terms, in such aspects as consultations, the notification of violations or, in particular, the payment of taxes.

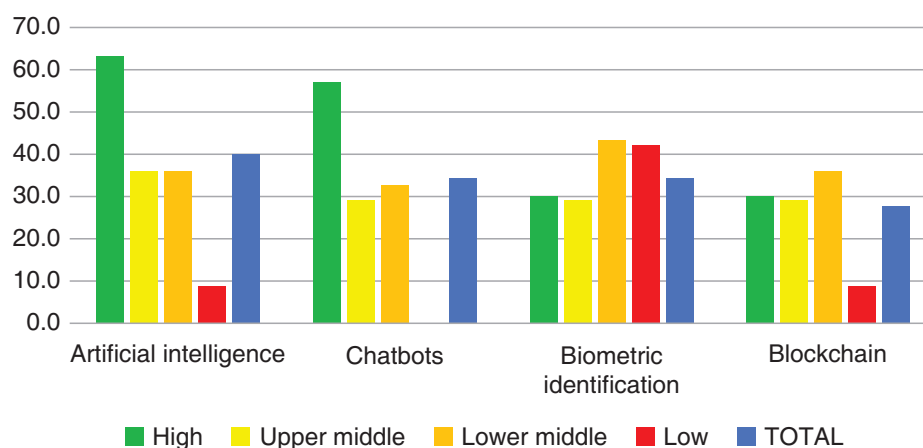
Chart 1.3-2 Mobile Apps



Source: Prepared by the author with data from ISORA (2017)

This same phenomenon is evidenced when analyzing the tax administration practices dealing with the adoption of innovative technologies (*Chart 1.3-3* and *Table 1.3-1*). The most advanced countries present in greater percentage innovations such as applications of artificial intelligence or chatbots, but also the administrations of middle-income countries are experimenting with them, even surpassing them in some areas such as the exploration of biometric identification systems or potential applications of blockchain technology.

Chart 1.3-3 Innovative Technologies



Source: Prepared by the author with data from ISORA (2017)

Table 1.3-1 Innovative Technologies

Artificial intelligence (%)					Chatbots (%)			
	In place	Implementing	Planning	Total	In place	Implementing	Planning	Total
High	9.8	9.8	43.1	62.7	7.8	13.7	35.3	56.8
Upper middle	2.2	6.7	26.7	35.6	6.7	6.7	15.6	29.0
Lower middle	0.0	5.4	29.7	35.1	5.4	5.4	21.6	32.4
Low	0.0	0.0	8.3	8.3	0.0	0.0	0.0	0.0
Biometric identification (%)					Blockchain (%)			
	In place	Implementing	Planning	Total	In place	Implementing	Planning	Total
High	17.6	2.0	9.8	29.4	0.0	3.9	25.5	29.4
Upper middle	17.8	6.7	4.4	28.9	0.0	2.2	26.7	28.9
Lower middle	13.5	13.5	16.2	43.2	2.7	2.7	29.7	35.1
Low	16.7	0.0	25.0	41.7	0.0	0.0	8.3	8.3

Source: Prepared by the author with data from ISORA (2017)

As we shall present throughout this publication, the transformation of the tax administrations of the less developed countries through the adoption of new information and communication technologies is not a simple task; it demands a high level of planning and institutional reform of the organizations. However, at the same time, we are convinced that it is an almost unique opportunity for overcoming the limitations faced and developing new administrations for complying in a more just and efficient manner with the requirements of society.

1.4. Developments and lessons learned

As previously mentioned, there is clear evidence that some Latin-American countries have successfully implemented some of the leapfrog actions in terms of the use of technology for both the support and improvement of internal processes and the provision of services to facilitate compliance. There are two examples of such developments that we can mention.

➤ The generalization of electronic filing of tax returns

It was first introduced as an alternative to paper-based tax returns in the 90s, with support on magnetic or optical portable media that were to be presented to the tax administration instead or accompanying the signed returns, later as a file being sent or uploaded to the tax administration over the Internet and more recently, as on-line interactive forms or applications.

Paper-based tax returns generated never-ending difficulties (Zambrano, 2002) from the identification of the taxpayer or period, to mistakes made in computations of derived fields, application of conflicting situations or discrepancies with other periods previously reported. These errors were, in many cases, created by the taxpayers, their accountants or advisors, but could also be introduced during the keying process. Many tax administrations had to invest significant resources to deal with the data problems while others ended with backlogs that affected many periods.

The software used to prepare and electronically file the tax returns significantly minimizes these errors ending with the verification that the taxpayer number exists and matches a record within the tax administration registry, the correct computation of calculated fields, the correct application of rules to avoid conflicting situations and the verification of consistency in terms of thresholds and limits.

The percentage of tax returns filed electronically is close to a hundred percent in many Latin-American countries (*Table 1.4-1*), including some where the paper is no longer an option to prepare and file returns; a situation not observed in some higher-income countries (*Table 1.4-2*).

Table 1.4-1 Tax returns received via electronic channel (%) LAC/CIAT

Countries	CIT	PIT	VAT
Argentina	100.0	100.0	100.0
Brazil	100.0	100.0	-
Costa Rica	100.0	100.0	100.0
El Salvador	100.0	100.0	89.5
Mexico	100.0	100.0	-
Peru	100.0	100.0	100.0
Paraguay	99.7	100.0	98.8
Chile	99.5	99.8	15.8
Colombia	98.8	84.5	99.9
Dominican Republic	96.7	89.1	95.9
Uruguay	26.6	47.7	34.2

Source: Prepared by the author with data from ISORA (2017)

Table 1.4-2 Mandatory e-filing in LAC/CIAT

Countries	CIT	PIT	Employers withholding	VAT
Argentina	Yes, for all	Yes, for all	Yes, for all	Yes, for all
Brazil	Yes, for all	Yes, for all	Yes, for all	Yes, for all
Colombia	Yes, for all	Yes, for some	Yes, for all	Yes, for some
Costa Rica	Yes, for all	Yes, for all	Yes, for all	Yes, for all
Ecuador	Yes, for all	Yes, for all	Yes, for all	Yes, for all
Guatemala	Yes, for all	Yes, for all	Yes, for all	Yes, for all
Mexico	Yes, for all	Yes, for all	Yes, for all	Yes, for all
Nicaragua	Yes, for all	Yes, for all	Yes, for all	Yes, for all
Panama	Yes, for all	Yes, for all	-	Yes, for all
Peru	Yes, for all	Yes, for all	Yes, for all	Yes, for all
Bolivia	Yes, for some	No	Yes, for some	Yes, for some
Chile	Yes, for some	Yes, for some	Yes, for some	Yes, for some
Honduras	Yes, for some	Yes, for some	Yes, for some	Yes, for some
Paraguay	Yes, for some	Yes, for all	-	Yes, for some
Uruguay	Yes, for some	No	Yes, for some	Yes, for some

Source: Prepared by the author with data from ISORA (2017)

With the support of more and better third-party information, some tax administrations have been pre-filing tax returns (CIAT, 2019).

➤ The use of electronic invoice and other electronic documents

A model where VAT taxpayers, using their own software or a service provided by the tax administration, generates electronic invoices, essentially XML files with a defined and mandatory format. These electronic documents are delivered to the buyers and to the tax administration, not just the reports or summaries, but the entire XML document. This approach marks a milestone: a transition from the tax administration working with reported data of what happened in the not so recent past, to a new time where the administration is working with what is currently happening.

This kind of system also imposes an enormous demand for storage and processing capacity, as well as a solid communication infrastructure. *Table 1.4-3* shows the total number of electronic invoices issued and sent to the tax administration since the implementation of the system in selected countries. The numbers shown here are huge. They imply that some tax administrations are getting an average of a few hundred documents per second. In a range of a few days, the number of documents received is greater than the number of tax returns that the administration was used to getting in a full year.

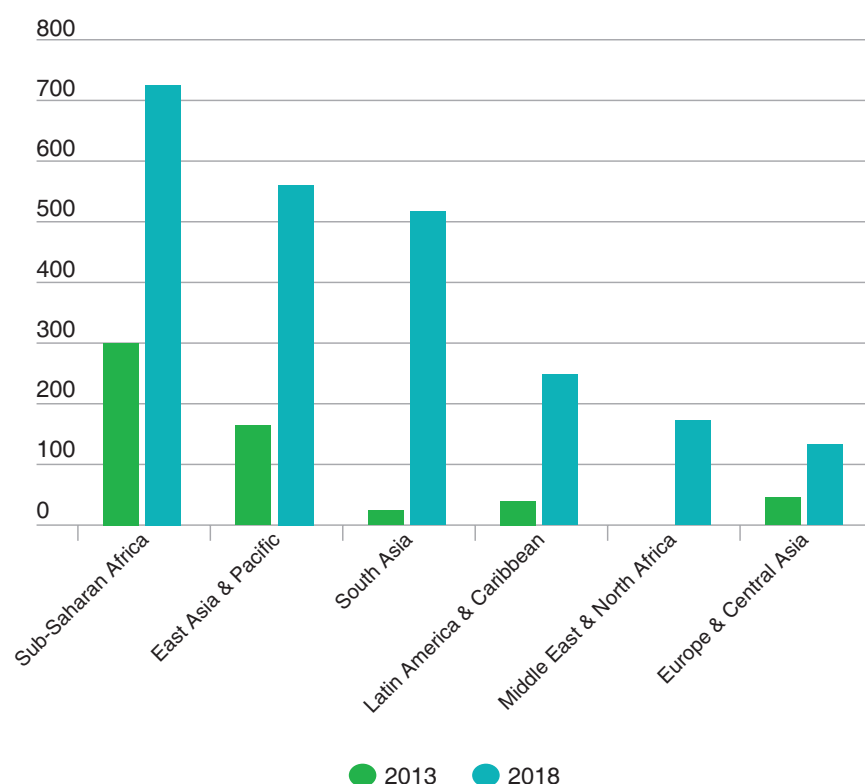
Table 1.4-3 Total number of electronic invoices by May 2018

Country	Total Documents	Total Documents TA
Argentina	7,160,939,584	7,160,939,584
Brazil	31,292,720,000	31,292,720,000
Chile	3,068,043,039	3,038,834,532
Colombia	2,660,444	2,660,444
Costa Rica	34,457,498	34,457,498
Ecuador	4,647,491,441	4,647,491,441
Guatemala	3,900,551,351	-
Mexico	28,114,610,859	28,114,610,859
Peru	3,468,894,145	3,468,894,145
Uruguay	2,491,944,091	321,124,280
Total	84,182,312,452	78,081,732,783

Source: CIAT Electronic Invoice Network

➤ The wide use of mobile payments

Especially in sub-Saharan Africa, the high penetration of the mobile telephone network offers opportunities to tax administrations. It is estimated that by 2022 Sub-Saharan Africa will have one billion mobile phones, for an estimated population of one billion two hundred million people (IEEE, 2019, p. 4). Based on this network, mobile money services were developed using the Unstructured Supplementary Service Data (USSD) text protocol, like Short Message Service (SMS), and this region has the largest share in the world for this type of service. Meanwhile, in Asia (particularly South Asia) mobile money accounts are growing at average annual rates of 46% (Chhabra & Das, 2019).

Chart 1.4-1 Banking on mobile phones – registered mobile money accounts by region, number per 1,000 adults

Source: Banking on mobile phones. From "Mobile Money Spreads to Asia," by E. Chhabra, and B. Das, 2019. Retrieved January 27, 2020, from <https://blogs.imf.org/2019/09/30/mobile-money-spreads-to-asia/>.
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In this context, the Kenya Tax Administration (KRA) has implemented a tax payment service through mobile money since 2014, with a projected amount of revenue for 2019 reaching \$ 21 million. Tanzania and Mauritius also are implementing this kind of tax payment service.

These three very successful developments rely heavily on the use of technology. They demand that many taxpayers interact with the tax administration over the Internet and so they required an infrastructure in place. The tax administrations of those countries where these kinds of efforts were undertaken have improved their efficacy and efficiency.

The level of adoption of these components, two in Latin America and one in Africa, is higher than in higher-income countries in other regions. This is important for at least two reasons: first, it is proof it can be done in countries not classified as higher-income economies; second, there are lessons learned that will be valuable for other lower-income countries that would want to follow a similar path.

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2. CONCEPTUAL FRAMEWORK: THE TAX ADMINISTRATION FUNCTIONS

2.1. Introduction

The tax administrations are in charge of obtaining the necessary resources for implementing public policies and defraying public expenditures. This mission greatly sets the tax administration's policies and determines what two major strategic guidelines to be established. The first one is aimed at facilitating citizens' voluntary compliance with their tax obligations by providing information and assistance services. The second one is focused on the detection and regularization of tax noncompliance through control actions that may guarantee the generalized and equitable contribution to public expenditures.

The common objective of both lines of action is to ensure that all citizens voluntarily comply with their tax obligations, a very ambitious goal that guides and gives sense to the tax administrations' action. In practice, there are two complementary approaches. On the one hand, the tax administration provides support and assistance to citizens and enterprises as a whole, of which the great majority wish to comply with the duty to pay the corresponding taxes. However, at the same time it pursues those who refuse to comply with their tax obligations.

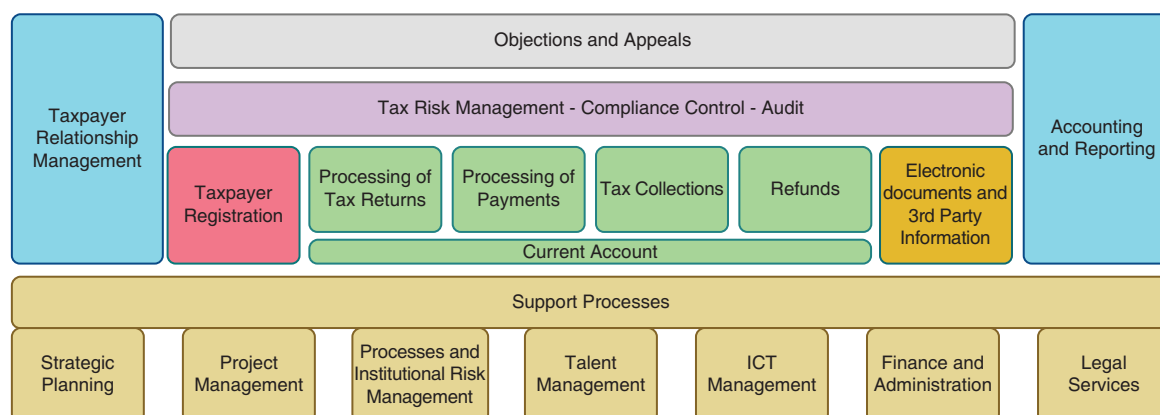
The tax administration functions are related to the taxpayers' main obligations or duties, namely: registering as a taxpayer; the presentation of returns within the required terms; timely payment of tax obligations; and, accuracy and completeness of the returns presented.

Based on these obligations we may identify the main activity of the tax administrations¹ in relation to the following functions:

- Taxpayer registration and identification.
- Taxpayer services.
- Returns process.
- Payment and current account management.
- Tax control/audit.
- Enforced collection.

- Refunds.
- Dispute resolution: management of administrative and judicial appeals.
- Revenue accounting.

Figure 2.1-1 Tax Administration Functions



Source: Prepared by the author

A series of horizontal, complementary and support functions contribute to the performance of the main functions. These include strategic and operational planning; human talent management; institutional risk management; administrative, logistic and financial resources management; and, technological, legal and statistical services.

2.2. Taxpayer registration and identification

The correct and complete incorporation of the taxpayers' (individuals, corporations or other entities without legal personality) data to set up the taxpayer file and its permanent review and update is an essential function of the tax administrations.

It is not by chance that in the TADAT (Tax Administration Diagnostic Assessment Tool) methodology for the evaluation of the performance of the tax administrations, the first area of evaluation is the taxpayer registration file. The primary reason is because the taxpayer registration file supports the activity of the tax administrations, which requires maximum attention, in as much as without a reliable, updated and complete file, the structuring of effective compliance programs or plans becomes an impossible task.

Each tax administration is in charge of the development and updating of the file, in accordance with each country's regulations and peculiarities. In general, one may distinguish between the census or registry of taxpayers (formed by the totality of individuals, corporations or entities without legal personality, which must have a tax identification number for their economic or tax relationships). On the other hand, there is the census or registry of businessmen, professionals or third-party

withholders who must enroll therein when carrying out an economic or entrepreneurial activity or obtain revenues subject to withholdings or payments on account.

The file will necessarily include such data as the following:

- Complete identification of the individuals and corporations.
- Tax domicile and, as appropriate, commercial domicile and mailing address; and, if applicable, information on domicile abroad.
- Contact details: telephone number and electronic mail account.
- Date of birth in the case of individuals and dates of establishment and registration of corporations.
- Establishment date and, if required, ending date of the economic activities.
- Nature of the activity according to national classifier of economic activities (e.g., the International Standard Industrial Classification of All Economic Activities).
- Taxpayer segment: microentrepreneur; small, medium or large enterprise; independent professional; or, other segments in accordance with the definitions of the tax rule.
- Corporate relationships: Identification of related entities, partners and stockholders and legal representatives.

The tax administrations have other tasks, in addition to allowing taxpayers facilities to voluntarily update the information on file. These are: to verify, check and investigate for updating the taxpayer database file, of those who should be registered but have not done so voluntarily. Also, the discovery of concealed activities, the deletion of individual taxpayers who have passed away or corporations that have been dissolved or liquidated or without activity, as well as the elimination of files that are inactive or without tax obligations or the elimination of duplicities or incorrect registries.

The tax administration's own initiative to update the taxpayer registry database is essential in order to ensure effective compliance control programs.

In addition, these initiatives involve other government entities or agencies. Therefore, it is necessary to seek the interoperability between systems and promote alliances for the effective exchange of data and relevant information with other institutions. The latter would be entities in charge of managing social contributions, other state, subnational or local entities for the identification of economic activities, the civil registry, the ministry of security or electoral tribunal in charge of assigning an identification document to individual taxpayers and the entities in charge of the commercial or mercantile registry of corporations.

The incorporation of practices such as georeferencing for the taxpayers' establishments and the consolidation of the electronic domicile with these actions are a trend in many tax administrations.

A good international practice is the automation of the registration process (and its modification) in the taxpayer registry file. This can be done by means of a flexible procedure in the “virtual office” of the tax administration where the taxpayer’s identity is proven through the use of an advanced electronic signature, without the need for physical presence in the offices. Alternatively, it may be done through common interfaces with other government agencies involved in this process. In some cases, the physical presence is limited to the capturing of biometric data at the headquarters of the tax administration.

The assignment of a single Tax Identification Number (TIN) is an essential element in this respect. This single number simplifies tax compliance and facilitates its control, allowing, for example, the automated crosscheck of data and information. In addition, it facilitates the exchange of information between government entities and agencies and with other tax administrations, inasmuch as it allows for arranging and classifying the data available in the tax administration with respect to every taxpayer.

The TIN serves to identify the taxpayers in their relationships with the tax administration and it is recommended that it be used in all of the citizens’ financial, mercantile operations, etc., inasmuch as they are of a tax nature or importance.

Finally, the registration file includes a module referred to as “taxpayer obligations management” section that contains information on each taxpayer entity’s tax obligations (e.g., filing requirements), which are based on the taxpayer’s economic, entrepreneurial or professional activities, the taxpayer’s profile or rules associated to specific regimes. Also known as the “fiscal vector,” this module shows the frequency and filing dates according to each taxpayer’s different obligations (dates of expiration of the returns, dates for making payment, dates for filing information returns, etc.).

2.3. Taxpayer services

Assistance to the taxpayer is essential for increasing the levels of voluntary compliance. The base of the tax compliance pyramid consists of a large number of taxpayers that are more than willing to comply with their tax obligations, who require maximum assistance from the administration, with all types of services and assistance channels.

The complexity of the tax rules (whose simplification must be promoted by the tax administration), the need to approach the taxpayer when he needs it most, the obligation to provide truthful, reliable and complete information to the citizen, different for each taxpayer segment and adapted to their needs, constitutes a real challenge for the tax administrations. This challenge has been favored by the upsurge of information and communication technologies, which offer taxpayers a wide range of possibilities for interaction.

Today, tax administrations count on a number of avenues in order to provide service to the taxpayer. Among these are, telephone assistance centers, face-to-face channel without a waiting lists or queues, the tax administrations’ Web page, 24/7 virtual office services, mobile telephone

applications, electronic mailboxes, virtual assistants, and “Frequent Questions” systems. Add to this the frequent use of social networks by the tax administrations to disseminate messages, interact with taxpayers, receive recommendations and feedback.

There are strategic measures to simplify compliance with tax obligations and reduce the costs associated with compliance. This is often accomplished through a review process in order to not require from the taxpayer information that is already available, request for excessive or unnecessary information, or measures to avoid having the taxpayer to unnecessarily go to the tax administration offices when the procedures can be completed online. In this context, one special initiative is the preparation by the tax administration of prefilled returns (in the case of the direct tax as well as VAT), which the taxpayer must only confirm or correct. This trend is consolidated with mechanisms whereby the administration may obtain specific information about taxable events, in particular, the use of electronic tax documents (invoice, withholding certificates, and interest payment vouchers, among others) or the periodic receipt of detailed information on these same matters.

In this area it is also important that tax administrations (as service providers) carry out in-depth opinion polls and sociological studies that allow for feedback on the degree of taxpayer satisfaction concerning the level and quality of the services provided. The analysis should also address taxpayer behavior in relation to tax compliance.

2.4. Returns process

Worldwide, there is legislation that establishes as the principal obligation of taxpayers the requirement to declare and pay taxes within the set timeframes. For example, the CIAT Tax Code model mentions:

Upon the occurrence of the events set forth by law that originate the tax obligation, liable parties shall fulfill said obligation on their own by way of a self-assessment when the intervention by the Tax Administration is not required. If such intervention is required, the liable party shall file the events and provide the information that the Tax Administration requires to make assessments. (CIAT, GIZ, & IADB, 2015, p. 114)

The comment to said rule states:

The article establishes the duty of initiative of the liable parties, who shall be required to pay the tax upon self-assessment or furnish the necessary information when the applicable tax is assessed through a combined or administrative assessment. In the first case, in addition to communicating the data required in determining the tax to the Tax Administration, the liable parties shall individually conduct the classification and calculation procedures required in assessing and entering the amount due, or otherwise, determine the amount that shall be reimbursed or offset. In the second case, the Tax Administration shall perform the latter procedure. (CIAT et al., 2015, p. 115)

As we have seen, the policies aimed at the simplification of formal obligations, the reduction of indirect charges and costs associated to compliance are definitely in favor of the intensive use of electronic means for the filing of returns.

Tax administrations are ever more preparing prefilled returns, which the taxpayer must only confirm or correct and comfortably file from his computer or mobile application. Likewise, the income tax withheld at the source is very frequently considered final for a large number of taxpayers. The regulations for each tax-type shall establish the rules for filing the return and paying each tax (through either self-assessment or subsequent assessment by the tax administration). They shall also indicate who are the taxpayers, the forms of filing, the terms thereof, the documentation to be provided, the rules for filing the returns by third parties authorized by the taxpayers, etc.

The design of the forms is an element that needs to be taken into account. The forms should correspond to the tax administration's corporate identity rules (e.g., trademarks, logos, and specific requirements set forth by a government oversight agency). They should endeavor to ensure that the information required be consistent with other tax forms. Sufficient (not excessive) information should be provided. Thus, one should only request the strictly necessary data for the pursued objective, as well as use self-adjustable formats so that the taxpayer will only fill out the fields with information corresponding to his tax profile.

In addition to the tax returns and their related payments, the tax administration's activity involves capturing information through the information returns program wherein taxpayers report to the tax administration the economic, professional or financial operations of tax importance, which they have carried out with third parties.

The catalogue of information returns will depend on each country's regulations. These are some examples:

- Operations carried out with third parties.
- On accounts, operations and financial assets.
- Loans and credits and cash transactions.
- Collections through credit cards.
- Securities, insurance and income.
- Issuance of checks by credit entities.
- Declarations of operations with financial assets, public debt operations.
- Constitution, establishment, modification or termination of entities.
- Contributions to pension plans.
- Real estate financial operations.

- Properties and rights abroad.
- Transfer of housing for tourist purposes.
- Detail of invoices issued and received.

In “Electronic Invoicing: Lessons from Latin America” (Barreix, Corrales, & Zambrano, 2018) is it possible to distinguish the electronic invoice has become a fabulous source of information. The promptness with which the information is obtained (simultaneous at the time of carrying out the generating transaction), the reliability and traceability of the information, the window of opportunity opened for the efficient use of risk management techniques, make the electronic invoicing systems an essential factor for improving the control systems.

To conclude, in order to have an appropriate compliance control system, the tax administration must have an adequate information system, capable of managing the enormous amount of data, as well as a reliable, updated and complete registry file, that may allow for detecting noncompliance with the obligation to declare, in particular, the control of non-filers which becomes an essential activity. This non-filer control is improved with tools and kits that may allow for immediately applying the corresponding fines, as soon as possible.

2.5. Payment process: The current account

Regardless of the fact that the filing of tax returns and their payment can be a joint or separate transaction, the fact is that the process of making an electronic payment has been simplified (CIAT, GIZ, & IADB, 2016). For example, today we can count on the Web platforms of collection entities, credit cards payments via the Web, and payments at the tax administration virtual office.

There is also general use of the financial and banking system (through corresponding agreements) for the payment of taxes. The financial and banking entities can transfer funds electronically, or by means of a bank transfer, immediately after collection, to the state’s tax revenues treasury accounts. In addition to clearly agreeing on the manner in which this service will be remunerated, the tax administration must count on sufficient legal (as well as technological capability) powers to ensure that the service is rendered with the maximum guarantees of security and certainty, with respect to the funds that are collected. The tax administration should also have a system that provides for control or audit with sanctions for noncompliance with the conditions of the agreement for the collection of funds.

The advantage of these collection systems is that they reduce the use of cash at the tax administration offices, while expanding the network of payment offices, as well as the payment facilities for the taxpayer. The use of mobile platforms and mobile devices for making payments has become a trend.

In this context, the tax administration’s comprehensive current account constitutes an information system that registers debits and credits (including those that must be automatically calculated as a

result of penalties or fines, interests and surcharges) of its taxpayers, and is essential for the effective management of a tax system. In the countries where there is no specific current account system, there are alternate systems with similar functions, which definitely allow for a transparent relationship with the taxpayer (CIAT, GIZ, & IADB, 2016). They include updated information on their payments, debts and credits and likewise allow the tax administration to implement compliance programs for the control of non-filers, management of debts not paid within the term, delinquent debt, etc.

The tasks for the criterion and design of this tool (or similar) are broad: identification of the forms for declarations and payments; the rules to apply balances; the formulas for application of interests; the rules for the allocation of payments; the rules for refunds and/or compensation; the registration of payment plans or other agreements; those relating to the additional amounts resulting from the audit and control processes; and, cases enforceability, or not, of debts depending on the outcome of the dispute resolution process. This system must be connected to the accounting system, since it is the basis for the tax revenue accounting, which must comply with the government accounting rules and allow for the preparation of statistical analyses to follow up and monitor the tax revenues.

2.6. Tax Control: Examination and auditing

In a broad sense, tax control does not only involve the examination and auditing activities. To these two categories one must add, compliance control, non-filers control, as well as, the control and follow-up of the previously mentioned delinquent debtors.

In a strict sense, the examination and auditing functions include the verification, confirmation and investigation of the truthfulness, accuracy and completeness of the tax returns. It is a main function of the tax administrations, which generates the perception of risk in the taxpayers, an important factor for promoting voluntary compliance.

The types and scopes of the examination and auditing activity are very broad:

- Massive verification and control for determining compliance with formal obligations and the accuracy of the returns filed. In this case, use is made of the information available in the tax administration, without examining accounting documents or records or having available information from banking or credit entities and the work is carried out in the tax administration offices (desk audits).
- Intensive audit controls for determining the omitted taxes by means of the powers granted by the legislation to the tax administration. These include: access to the offices or sites where the economic or entrepreneurial activity is carried out; obtaining specific information through requests to third parties (in particular, information from financial institutions regarding bank account transactions); origin and destination of checks and means of payment; and, determine possible recharacterization of corporate businesses (e.g., creation of a shell corporation) or simulated business activity for the purpose of tax fraud. In this case, audits may be carried out at the offices or premises of the economic activity (field audits).

- Depending on the scope (tax items and periods), the examination activities may be partial (when they are limited to one tax item of a period or even taxable event or specific operation) or general, when they cover the main taxes and complete periods that are not affected by the statute of limitations.
- Depending on the nature of the determinations or settlements resulting from the examination, a distinction is made between the provisional settlements from the final ones, which are reserved for those determining audit results that cover the totality of the taxable event.

The success of the tasks of mass control and selective audit rests in the realization of a great effort to build plans that, centrally and within the framework of the strategic and operational planning of the tax administration, order and guide this task by defining the following: the number, classes and types of audits to be performed; the areas of key attention based on the selected risk factors; the primary programs; the deadlines for completion; the assignment of tasks and cases to the examination department; and, the rules for case follow-up and monitoring their effectiveness, among others.

Such planning calls for determining adequate selection criteria. The automated crosscheck and combination of information available from different sources (tax returns, third parties, other administrations, etc.) allow for identifying and analyzing tax risks, their prioritization and the establishment of mitigation measures and subsequent monitoring or follow-up.

To this end, it is important to measure the effectiveness of the tax control programs, by monitoring the collection related to said programs and its effect in terms of tax compliance. Also important are the studies on the compliance gaps, which despite the controversy in relation to the different methodologies used, they provide very valuable information for the tax administrations.

On the other hand, the complex nature of the auditing activity requires a continuous standardization effort. This involves: preparation of procedures manuals permanently updated with rules, administrative and jurisdictional doctrine, complemented with general and specific verification guides for the most relevant economic sectors; automation of processes through the use of electronic file utilities; and, standardization of documents and testing during the processes. All of these activities contribute to greater effectiveness and efficiency of the control actions. The perception of risk generated in the taxpayer by the existence of an effective examination system and a balanced, consistent and dissuasive sanctioning system is complemented with initiatives for increasing the social acceptance of taxes, as well as with new strategies with a more preventive rather than corrective approach.

According to the OECD (2013) the implementation of cooperative compliance programs (e.g. the forums or sites of cooperative relationships with large businesses, codes of best practices) are reinforced with such measures as the obligatory approval of the tax strategies by the administration councils of the corporations. In addition, they must have risk management models for identifying their tax risks and informing them to the tax administration. Such instruments as the obligation of the intermediaries to report cases of aggressive tax planning serve this same purpose. Another activity that can be considered “cooperative” are Advanced Pricing Agreements (APA). These assist

in determining product costs for both tangible and intangible taxpayer assets/properties and transactions.

As a result of globalization, new approaches to control have been developed. These include multilateral controls, joint inspections with the participation of the tax administrations of different countries for a better control of the large transnational groups. Likewise, the organizational model must be permanently adapted to the needs of tax control, such as the creation of specialized groups in international taxation or in the examination of large enterprises.

2.7. Enforced collection

The collection process is the activity charged with the securing of the tax obligations not paid by the taxpayer in due time. This function has different characteristics depending on each country's legislation. Thus, the different collection models range from those centered on persuasive collection to those focused on the enforcement processes executed by the tax administration or judicial bodies (where the tax administration may or may not act as agent, or it's carried out by third parties). In any case, management of the delinquent debt is a challenge for tax administrations, which must optimize their processes, in order to avoid the accumulation of debts that through time become uncollectible.

Essential in this sphere are the correct identification of the status of the different debts. For example, those that are suspended, pending resolution before the courts, guaranteed payment, postponed, subject to bankruptcy or meeting of creditors, etc. Also important is the segmentation of debtors and debts according to criteria of importance, legal priority, possibilities of collection and the application of risk analysis techniques.

The implementation of coordination measures for advancing collection action before further delinquency occurs, as well as an effective payment agreement processes are an important factor in this respect. Also, a procedure that systematically and correctly determines the net worth of property is important information in order to promptly carrying out seizures of taxpayer assets, when this becomes required.

2.8. Refunds

The management of refunds is an essential activity of the tax administrations. These refunds arise from the innate nature of taxes, whereby, a taxpayer has met their tax obligation and has credits to their advantage. Occasions where this may occur are with the advanced payment and withholdings systems (in the case of direct taxes) and in the VAT systems, as a result of the existence of exempt operations where the taxpayer has the right to a VAT deduction from purchases; Also, as a result of acquisitions and investments that generate tax credits to be refunded or compensated. In addition, there may be cases of refund because of undue or duplicated revenues.

The different legislations also take into account the possibility that a taxpayer may request that debits from one account (same or different tax type or filing period) be liquidated or partially paid

with credits from another account. Often, these transfers of credits to debits are performed automatically by the tax administrations.

Thus, the management of refunds is a real challenge for the tax administrations, which must promptly respond to these requests (e.g., commercial activity related to exports). They need to verify and ensure that the refund meets all the legitimate requirements. In other words, that such credits are the result of real operations with a right to be deducted. This calls for implementing risk management methodologies which, while accelerating refunds or compensations to the taxpayers with lower risk profiles, may also allow a more exhaustive control of taxpayers with greater risk, so as to avoid economic losses and harm to the State due to fraudulent operations (especially in VAT refunds) that are going on in many countries.

2.9. Dispute resolution

The right to appeal, not share or disagree with the decisions of the tax administration is an inalienable right of the taxpayer. The existence of an appeals resolution system that is balanced, prompt and respectful of the rights of the taxpayers enhances voluntary compliance and social acceptance of taxes.

The appeals system varies among the different legislations. The Tax Administration Diagnostic Assessment Tool (TADAT Secretariat, 2019), call for having available a system that allows several levels of appeal spread out at intervals, where there is a first in-house stage of the appeal where the tax administration is represented by a committee or persons separate or independent from those that have conducted the audit. Then a second stage represented by a court or tribunal (whether administrative or not) that within the framework of the appeal may review the resolutions determined in the first stage and a third review stage normally headed by the jurisdictional bodies that are in charge of the jurisdictional control of the administrative action.

All of the foregoing should be based on a regulated process duly disseminated which takes into account the hearing of the interested party, the opening of the test period, the notification of the resolutions and, in general, measures that may guarantee the specifically coded and regulated rights of the taxpayers.

In these past years, many countries have introduced alternate mechanisms for solving conflicts by resorting to such measures as mediation, conciliation or arbitration. There are also legislations that favor the agreement to avoid the appearance of conflict with the tax administration (e.g., conclusive agreements as is mentioned in the CIAT Tax Procedure Code Model).

As important as the existence of this balanced system for solving conflicts is the fact that the administrative action be adapted to the decisions of the entities in charge of the solution of conflicts. They should thereby generate feedback mechanisms; follow up of conflicts and adoption of corrective measures for preventing the repetition of the defects, errors or interpretations evidenced in the review process.

Regardless of the above comments, in the sphere of the juridical-tax relationship there is a “gray zone”. It has nothing to do with the application of the juridical regulation but is related to the equitable and weighted treatment that should be given to the taxpayer. It constitutes the sphere of action of such institutions as the “ombudsman” or the taxpayer’s defender. These institutions, with the help of the tax administration’s own entities, must solve these issues dealing with equal treatment of taxpayers.

In addition, the tax administrations should have mechanisms for solving complaints regarding the unsatisfactory performance of services, as well as available means for responding to suggestions.

2.10. Revenue accounting and agency accountability

The forecasting of tax revenues, the monitoring and analysis of collection and the preparation of tax base statistics are an essential function in the tax administrations.

The public revenue accounting system should receive information from the current account records (or their alternate methods), as well as comply with the principles and criteria established in the accounting rules of the public sector. The continuous and detailed monitoring of the evolution of the public revenues is essential for the decision-making process of the political entities.

A characteristic of the budgetary process is that it requires an estimate of the tax revenues for the fiscal year in question. This is a fundamental task of the tax administrations, which, through the combination of various information sources, must be capable of generating these forecasts and monitoring the level of what has actually been collected, so that corrective measures or other decisions are possible.

The studies regarding the analysis of the impact of the tax reforms or the implementation of tax policy measures through the corresponding simulations and macroeconomic analyses allow for estimating the expected increase or loss of collection with the pro-posed measures, the economic segments or sectors of taxpayers benefiting or not with said measures, etc.

The publication of tax base statistics and follow up of collection is a powerful instrument at the service of transparency in the performance of the tax administrations and contributes to improve social acceptance of the taxes. In addition, the tax administrations should have available a governance framework for promoting transparency and accountability in its performance (Redondo, 2019), not only through these types of publications, but with many other instruments for this purpose (accountability to Parliament, supervision by external entities, audits by internal control entities, etc.)

2.11. Final comment

As discussed above, the main operational functions of tax administrations is only possible with transversal functions and tasks such as: strategic and operational planning that has been described

in some detail; compliance programs and operational risk management; effective management of human talent; efficient administrative, logistics and financial resources management; IT services; the adequate performance of the legal, statistical, internal audit services; and, finally, with the policies and measures that favor transparency and accountability.

In this context, the incorporation of ICTs into the tax processes, that is, the implementation of an adequate Tax Information System for the registration of taxpayers, the presentation and payment of tax returns, the audit function, the providing of information services and assistance to citizens in fulfilling their obligations and, in general, to all the processes, functions and tasks that we mentioned in the previous sections constitute an opportunity for the improvement of the performance of the tax administrations that should be used to promote sustained and inclusive economic growth that favors the welfare of citizens.

ICTs are undoubtedly an authentic dynamizing and catalytic element in this process of improvement of the tax administrations, which will require less time and lower costs for implementing and executing this process.

In addition, one should bear in mind that the tax administration is a fundamental pillar of public action, which, in one way or another involves the citizens, businesses, and society as a whole. Therefore, it is crucial that the tax administrations play a leading role in the promotion of electronic administration services throughout the public sector, thus becoming the spearhead of this modernizing process, which the ICTs are carrying out.

Note

1. Herein we are referring to tax administrations considering autonomous agencies, semi-autonomous entities or directorates that are part of ministerial structures, whether state or subnational, which are in charge of the management and application of the tax system, without including customs or social security contributions.

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3. THE REGISTRY

3.1. Taxpayer Registry

A taxpayer registry identifies individuals and legal entities, as determined by law, that apply for and obtain a Taxpayer Identification Number (TIN). A registry contains data for identifying, locating, classifying taxpayers and their taxes, and ancillary obligations. The law may require registration for the taxpayer entity, tax withholding agents, third parties or individuals or entities jointly liable for tax payments. It may also require the registration for exempt organizations and owners or those responsible for monetary assets, financial, real estate or means of transportation valued above established limits.

There are different taxpayer registries, for individuals and legal entities. If states or local administrations have their own taxes based on a different set of triggering events, even when they are dependent on the trade of goods and services or of the income tax type, they usually tend to adopt different registries. This document does not deal with property taxes.

3.1.1. *Relevance for the taxpayer*

In order to operate within the country's tax law, the taxpayer's first step is to comply with the obligation to register and apply for a TIN in their country's respective issuing offices.

Without a TIN, it is not possible to file a return and/or pay taxes, being at risk of incurring heavy penalties for not having a TIN, not filing a return and being delinquent on tax payments. It is not possible to have a business bank account, and, in many countries, individuals may not have a bank account without a TIN.

Ideally, no person could own, buy or sell real estate and properly register the operation or invest in financial assets or own and get a license for a car, boat or plane without a TIN. For persons who show signs of earning enough income to be considered potential taxpayers, life is difficult without a TIN.

Nevertheless, depending on the number of offices involved and their degree of integration, the number of forms and data required and the efficiency of tax offices in different political and geographical levels, it may be a cumbersome and lengthy task for legal entities to register as a taxpayer.

On the other hand, in countries with a large informal sector of the economy, creating a special entity type that allows self-employed individuals with low income to register as an entity and have a business, TIN may be a strong tool for social integration. However, this program has limitations; it is not designed for street vendors or land proprietors working on subsistence agriculture.

The objective is not an increase in tax collection through an increased tax base, although hopefully it will happen in the long run. By adopting this policy that will bring people out of the informal sector of the economy, a government aims to achieve a higher level of belonging and citizenship for a great number of people.

In this case, registration forms and procedures should be simple and basic as well the corresponding return and payment forms, all accessed online from mobile applications or computers. The monthly payments could be a low fixed amount that covers all taxes, including VAT and social security. With a business TIN, the individual would access special lines of private credit, tailored training programs and some social security benefits.

There are advantages when the TIN number for individuals matches or extends the National ID number by adding a check digit, if there is none; this is possible only when it exists, and it is reliable. Various countries generate a TIN at birth for individuals (New Zealand and Brazil are also in the process of implementing this procedure) or take into consideration birth records data (Mexico). However, many countries do not have a national identification document. In Brazil today, the individual TIN is already accepted as a de-facto National Identification number in many situations where an identification is required. A reliable ID number is an advantage for businesses as a whole, and for the individual it's a simple and convenient means of identification.

3.1.2. *Relevance to the tax administration*

The Taxpayer Registry allows the tax administration to identify the taxpayer, its taxes and ancillary obligations. It is essential for compliance control and the consequent identification of risk criteria used for taxpayer selection in inspection and auditing programs, granting of fiscal incentives and authorization for installment payments.

The TIN is the fundamental link for the information generated by the Tax Information System. Not only does it allow for the integration of data for each one of the taxpayers but also the cross-checking against relevant information from other taxpayers and third parties:

Cross-checking the TIN - tax obligation- due date against TIN - returns filed:

- Detects non-filers and late filers.
- For each return filed it will generate debit/credit transaction for the taxpayer's tax account.

- Cross-checking the TIN - tax obligation- due date against actual tax payments:
 - ❑ Detects non-payment and late payments of taxes.
 - ❑ For each tax payment, it generates a credit transaction for the taxpayer's tax account.

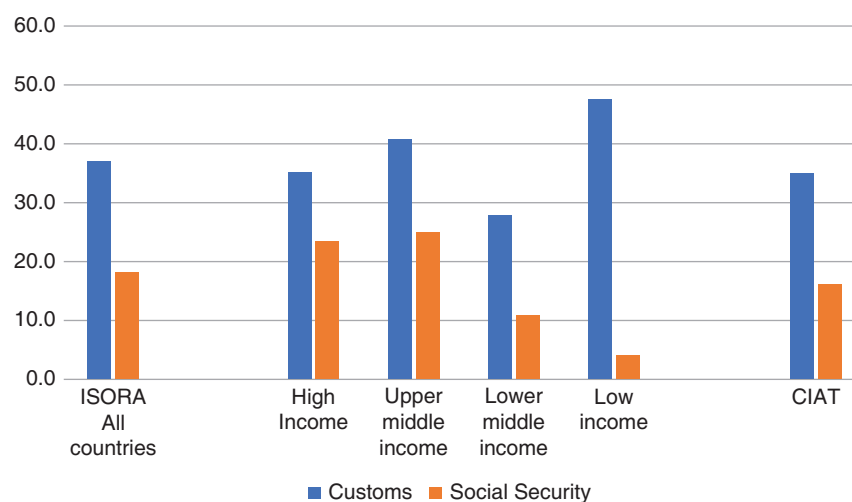
Cross-checking TIN against third party returns, online electronic fiscal documents or special forms from real estate registry, motor vehicle departments, banks and financial institutions, or whatever information source the law requires to identify its clients and transactions, is a valuable tool for detecting potential tax evasion.

The Registry information generates statistics of active taxpayers by economic activity, type of entity, registered capital, geographic location and the registration, deregistration, suspension and other registry's database alterations. The use of these statistics, as an input to management decision-making process has positive consequences:

- Strengthens the tax administration ability to formulate policies on taxpayer orientation and control.
- Supports a better allocation of human and material resources to the tax offices affected and the creation of training programs according to taxpayer type.

In cases in which a legal entity is responsible to pay a corporate income tax and taxes on the production and sales of goods and services, it is important to have a unique TIN for all tax obligations in every government level and for customs duties:

- A unique registration form contains all the information necessary for the system to generate the tax obligations for the taxpayer.
- To make things practical, cost effective as well as to lessen the bureaucracy, one singular registry office should be responsible for all applications for TINs.
- A unique TIN facilitates and standardizes the control of non-filers and delinquent taxpayers and triggers the corresponding administrative actions.
- It allows for the creation of integrated information systems including the Taxpayer Current Account, queries on taxpayer data and conducting statistical studies.
- Facilitates the flow of information from third parties.

Chart 3.1-1 Integration with Customs and Social Security Administrations

Source: Prepared by the author with data from ISORA (2017)

Table 3.1-1 Integration with Customs or Social Security. CIAT Member Countries.

CIAT	Organization Structure	Customs	Social Security
Angola	USSB	Yes	No
Argentina	USSB	Yes	Yes
Aruba	SDMIN	No	Yes
Barbados	USSB	No	No
Belize	SDMIN	No	No
Bermuda	SDMIN	No	No
Bolivia	USSB	No	No
Brazil	SDMIN	Yes	Yes
Canada	USSB	No	Yes
Chile	USS	No	No
Colombia	USS	Yes	No
Costa Rica	MDMIN	No	No
Dominican Republic	USSB	No	No
Ecuador	SDMIN	No	No
El Salvador	SDMIN	No	No
France	SDMIN	No	No
Guatemala	OIA	Yes	No
Guyana	USSB	Yes	No
Honduras	OIA	No	No
India	SDMIN	No	No
Italy	USS	No	No

(continued)

Table 3.1-1 Integration with Customs or Social Security. CIAT Member Countries. (*continued*)

CIAT	Organization Structure	Customs	Social Security
Jamaica	USSB	No	No
Kenya	USSB	Yes	No
Mexico	USSB	Yes	No
Morocco	SDMIN	No	No
The Netherlands	SDMIN	Yes	Yes
Nicaragua	USS	No	No
Nigeria	USSB	No	No
Panama	SDMIN	No	No
Paraguay	SDMIN	No	No
Peru	USSB	Yes	Yes
Portugal	SDMIN	Yes	No
Spain	USSB	Yes	No
Suriname	SDMIN	Yes	No
Trinidad and Tobago	SDMIN	No	No
United States of America	SDMIN	No	Yes
Uruguay	SDMIN	No	No

Source: Prepared by the author with data from ISORA (2017)

Note: **USSB:** Unified semi-autonomous body with board; **SDMIN:** Single Directorate within the relevant ministry; **USB:** Unified semi-autonomous body; **MDMIN:** Multiple Directorates in Ministry; **OIA:** Other Inappropriate Administration.

If it is not possible to implement this desired degree of integration between tax offices, at a minimum, it should be obligatory to include in all the state and local tax registries databases the national TIN number of the taxpayers. Certainly, it would facilitate communication and flow of information between administrations of different levels.

3.1.3. Legal/administrative requirements

The obligation of the taxpayer to apply for registration, the infractions, sanctions and fines for non-compliance with the registry rules, must be included in a law. There are alternatives:

- A specific law that establishes the obligation to apply for registration for all taxes in the tax system.
- All Tax Acts must include the obligation to register and its applicable rules.
- A National Tax Code that includes this provision and is valid for all taxes in the tax system.

A National Tax Code establishes the regulations to be followed in the relationship between the tax collecting agencies and the taxpayer, plus establishing their rights and obligations and the legal framework to avoid inconsistencies between codes for different taxes. The registry of individuals contains a few elements: name; date and place of birth; main address; and, mother's name. It is

indispensable for Income Tax purposes, and its presentation is required in several situations that by far exceed the taxpayer-tax administration direct relationship.

For business activities, (companies, partnerships, associations and individuals that operate like small businesses or are self-employed), a registry law and its correspondent regulation should cover at least:

- A definition of the Taxpayer Registry.
- The content of the Registry may be (suggested):
 - ❑ Legal name and trade name.
 - ❑ TIN number (registry of company's number).
 - ❑ Registered tax address.
 - ❑ Tax obligations.
 - ❑ Entity type.
 - ❑ Economic activity.
 - ❑ Estimated annual turnover.
 - ❑ Registered capital.
 - ❑ Capital participation of owners of company or partners in a partnership.
- Situations that determine the status of a taxpayer in the Registry: active; compulsory deregistered; voluntary deregistered; voluntary suspended (interruption of business activity for a period of time); compulsory suspended (as a sanction); and, inactive.
- Rules, forms and procedures for change of status. What actions can be done online, at the tax administration site or requires the presence of the taxpayer or representative at the tax office.
- Establishing obligations for informing TIN in documents:
 - ❑ Communications between taxpayer and tax administration, including TIN of individuals and entities mentioned in the communication.
 - ❑ Seller's TIN on invoices, sales tickets and receipts. Buyer's TIN on invoices or according to necessity or demand (a receipt for a deductible expense) in ticket sales and receipts.
 - ❑ Documents for opening accounts in financial institutions and for informing its operations.
 - ❑ Documents necessary for the registration or transfer of ownership in real property.
 - ❑ Information for the registration of ownership of any means of transportation (motor vehicles, air and sea crafts).
- Sanctions and fines for infractions to the registry's rules.

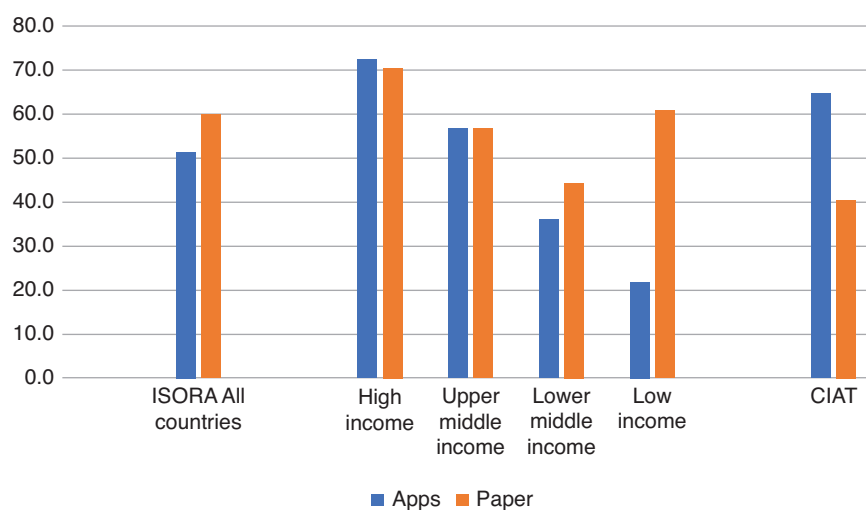
After the registration process is finished, the administration should issue a TIN card or document, physical or electronic, and a basic orientation guide that states the tax liabilities; ancillary obligations; due dates, sanctions and penalties. This formalizes the relationship between the tax administration and taxpayer, ensuring transparency between both parties.

3.1.4. *New technologies applications*

Some technological advances, although currently sparsely applied, could improve the performance of a registration office and provide the registry with reliable data.

- Biometric Identification.
- Mobile services for online updating of the registry.
- Geo Spatial Mapping, already in use for determining exact location, shape and size of houses, buildings and rural properties, would help on the identification of business clusters in new areas of development, for detection of unregistered taxpayers.
- Blockchain technology for linking the public sector participants in the authorization to start a business and integrating the issuance of the necessary registrations and licenses. Through a registration portal, all the participants in this process (registry of companies, tax registration offices at various government levels, municipality departments) have access to standardized records and have defined rights to include and adjust their data by electronic means. Each intervention is recorded with a time stamp and all the participants have complete visibility of the process, from the beginning to the end, through the integration portal.
- The federal tax administration of Brazil (RFB) currently implements a blockchain-based system, called “bCPF”, to share data from the Taxpayers / Natural Persons Registry (CPF) among tax and regulatory institutions of the 3 levels of government (federal, states and municipalities). The next step to RFB is to implement the blockchain-based Legal Entities Registry, “bCNPJ”, with the same goals. For more information, see Chapter “New Disruptive Digital Technologies and Services – Opportunities and Challenges”.
- The consulting firm Deloitte developed, in the United States of America, an artificial intelligence supervised machine learning tool that is in use for a variety of tax cases. The tool uses natural language processing and machine learning to automatically extract clauses in contracts, deeds, agreements and other legal documents. By building sophisticated probabilistic models from contextual language facilities, such as synonyms and word proximity, the tool improves its performance over time. One of the applications made was the reading of huge digitized texts of trust agreements or contracts to classify them properly for tax purposes.
- Aggregate the TIN into a digital identification certificate, for issuing electronic invoices and other electronic documents, filing returns or consulting taxpayer data. It offers greater security of communication between taxpayer and administration and data reliability.

The following chart presents how tax administrations are using channels for registration, specifically support for apps and traditional paper-based forms.

Chart 3.1-2 Channels for Registration (% of countries)

Source: Prepared by the author with data from ISORA (2017)

The following table shows the usage of different channels for registration purposes.

Table 3.1-2 Percentage of registrations by channel in CIAT member countries

Country	% Apps	% Phone	% Email	%Paper	% In Office	% Others
Angola					100.0	
Argentina	100.0			0.0	0.0	
Aruba				D	D	
Barbados	D	D	D		D	
Belize			2.0	10.0	88.0	
Bermuda			20.0	60.0	5.0	
Bolivia	D				100.0	D
Brazil	D				D	
Canada	59.0	24.0	0.0	6.0	3.0	8.0
Chile	88.3				11.8	
Colombia					100.0	
Costa Rica	35.3				64.7	
Dominican Republic	33.8			66.3		
Ecuador					97.7	2.3
El Salvador					100.0	
France	D		D		D	
Guatemala	2.0			98.0		
Guyana				100.0		
Honduras					100.0	
India	D			D		
Italy	29.0				40.0	31.0

(continued)

Table 3.1-2 Percentage of registrations by channel in CIAT member countries (*continued*)

Country	% Apps	% Phone	% Email	%Paper	% In Office	% Others
Jamaica	D			99.0	99.0	D
Kenya						
Mexico	59.5				40.4	
Morocco					98.6	1.3
The Netherlands						100.0
Nicaragua					100.0	
Nigeria	D			D	D	
Panama	40.0				60.0	
Paraguay	100.0					
Peru	27.0				73.0	
Portugal	28.4				71.6	
Spain	D	D	D	D	D	D
Suriname	D	D	D	D	100.0	D
Trinidad and Tobago	D			D	D	
U.S.A.	D			D	D	
Uruguay	0.0				100.0	
Average	46.3	24.0	7.3	54.9	70.6	28.5

Source: Prepared by the author with data from ISORA (2017)

3.1.5. Tax Compliance Risk Management

Reliable Registry data is essential for the successful control of late payers and non-filers and to determine the corresponding actions required to take against them. It is especially relevant to have up to date taxpayer identification and identification of company owners, their tax obligations, economic activity and or occupation, registered tax address, and legal entity type.

Also, an inflated registry, where a high percentage of businesses are non-filers because they are no longer operational or because they are doing business elsewhere, demoralizes compliance enforcement activities.

Some areas of concern are listed below:

- Dependable identification and registered address of individuals and legal entities are indispensable for notifying, summoning, inspecting, auditing and pursuing administrative and legal measures to correct the irregularities detected. It is important to get them correct from the beginning.
- Measures must be taken not to register twice an individual taxpayer. Whenever there is a taxpayer with the same name of another already registered, the system must verify data and place of birth and sometimes include a mother's name in order to make sure a taxpayer is not registered twice. It would be safer to systematically validate the information with reliable national databases or birth records.

- Simultaneously creating a legal entity and applying for a TIN creates data reliability. Although each government agency has a particular area of interest, their registration data very often coincide (e.g., the information contained in a TIN registration form with that found in the registration of a corporate entity). It is necessary to have a degree of integration between each office registration system to make this procedure possible.
- Addresses could be cross-checked against other documents like utilities bill, rent contracts or consulting databases from utilities companies.
- Taxpayers should be able to update their registration information when needed through online facilities at any time, and particularly when filing tax returns. The processes could benefit from an opportunity to geo-localize their location either through the use of mobile phones or IP address location, providing the taxpayer with a map of the area where they can confirm the specific location. Inspecting selected businesses based on risk assessment, mainly if they belong to a sector prone to VAT fraud, or if they are owned or managed by high-risk individuals, before they begin to operate or right after they start operating, is a good way to guarantee that reality confirms the information in the registry form.
- Tax obligations are determined by the administration and not an option for the taxpayer. The creation of obligations derives from the data filled in the registration form: what kind of taxpayer (individual or entity type); economic activity or occupation; and, level of registered capital, estimated revenue.
- The liability of a VAT tax depends heavily on business activity and occupation of the individual. The same with excise taxes. It is important to have an official table of economic activities and occupations common across all government agencies in order to produce integrated statistics. It is more important that the table be adapted and included in the taxpayer registry forms with at least the same level of detail specified in the Tax Law. If only one product in an economic sector is liable to pay a tax, this product code should be explicit in the table, so the taxpayer may select it and the tax administration may correctly determine the taxpayer liability.

3.1.6. *Lessons learned from the experience*

Cleansing of the Registry

Occasionally we find unreliable registries, to the point where the taxpayer data is inadequate for their usual purpose of detection of non-filers, communicating with taxpayer, support of auditing programs, etc. In these cases, there are some common administrative reactions to the situation:

- Administration stops using the registry for its main objectives which aggravates its already poor condition.
- Conforms itself with quite unsatisfactory results, with mail being massively returned by the post office and being unable to contact taxpayer by other means.

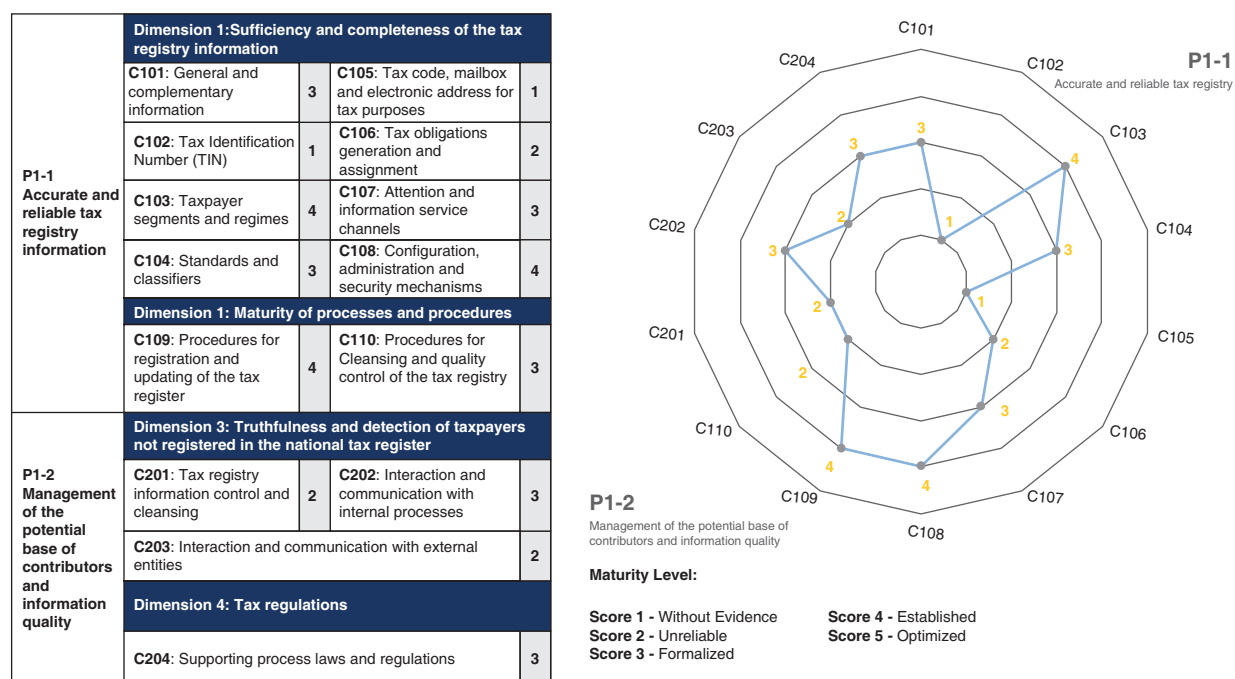
- Tries to start all over again, reregistering the taxpayer without solving the basic problems that lead to the current database deterioration.

Reregistering taxpayers is a lengthy and expensive operation, only to be made in situations where a change of TIN is recommended because, for instance, a lack of a check digit or the existence of a large number of duplicates, or the data stored in the database is insufficient or extremely poor in terms of quality and confidence for the Registry to carry out its functions.

Maintaining a good Tax Registry is a challenging task. It has several issues, to mention just a few, it is not necessarily a priority for taxpayers that are going out of business to timely inform the tax administration, or it might be the case that relevant changes are purposefully not updated to remain out of the radar, or it can historically be a lack of data that is not collected because of cultural resistance or even legal impediments.

CIAT developed a tool to evaluate or self-diagnose these characteristics in the registry. The scoring method is presented in *Figure 3.1-1* with an overview of the method. It covers two parts, the first dealing with “Accurate and reliable tax registry information”, with two dimensions: Dimension 1 - Sufficiency and completeness of the tax registry information; and Dimension 2 - Maturity of processes and procedures. The second part “Management of the potential base of taxpayers and information quality” with also two dimensions: Dimension 3 - Truthfulness and detection of taxpayers not registered in the national tax register; and Dimension 4 – Regulations.

Figure 3.1-1 Scoring Method for Taxpayer Registry Assessment



Source: Taxpayer Registry Diagnostic Report made by CIAT as part of a Technical Assistance in 2019

The dysfunctionality of the Registry likely has its origins in one or more of the situations below:

- Lack of an e-tax domicile that greatly facilitates the communication between tax administration and taxpayer (one way).
- There is no legislation determining sanctions and fines for violation of basic registry's rules: the obligation of updating taxpayer's registry data and status at the registry.
- There is no legal provision for:
 - ❑ Supporting compulsory deregistration or suspension from the registry or signaling this taxpayer as having irregular status for violation of registry norms.
 - ❑ Allowing the administration to refuse a TIN for a new entity that has as partner or associate or shareholder (individual or entity) with an irregular, suspended or compulsory deregistered TIN. Not allowing as a new associate in an already registered partnership, LLC or company, an entity or individual in the same situation. It is necessary to correct the status problem first before continuing.
 - ❑ Suspension of any fiscal incentives and favorable treatment for taxpayers that do not file the appropriate returns.
 - ❑ Prohibiting import of goods and services or buying goods and services (in case the administration has an electronic invoice system) for a suspended TIN.
 - ❑ Lack of on-site business premises physical inspection in cases the taxpayer stops filing VAT or sales tax returns for two or more periods. If at inspection it is found there is no business operating at the address, the inspector informs the Register to take appropriate measures, stopping the bloating of the Registry.
 - ❑ Strong administrative penalties like TIN suspension or cancelation should be taken if an active taxpayer is a non-filer for successive tax periods. Except in the case the taxpayer has required temporary suspension for non-operating for a pre-determined period, the ancillary obligation of filing a return must be carried out.
 - ❑ Applying sanctions and fines for violation of established rules.
- There is legislation supporting the strengthening of the registry but not the political will to apply it. The administration must have teeth and the will to bite if it wants to provoke changes in an environment of massive non-compliance.

The need for inter-operability

The information in the Taxpayer Registry is used in risk management processes. Having access to original sources bring valuable capabilities to the tax administration. As was said before, it is important to have access not only for validation purposes but to trigger actions within the tax administration, to the systems where data is recorded in terms of births, deaths, adoption of

nationality, change of legal name, residence status, temporary work permits, incorporation of companies, closures, merging and acquisitions. The same could be said, with less direct implications but important for risk management or the verification of correctness in terms of obligations and benefits declared by taxpayers from other sources of information, for instance, migratory movement, prison sentences, status changes in professional colleges and so on.

Economic activity information

Knowing the right economic activity, a taxpayer has is important for risk management purposes. The declaration of such activities by the taxpayer alone could introduce noise because of the difficulty the taxpayer can have to correctly identify their activity within a complex code or, even worse, when taxpayers or their advisors purposely misidentify their activity in order to access specific benefits or avoid some obligations. The use of advances and analytics and artificial intelligence techniques could be used to improve the tax administration capabilities to find hints of the right activity from evidence gathered by the tax administration like what or from who taxpayers buy or to whom they sell, etc.

3.1.7. *Attributes needed in integrated tax administrations*

Some tax administrations are integrated with other government services, particularly customs or social security aspects. In those cases, it is desirable that a single Taxpayer Registry be managed with attributes specific to the corresponding needs. As an example, instead of having a specific registry for authorized customs brokers, a set of attributes could be put in place to identify a taxpayer that is also an authorized broker during a certain period of time.

Some of these measures might be considered extreme for some countries. For others, it would be very natural. It depends on the cultural and political environment of each country and tax administration. Once basic legislative and regulatory measures are implemented, the administration can compulsory deregister or suspend the entity's TIN that is not operating at the informed tax domicile or not filing returns according with its obligations. This action should be accompanied by much publicity to discourage future infractions.

For regularization of past situations, we suggest:

- Prioritize the search and contact of taxpayers most recently identified as non-filers. Among them, focus on the most economically important, considering annual turnover.
- To reduce the list, make efforts to get third party information: registry of companies; Motor Vehicles Registry; real estate transactions; E-commerce; etc.
- Advance step by step, for the remaining periods. Stop when the results do not compensate the effort. Deregister massively.
- Persevere. Make a routine search and contact of non-filers each month.

As a final lesson, do not allow an inflated registry to prosper!

3.1.8. *Tendencies*

There is a growing demand for the provision of better services to the taxpayers. Registering at the tax offices and getting a TIN maybe a cumbersome process, causing unnecessary difficulties to carry it out. Registration at the corporate registry, at the tax and social security offices are part of a larger process of starting a business, including getting corresponding city permits, publication of incorporation notices, paying fees, etc. There is an effort, perceived globally, to reduce the time and cost of starting a business. It is expected that these measures energize the private sector, benefiting individuals and the countries' economies as a whole.

Some measures adopted in various countries to respond to the fast track requirements are:

- Creating a “one stop shop” where it is possible, to register a new entity and get a company number, a TIN, a Social Security Number also city license, fire department, health license, etc. For this, it needs:
 - ❑ It demands a lot of involvement and negotiation between offices and agencies of different government levels. The adhesion of an institution to a “one-stop shop” is voluntary.
 - ❑ Needs government support, strong leadership and political will to implement it.
 - ❑ IT resources, including own databases, for each of the offices involved.
 - ❑ Depending on the type of business, some of the applicants will not get their licenses on the spot (firecracker factory, gas station, restaurant, etc.). They may need physical inspection before approval.
 - ❑ Minimum of documents. Requirement to notarize the documents depends on the cultural environment.
 - ❑ Minimum of forms to be filled out, all available online at the “one-stop shop” site. Also, it is convenient to fill out a preliminary online form informing type of entity; economic activity (city zoning laws); and proposed business name (companies' registry) to get approval before filling out the required forms.
 - ❑ Most ambitious form: the entity has the same number across all the registries in different areas.
- Implementation of a mostly online system that integrates registration at company's registry, state and federal tax administrations and the process of obtaining city authorizations. Every form is available online; only at the end the applicant goes to the registry of companies to obtain the registrations he has applied for:
 - ❑ Demands at various government levels are like the one-stop-shop.
 - ❑ Although the system is integrated and centralized, requires partial and unique systems implementation at many offices. Difficult to develop and implement. Difficulties increase when a higher number of government areas participate in the system.
 - ❑ The use of blockchain technology is likely a better solution to implement this vision.

- Rationalization of internal procedures: streamlining the process and allowing registration, updating registry data, deregistering and voluntary suspending registration by filling out online forms.
 - ❑ It is a safe procedure, if there is third party information to validate the forms data (registry of companies' database, birth records, utilities database, national ID database).
 - ❑ If third party information is not available, the administration should require the attachment of documents, certified or not, depending on cultural environment or the presence of the taxpayer at its office to finish the registration process.

3.1.9. Additional comments

Also perceived globally are the efforts for legalization of informal business and stimulation of the growth of small business. One important measure is the creation of entity types like Individual Business, or Limited Liability Individual Business. They have privileged treatment in relation to other taxpayers, having simplified tax treatment and significantly lower taxes than individuals with the same income. These entities are registered at an official registry and get their business TIN at the tax administrations offices, if the registry and tax offices are not working together. The individual TIN is used only for income tax purposes.

Another tendency is to increase the communication between third parties, receiving files or accessing databases from the registry of companies, civil register of national persons, and/or social security, that could validate or complement the data sent by the taxpayer on registry forms. Information from the judicial system on money laundering or from real property registries can also help the tax administration detect unregistered individuals and entities.

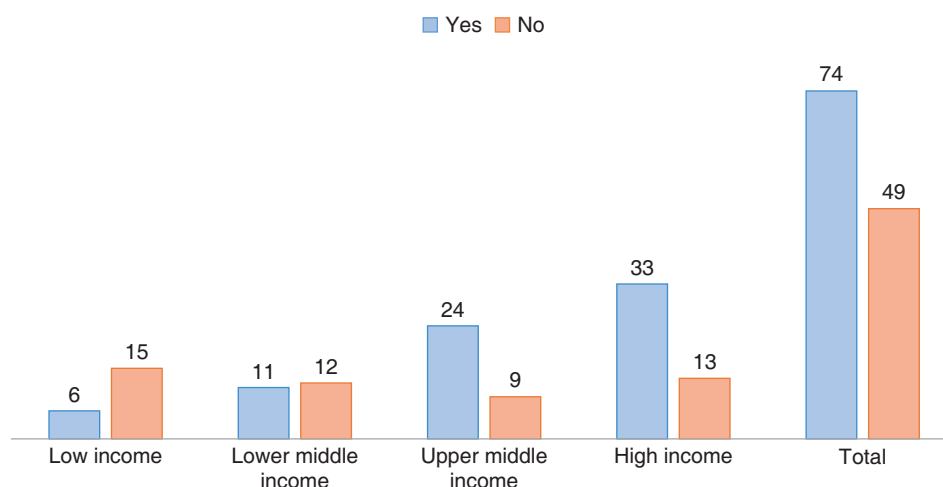
3.2. Electronic tax domicile and communications to the taxpayer

3.2.1. Introduction

The incorporation of the Information and Communication Technologies (ICT) to the processes for complying with tax obligations is an opportunity for improving the performance of the tax administrations that should be taken advantage of.

The electronic filing of returns and self-assessments is already a reality in numerous countries. Likewise, the use of electronic means of payment of tax debts, through the banking system and other means, is of general use.

In this context, according to data obtained from ISORA, electronic communication systems ([Chart 3.2-1](#)), digital electronic mailbox used to maintain contact and a working relationship with the tax administration is commonplace in many countries (74 countries versus 49 which do not have available such benefits).

Chart 3.2-1 Digital electronic mailbox for communicating with taxpayers

Source: Prepared by the author with data from ISORA (2017)

In this sense, the possibility of sending notifications via electronic means to the taxpayer's electronic domicile is a new opportunity to continue advancing in a sphere wherein the interest of the tax administration in improving voluntary compliance with the tax obligations fully coincides with the taxpayers' interest in incurring in the lowest possible costs in compliance with said obligations.

3.2.2. Tax notifications

A quick review of the tax codes of Latin America and Spain will show the importance of notifications for the effectiveness of the tax administrations.

By way of example of what is found in each country's regulation, we can look at the regulation proposed by the CIAT Tax Procedure Code Model (2015) which covers, among others, the following matters:

- The obligation of the administration to notify taxpayers the resolutions and acts that affect their rights and interests, in such a way that the effectiveness of its acts is conditioned to making notifications.
- The requirements that the notifications must meet in order to be valid are: complete text of the act; indication of whether or not it is definitive; actions that need to be taken; and, official body or entity before which to file said resources and deadlines.
- The effects of defective notifications.
- The means whereby notifications can be made. In any case, they should allow for having evidence that it has been received, date, identity and contents of the notified act.

- Forms of notification: personal, by mail, official document, appearance, notice boards, edicts and electronic notifications.
- Site for notifications: the tax domicile registered by the taxpayer or any other specially designated.
- Persons with legal rights to receive notifications.
- Proof of the notifications.

In brief, in the legal systems of Roman-Germanic origin, there is a whole panoply of rules in relation to administrative and tax notifications, whose effectiveness and validity depends on the compliance thereof.

3.2.3. *The tax domicile*

The rules that govern the practice of notifications provide for the place to which they must be addressed. Thus, for example, the CIAT Tax Procedure Code Model proposes that notifications be sent to the taxpayer's domicile. In general terms, it shall be the place of his residence or where he carries out his activities in the case of individuals and, for corporations, it shall be the main office, the management headquarters, physical address, or where the economic activity is carried out.

Likewise, this type of rules regulates the taxpayers' obligation to inform the tax administration the domicile and its changes, as well as the power of the administration to rectify the domicile and being able to consider valid for all purposes, the latest domicile declared.

The interpretation and practical application of these rules has given way to a huge number of litigations regarding the validity of the notifications made. In turn, they have generated a broad jurisprudential doctrine on this issue.

We cannot disregard the demographic and geographic reality of the developing countries where there is an alternation of megacities –with millions of inhabitants- and large inhabited geographical areas of difficult or impossible access. To this, one must add that, in many cases, there is no urban or rural nomenclature –precisely due to these circumstances– thus rendering it even more difficult and costly to make or serve notifications.

All this leads to a considerable use of notifications via edicts, through the publication of summaries in newspapers or official gazettes and the display of lists in the tax administration offices.

In addition, if we could calculate the cost for the tax administrations involved in making notifications through its own staff, with hired staff for such purpose or paying for the public or private mail services, most certainly the amount spent is far from negligible with respect to the total operating expenses of a particular administration.

3.2.4. *The creation of tax mailboxes: electronic tax domicile*

There are enormous benefits provided by the ICTs (in terms of cost savings, increased effectiveness and efficiency for the administration and improvement in the guarantees of taxpayer rights). Thus, this calls for exploring and implementing new forms of communication with the taxpayer that may be easy to implement with the less legal determinants of the notifications (as it occurs in the *common law* countries).

In this sense, ICTs offer the possibility of simplifying this process within a framework of maximum legal guarantees. That is, through the creation of an **electronic domicile** at the virtual office of the tax administration through the Internet or other mobile applications. In essence, the electronic tax domicile is an authorized electronic address that carries all the legal elements of the taxpayer's "place of abode."

In order to have full legal guarantees of confidentiality, integrity and identity, as well as non-rejection regarding knowledge of the acts thus notified, this electronic tax domicile is essentially different from the usual electronic message addresses, even though they are registered in the tax administration.

Therefore, the proposal is to create a "**Tax mailbox**" at the virtual office of the tax administration wherein an **electronic tax domicile** – or electronic address – would be established. Additionally, one may incorporate **added services** regarding taxpayer communications. For example, the sending and making available notifications in the Mailbox or authorized address may be complemented with a "**notices system**" by means of instantaneous messages, SMS, normal electronic mail or similar ones. These notices will alert the taxpayer of the arrival of new documents or the existence of notifications pending confirmation.

The mailbox facilities would consider the possibility of looking for all administrative acts or other documents that have been received within term ranges, fiscal periods, represented obligations, type of administrative act, related processes or person responsible for confirming receipt (e.g., in the case of corporations or authorized delegates or representatives).

In special processes requiring proxies on the part of the taxpayer, the mailbox will provide a special domicile for the specific use of a particular process. In this case, the special mailbox shall be managed by the proxy authorized by the taxpayer, regardless of the fact that the taxpayer may always consult the documents placed in the mailbox by the tax administration.

On the other hand, it may include specific facilities for consulting possible notifications by means of edicts or groups, which may affect the particular taxpayer. Ideally, the tax administration should include in these search facilities, the documents notified by edicts prior to the introduction of the electronic domicile.

Likewise, it may include capability for the receipt of messages and notices from the tax administration, and they could be of an informative nature, whether general or adapted to specific taxpayer segments. The information received could be: expiration of time a period to comply with a specific requirement; opening of a time period to make payments; processing of certain regulations; entry into force of new provisions; extension of time period to complying with new tax forms; and, others.

3.2.5. *Key strategic decisions*

It is important to reflect on some key strategic decisions for the implementation of an electronic mailbox.

First of all, one must decide, given the situation and characteristics of each country, whether the tax administration implements this system in a private or exclusive manner for the relationships of the taxpayer with the tax administration or, on the contrary, whether this mailbox is implemented within the framework of the state's general digitalization strategy. The tax administration is an essential pillar of the state's action, but it is not the only one. Multiple state and governmental services could also take advantage of these applications. To a certain extent, this conditions the technical requirements and the development of the benefits of the mailbox and electronic domicile. However, this decision should not be an obstacle to its implementation.

Secondly, and within the sphere of action of the tax administration, it is necessary to determine whether the authorization or assignment of the electronic domicile will be obligatory for all taxpayers or for specific segments. Or, whether it will always be voluntary for those requesting it, or mixed systems are used wherein both situations may coexist.

In international practice, the electronic domicile is obligatory for corporations, large businesses and for those who are already required to file tax returns electronically. However, it is voluntary for wage earners and taxpayers having an occasional contact with the tax administration.

In any case, the regulation must be clear in this respect, it being also possible to establish “incentives” in the regulation (for example, extension of terms) to favor electronic notifications.

In the same way and from the standpoint of the regulation governing this subject, there should be a clear rule on the effects of failing to open the notifications sent to the electronic domicile and the time it is understood that the notification has been made.

The experiences with electronic tax domiciles in Latin America and Spain afford different solutions for considering key issues in this respect. In the case of Brazil, a taxpayer entity is considered notified on the fifteenth day following processing of the notice. In Spain notifications are considered as having been made if within 10 calendar days the electronic tax domicile has not been accessed.

In any case, regardless of the existence of common elements, the fact is that the regulation regarding the electronic mailbox or authorized electronic address, as well as the notifications via electronic means shall provide different juridical solutions, in accordance with each country's characteristics and juridical resources.

3.2.6. *Basic characteristics of a communications and electronic notifications system.*

The proposed tax mailbox would involve an authentic system for communicating and notifying the taxpayers with all –or part- of the following elements:

Table 3.2-1 Characteristics of an electronic notification system

Characteristic	Description
Electronic Tax Domicile (ETD)	<p>Assignment of an electronic domicile in the Tax Mailbox, either obligatorily or when the interested party submits a request.</p> <p>Authentic communication to the interested party of the electronic domicile or address.</p> <p>The domicile shall be associated to the regulated system of notices via SMS or other mobile telephone applications to the number of the mobile/cellular telephone or device indicated in the application or via electronic mail (regular e-mail) to the personal electronic mail address indicated in the application.</p>
Location of the Electronic Tax Domicile and Tax Mailbox	<p>The tax mailbox as well as the electronic domicile are located in the Virtual Office of the tax administration in the Internet or other applications that may be developed in the future (for example, an App in mobile/cellular telephone)</p>
Authentication for access	<p>TIN (Tax Identification Number)</p> <p>User: Unique alphanumeric or assigned name by the tax administration – at the time of enrolment in the TIN or subsequently.</p> <p>Password: personal and non-transferable for accessing the electronic domicile.</p> <p>Digital certificate of the system's user, when available.</p>
Electronic notifications in the electronic domicile (E.T.D.)	<p>Copy of the document corresponding to the resolution in PDF or, as appropriate, the electronically generated document to be notified.</p> <p>Indication of the appropriate appeals.</p> <p>Entity or official before whom they can be filed.</p> <p>Term for filing the appeals.</p> <p>Certification proving the identity and integrity of the digital copy of the Document to be notified or the electronically generated document.</p>
Acknowledgment of Receipt	<p>Electronic certification of the date, time and day, user, device and IP of Access to the digital copy or document deposited.</p> <p>Electronic certification of the date on which the copy of the act to be notified is deposited in the electronic domicile.</p>

(continued)

Table 3.2-1 Characteristics of an electronic notification system (*continued*)

Characteristic	Description
Tax Mailbox	Shall include the assigned Electronic Tax Domicile. In addition, all the taxpayers registered in the Taxpayer File having a TIN, user and password for accessing the Virtual Office (of the tax administration web or other applications that may be developed in the future) may access the Electronic Mailbox. The latter shall include by way of information all the notices and communications, which the tax administration may make, in order to facilitate to the citizens, the knowledge of the acts and resolutions issued. Likewise, the Mailbox may include personalized information regarding specific tax obligations that may affect the aforementioned taxpayers.
System of Notices associated to the electronic domicile	<p>The tax administration may send either SMS messages to the taxpayer's registered mobile/cellular telephone, or else a message to the message application or electronic mail designated by the taxpayer informing that a notification has been deposited.</p> <p>The SMS message or that sent to the electronic mail will be reiterated for X calendar days or until accessing the digital copy or document made available, whichever occurs first.</p> <p>As appropriate, an SMS notice message or message via mobile telephone applications will be sent. It will inform that the electronic certification of the X days elapsed since making available or depositing the digital copy or PDF of the notified act or the electronically generated document, has been sent to the electronic mail registered in the application, without there being access to the virtual office of the web or other applications, for proving rejection of the notification and, therefore, of its effectiveness.</p>
General communications	<p>The tax administration may implement in general for all taxpayers registered in the tax administration and having a TIN, user and password, a general Communications and Notices System, in order to notify via SMS, messages through other mobile telephone applications or messages to electronic mails that a Notice has been sent to his electronic Mailbox informing of tax procedures, collection notices, etc.</p> <p>Likewise, one may include in said mailbox communications regarding the taxpayer's calendar, information on recent regulations, reminders, etc.</p> <p>In addition, an alerts system may be implemented via SMS, to mobile telephone services and messages to electronic mails regarding the existence of personal notifications.</p>
Publication of Edicts	By way of information and for purposes of facilitating knowledge to the taxpayers of notifications made through Edicts, one may insert in the tax administration web, the edicts that are periodically issued and which will be kept for at least 6 months after being placed in the tax administration's bulletin board. It is possible to establish a search engine so that the taxpayer through his TIN may know whether he has been notified by means of edicts.

Source: Prepared by the author

3.3. The problem of taxpayers' identification

The problem of correctly identifying a taxpayer has reached a new qualitative and quantitative dimension. This is a consequence of the demand of tax administrations for information on electronic invoices² in many Latin American countries, or of invoice registration systems such as the Immediate Supply of Information system (SII) in Spain, for access with *crawlers and scrapers* on the Internet for downloading data necessary for the control of the collaborative economy, and with the increase in international transparency (Foreign Account Tax Compliance Act - FACTA, Common Report Standard - CRS, Country by Country Report – CBC Report) that requires the exchange of information between countries with different forms of identification of their citizens. Tourism and globalization have increased the problem. A few years ago, the issue was to identify hundreds of millions of data. Currently, we need to identify billions of data in very short time periods.

During the year 2019, and to prepare the pre-filled draft tax returns for the individual income tax of the Spanish taxpayers, the State Tax Administration Agency (AEAT) has received 464,178,746 records in 12,479 massive returns. This corresponded to: 15 forms (withholding on individual income, returns on financial products, subsidies, etc.); 35,543,350 records for the main tax return form; and, the SII system has registered more than 180 million invoices per month.

Traditionally, the information received a basic format validation at reception, and was subsequently processed. In the second phase, the identification and detailed control was performed on the values in the boxes to detect any errors or inconsistencies. The result of the process was communicated to the interested party, who had to resend and rectify the information of those whose identification was wrong, usually their clients. Occasionally, after successive attempts, part of the information remained stored as “unidentified”.

Today, in a world adapted to the Internet culture, the taxpayers require immediacy. Via the ministerial order HFP / 231/2018, the possibility of providing information on magnetic media has been removed and, for the first time in 2019, a real-time identification of the massive information transmitted to the AEAT via the Internet took place, using an innovative platform to process the data in memory, reaching an admission output of 140,000 records per minute. This approach has forced to increase dramatically the quality of the identification. The immediacy has exacerbated the difficulty of the task.

The data provided by a taxpayer on himself are immediately and absolutely associated with his TIN (Tax Identification Number). When the data are attributed to third parties or obtained on the Internet, the linking is not assured. In many circumstances, the taxpayer under obligation to inform is not bound to verify or cannot verify his customers' data, and in other cases he makes mistakes.

From the identification perspective, the person who supplies an information to the tax administration provides a code (usually with a control digit created to avoid typing errors) and a name or business name, associated with the data presented (the information identification). In Spain, the algorithm for obtaining the digit control of the Tax Identification Number is shared with the

Ministry of Interior and is public. It is possible, therefore, to create a dummy code using a string of numbers (e.g., 11111111), to seek its control digit on a public page and obtain the letter H and use the combination 11111111H, associating it to a name, “Ignacio González García,” to submit a statement or impute certain data.

That is why the Administration should test the combination 11111111H+ Ignacio Gonzalez Garcia against their census in the best way possible and reject the information, if applicable. In this case, the detection of the error would be easy because of the difference between the delivered combination and the correct combination. However, in other cases, it is not so easy to resolve the matter.

- Wrong codes can occur, such as the 11111111R, which is easily rejected.
- Some codes are correct but associated with a name with typos. For example, Ignacio M. Gonzáles Gonzalz.
- Altered names, *for example*, Mr. D Igancio Gonzalez Gonzalez.

For this reason, and as a preliminary step, names must be “cleaned” to remove the dots, commas, capital letters, accents, blanks, double spaces, restore standard abbreviations, remove irrelevant words like “of”, “the“, and abbreviations like “H.E.”, “Esq.”, “Mr.”, “Spouse”, etc. Finally, we must perform the phonetic transcription of certain characters. For example, “h” letters are eliminated; “k” letters are replaced by “c-”, etc. The task is more laborious when information is obtained with *crawlers* and *scrappers*, which is necessary for control of the collaborative economy.

Sometimes, the errors are caused by the taxpayer and we should not place an unfair burden on the third-party reporter. This happens when the interested party, who knows that the data will be delivered to the administration, alters part of his name, for example, to include name abbreviations. For example, it includes the first name correctly, alters the second and invents a tax identification code because the algorithm for calculating the verification code is public. Internet platforms have no way of verifying it and other filers can make mistakes, transferring information that is partly erroneous.

All these circumstances place the tax administration before a decision problem. If misidentified data are accepted in order to not interfere with the speed of entry, for example around 3% of 750 million, the volume of data received in Spain in a month would create 21 million of erroneous data, which would cause an outcry of indignation among those falsely charged. If we try to debug them, contacting the approximately 12,000 presenters, this would be almost impossible, and very expensive, to resolve all the issues in one month.

If errors were reluctantly accepted, all of these data could remain without being attributed to the corresponding taxpayer, and possibly causing that millions of tax returns be proposed to taxpayers with errors, all to the detriment of the tax administration.

3.3.1. The implemented solution

There is a tendency to think of mathematical solutions or advanced analytics as useful only when it comes to detecting fraud. Their use by companies such as Google or Facebook makes it clear that they can be used for other issues, including for taxpayer service.

In order to solve *identification* problems, it is necessary to develop systems that detect *similarity* well, as do facial recognition tools, which recognize a face, even if the hairstyle has changed. In our case we don't need to look for similar faces but for similar texts. It is necessary to assess the similarity between a *pattern* - the name and code known by the administration of a taxpayer, the face that is in the database of passports - and *the name* - the combination of code and name transmitted by a third-party informer.

Two faces may differ for different reasons: 1) because the traveler has gained weight; 2) the traveler wears a hat that day; or, 3) because they smile or not. If there were one sole reason for the difference in the declared name and the pattern, then it would be enough to use an algorithm, regardless of how complicated it might be. However, it happens that the causes are multiple and different so the AEAT uses a system with 6 different cascaded algorithms, each based on a different principle. For each one, a threshold is defined, so that if it is matched or exceeded, the identification is accepted.

The created solution

The system created combines algorithms based on three different philosophies: **Layer 1:** Monge_Levenshtein, Monge_Elkan_Trigram and Monge_Elkan_Bigram; **Layer 2:** Trigram and Compara; Layer 3: TF-IDF.

The names are not relevant and are only useful for the specialists in this field.

The principles on which the idea is based are very simple and we analyze them below. The reader interested in algorithms can consult (Gonzalez & Mateos, 2019).

3.3.2. History and development

During the last century, when the identification process was carried out in mainframes, the AEAT used an algorithm (COMPARA), developed in a language called PLI to be executed in massive batches. It allowed to treat as input the "Tax_identification_number+Surname/Name" or "Tax_identification_number+ 3AnagramLetters". In addition to the name, it used supplementary information, the anagram, formed by four digits extracted from the names and previously delivered to taxpayers in identification labels for easy identification. It contains routines that purify the data by eliminating commas, spaces, double spaces, eliminates dots and capital letters, eliminates irrelevant words such as articles, courtesy treatments (ex: Sir, Honorable), replaces Basque and Catalan names with their Spanish equivalents and performs a pseudo transcription of Asian names. This process

of previous preparation is equivalent to that which, in face recognition, asks the traveler to remove his hat or place his eyes at the proper height and look at the machine.

Later, already using servers and programming in Java, new algorithms were added. The first was a Java implementation of TRIGRAM (3-gram). An n-gram is a sequence of words and a bigram is a 2-gram [1]. The underlying philosophy is that two strings are very similar if they have many n-grams in common. The idea is simple: to see if there are many similar pieces. To check the similarity between PEPE and LEPE, with 2-gram they are cut into pieces, PE, EP, PE on one hand, and LE, EP; PE. If all the pieces are different, value is zero and if all are equal, the value is one.

Their implementation is now a standard.³ There are dozens of similar ideas. Some of them work with tokens instead of with complete strings, others are sequence based that try to find the longest sequence, which is present in two strings, others are editing distances that try compute the number of operations needed to transform one string to another, etc. Gomaa & Fahmy (2013) has studied the main solutions to the problem of *similarity of texts* but did not deal with the effectiveness of the different alternatives whilst Gelbuck (2017) has edited a text that compiles the existing bibliography on different similarity metrics.

No single metric is the best to see if two strings are similar, because each one can be most appropriate in certain situations. Measurements oriented to typefaces, comparing raw strings, are good to recognize typos, but if you want to find out if a text is plagiarized, metrics based on tokens (words) are superior. In *name-matching*, combining the above with TF-IDF is useful [6]. It seems reasonable to use a solution that combines more than one tool.

Moreover, AEAT had built a warehouse (data storage) in which transactional data were deposited, each with the due periodicity.

A multidimensional analysis system is used for many purposes. The most general is to answer by delivering all the information that meets certain conditions. However, sometimes the user has only partial information on what he or she wants. Suppose we want to identify the TIN of a taxpayer that is known to be male, with income close to 24,000 euros, who lives in Madrid, has children and an account at BBVA. The search is characterized as follows:

$$Y_1 = \text{male}; Y_2 \cong 24,000; Y_3 = \text{Madrid}; Y_4 > 0; Y_5 = \text{BBVA}$$

The system should return the TINs of the best candidates with a similarity score between 0 and 1. The problem is similar to asking the system and presenting a photograph, “Who are the most similar subjects who have passed through the control?”

One solution was built using TF-IDF (Term Frequency - Inverse Document Frequency), which is a concept used in the Theory of Information Retrieval and belongs to the *edit distance* family. The TF-IDF pair are two numerical values used to quantify the importance of a word in a document. TF

measures how many times a particular word appears in a document and IDF measures if the word is rare or not, within the document. For a term t in a document d , the weight $W_{t,d}$ of the term in the document is given by $W_{t,d} = \text{TF}_{t,d} \log(N/\text{DF}_t)$. Google has been using the product $\text{TF} \cdot \text{IDF}$ as a factor for sorting and there are evolutions such as TF-IDF-AP that consider the position of the word.

As we have seen an *edit distance* is the minimum number of editing operations with a single character needed to transform one string in another. This is one more option among many: Hamming (1950), Levenshtein (1965a), Damerau (1964), Needleman & Wunsch (1970), Jaro (1989, 1995), Winkler (1990), Kondrak (2005). In addition to these *resemblance coefficients*, there are measures based on token (words) and combinations of both. Monge & Elkan (1996, 1997) proposed one of these hybrid solutions.

A solution was developed by using the ideas developed in Chen, J., Chen, C., & Yi (2016), Bafna, (2016), Gautam & Kumar (2013) and Prasetya, Wibawa & Hirashima (2018) that combined the experience in TF-IDF with other ideas.

The electronic invoice problem

The need to process e-invoice information in the framework of the SII system required to introduce changes. It was necessary to achieve a higher quality, since when processing 180 million records monthly, a similar percentage of errors or unnecessary notifications to taxpayers is not acceptable, and it was necessary to process in real-time. The problem needed to be better understood. While for detecting plagiarism, medium-length phrases are sought in long texts, the problem in the case of identification in invoices must be solved using subtle differences in short texts.

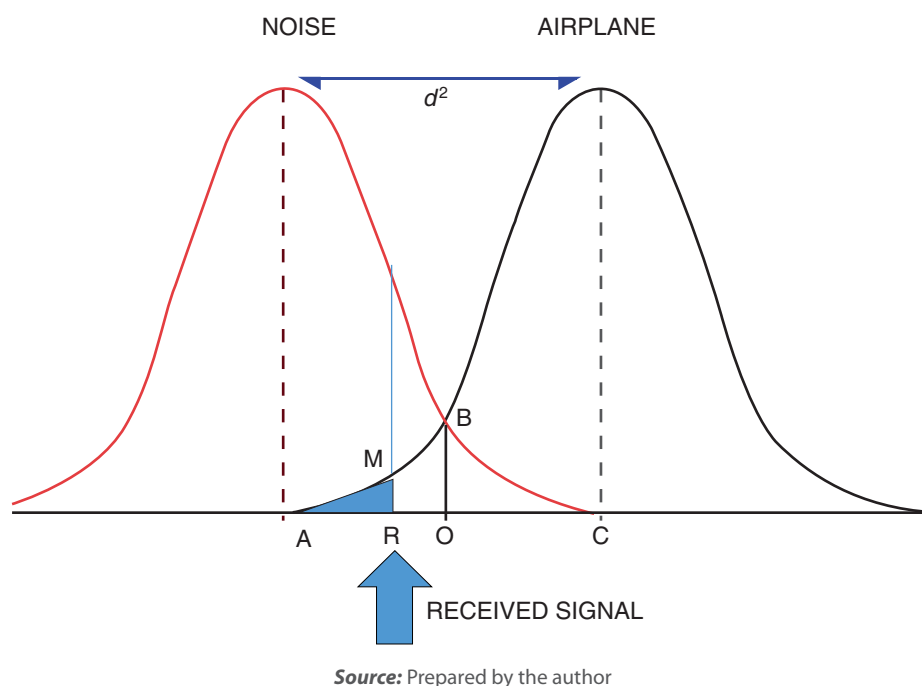
In most cases the similarity among names and surnames is high, which carries the danger of false positives. Take for example, the two names Ana Gonzalez Martinez and Eva Gonzalez Martinez. The difference between the two strings is very small. The system for measuring it cannot be the same as the one used to see if someone has plagiarized paragraphs in their doctoral thesis. In the information supplied massively by merchants in the Immediate Information System of SII, the data are not false but incomplete. Each person has, in the general case, two first names and two surnames, but in many cases only two or three are communicated. Are they both surnames? Is the order correct? If the merchant only knows that his client's name is Juan Martinez and the TIN, he cannot provide more. It would be an unnecessary inconvenience to ask him for a modification and to send again the registry.

3.3.3. The construction of a solution

Once all the similarity measures are available, we need to know what to do with them, to decide whether to recognize the traveler, or not. There is always the possibility of accepting false positives or false negatives. In our case, a false-positive lead us to accept an error as valid, imputing the data to someone who it does not correspond, and a false negative lead us to lose, being prevented from using the benefit of the data. The branch of mathematics that deals with this problem is the Signal Detection Theory.

The idea that was used is explained in [Figure 3.3-1](#), with a diagram based on the Signal Detection Theory (Spackman, 1989), which is widely used in perceptual psychology. Let's suppose that we have a radar to avoid collisions between aircrafts. Based on [Figure 3.3-1](#), a signal, R, is received and it belongs to the left curve, which is a noise. But it could happen (though unlikely) that it is in fact an approaching aircraft. When making the decision not to change course, we assume that there is a likelihood of a dangerous approach that must be evaluated against the overwhelming probability, on the left side, that it is really just a noise. If we don't do this, we would have to change course at any time and the flight would be a nightmare. For each problem, as in medical testing, we must assess the costs of false positives against false negatives.

Figure 3.3-1 Tuning of the thresholds



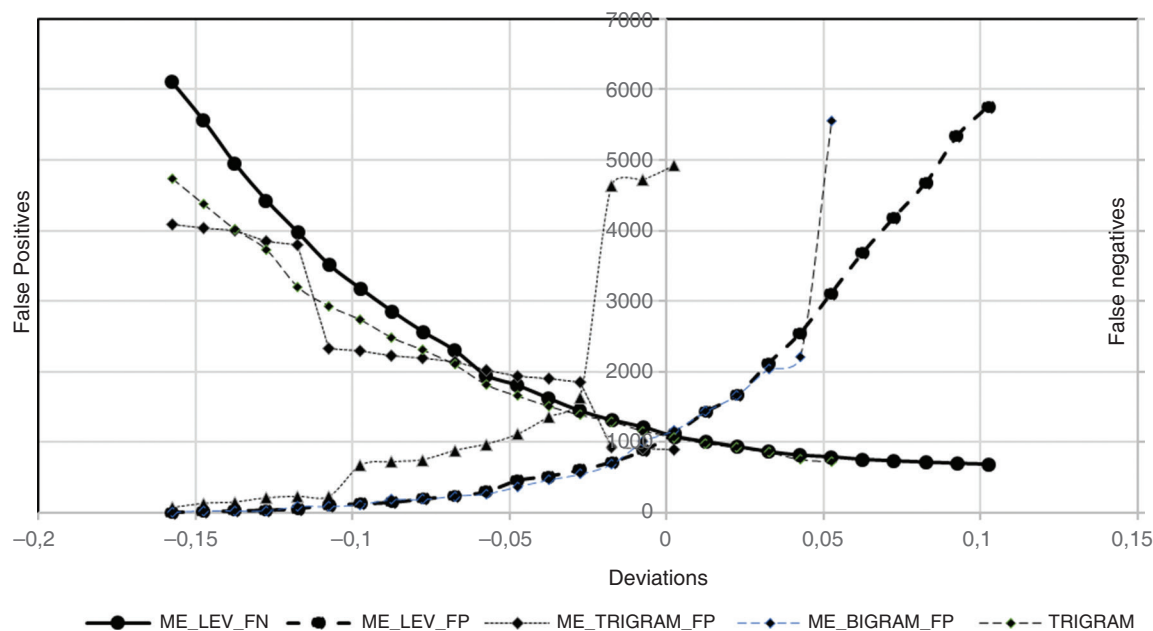
In our case, we must also decide whether the received signal must be accepted or not.

[Chart 3.3-1](#) illustrates the elaborate curves that show the percentage of false positives and false negatives for each type of metric obtained in the analysis. It was created by experimentation in AEAT's Department of Informatics, with a file of 68,999 records developed by experts with real data and selecting all possible cases (e.g., very common surnames, names of men and women, from different parts of the country, etc.), and verifying in each case the similarity that calculates the metric and if the data was basically correct. It is, in short, a supervised calibration of the system.

In the X axis are presented the distances relative to the intersection point (curves of false positives and false negatives), equivalent to point B of [Figure 3.3-1](#).

The ME_LEV_FP (Monge Elkan_Levensthein_FalsePositives) curve begins at point (1) with 6,098 false positives and 1 false negative. The intersection of the curves occurs at the point with threshold 0.5575, and all metrics have been rescaled. It can be seen that when the Monge Elkan metric is used as a measure of interior similarity the curves are smoother.

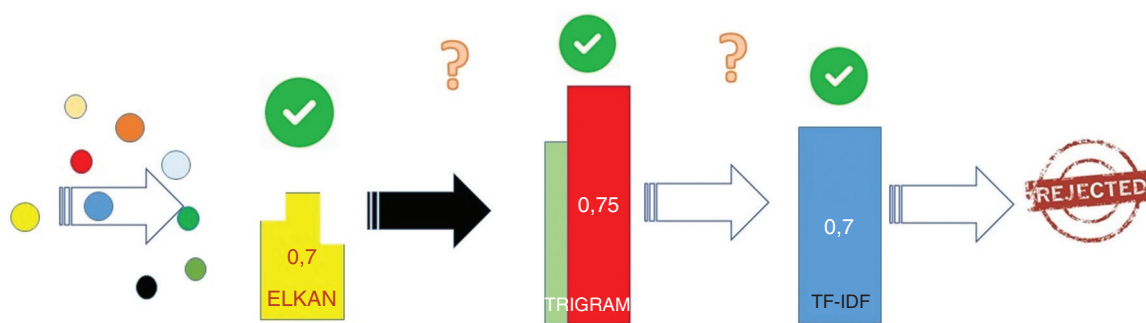
Chart 3.3-1 Errors by threshold type and metric



Source: Prepared by the author with data from the AEAT

The last step is to adjust the system. Let's think of a medical case. In the case of a patient with fever and sore throat, it would be necessary to know whether or not his symptoms are similar enough to a cold. If yes, for example, if the similarity is 0.9 you must accept that he has it and treat it as such, but if it is lower, for example 0.6 you can think that he has mononucleosis and you should double check. If new tests, built based on other principles, yield result very similar to this one, that is a cold, for example with a similarity of 0.8, it will be treated as such, but if this is not the case, it would be necessary to test with another filter.

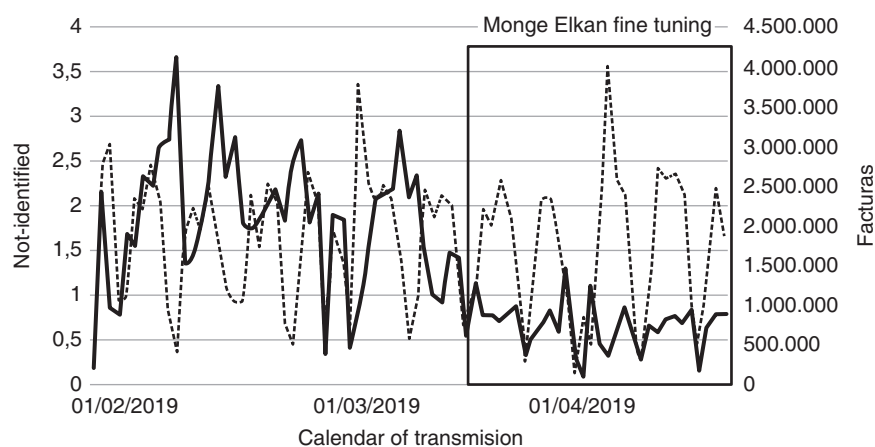
It is important to decide the correct order of the filters, to avoid making useless tests on many patients, then to establish the appropriate thresholds and decide about the number of decision layers.

Figure 3.3-2 Decision layers

Source: Prepared by the author

This was the task undertaken by the AEAT. [Chart 3.3-2](#) shows the evolution of the process in successive days from March 3, 2019 to March 13, 2019, with the COMPARA threshold (in our example of the patient with a cold, the simplest) was adjusted to 0.7. From March 14, 2019 to April 18, 2019, the thresholds of the first layer were reduced, allowing more records to pass to the later ones. This was optimizing the decision in the first layer, identifying incomplete *names* with codes and reserving the gravest errors (mononucleosis) for later layers.

It shows that the percentage of unidentified (rebel diagnosis) continuously decreased from more than 3.5% to less than 0.8% when the total structure of layers was adjusted while maintaining a “throughput” of more than 4 million records processed per day.

Chart 3.3-2 Adjustment Process

Source: Computer Department Data (AEAT)

Currently, the Layer 1 implements Monge-Elkan_Levenshtein (75%), Monge-Elkan_Trigram (66%) and Monge-Elkan Bigram (75%). The second implements Trigram (50%) and Compara (705) and the third implements TF-IDF (70%). The call to Java classes is done sequentially and in this specific order.

The quality of service has improved drastically. In the monthly processing of electronic invoices, more than 180 million have been processed and it can be estimated that on average the number of erroneously treated cases has been reduced by 5,370,000 per month.

Notes

2. For more information, see: <https://www.ciat.org/la-factura-electronica-en-america-latina>
3. For more information, see: <http://sourceforge.net/projects/secondstrings/> or <http://sourceforge.net/projects/simmetrics> or <http://geographiclib.sourceforge.net>

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4. TAX RETURNS, PAYMENTS AND REFUNDS PROCESSING

Some processes need to deal with all taxpayers and all their interactions with the tax administration. There is no option to select a fraction of the tax returns that need to be processed, or a fraction of the payments that must be collected and posted, or a fraction of the refunds requests that need to be analyzed and be eventually approved or rejected. As opposed to, for example, audit, selection of cases to act upon based on risk assessment, is not an option. This chapter precisely covers those processes that are, in general, transaction based.

The chapter is divided into five parts: returns processing, payment processing, tax collection, refunds processing and current account. Each part is based on actual implementations and good practices and highlights the usage of information technology (IT) to support those processes. The separation of topics in this chapter does not necessarily promote an organizational structure based on a division of functions. It just reflects the need to cover those processes as a mandate for the tax administration and can in fact be assigned to different sections or subsystems within the tax administration that coincides with the strategy and organizational culture.

4.1. Dealing with Tax Returns

4.1.1. Definition

Many taxes require taxpayers to file a tax return that describes various aspects of their income or commercial activity in order to establish the taxpayer's tax liability. The ability of tax administrations to process tax returns in an efficient manner is crucial to ensure taxpayer compliance with their tax obligations. Generally, taxpayers are enrolled for a given tax before they are required to file returns on a periodic basis; in such instances, taxpayers are expected to file even if they have no activity to report on for the period in question. However, some taxes may require taxpayers to file (and remit payment) on an ad-hoc basis only when certain activity occurs, for example if the taxpayer happened to withhold an amount during a period in question, whereas this occurrence is not normally part of their usual activity. Tax administrations should closely monitor the return filing process as it's generally a good indicator of how compliant the taxpayer population is in various areas of taxes.

4.1.2. *Relevance to the taxpayer*

The filing of regular tax returns by taxpayers is a firmly entrenched practice within tax administrations. Once taxpayers enroll for a declaration-based tax, they are expected to file returns periodically, be it monthly, quarterly, annually or any other frequency. One of the main indicators of compliance within a jurisdiction is the proportion of taxpayers who file tax returns and remit payments by the due date. Accordingly, a high incidence of late-filing and non-filing is an indication of either deliberate low compliance, of broken tax administration processes, or both. In general, taxpayers try to comply with their tax obligations. However, overly complex filing processes including the use of return forms that are unnecessarily complex may hinder voluntary compliance, especially among smaller taxpayers who may not have the knowledge or resources to navigate complex processes or return forms. The tax administration should consider a broad range of taxpayers and taxpayer sizes when designing business processes for return filing.

4.1.3. *Relevance to the tax administration*

Timely filing is considered to be one of the four main categories of taxpayer obligations (OECD, 2004). Tax administrations should pay close attention to the return filing process and filing rates. A relatively large percentage of late returns or non-filers is indicative of problems – these may be related to voluntary non-compliance, but it is often the case that other causes may play in part as well. For example, a high level of non-filers may be related to a broken registration process where many taxpayers were erroneously enrolled, where duplicate registrations occur, or where taxpayers were not clearly notified of their filing obligations. Similarly, late-filing may be related to disorganization on the part of taxpayers, but may also indicate overly burdensome filing requirements, particularly among smaller taxpayers.

From the tax administration's point-of-view, in relation to tax returns, it should aim to balance its need for information from taxpayers with the ability for taxpayers to comply. For example, requiring monthly returns from all taxpayers regardless of size may place heavy administrative burdens on smaller taxpayers. The tax administration should also take into consideration its own ability to process tax returns efficiently and effectively.

Data entry is a time-consuming endeavor that, while necessary in many cases, may not make the best use of tax officers' time. For example, requiring monthly returns from all taxpayers would significantly increase the quantity of taxpayers that have to be monitored monthly for late- or non-filing, which may overwhelm staff. Moving smaller taxpayers to quarterly filing reduces the total number of returns to monitor during the year and allows the tax administration to focus its attention on ensuring the compliance of larger taxpayers whose non-compliance would have a larger impact on revenue. A lower filing frequency will have an impact on the government's cashflow, and the tax administration should consider cashflow along with other factors when deciding on assigning taxpayers to a given filing frequency.

➤ Tax return filing frequency

Depending on the type of tax, filing frequency can range from weekly to annually, as well as ad-hoc in some cases. While some taxes may have a fixed filing frequency for all taxpayers, some taxes may have variable filing frequencies that are dependent on the taxpayer size. Notably, payroll tax and sales tax are often of a variable nature whereas income tax is usually annual, even though most jurisdictions require interim payments of income tax during the year. When considering variable filing frequencies, tax administrations may use turnover as a proxy for taxpayer size, as is the case many of the Caribbean island-states. An alternative is to review the total amount of remittances over the period of a year and determine how taxpayers would be assigned to different filing frequencies, as is the case in the United States of America⁴ or Canada⁵ presently. If government cashflow is the main consideration, then the amount of remittances would be a better parameter to consider than turnover, as some taxpayers may have high overall turnover but remit little to the tax administration.

Tax administrations should implement automated processes to monitor taxpayers and periodically reassign them to a different filing frequency if their tax information has changed. Tax administration information systems should include configurable functionality that allows the tax administration to identify taxpayers who should be reclassified and to reclassify them, and to communicate with taxpayers and inform them of impending changes reasonably in advance. The process of reclassifying taxpayers is business rules-based and, as a result, lends itself very well to automation.

➤ Design of tax return forms

The content of tax return forms is often dependent on tax legislation and tend to be as precise as needed in order to capture all relevant information that is required to make a determination of tax due. However, many of the exceptions and special cases that are handled in various sections of tax returns often apply only to a small subset of taxpayers. In practice, many of the lines and fields on tax return forms are unused by a majority of taxpayers. Tax administrations should strive to achieve a balance between obtaining the information that they need and offering tax returns that can be read and interpreted by most of their taxpayers.

As an example, several jurisdictions allow very small VAT or GST registrants to report using a simplified return where they only report supplies (sales) and remit an amount that is proportional to their reported supplies. Their input does not need to be reported but is instead estimated and integrated into the remittance rate. Within the Americas, The Bahamas⁶ and Canada⁷ both offer a simplified reporting scheme for the smallest taxpayers. It should be noted that taxpayers in most cases require approval before reverting to a simplified reporting scheme, and that the ability by the tax administration to offer such a scheme depends on the legislation.

Nevertheless, with the advent of online return filing, as will be discussed in detail in further sections, tax administrations now have the ability to offer views that are customized to taxpayers so that taxpayers would only need to view the fields and lines that may be relevant to

their circumstances. The possibility of offering more tailored returns depends in large part on the information system, and tax administrations should take the design of tax return forms into account when implementing such systems.

➤ Late-filers

A large proportion of taxpayers who file after the due date is a red flag, as it indicates lower compliance rates and may eventually translate to even more serious issues such as non-filers, or stop-filers, as they may be known as in some jurisdictions. Late-filing may have various causes, including a lack of a compliance culture among taxpayers, a lack of punitive penalties in case of late-filing, a lack of follow-up by the tax administration, or a genuine difficulty for some taxpayers to comply as required by law.

As an example, a VAT/GST threshold that is too low may require many taxpayers to register, even though they may not be disciplined or knowledgeable enough to keep proper accounting books to be able to report on time. In general, the higher rate of on-time filing among VAT/GST registrants relative to other tax types may be attributable to the fact that, due to a high threshold for registration, registrants tend to be larger and have the resources and capacity to comply with their filing requirements. Additionally, the fact that there are fewer VAT/GST taxpayers allows the tax administration to use its resources more efficiently and effectively for follow-up.

A common observation is that compliance rates in terms of on-time filing are usually relatively high at the time of introduction of a new tax but tend to decline over time. Tax administrations should monitor late filing closely, identify the causes and take corrective action before it becomes a common issue. It should be noted that late-filing's main impact is on governments' cashflow. In some jurisdictions, taxpayers are granted additional time to file their returns when requested, with the caveat that they must remit what they estimate their tax due would be, and that a late-payment penalty and interest would apply if the payment is short. In fact, where late-filing penalties are applied, they are often either linked to the amount of unpaid taxes, or are almost symbolic in nature, where the amount of penalty is rather on the low side. Tax legislation should allow tax administrations to levy heftier penalties where taxpayers are excessively late in filing or where is a noticeable pattern of late filing.

➤ Non-filers

In addition to late-filers, tax administrations are often faced with taxpayers who register for a given tax and obtain a TIN, but who either never file a return, or who file for a period of time and then stop doing so. Non-filers are a major indication of low compliance among the taxpayer population; as such, the tax administration should give particular attention to non-filers, following up with them as quickly as possible, inviting them to submit their missing return.

As the number of non-filers may be substantive and tax administration resources limited, tax administrations are faced with the decision as where to focus its resources and its attention. Accordingly, the tax administration should prioritize the list of non-filers for a given period

and decide how to follow-up accordingly. Presumably, larger taxpayers and those who are expected to remit larger amounts would be followed-up with as a first priority, with the tax administration expending significant effort to ensure that the taxpayers file and the revenue is secured.

➤ Reminders

Once a filing deadline passes without receiving a tax return from a given taxpayer, the tax administration should not delay in sending one or more reminders to taxpayers, inviting them to submit the missing return and reminding them of their obligations. With modern tax administration information systems, initial reminders can be largely automated; however, tax administrations may revert to human-based modes of communications such as phone calls whenever automated reminders do not prove effective.

In regard to filing reminders, tax administrations should monitor and collect data on how effective their various campaigns are. Some studies suggest that the content of the reminders plays a critical role in whether taxpayers will respond or not. For example, a study conducted by the tax administration in Guatemala showed that standard reminders that invited taxpayers to file were slightly effective, but those that included references to the proportion of on-time filers suggesting that the non-filer was in the minority, and those that described non-filing as a deliberate choice by the taxpayer rather than oversight were significantly more likely to elicit a positive response from taxpayers (Kettle, Hernandez, Ruda, & Sanders, 2016). The tax administration should also keep in mind that while automated reminders should be the first step in inviting taxpayers to file, it should be ready to take escalated measures, particularly in regard to larger taxpayers, where such measures can include phone calls, in-person visits and further enforcement action as needed.

➤ Estimated Assessments

Also known in some jurisdictions as default assessments or best-judgement assessments, these are raised when a taxpayer has failed to file a return on time and has not responded to multiple reminders by the tax administration to submit a return. The amount of assessment can be determined through various ways, including reviewing the reporting history of the taxpayer or researching peer groups and making a determination accordingly. Once a determination is made, taxpayers are normally notified of the assessment and granted a set amount of time to contest it by providing the missing tax return, where failure to do so would confirm the assessment and turn it into collectible tax arrears that are due immediately.

The effectiveness of estimated assessments in driving taxpayers to file their returns is unclear. Anecdotally, a proportion of non-filers may respond to raised estimated assessments by submitting their own missing return, provided that the tax administration acts quickly and communicates with non-compliant taxpayers promptly. Estimated assessments must be of a punitive nature to be effective; the amount due must be significantly higher than what the taxpayer would normally remit. It should be kept in mind that the main purpose of estimated assessments is not to collect more taxes, but rather to improve taxpayer compliance and encourage them to file their own returns.

Tax administrations should also be careful about raising too many estimated assessments that remain on the books but are never paid or resolved as they artificially inflate tax arrears and the government's receivables. Once an estimated assessment is raised, tax administrations should promptly communicate with the taxpayer to resolve the matter and ensure better compliance in the future. Where a raised estimated assessment does not lead to a favorable result with a given taxpayer, the tax administration should be wary of raising further estimated assessments and consider other enforcement means including audits which have more weight in case of eventual litigation or court action.

Tax administration information systems can play a major role in the raising of estimated assessments, as they can identify taxpayers for whom an assessment should be raised and provide an estimated amount due based on configured business rules. Such systems should also be able to track the response of taxpayers to raised assessments, providing statistics on how different segments respond and how effective the measure is in improving compliance. Estimated assessments are one of many tools available to tax administrations to improve compliance and should be used in conjunction with other compliance measures.

4.1.4. *Legal and administrative requirements*

The filing of tax returns is usually prescribed in various tax acts. Tax acts should not be too prescriptive when describing taxpayers' filing obligations, as that would hinder the tax administration's ability to adopt new technologies that facilitate return filing. Tax legislation often indicates that taxpayers must file in the form prescribed by the tax administration or its director, thus allowing the administration to decide on the design of the tax return forms or whether to offer or even require the submission of returns in electronic formats. There are examples of legislation where tax return forms are regulated through law as well as the exact method of filing; best practices caution against restricting the tax administration's ability to update tax returns as needed and to consider offering various filing methods such as online filing or mobile filing. Such filing methods are discussed in further details in subsequent sections.

One element that tax administrations contend with when considering converting to online filing is the requirement for a signature to accompany formal documents including tax returns. Many jurisdictions have in fact passed legislation that regulates electronic transactions, with the understanding that filing electronic tax returns would be governed by such acts. These acts usually supersede existing legislation and recognize that an electronic signature can be legally accepted where a legal text requires a physical signature. The requirements for a valid electronic signature vary by statute and jurisdiction; tax administration should aim to meet the legal requirements prescribed by the corresponding act when offering electronic return filing. Digital signatures may be required, and tax administrations should consider integrating such a requirement into their tax information system if applicable.

An important point to keep in mind is the distinction between return filing and payments. While taxpayers are expected to pay their determined tax liability, the tax administration

should not refuse payments that do not match the determined liability. Tax administration processes should accept short payments and overpayments by the taxpayer relative to the filed return. Overpayments can eventually be either reallocated to another tax liability or refunded, whereas short payments should be followed up on by the enforcement and collections units of the tax administration.

4.1.5. *Technological best practices*

Tax administrations can offer a variety of return filing channels to taxpayers, ranging from submitting paper returns through the mail or at in-person at the tax offices, to online filing by uploading a structured file, to online filing by completing a web return form, to mobile return forms. The different return filing channels are discussed in the following sections, with [Table 4.2-1](#) below providing a comparison of the channels respective advantage and disadvantages.

➤ Paper returns

Where tax returns are required, paper returns had long been the sole channel available for taxpayers to report through. Once received, paper returns are typically manually entered by tax officers into the main tax administration information system for processing, even though some tax administrations may rely on two-dimensional scanners to input information, provided that the paper return form was itself generated by computer software. As expected, the processing of paper return forms by the tax administration is very labor intensive and prone to data entry errors, thus requiring additional steps for data quality review to be integrated into the process. None-the-less, some tax administrations still offer paper returns to at least some segments of the taxpayer population, even though their use is decreasing over time.

Some tax administrations, particularly in Latin America, signed contracts with banks so they could act as entry points for receiving paper tax returns and the payments associated with them. The services provided by banks extended to the keying of those tax returns for transmission to the tax administration. In some instances, these services were passed used a floating mechanism where banks would keep and use for an established number of days the revenue that came with the tax returns. With time banks also accepted tax returns in electronic format (via floppy disks or CDs). Tax administrations set up functionalities within their own systems to accept the information transmitted by the banks and to manage the contracts that usually include penalties for mistakes and mishandled documents (Zambrano, 2002). With the availability of the Internet the practice has been significantly reduced.

Apart from the risks of data entry errors introduced by tax administration staff while capturing returns, (keying errors, fields left out, misaligned fields) that could have been reduced using verification mechanisms like two-pass verification, paper returns also introduce the risk of improperly completed returns by taxpayers such as missing or incorrect Tax Identification Numbers (TIN) being filled, incorrect tax periods, illegible handwriting if completed by hand and incomplete sections or information that is required by the administration to be able to process the return effectively. Some administrations have sought to prevent some of

these issues by printing personalized tax return forms where the name, TIN and tax period is printed on the tax return form being sent to taxpayers to fill. (Printed labels were also an option, however, that brought the problem of tax advisers mixing labels for different clients.) Overall, tax administrations should avoid paper return forms as they offer very little in terms of benefits to both taxpayers and the tax administration.

➤ Online filing by uploading return

Some tax administrations offer the possibility of uploading a tax return in electronic format via the Internet. Technically, this can be achieved through different ways; typically, the electronic return is submitted as a structured file such as XML, where it is validated by the tax administration system before being accepted. The software that produces the XML varies. For example, the tax administration may provide the template, and require that any taxpayer who wishes to submit using electronic files to modify their software so that it is able to generate the file using the required format.

In some countries, third party software vendors may provide a tax filing software which is used by taxpayers to complete their information and then upload their returns to the tax administration system. It is common in both Canada and the United States of America for persons to use third party software to file their income tax returns. In both instances, the tax administration certifies the third-party software on a yearly basis before it can be sold and used by taxpayers. In other jurisdictions, the tax administration may provide structured return forms in Excel format which are then completed and uploaded by taxpayers when filing their returns. The Excel sheet is validated and verified upon upload to ensure that the information is complete and is provided in the correct format.

Uploading returns or schedules may be the preferred channel for taxpayers who have a large amount of information to submit to the tax administration. For example, employers with many employees would be able to extract payroll information in a format that is compatible with the tax administration system and then upload it in order to fulfill the filing requirement. However, the channel is not limited to payroll as taxpayers can configure their accounting systems to be able to extract the needed information to file a VAT or Income tax return as well. In a more elaborate setup, systems may be able to communicate and exchange information directly without the need for downloading and uploading files as intermediate steps.

➤ Online filing by completing web form

As a relative recent development, some jurisdictions may allow taxpayers to submit their tax returns by completing web-based return forms that are provided via the tax administration's online services. Taxpayers would be required to log in to their web account with the tax administration, select the tax period that they wish to file for, and complete their return using a standard web browser; no specialized software is required for this channel. Tax returns can be customized to a taxpayer to some extent in that the taxpayer would only see those lines that are relevant to them whereas those that are not relevant are excluded.

A definite benefit of using web return forms is that they allow the tax administration to pre-fill some of the information whereby taxpayers can update the information if necessary. For example, the taxpayer's identifier, name and tax period of filing do not need to be entered by the taxpayer as these would be automatically associated with the return. Additionally, if the tax administration already has historical data or third-party data available to it relating to the taxpayer completing the return, the use of web forms allows it to prepopulate the return with the available information. The taxpayer can then edit the figures if needed before submitting the return form. Returns where the figures provided by the taxpayer do not match the information available to the tax administration can be flagged for a review.

A good practice when dealing with the online web-based forms is to provide the ability to save drafts of tax returns and to constantly save modifications so a user would not lose their unsaved work in case of disconnections. The availability of drafts is particularly interesting for taxpayers that use help preparing their tax returns. An additional service that a tax administration could offer is to remind a taxpayer of the existence of unfiled drafts when a due date approaches.

Tax administrations can use a combination of web forms and uploads, for example allowing taxpayers to complete a web form if they so wish, but also allowing them to extract a file from their own systems and upload it where the quantity of information is too large to be entered manually in web forms and where the extracted information is in a format that is compatible with the tax administration's systems.

➤ **Mobile return filing**

This return filing channel refers to filing returns using a GSM protocol such as Unstructured Supplementary Service Data (USSD), rather than completing a web return form which is visible on smartphones. Taxpayers can file simple tax returns by keying in codes and figures and submitting the return. This channel does not require smartphones but can be used with any mobile device that supports USSD. To be able to process USSD based returns, the tax administration needs to interface with the information system of the mobile provider.

The functionality provided by USSD return filing is restricted due to the fact that only limited information can be exchanged; however, the technology may be suitable for simple, short returns that consist of one or two form lines that need to be completed. The technology is also convenient in countries where the Internet may not be accessible to everyone. In addition to filing returns via GSM, tax administrations may also offer the option of filing via the Internet using a smartphone where the return can be accessed either via a web browser, or via a mobile application. Taxpayers filing using smartphones can submit relatively complex tax returns when compared to GSM-based returns.

Ideally USSD filing services should have an equivalent function supported by applications on smartphones.

Table 4.1-1 Return filing channels, advantages and disadvantages

Return Filing Channel	Advantages	Disadvantages
Paper returns	Available to all taxpayers including taxpayers without Internet access	<p>Require a significant amount of effort, staffing and resources to operate</p> <p>High processing costs relative to other methods – salaries, rent, office space</p> <p>Require significant time by the tax administration to process</p> <p>Highly susceptible to data entry errors, inconsistent and incomplete return data</p> <p>Dependent on either an effective postal system or the existence of physical drop-off locations</p> <p>May require taxpayers to present themselves in person</p> <p>Number of drop-off locations may be limited</p> <p>Limited availability to file outside of business hours</p>
Online filing by uploading return	<p>Available to taxpayers 24/7</p> <p>Does not require any physical office or infrastructure by the tax administration</p> <p>Suitable if a large amount of information needs to be submitted by taxpayers</p> <p>Can be processed immediately by the system upon upload</p> <p>Prevents data entry errors by tax officers</p> <p>Frees up tax officers for more valuable work</p>	<p>Technically complex to set up</p> <p>May require third-party software by taxpayers to use</p> <p>Requires solid validation by tax administration information system upon upload to prevent data quality issues</p> <p>Requires Internet access by taxpayers</p>
Online filing by completing web form	<p>Available to taxpayers 24/7</p> <p>Does not require any physical office or infrastructure by the tax administration</p> <p>Can be processed immediately by the system upon upload</p> <p>Return forms can be customized for taxpayers</p> <p>Some of the return information can be prefilled by the tax administration</p> <p>Does not require third-party software to complete</p> <p>Field-based validations relatively simple</p> <p>Prevents data entry errors by tax officers</p> <p>Frees up tax officers for more valuable work</p>	<p>Technically complex to set up</p> <p>Requires Internet access by taxpayers</p> <p>Requires data entry by taxpayers – not suitable for large amounts of information</p>
Mobile return filing	<p>Available to any taxpayer who has a mobile phone</p> <p>Available 24/7</p> <p>Minimize risk of data entry errors by tax officers</p> <p>Free up tax officers for more valuable work</p>	<p>Dependent on mobile network carriers</p> <p>Require significant technological infrastructure</p> <p>Can only accommodate very simple tax returns (USSD)</p>

Source: Prepared by the author

4.1.6. Risk management

As with most tax administration processes, there are various risks that are associated with processing taxpayer returns that tax administrations should be aware of and plan for. The risks vary by filing method or channel, and the tax administration should utilize different mitigation strategies accordingly. The risk of most significance is that taxpayer returns are not received on time, whether deliberately on the part of the taxpayer or whether due to unforeseen circumstances. Other risks are related to the accuracy and quality of data that is reported by taxpayers. Finally, there is always a reputational risk in situations where the tax administration does receive tax returns on time but is unable to process them in a timely manner due to inefficient processes.

Table 4.1-2 below describes some of the main risks inherent with different return filing channels and suggests some strategies to mitigate those risks. The table does not quantify each risk as its likelihood and impact largely depend on the context and environment in which the tax administration operates.

Table 4.1-2 Return filing channels - Risks and mitigation

Return Filing Channel	Risks	Controls / Mitigation
Paper returns	Risk of illegible hand-written figures	Accept risk and follow up with taxpayers if unclear
	Risk of data entry errors by cashiers	Set up of quality review process to verify entered data systematically
	Risk of receiving incorrect (outdated) return form version	Issue personalized return forms to taxpayers with pre-printed identifying information clearly indicating tax period
	Risk of inaccurate identifying information completed by taxpayers on returns (wrong TIN, tax period)	Issue personalized return forms to taxpayers with pre-printed identifying information
	Reputational risk for the tax administration or risk of lower compliance if taxpayers must wait in long queues during peak periods	Have sufficient customer service staff and drop-off locations in place during known peak periods Allow mailing in of returns if postal system exists
	Reputational risk for the tax administration or risk of lower compliance if processing of returns takes excessively long	Ensure sufficient staffing during peak times, including hiring of temporary staff if required
Online filing by uploading return	Risk of receiving invalid data	Implement strong validation algorithm when uploading file
	Risk of inaccurate identifying information completed by taxpayers on returns (wrong TIN, tax period)	Accept risk and implement system features to rectify such situations when needed
	Risk of receiving incorrect (outdated) return form version	Implement strong validation algorithm when uploading file
	Risk of server or Internet outage thus preventing the filing of returns	Ensure software and hardware is capable of handling high volumes of return filing during peak times Implement server backup plans, business continuity plans Have policies in place for extensive outages – for example filing extensions Implement contingency manual plan as last resort

(continued)

Table 4.1-2 Return filing channels - Risks and mitigation (*continued*)

Return Filing Channel	Risks	Controls / Mitigation
Online filing by completing web form	Risk of server failure or Internet outage thus preventing the filing of returns	Ensure software and hardware is capable of handling high volumes of return filing during peak times Implement server backup plans, business continuity plans
		Have policies in place for extensive outages – for example filing extensions
		Implement contingency manual plan as last resort
Mobile return filing	Risk of mobile network failure preventing return filing	Accept and offer alternative channels of filing that do not depend on the mobile network

Source: Prepared by the author

4.1.7. *Tendencies*

Return filing is moving towards **pre-filled tax return forms** where some of the information in the return is completed by the tax administration with the taxpayer being able to edit and update the information as needed before submitting the return. The information that is used to pre-fill tax returns is already available to the tax administration and can originate from a variety of sources including historical taxpayer information or third-party information. The type and source of information often varies depending on the tax in question as discussed further below

➤ Income Tax

Many tax administrations already receive a large amount of information from third parties including employers, banks and financial institutions, charities and so forth. Information typically includes information such as salaries and remuneration, taxable benefits and deductions. Existing technology allows tax administrations to efficiently link third-party information to taxpayer returns allowing the tax administration to prefill parts of the return including various schedules. Additionally, automated systems allow tax administrations to easily track and carry over credits and amounts from one period to another such as business or capital losses and amortization amounts, pension amount ceilings and the like without requiring taxpayers to enter these figures themselves. This in turn makes it simpler for taxpayers to comply with their filing obligations as much of their information would have already been captured and validated in their income tax returns. In Latin America, tax administrations in Mexico and Chile are leaders in this respect, but the practice is becoming more and more prevalent in the region.

➤ Value-Added Tax / Goods and Services Tax (VAT/GST)

Innovations such as the adoption of electronic VAT/GST invoices would allow the tax administration to receive tax invoices or the list of imports well in advance of receiving the tax return thus allowing the administration to prefill several sections of VAT tax returns,

particularly on the input side of the return. Additionally, where VAT withholding is mandated by law, the administration can also prefill such information on the return of the person from whom the VAT was deducted. However, such a process would only work well if withholding information is provided to the tax administration in real time. Refer to the chapter “Invoices and Electronic Documents” for further information on electronic VAT invoices.

The pioneering experience of the Chilean tax administration in offering its taxpayers pre-filled VAT returns is described later in this chapter, with the title “The Chilean experience with pre-filled VAT tax returns”.

➤ **Mandatory electronic tax returns**

There is a tendency among CIAT member countries to enforce the use of electronic tax returns. Electronic tax returns are often available and obligatory for all taxpayers regardless of size or nature, whether individuals or legal persons. The uptake of electronic tax returns among CIAT member countries is above the global average. Argentina, Brazil, Costa Rica, Italy, Mexico, Peru and Portugal, have attained one hundred percent electronically submitted tax returns (ISORA, 2017). Additionally, the Kenya Revenue Authority in Kenya and the tax administrations in Barbados, all CIAT members, also require that all tax returns be submitted electronically.

4.1.8. The Chilean experience with pre-filled VAT tax returns

In August 2017, SII, the Chilean Tax Administration, started to pre-fill VAT returns of regular taxpayers marking a significant milestone in our field. The information required in terms of opportunity, quality and volume is beyond impressive. It has required a hundred per cent adoption of electronic invoice, an ability to process all of them in a lapse of just days after the completion of a monthly period, the preparation of the equivalent of input/output books on behalf of taxpayers and a way to make those pre-filled returns available for taxpayers to accept or modify.

We consider this experience highly relevant, not only for its originality and innovation, and the tremendous impact on voluntarily compliance, but also as a demonstration that complex and challenging projects can be achieved by emerging and developing economies through the use of technology. Fernando Barraza, who as Chilean Commissioner led this project, presents below this experience. (Raul Zambrano, CIAT)

Introduction

September 1, 2017, marked a new milestone in the history of innovation in service to citizens that distinguishes the Internal Revenue Service (SII) of Chile. On that day, an electronic pre-filled Value Added Tax (VAT) preliminary declaration was made available to more than 900 thousand taxpayers across the country. It allows them, just as was the case for more than a decade with the income

tax return, to declare and pay VAT based on an electronic pre-filled declaration prepared by the Internal Revenue Service, which automatically calculates the monthly VAT to declare and pay. This initiative mainly benefited small and medium enterprises.

It was another advance of modernization, only comparable with the step taken more than fifteen years ago by offering a pre-filled electronic Income tax return proposal to the taxpayers of the country, which is now accepted by 86.29% of them, and marked a profound change in how to report and pay the tax.

Once again, the Internal Revenue Service was distinguished, being pioneers worldwide by including an electronic pre-filled VAT return, which sought to facilitate the declaration of the most relevant tax in matters of tax revenue in Chile, representing almost half of the total, equivalent to more than \$CL 1.3 trillion⁸ each month.

This innovation also completed a journey that has begun for more than a decade with the Electronic Invoice, in which they were also pioneers, which will be recognized surely as one of the most important innovations driven by tax authorities in the region, and that new countries adopt every day.

Electronic Pre-filled VAT Return

The Internal Revenue Service of Chile has extensive expertise and experience in making electronic pre-filled tax declarations for the taxpayers. This process started in 2002, with the pre-filled tax individual income tax returns, which were refined and extended to all taxpayers. Currently, 99.82% of the income tax declaration is done electronically via the Internet, and 86.29% of taxpayers file their income taxes using the Electronic Pre-filled Preliminary Income Tax Return prepared by the Internal Revenue Service.

The implementation and massive use of electronic invoices, essential base for preparing the Electronic Pre-filled VAT Return (VAT) in Chile, began in 2003. It was extended progressively until 2014, when its use became mandatory. It expanded gradually, in successive installments by taxpayer segments. Thus, since 2018 all taxpayers in Chile who issue invoices do so electronically, via a model in which the Internal Revenue Service receives an electronic copy of each of the electronic invoices issued in the country. Currently, there are 934,377 electronic invoicing taxpayers, who produce more than 50 million electronic tax documents per month.

From the information obtained from electronic invoices, the Internal Revenue Service keeps updated the electronic records of purchases and sales of each company that invoices electronically. This registry replaced the purchases and sales book that companies were required to keep, and which information had to be sent to the Internal Revenue Service, an obligation now eliminated.

Thus, the new Electronic Registration of Purchases and Sales automatically records the electronic tax documents of purchases and sales of each taxpayer, as well as allowing them to add and complement transactions with any documents received on paper. This application began a month before the Electronic Pre-filled VAT Return, on August 1, 2017. With the information of the new Electronic Purchases and Sales registry, the New Electronic Pre-filled VAT Return was built, and made available since September 1, 2017. The solution consists of two electronic records: the electronic registry of purchases; and, the electronic registry of sales. Both contain all electronic tax documents issued by taxpayers and received by the Internal Tax Service, plus non-electronic documents issued or received and supplemented by the taxpayer.

With the electronic registry of purchases, the use of the tax credit is also determined and it is composed of four sections: (1) Registry, including the sum of purchases and the nature of each operation; (2) Pending Documents, these are electronic taxpayer tax documents sent to the Internal Revenue Service, but not yet “acknowledged” as “received”; (3) Disputed Documents, includes all electronic tax documents refused or not accepted within the legal deadline of 8 days; and, (4) Not Included, these are electronic tax documents that the taxpayer decided not to consider as an expense associated with the development of its commercial activities (they are not considered credits or debits).

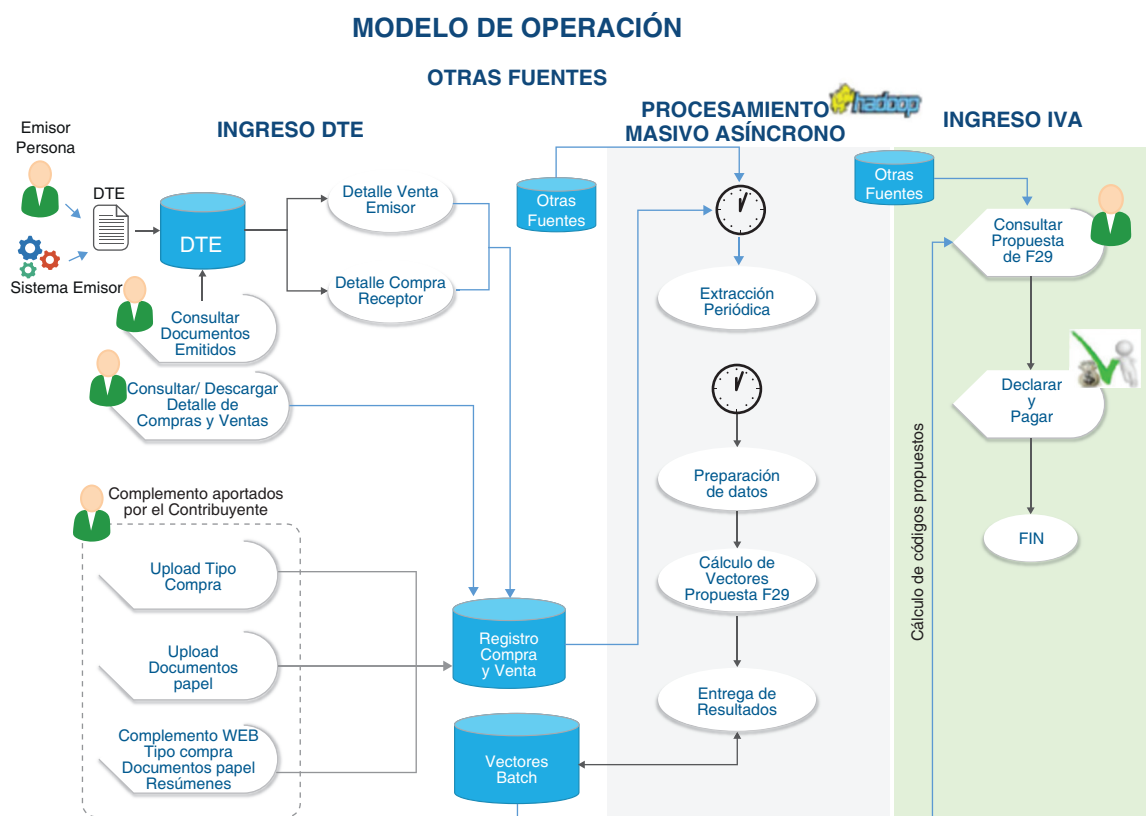
The Electronic Sales Register considers all sales transactions documents issued, and from this information, the tax debt is determined. Changes in the electronic records of purchases and sales are made directly in the system, which includes different filters to help taxpayers to manage the documents and their consolidated download.

The Electronic Pre-filled VAT Return is presented to the taxpayer based on electronic tax documents sent and received, records and assistants (tax calculators) online, that complement additional information that is declared and paid with this statement, such as monthly payments or fees withholdings that companies must pay monthly through this route.

Taxpayers can accept, amend or reject the pre-filled proposal. In the latter case, they may propose another declaration and submit it to the control department, if necessary.

Currently 93.7% of taxpayers who declare VAT debit or credit make it through the Electronic Pre-filled VAT Return, representing 92.9% of the total VAT collected monthly.

Surveys of users of the system indicate that declaring and paying the value added tax, using the Electronic Pre-filled VAT Return is now 60% faster, and completing the Purchase-Sales registry is 70% faster. It requires at most 30 minutes to complete, whereas more than an hour and a half was needed to prepare the corresponding declaration before the availability of the pre-filled proposal.

Figure 4.1-1 Operational model

Source: Servicio de Impuestos Internos (SII) - Chile

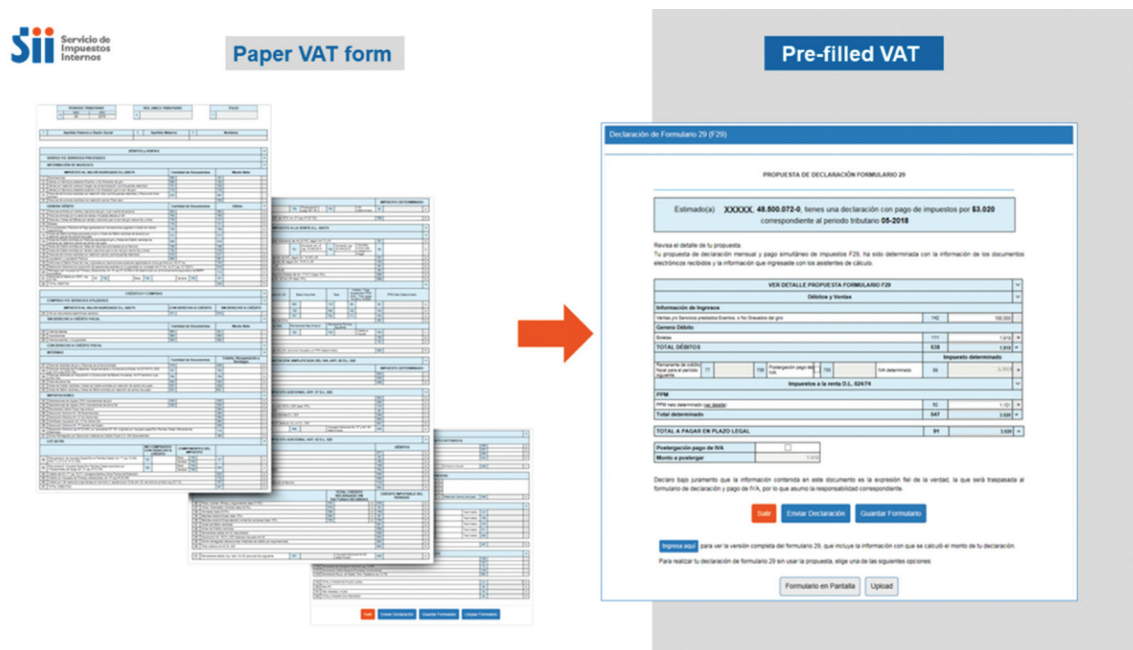
Advantages

Some advantages of the Electronic Pre-filled VAT Return for the taxpayers are as follows:

- Simplifying the monthly VAT declaration and payment process, as the Internal Revenue Service offers electronically on its website a personalized Electronic Pre-filled VAT Return on the amount of VAT to declare and pay.
- The Internal Revenue Service automatically generates the electronic registry of purchases and sales, exempting the electronic invoicing taxpayers from the obligation of keeping their sales and purchases ledgers, from the information of their electronic tax documents.
- Any inconsistencies of information between the VAT declaration and the Purchases and Sales registry, integrated in the proposal, are eliminated. Before the start of the system, these differences amounted to 511,963, of which 81% corresponded to small and micro enterprises and individual entrepreneurs.
- Errors are reduced because, by obtaining information from validated documents, fewer errors and inconsistencies in the VAT refund processes occur.

- By eliminating the mandatory Purchase and Sales Ledger, the fines for failing to submit the information disappear, as well as for delays or for not keeping it updated.
- The VAT tax credit declaration is still provided in cases of loss of documents by disasters, fires or other force majeure.
- The legal option to defer payment of the VAT declared is displayed automatically. When selected, the amount of VAT to declare is also adjusted automatically.
- The efficiency and automation of relevant aspects associated with tax audits increases.
- This improves the risk management and analysis, and fraud detection.
- It reduces the use of paper; with this innovation, more than 8 million physical books per year are no longer used.

Figure 4.1-2 From paper to digital



Source: Servicio de Impuestos Internos (SII) - Chile

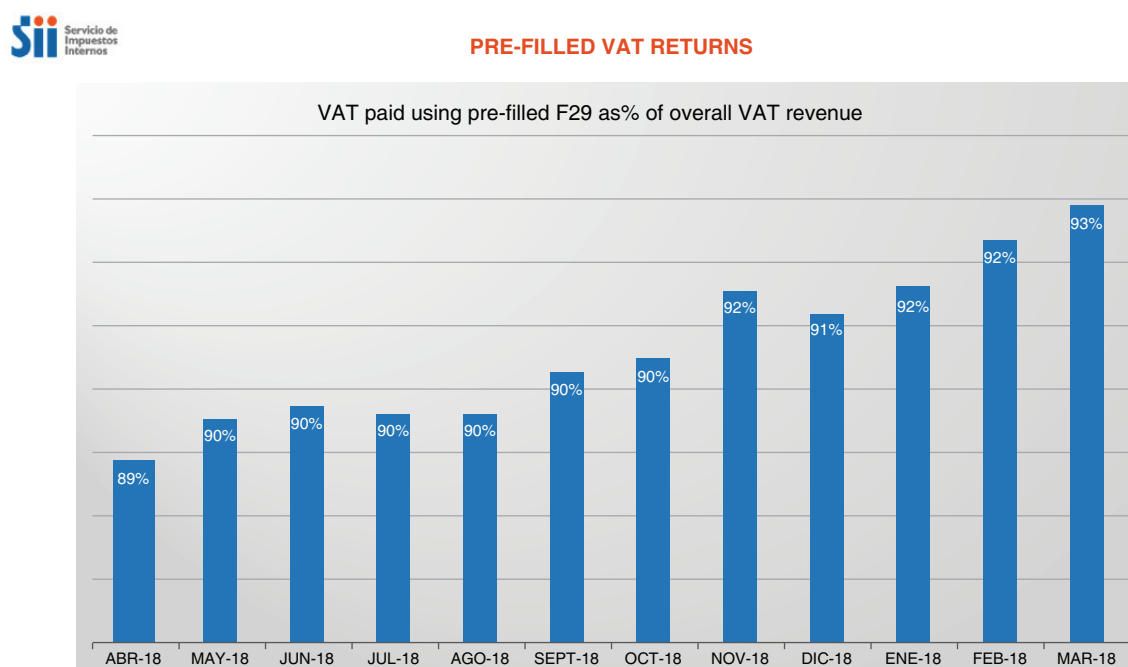
Key figures

Among the major statistics associated with the Electronic Pre-filled VAT Return, the following figures are noteworthy:

- VAT is the most important tax revenue in Chile, representing in 2018 47.3% of the total tax revenues, collecting US \$ 25,319 million (CL \$ 16.2 billion).

- The rate of VAT evasion in the country reached 21.3% in 2018, the lowest in the last 5 years, with a decrease of 0.14 percentage points compared to 2017, equivalent to US \$ 6,293 million.
- During 2018, 15.2% of VAT taxpayers did not declare or present timely their statement.
- During 2018, 15,548,618 VAT returns were received, of which 9,573,844 were received with payment.
- In the year 2018, 543,000 Electronic pre-filled VAT preliminary declarations with deferred payment were accepted and received.¹⁰
- Currently 93.7% of taxpayers who declare VAT debit or credit make it through the Electronic Pre-filled VAT Return, representing 92.9% of the total VAT collected monthly.

Chart 4.1-1 VAT paid with pre-filled tax returns (as % of overall VAT revenue)



Source: Servicio de Impuestos Internos (SII) - Chile

Conclusion

The main objective of the Electronic Pre-filled VAT Return is to facilitate tax compliance of taxpayers, reducing administrative and transaction costs, improving the quality of the information included in the declarations and thus increasing revenue.

In all its advances and innovations, the Internal Revenue Service of Chile has always been seeking to bring the tax administration to citizens, so that the tax process is part of the everyday life of each taxpayer, in which tax equity is a superior value.

The Electronic Pre-filled VAT Return would not be possible today without the successful implementation of the electronic invoicing in the country, which allows that 100% of invoices issued in Chile today are electronic, surpassing the 50 million of electronic tax documents each month.

By providing massive information on taxpayers' electronic transactions, it was possible to eliminate the obligation they had to maintain a purchases and sales ledger, and automatically build an electronic record of purchases and sales. This forms the basis for the new Electronic Pre-filled VAT Return, measures that once again benefit mainly small taxpayers, freeing them from the administrative burden involved in the preparation and maintenance of such books.

This new tool makes it possible to greatly facilitate the monthly declaration process, giving taxpayers the opportunity to carry out the entire tax declaration process electronically in one place. This is possible through the SII website. Here they can electronically complete their tax documents, receive copy of them, access their Electronic Purchase and Sales Registry, their Electronic VAT Declaration Proposal with or without activity, make electronic payment of their taxes, or postpone payment if required.

The new electronic pre-filled VAT preliminary declaration is a concrete example of how a tax administration fulfills its commitment to the taxpayer by placing them at the center of its management principles. It is working to make simple and easy the process of filing and paying taxes, which is the primary method that we all contribute to the development of our countries. It is a huge challenge, and to address it we must constantly innovate, always taking advantage of the possibilities and opportunities that information technology may offer.

This new measure is inserted, too, in the new Management Model of Tax Compliance that the Internal Revenue Service is implementing, establishing differentiated and proportionate strategies to support and assist those who make mistakes in complying with their tax obligations and to confront resolutely those who, intentionally or in a repeated manner, do not meet them. The procedure seeks precisely to accompany and facilitate the process for the vast majority of taxpayers who meet or want to meet their tax obligations.

This Electronic Pre-filled VAT Return adds to other technological tools that the Internal Revenue Service has made available to taxpayers to facilitate tax compliance, including electronic reporting, electronic filing, simplified company closure, SII Maps, and mobile applications such as e-RUT, e-Rent, e-tax, e-Boleta, e-invoice and e-Check, which enable the use of the various electronic services through mobile devices.

Figure 4.1-3 Selected articles from local news outlets

A partir de agosto: Impuestos Internos ofrecerá declaración de IVA “pre llenada”

Se eliminará la obligación para las empresas de llevar un libro de compras y ventas.

BERNARDINA PERAZO

2003, obligatoria desde 2014. La propuesta pre llenada de IVA se complementará con los antecedentes de las compras y ventas del contribuyente registrados en los libros de datos del SII, fundamentalmente con la información disponible de los documentos tributarios electrónicos. Con el cambio, los contribuyentes podrán acceder a un registro de sus compras y ventas controlado electrónicamente por el SII a partir de la misma información.

BENEFICIOS
“Tiene un efecto en la productividad y el cumplimiento tributario”, destacó el ministro de Hacienda. Actualmente, 595 mil contribuyentes emiten facturas electrónicas, la gran mayoría micro y pequeñas empresas. También existen 55 mil contribuyentes que emiten boletas (sin ser facturas electrónicas) y 55 mil trabajadores independientes que emiten boletas de honorarios electrónicas, que serían beneficiados. La nueva propuesta de declaración de IVA fue posible gracias a la implementación de la factura electrónica a partir de

SII implementa su nueva Propuesta de Declaración Mensual para el pago del IVA

Con la puesta en marcha de estas innovaciones, junto al nuevo Registro de Compras y Ventas, el Servicio avanza en facilitar el cumplimiento tributario de los contribuyentes.

Prepárate para esta gran innovación
Propuesta de Declaración de IVA.

Beneficios:
- Eliminación de la obligación de llevar un libro de compras y ventas.
- Acceso a la información de las compras y ventas controlado electrónicamente por el SII.
- Reducción de errores y simplificación del proceso de declaración.

El Registro de Compras y Ventas comenzó a operar el 1 de agosto pasado y la Propuesta de Declaración de IVA estará disponible para los contribuyentes a partir del próximo 1 de septiembre.

Verónica Valle
Subdirectora de Asistencia al Contribuyente del SII.

ECONOMÍA

El Servicio de Impuestos Internos ofreció una propuesta que se podrá aceptar o rechazar

Conozca las ventajas del nuevo sistema online para declarar y pagar el IVA

Muere el libro de registros de compras y ventas que tienen las empresas beneficiadas. “Como el SII tendrá directamente los datos, se hará más eficiente fiscalizar”, afirma especialista.

JUAN DE DIOS

El Servicio de Impuestos Internos (SII) presentó una propuesta para que las empresas beneficiadas por la implementación del Registro de Compras y Ventas (RCV) puedan declarar y pagar el IVA a través de un sistema online. Este sistema permitirá a las empresas declarar y pagar el IVA de manera más eficiente y segura, reduciendo los errores y simplificando el proceso de declaración.

706.000
contribuyentes podrán declarar y pagar el IVA a través del nuevo sistema online.

¿Cómo se opera?
El sistema online permitirá a las empresas declarar y pagar el IVA de manera más eficiente y segura, reduciendo los errores y simplificando el proceso de declaración.

Source: Servicio de Impuestos Internos (SII) - Chile

4.2. Paying Taxes

4.2.1. Definition

The ability to receive tax payments is an essential need for any tax administration. Tax administrations, large and small have long recognized the importance of being able to receive and process payments. In fact, in many tax administrations, the payments process receives far more attention in terms of controls and oversight compared to other processes, as it is often identified as a risky process where a lack of control could easily lead to misappropriation or embezzlement of government funds. As a result, it is often noted that a significant amount of effort and controls are put in place for the receiving of payments, to ensure that amounts are accurately received, recorded, reported and transferred to a financial institution for depositing, even when taxpayers manage to avoid enrolling for taxes or evade taxes by underreporting or not filing.

4.2.2. Relevance to the taxpayer

A main tenet of any organization including tax administrations is that securing payments should always come first. Both government and private organizations recognize that maintaining a proper cashflow is critical to the operation and even survival of the organization. Accordingly, the obvious conclusion is that payments should never be refused by a tax administration, and every effort should be made to facilitate the processing of payments from a taxpayer. Therefore, advance or partial payments should never be refused by the tax administration. Additionally, if possible, tax administrations should provide multiple means of payment to taxpayers, including electronic payments that can be made outside of working hours and those that can be completed from the comfort

of the taxpayer's office or home. The administrative burden for the payment of taxes is one of the 11 areas of regulation that are factored into the World Bank's "Doing Business" indicator¹¹ which aims to compare the ease of doing business amongst various countries.

4.2.3. *Relevance to the tax administration*

The tax administration should oversee the payment process closely, while allowing for multiple methods of payments that suit most of its taxpayers. The aim of the tax administration is to reduce its costs for receiving and processing payments while maintaining the required level of control to ensure that funds are not lost or diverted during processing and that funds promptly deposited in government accounts. The tax administration should also strive to remove any unnecessary obstacles for taxpayers to comply with their payment obligations; this is achieved by simplifying the payment process for taxpayers and by offering more than one channel of payment. The tax payment process directly impacts the tax current account which reflects the tax administration's and taxpayer's debt and credit balance.

4.2.4. *Legal/administrative requirements*

There are usually no legal restrictions on the methods of payments that a tax administration may accept, beyond specifying the currency that taxes should be paid in, in some cases. As a result, tax administrations generally have the freedom to make use of any innovations that simplify the processing of payments, that reduce the costs of receiving payments, that increase convenience for taxpayers and staff or that reduce the possibility of entering inaccurate data in the tax information system.

While tax administrations are responsible for payment processing in a majority of jurisdictions, it should be noted that some jurisdictions assign the responsibility of receiving payments to the Treasury instead, normally because of historical justifications. Thus, the tax administration would be responsible for the assessment of taxes but would not be responsible for their collection. However, the model described above is generally considered to be obsolete as tax administrations should be accountable for securing internal revenue, and it is difficult to do so in a situation where processes are divided amongst two separate government bodies. Consequently, states should aim to consolidate tax administration processes including payment processing at the main authority or department that is responsible for the administration of internal taxes. That is not to say that the tax administration cannot outsource receiving payments, as the sections further below will discuss. However, oversight and accountability for payment processing should reside with the tax administration rather than other departments or bodies, even when payment processing is delegated or outsourced to an external party such as a financial institution.

4.2.5. *Payment methods*

Tax administrations have relied on different payment methods to receive and process payments, ranging from payments at the counter at tax administration offices, to payments through financial

institutions, to online payments, to mobile payments. The following sections describe each method, explaining the advantages of each. *Table 4.2-1* summarizes the advantages and disadvantages of different payment methods.

➤ Payments at the counter

Most modern tax administrations either presently accept or historically accepted payments at the counter at their offices. Payments are typically made in cash, personal cheques, cashier's cheques or bank draft, even though many jurisdictions also accept payments by bank cards or credit cards. Payments are usually but not always made at the same time that a tax return declaration is submitted to the tax administration, as the due dates for filing and payment frequently fall on the same date, with variations between jurisdictions.

Offering the option of payments at the counter requires tax administrations to set up a sufficient number of locations that accept payments, to train and staff a sufficient number of cashiers, supervisors and managers, and to organize daily balancing and depositing of funds at financial institutions. Frequently, funds are entrusted to third parties such as security companies for deposit. A common trait of counter payments is the prevalence of queues and relatively long waits particularly around payment due dates.

➤ Payments through financial institutions

As an alternative to, or in addition to receiving payments in person at tax administration offices, some tax administrations have agreements in place with commercial banks and financial institutions allowing taxpayers to pay through the bank or institution. This venue has the advantage of freeing tax administration staff and resources which would otherwise be assigned to payment processing. As banks are already well prepared to process payments, it may be more efficient to rely on the banks instead of setting up local operations at tax administration offices to receive and process payments.

In practice, sometimes, only some commercial banks may accept tax payments, for example where the tax administration has signed an agreement with one or more banks but not others that operate in a country. In other instances, taxpayers may pay at any bank where the funds will eventually be channeled to the tax administration's deposit account. Some jurisdictions set up a bank account at every commercial institution that operates in the country, with the understanding that all payments received would be deposited to the respective bank accounts held by the government. Eventually, all funds are transferred to a main account which could be located at one of the institutions. In other jurisdictions, only a single government bank account is opened at one of the commercial financial institutions in the country, and payments made by taxpayers at any of the other banks are transferred daily or overnight to the bank where the government account is held.

Each of the arrangements described above has its advantages and disadvantages. Where the government has a bank account at each financial institution, the difficulty lies in managing multiple bank accounts, whereas in the situation where only one government bank account exists, the risk lies in having to rely on different financial institutions to transfer funds

accurately and in a timely manner. Neither downside is unsurmountable, and tax administrations that are interested in delegating the processing of payments through commercial banks should verify what the banking system is able to accommodate and what it has to offer.

When contemplating the processing of payments, an important element to consider is the fees that commercial banks will charge for the handling of tax payments. These can be fixed fees per transaction, or a percentage of monies processed. Tax administrations should discuss and assess these while negotiating with partner commercial banks to decide on which fee model is best suitable to the tax administration's circumstances. There may be other compensation models that banks may be willing to consider as well; governments should discuss these with the banks. One point that is important to agree on is that any fees that would be deducted should be itemized separately from payments received from taxpayers, otherwise the payment amount reported to the tax administration would be inaccurate.

Taxpayers should generally need minimal information to make a payment through a commercial bank or financial institution. At the least a tax type and identifier or a reference number would be needed to be able to deposit the payment and report the payment to the tax administration. Utilizing a reference number is good practice; the reference number should be linked to the taxpayer, the tax type and period of payment. Taxpayers can obtain a reference number either through the tax administration, or, better, through an online account provided by the tax administration's main information system.

In terms of payments through commercial banks and financial institutions, these can take different forms or take place through different methods or means; at their most basic, taxpayers can pay at the counter at a bank branch. Some commercial banks allow taxpayers who do not hold an account with them to pay their taxes at the counter, provided that the taxpayer provide a reference number or identifier and tax type. Other banks restrict at the counter payments to their clients. Tax administrations that wish to allow payments through commercial banks should discuss whether payments are restricted; ideally both clients and non-clients should be able to pay at the bank counter as not all persons utilize commercial banks for their financial needs.

The bank systems may be linked to the tax administration's system in real-time where the teller can validate the taxpayer's information before processing the payment, and, once processed, the payment would be posted to the taxpayer's ledger in the tax administration's information system. As an alternative, bank systems may not interface with the tax administration's system in real-time; instead, a report of received payments in electronic format is transmitted overnight to the tax administration and uploaded automatically or semi-manually to the tax management system which then posts the payments to the taxpayers' ledgers. Best practices advocate automating processes to the extent possible and limiting manual interventions to exceptions.

In addition to over-the-counter payments, banks that allow clients to pay their utility bills using online banking may also allow them to pay their taxes using the same channel. Taxpayers typically require their identifier or reference number to make a tax payment online. Some banks may allow paying taxes online through a third-party business application that connects

to the online banking system. In all cases, payments through online banking can be made at any time of the day typically and offer the convenience of paying without having to present oneself in person to a bank branch.

➤ Wire transfer/electronic transfer

This method is often offered to taxpayers who are not physically located in the jurisdiction and who do not have a bank account at a local bank, allowing them to pay their taxes from their own country of residence. The main disadvantage of this method, apart from the outgoing and incoming fees which can be substantial for both taxpayers and the tax administration, is the difficulty of reconciling the payment with the taxpayer, tax type and period that it intends to pay. While taxpayer may include a reference or other information in the wire transfer instructions, this normally must be manually processed by a back-office cashier and entered in the main information system. In many cases, taxpayers may fail to include meaningful information, thus requiring further investigation in order to process and correctly post the payment to the correct ledger.

➤ Online payments by cards

Some jurisdictions offer online payments by credit or bank cards. Typically, such payments would take place when a taxpayer logs in to their online web account provided by the tax administration, which is connected to the administration's main information system. Once the taxpayer decides to pay, the tax administration system connects to a payment processor that accepts major credit cards or debit/bank cards. After the payment processor verifies and confirms the payment, it transmits the confirmation instantaneously to the tax administration system to inform it that the payment was successful. The payment is considered to have been made at the moment of confirmation, even though the funds may be batch-deposited after 2 or 3 business days.

The advantages of this payment method are that it allows taxpayers to pay using any major credit card including foreign cards, which is convenient for taxpayers who may not be resident in the country but who may still need to pay taxes. An obvious disadvantage is the cost, particularly in relation to credit cards as the fees may be significant.

➤ Online payments through the tax administration's information system

Some tax administrations allow taxpayers to make a payment when logged in to their online web account provided by the tax administration. Typically, the web account requires a one-time set up of taxpayers' banking information. Once that is done, taxpayers may make payments online, where the tax administration's main information system communicates with the taxpayer's financial institution and debits the taxpayer's account. Depending on the configuration, the tax administration system may first verify that sufficient funds are present before approving the payment; whereas in other situations, the tax administration schedules a direct debit from the taxpayer's account and the onus is on the taxpayer to ensure that there are sufficient funds in their account to complete the debit. If there are insufficient funds, the attempt to debit is repeated after a few days, along with any penalties and accrued interest due to insufficient funds. This method of payment, also known as

direct or pre-authorized debits, normally requires the involvement of a clearing house to process the withdrawal.

➤ **Mobile payments**

In countries where formal banking uptake is relatively low, tax administrations may offer the possibility for taxpayers of paying their taxes using their mobile phones. This is not to be confused with a mobile app which debits or transfers money from the taxpayer's bank account. Taking East Africa as an example, taxpayers may top up their phones at any mobile service center by paying cash. Taxpayers can then use the credit on their mobile phones to make payments and transfers to any person who is set up to receive mobile payments, including tax administrations. Tax administrations require a third-party payment gateway to receive payments. Mobile payments rely on the Unstructured Supplementary Service Data (USSD) protocol in order to identify the intended destination of the payment. It should also be noted that mobile payments must be offered by the mobile network carrier before the tax administration can offer these to taxpayers.

In this context, the Kenya Tax Administration (KRA) implemented a tax payment service through mobile money since 2014. Tanzania and Mauritius also are implementing this kind of tax payment service.

Table 4.2-1 Payment methods - Advantages and disadvantages

Payment Method/ Channel	Advantages	Disadvantages
Payments at the counter	<p>Technologically easy to set up</p> <p>Lower variable costs as there are no fees associated with individual cash transactions → credit card payments still attract fees</p>	<p>Require a significant amount of effort, staffing and resources to operate</p> <p>High fixed costs relative to other methods – salaries, rent, office space</p> <p>Susceptible to data entry errors Risks related to cash shortage, diversion or misplaced cheques are borne by the tax administration Security risks → may attract robberies</p> <p>Require taxpayers to present themselves in person</p> <p>Payment locations may be limited Not offered outside of business hours → Exception may be for cheque drop-offs</p> <p>Risk of cheques that bounce → Extra processing required to cancel these payments</p>

(continued)

Table 4.2-1 Payment methods - Advantages and disadvantages (*continued*)

Payment Method/ Channel	Advantages	Disadvantages
Payments through financial institutions	<p>Relatively easy to set up</p> <p>Large number of payment locations, convenient for taxpayers</p> <p>Free up tax officers for more valuable compliance work</p> <p>Shifts the risk of cash shortages to banks</p> <p>Online banking when offered allows payments 24/7</p>	<p>May require multiple agreements with different banks</p> <p>Susceptible to data entry errors Fees charged by banks may be significant</p> <p>Can only be as automated or sophisticated as the banking system allows</p> <p>Multiple banks may be required to process one payment → increased risk of something going wrong</p> <p>May require taxpayers to have a bank account in the country to be able to pay</p>
Wire transfers/ electronic transfers	<p>Do not require any sophisticated technological infrastructure</p> <p>Convenient for taxpayers who are not physically in the country and who do not have a local bank account</p> <p>Allow taxpayers to pay in their own currency which is then converted</p>	<p>High outgoing and incoming fees</p> <p>Normally must be processed manually</p> <p>May be difficult to reconcile by the tax administration</p>
Online payments by cards	<p>Available to anyone who has a credit or bank card</p> <p>Available 24/7</p> <p>Minimize risk of data entry errors</p> <p>Can be paid in any currency and converted</p> <p>Largely automated, need minimal reconciliation</p> <p>Free up tax officers for more valuable compliance work</p>	<p>Requires the taxpayer to adopt formal banking</p> <p>Require significant technological infrastructure</p> <p>Depend on the availability of a payment processor in the country Potentially high transaction fees</p>
Online payments through the tax administration's information system	<p>Available to any taxpayer who has a bank account</p> <p>Available 24/7</p> <p>Minimize risk of data entry errors</p> <p>Largely automated, need minimal reconciliation</p> <p>Free up tax officers for more valuable compliance work</p>	<p>Requires the taxpayer to adopt formal banking</p> <p>Require significant technological infrastructure</p> <p>Depend on the banking infrastructure</p> <p>Risk of insufficient funds when attempting to debit account</p>

(continued)

Table 4.2-1 Payment methods - Advantages and disadvantages (*continued*)

Payment Method/ Channel	Advantages	Disadvantages
Mobile payments	<p>Available to any taxpayer who has a mobile phone</p> <p>Does not require formal banking</p> <p>Available 24/7</p> <p>Minimize risk of data entry errors</p> <p>Largely automated, need minimal reconciliation</p> <p>Free up tax officers for more valuable compliance work</p>	<p>Dependent on mobile network carriers</p> <p>Require significant technological infrastructure</p>

Source: Prepared by the author

Other methods

➤ Certificates, credit notes, securities

These are documents that are used in some countries for the payment of taxes. The documents can be presented physically by the taxpayer to the tax administration for payment of taxes, or, alternatively, tax officers can search for them in the tax information system if there is a virtual record of them in the system. In both cases, the taxpayer can offset his or her tax obligations using these credits. Often, these documents are generated through a refund where the tax administration issues such documents in place of a monetary refund. In some jurisdictions, taxpayers are allowed to trade their documents with other taxpayers.

➤ Compensation

As an alternative arrangement, some tax administrations may, instead of issuing a refund in monies, post tax refunds as credit to the taxpayer's current account allowing the taxpayer to use that credit to offset his or her tax obligations or to transfer it to another taxpayer through the system and the tax current account. Some tax administrations may restrict offsetting to tax obligations that are of the same type as that from which the credit originates. For example, VAT refunds may only be used to offset VAT balances. Other administrations may allow offsetting against any tax owing regardless of source. While compensation is often triggered at the taxpayer's request, tax administrations can decide to apply a refund against taxpayer debt without pre-approval from the taxpayer. In fact, legislation often requires tax administrations to do so.

4.2.6. Risk management

There are significant risks inherent with the processing of tax payments. Different payment methods are associated with different risks, and as a result, different mitigation strategies are required in

order to reduce the likelihood and impact of said risks, should materialize. The most obvious risk is a financial risk in terms of loss of funds that are intended for the tax administration; however, other risks exist as well. For example, there is a risk that inaccurate or incomplete payment data may be captured in the tax administration system due to process gaps. Another risk may be of a reputational nature, where the tax administration's reputation among taxpayers may suffer due to an error-prone or onerous payment process. *Table 4.2-2* below describes some of the main risks inherent with different payment methods and suggests some strategies to mitigate those risks. The table does not quantify each risk as its likelihood and impact largely depend on the context and environment in which the tax administration operates.

Table 4.2-2 Payment methods - Risks and mitigation

Payment Method / Channel	Risks	Controls / Mitigation
Payments at the counter	Risk of data entry errors by cashiers	Use of unique reference numbers with check digits to identify taxpayers, tax types, periods and amounts to pay
	Reputational risk for the tax administration or risk of lower compliance if taxpayers must wait in long queues during peak periods	Have sufficient cashiers and payment locations in place during known peak periods
	Risk of cash shortage due to diversion or misplaced items	Close supervision of cashiers and solid end-of-day balancing/reconciliation process
	Risk of receiving cheques with non-sufficient funds, requiring extra processing to cancel	Accept the risk and formalize a process to cancel refused cheques OR
	Security risks when dealing with cash	Do not accept personal cheques and limit to certified cheques only Have security on site during operating hours Purchase insurance if available Entrust the depositing of cash to a security company
Payments through financial institutions	Risk of receiving inaccurate payment data by banks – wrong taxpayer, tax type, period or amount	Use of reference numbers for payments Use of suspense account function to accept and resolve payment in information system
	Risk of delay in receiving funds from bank, depending on process	Clear agreement with banks on acceptable levels of service and deposits
	Risk of large portion of payments going towards bank fees	Clear agreement with banks on fees and caps if possible
	Risk of deposit to wrong government account	Accept risk and implement solid payment reconciliation process

(continued)

Table 4.2-2 Payment methods - Risks and mitigation (*continued*)

Payment Method / Channel	Risks	Controls / Mitigation
Wire transfers/electronic transfers	Risk of missing payment information	Use of reference numbers for payments Use of suspense account function to accept and resolve payment in information system
	Risk of delay in being informed of transfer	Agreement with bank to report on transfers regularly
Online payments by cards	Risk of Internet or network failure preventing the payment process	Accept and offer alternative methods of payment that do not depend on the Internet
	Risk of delay in receiving payments from payment processor	Agreement with parties involved on frequency and delays in deposits
	Risk of large portion of payments going towards processing fees	Agreement with parties involved on fees and caps if possible
Online payments through the tax administration's information system	Risk of insufficient funds in account	Accept risk and develop process to cancel payment if required
	Risk of Internet or network failure preventing the payment process	Accept and offer alternative methods of payment that do not depend on the Internet
Mobile payments	Risk of mobile network failure preventing payments	Accept and offer alternative methods of payment that do not depend on the mobile network
	Risk of inaccurate payment information provided – taxpayer, tax type period, amount	Use of reference numbers to identify intended payment destination

Source: Prepared by the author

4.2.7. Collection costs to the tax administration

Any operation, including the payment of obligations by taxpayers, involves a monetary or non-monetary cost to the tax administration that can be in the form of bank commissions, reduced availability of cash for a specific period, delayed receipt of information and delayed availability of information for use within the tax information system. Some of the costs associated with different payment methods are described below. It should be noted that costs are described mainly from the point of view of the tax administration. However, taxpayers may only incur some costs as well depending on the payment method; these are not addressed here.

➤ Cash

If collection is made at the offices of the tax administration, there must be a chain of custody of the funds that begins with their receipt and ends with their deposit in the accounts of the National Treasury. On the other hand, if collection is carried out at the counter of commercial banks, normally the cost for the administration is translated into bank commissions

that can be a fixed cost per transaction, a percentage of the collected amount, an agreed-on holding period of the funds by the bank or a mix of the above.

➤ Cheques

Cheques are normally associated with the same costs as those of cash payments. However, cheques include an additional cost for the administration in the form of delayed posting, uncertainty and potential rejection of a cheque by the bank. Cheques may take longer than cash to post to a bank account, sometimes taking up to 72 hours. In addition, personal or company cheques require some time to clear and ensure that the issuer has sufficient funds, which may take a week or longer depending on the banking system and origin of the cheque.

➤ Online payment, online banking, debit / credit cards, bank debit and direct debit

Depending on the agreement negotiated with the banking system and payment providers, these services may have some costs to the tax administration that are generally lower than those associated with cash or cheque payments, since these are electronic operations. There may be also be some costs borne by taxpayers depending on their own agreement with their bank.

➤ Certificates, credit notes, securities and compensation

These forms of payment of obligations have no cost per transaction as they are managed in the tax administration systems.

4.2.8. *Tendencies*

➤ Electronic models of payment

The main tendencies are to move towards electronic modes of payment where payments are scheduled or made by the taxpayer with little manual intervention by cashiers or tellers, where payments can be made at any time of the day, and where the processing and reading of information is largely automated and requires minimal data input. As such, there is a move towards online payments, online banking payments and mobile payments which require simpler reconciliation and handling of exceptions, remove many of the risks associated with cash and are generally more convenient for taxpayers.

➤ Digital and Cryptocurrencies

As a recent trend, some tax administrations at local levels have begun experimenting with accepting payments in cryptocurrencies as well as paying refunds in such currencies. While this is an interesting innovation worth mentioning in the present section, there is not yet enough data to be able to analyze such payment methods, to identify their advantages and disadvantages and to clearly recognize the risks inherent in these payments.

It should also be mentioned that there are proposals to reduce VAT fraud in intra-EU transactions for the European Union, potentially applied to some federal countries, where payments and devolutions are made with a special cryptocurrency named VATCoin (Ainsworth, et al., 2018).

4.3. Tax Debt Collection

4.3.1. Definition

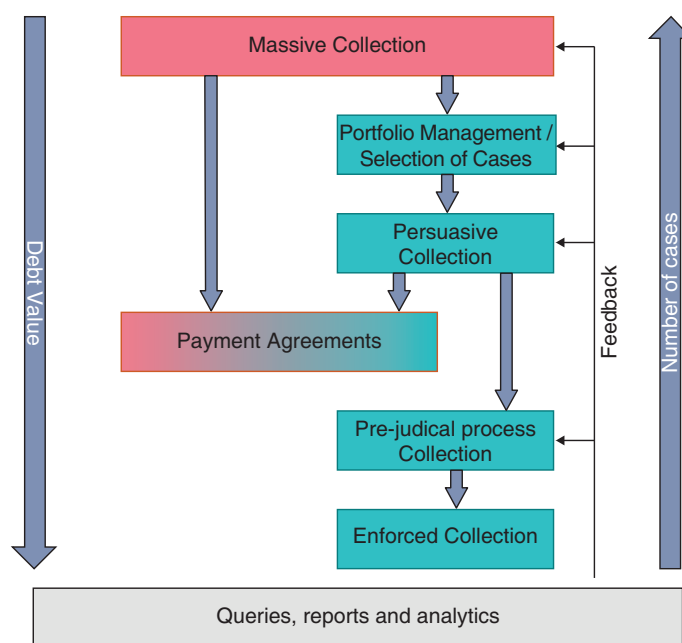
The Collection of tax debts component, described as part of an integrated system for tax administration, is responsible for facilitating the administration of tax debt by taxpayers.

Usually the spectrum of features of this component ranges from massive and automatic collection from the information recorded on the current account of taxpayers, to personalized persuasive collection to obtain payment or a payment arrangement. If applicable, it includes the executive or judicial collection, which according to the collection model of each country, may be exercised by the tax administration itself or by a judicial execution body external to the tax administration.

In addition, a few other features can be considered, including the massive or individual discharge of debts (as a result of expiration of the statutory period for collection, a *de minimis* outstanding tax amount, or when the tax is unrecoverable), if the rules so provide. The collection component interacts with the taxpayer registry component and very closely with the component of the current account because it is from information on the outstanding balances that the debt collection works, and likewise the current account will reflect the actions of collection affecting the taxpayers' balances.

4.3.2. Component description

The collection function can be organized in sub-components which address different processes of the collection process: (1) massive collection; (2) selection of cases; (3) persuasive collection; (4) payment agreements; (5) pre-judicial process collection; (6) administratively enforced collection; and, (7) studies, reports and processing of statistics necessary for the proper functioning of the component.

Figure 4.3-1 Components of collection

Source: Prepared by the author

Massive collection

The massive collection program leverages technology to exercise real-time collection of debts once recorded as a result of a return filing or final administrative actions. The trend in the treatment of accounts with recent debt is to use computing resources to systematically detect the arrears and generate messages, phone calls, and/or e-mails informing the debtor on the delinquency and the terms and conditions to satisfy the debt without an administrative or judicial process. This component also includes monitoring and registering the debt liquidation agreement.

Case selection

Case selection is a required component of a collection system since often the number of officers available for the collection effort are too limited to work 100% of cases with outstanding debt. These are cases that were not worked by massive processing and require a particular process to secure payment.

This selection component can use different criteria for proper selection of cases to process, for which the system must provide for the combination of different variables. These may be the age of the debt, the ranges of amounts due, debt classification or debt status, debtor's default rate, the level of risk associated with the type of taxpayer, economic activity or sector to which the debtor belongs. On the other hand, they can also consider the financial risk of the taxpayer, in relation to the taxpayer's cash flow position, credit standing and their level of commitment to transparency.

Case selection may be carried out for the different treatments of un-regularized debt: automatic persuasive collection, personalized persuasive collection, investigation of assets or prior seizures, and enforced collection.

Persuasive collection

Persuasive Collection may be executed automatically, for smaller debts, or by personal contact for debts that, according to the tax authorities, require contact with the debtor. In the latter case, the system will provide the necessary tools so the officer may contact the taxpayer and request payment and record the outcome of the contact.

Payment agreements

A subcomponent useful for collection management is the payment options offered to a taxpayer including the possibility of the debtor to apply for a payment plan through virtual channels offered by the tax administration, which after approval will result with the incorporation of credits to set off the existing debts and the inclusion of the new installment debts in the current account. The system must comply with the law governing such facilities, regarding requirements, deadlines, periodicity of installments, down payment, declaration of default, etc.

Investigation of assets

The assets investigation subcomponent takes place at the preliminary stage of collection and facilitates the identification of the debtor's assets (this includes search of assets for all individuals responsible for the tax debt), in order to execute the judicial process. This subcomponent can exchange information with external entities and with other entities, which may have information pertaining to the debtors' assets. The identified assets are recorded in the system, so they are available for the coercive enforcement process. The registration of the identified assets will reflect the status of the assets depending on the future actions taken, such as, seizure, release, and auction adjudication, among others.

Enforced collection

The enforced collection subcomponent, when it is under the responsibility of the tax administration includes issuing the debt certification, payment order and other documents generated to start the process. They include: the response to appeals or exceptions that the debtor may bring; actions ordered that require precautionary measures; seizure and sale of goods according to regulations; and finally, the actions that terminate the payment process and order the lifting of the precautionary measures in effect.

When the process of coercive collection is carried out by an entity other than the tax administration, the activities of the collection system are oriented to the issuance of the actions that initiate and promote the process. This can be the issuance of certification of debt, responding to legal action taken by the taxpayer, appeals against the inadmissibility of the claim, and other actions that the

plaintiff may issue in accordance with the legal order of coercive execution. This also includes documentation on the system of the sentences and acts issued by the court.

In some states of Brazil, an interface with external bodies that carry out the collection is already available. The states of São Paulo and Maranhão have a connection with the Attorney General's office, in order to update the information of the actions carried out, and with the court that oversees the coercive judgment. Therefore, it is no longer necessary to access the Attorney General's office to follow the case.

Queries and reports

Finally, the subcomponent “reporting and query” module should offer different types of queries. From broad global information to specific details. They can disclose the status and classification of the portfolio at different stages. Based on this information, the tax administration can structure the annual collection plan, measure the recovery by type of tax, by region, per employee, measure the average execution times of workflows for the persuasive collection or enforced collection, displaying the history of collection processes and payment facilities, among others.

4.3.3. *Some variants to the model*

Some tax administrations, in addition to managing the collection of tax debts, are responsible for debt collection of other state entities, as a result, it is necessary for the collection component to offer the possibility of automatic registration via web services or virtual mechanisms with generating credit institutions. They should be adjusted in parallel to other components such as collection and current account to complete the collection cycle for these debts.

Another variant mentioned in the description of component deals with the ability to perform mass or individual reliefs (write-off) for debts that could not be recovered and must be written off from the current account records through the collection process actions. This may be another subcomponent of the collection module, where the legislation of a tax administration on this matter develops different modalities under which they can terminate the obligations.

In other models used by tax administrations, the massive collection process is not part of the collection component; it's integrated as a component of mass processing that controls, in addition to the debts, other types of defaults such as non-filing of tax declarations, non-compliance with invoicing, breach of payment agreements, among others.

Finally, and as an exception with few successful implementations, it is worth mentioning the sale of the tax administration's tax debt portfolio to external entities as an option to eliminate uncollectable debts. Another collection model is the outsourcing of tax collection to a third-party entity. In these cases, there must be a component for the exchange of information, and documenting case activity and settlement, and payment of the agreed amounts. The United States of America, Colombia and Panama are some of the countries that with some variation tried unsuccessfully to implement the outsourcing of the collection of their tax debt. In some of the aforementioned countries,

there was backlash from taxpayers who felt that the collection of their tax liabilities should only be the responsibility of the tax administration.

4.3.4. *Relevance of the collection component for the tax administration*

The collection component, in a comprehensive system for tax administration, allows closing the circle of tax collection for cases where payment is not made voluntarily within the established deadlines. Institutions that provide a timely and dynamic handling of the collection hold higher rates of compliance than those where the collection is neglected and a lack of control of portfolio leaves accumulated debts, becoming unrecoverable, that finally they try to recover with amnesty laws that discourage the timely payment of tax obligations.

Taking collection action on outstanding tax debt at an early stage, informing the taxpayer of the amount and conditions of settling their debt, inviting the delinquent taxpayer to the tax administration office and help setting up a payment agreement is much more effective than sending the case to the enforced collection unit or publishing a blacklist of defaulters.

With a collection system that flags and fast-tracks the collection of arrears, tax administrations are able to reduce the cost of collection and recover a higher percentage of the tax by employing the process of massive and persuasive collection. In contrast, only a small percentage of payments are secured through the coercive collection.

The actions of searching for assets and electronic communication to taxpayers on seizure action effectively support massive and persuasive collection efforts. Together they produce important results for collection based on the risk specific to each defaulter, that is, in the loss of their property and the possibility freezing their funds in bank accounts or subjecting these funds to seizure in the collection processes.

4.3.5. *Legal and administrative mechanism to improve the effectiveness of collection*

When speaking about the ideal collection department model, the tax administration must view the taxpayer in the same light as businesspersons think of their clients, that is, it is not about permanently ending a company's operation or leaving an individual in financial ruin; consideration should be given to the fact that the entities could possibly generate financial resources for many more years as part of their contribution to the State.

For this reason, the legal mechanisms that govern collection must first be used to facilitate payment to delinquent taxpayers and secondly to deliver administrative and judicial powers to the tax administration to coercively obtain payment of debts when the debt payment fails through persuasive methods.

In Central and South America, there is a wide range of collection models. They range from those where enforced collection is relinquished to an entity external to the tax authorities, or those where

the tax administration only has persuasive collection powers, leaving the coercive collection process in the hands of external bodies such as the Attorney General's Office in which the tax administration plays the role of a plaintiff party during the trial. There are even models that give full autonomy to the tax authorities to exercise collection in through persuasive and coercive stages; in these cases, the administration itself operates as judge and party to the collection process.

Some models introduce variants in which the tax authorities may issue preliminary safety measures with certain caveats, and then move to the court for the execution of the asset frozen during this pre-judicial collection measure. It has the advantage that normally the debtor wants to pay the debt for the lifting of the measure, without having to start the coercive judgment.

In some states of Brazil, the tax administration can make use of legal mechanisms that are not properly tax enforcement, emanating from the civil law. They allow introducing the debt claim to the judicial registry, by which the collection process is based on a civil instance of non-payment that has the power to order the financial blockade of debtors by reporting them to the "Centrales de Riesgo (Risk Centrals)". This mechanism is used as an intermediate coercive measure for debts that do not exceed the threshold amount for cases that need to be sent for judicial collection by the Attorney General's Office.

As for administrative powers to improve collections, in recent years they have been introduced in legislation, with some of them being more successful. Suspension or inactivation of the Tax Registry or the key to assign invoicing or inability to obtain one, or closing establishments, when they are in default with the administration, are some of the mechanisms that seek to obtain payment of debts by pressuring the taxpayer. These measures are in the same line as the solvency certificate that still remain valid in some administrations and constitutes a requirement for some procedures, such as a tender with the state.

Concerning debts relating to the Sales Tax or withholdings practiced and/or declared, the regulations have given differential treatment ranging from not granting payment agreements for these items, to the closure of companies or the filing of criminal complaint because they consider the non-payment of these amounts as an offense punishable by imprisonment.

In the case of debts incurred in administrative proceedings in the area of control and determination of taxes, some laws have introduced the possibility of decreeing previous measures (before the debt is considered final) to guarantee payment of these obligations. In other administrations, the collection of these debts have priority treatment regardless of the amount or any other criteria that is being applied to the selection of cases.

A necessary measure to enable the system to exploit the information available to the tax authorities (in order to benefit the collection of overdue liabilities) is to allow access to the information obtained from the taxpayer and third parties for purposes of collection. Ironically, some laws still exist that restrict the tax administrations from using information on the taxpayer assets or

third-party information for the purposes of the collection process. These are essential in order to identify and enable the seizure of property, or obtain information on loans to individuals, imported goods, among others. This would not be possible without information on the taxpayer supplied by third parties or state entities.

In general, the mechanisms of withholding at source or the requirement of advances by way of payments of taxes that tax administrations have established in a greater or lesser extent over the past 20 years constitute tax collection measures that anticipate the collection and in turn prevent debt generation in segments of taxpayers difficult to control.

4.3.6. *Best technological practices*

The best technological practices that can be associated to a successful collection process have to do with:

Information technology (IT) developments aimed at preventing delinquency through preventive measures, for example sending reminder messages before the upcoming maturities of payment of a tax or a facility fee, or immediately following a delayed payment or missing payment.

The intensive use of information regarding the selection of debts, identifying the debtor's assets and identification of joint debtors who are called to account for payment. This intensive use requires establishing electronic communication channels with external entities whether public or private (web services, direct access, etc.) and access the own databases of the integrated system, prior design of the required information, the sources to consult, the frequency of consultation, among others.

The new data analytic techniques and artificial intelligence are being tested by some countries to improve the selection and maximize recovery. Another technique in use is a result of studies of behavioral economics. This technique is called Nudge and it aims, through letters or specially prepared messages for specific groups or classes of taxpayers, to convince them to pay their debts to the treasury. The tax administrations of the city of Rio de Janeiro, Guatemala and the United Kingdom are examples of the successful application of this technique.

Workflow tools are used for recording and monitoring of collection cases and for the execution of mass actions automatically. These tools are complemented by the use of electronic signature: They allow having a virtual file that can enjoy full legality and to this extent eliminate the use of physical file that generates administrative burden for the tax authorities.

Automating the collection process by introducing more and more intelligence, referring to the introduction of rules of action so the system itself may make decisions regarding the actions to be executed for different universes of debtors in various stages of the process. The application of artificial intelligence models enable these processes to learn from the results and gradually improve their effectiveness, automatically.

4.3.7. *Risks associated with compliance*

The main risks associated with the non-fulfillment of payment obligations are:

- Deficiencies in the quality of information that is a source for collection.
- Delay of the tax administration to intervene in the collection of the debt.
- Insolvency of the debtor.
- No location of the debtor and assets.
- Deficiencies in the legal system to provide treatment for debts.
- Persistence of old debt, probably uncollectable, close to the end of statute of limitations for collection, distracting the operational capacity of the tax administration.

4.3.8. *Lessons learned*

Some of the most important lessons learned over nearly 20 years in the administration of the collection processes and collections are:

- A recurring error in the design of collection components (which is common to other types of business processes) is to systematize without first analyzing the legal and administrative measures that can be taken to improve the process. It is much more effective to introduce regulatory and procedural changes and go adapting and adjusting the system based on the improvements, than to have to do the process in reverse.
- The information on debts should have a minimum level of quality to enter in the collection process. This ensures a decrease in complaints from taxpayers for undue charges, however, delaying the systematization of the collection component under the pretext of the lack of quality of information is a major error. Administrations should undertake joint plans to improve the quality of information, and at the same time, to achieve process automation.
- Establishing different treatment for collection depending on the classification of debt has proven to be a path of trial and error, but eventually, if it persists to until obtaining a proper classification, it ends up reporting large benefits.
- Discarding the path of regulatory reform has a very high price, therefore, the starting point must be to structure the collection model the tax administration wants and can manage, to mobilize policy changes needed and in parallel invest in technological changes, starting with what may yield the best results in the short term.

4.3.9. *Trends*

As in all systematization processes, the trend in developments to administer collection is aimed at automating the process with the increased use of human intelligence associated with data analytics

techniques and artificial intelligence. In this case, this intelligence should be invested in predicting the behavior and reactions of a tax debtor to the different collection strategies and provide feedback to the system itself so it can make appropriate decisions.

It should not be surprising that in the future, the system itself would predict the most effective mechanisms for collection and, as a result, redirect unsuccessful cases to these types of “no action cases” without operator intervention to make the decision. The role that the human plays in these cases is to monitor the results and calibrate the model.

4.3.10. Strategies to implement in the future

To implement effective collection strategies based on the use of the systems, it is necessary to measure at what exact point of the spectrum the collection process is in. A tax administration should consider questions such as: Do we know the total amount of debt? Do we know the rates of voluntary compliance in paying debt from returns? What percentage of the collection process is fully automated? Do we have rules to remove the accounts where the collection period expired or from the unrecoverable portfolio? What kind of information on assets can I access? Does it require regulatory adjustments to the collection process?

Depending on the diagnosis that is achieved, the tax authorities can focus their strategies to implement policy changes and to modernize and automate the collection process, always depending on the additional value that can be obtained in terms of effectiveness in the collection of debts and decreased time and resources invested.

Some of the mechanisms that should be considered include: (1) installation of collection centers to run massive processes of contact with debtors; (2) preventive actions carried out before and during the period of submission of returns directed to taxpayers based on the monitoring of their prior actions; (3) real-time exchange of relevant information to the collection process; (4) automation of operations and procedures in the collection process (automated seizures, online payment facilities, etc.) and notification to the taxpayer; and, (5) definition and measurement of indicators of the process effectiveness.

Administrations with a higher degree of development may aim in the future to use predictive models to improve compliance rates so as to reduce defaulted accounts, and to make more effective the processes of classification and treatment of debts.

4.4. Tax Refunds

4.4.1. Introduction

When we hear the words “tax refund” we immediately think of a benefit for a taxpayer. And with the ever-growing use of technology by taxpayers and tax administrations, these payments may go directly to their bank account. In many countries, they are close to living in a world of paperless

tax declarations and paperless tax refunds. (There are a few that have attained that Utopia.) On the ecological side, a tree is spared to replenish our oxygen supply.

However, when it comes to personal or corporate income tax, we can also make the argument that the taxpayer who gets a refund did some poor tax planning. They allowed the government to borrow their money for free. You can also argue that the instructions provided by the tax administration on taxable and deductible items, credits and general tax return preparation information were not clear enough for some taxpayers, causing an overpayment of tax deposit. And lastly, we can assume that the tax refund is a fraudulent scheme; one of many that plague the tax departments be they in the form of personal income tax, Value Added Tax (VAT), or others. Needless to say, all these assumptions are considered a negative factor. In a perfect world, using the case of an income tax return, the taxpayer either has made the correct deposits prior to filing their tax declaration and/or has accompanied the balance due of the tax liability with the tax declaration. Ideally, the tax department would not have to administer a tax refund program and consider the budget cost to run that operation.

Regarding VAT, the credits/debits would be a constant process since the declarations are filed either monthly or quarterly in most jurisdictions and a tax refund would be infrequent. Also, there are instances where an entity has a non-refundable tax credit that can be carried forward to a subsequent tax year or carried back to a previous tax year. There are also jurisdictions that allow the transfer or sale of tax credits.

These topics will be addressed with further details in the following paragraphs.

4.4.2. Definition

In general terms:

A tax refund is the difference between taxes paid and taxes owed. Each year (or each quarter, in some cases) a taxpayer submits a tax return that calculates their taxes owed. The taxpayer then submits the tax return electronically or via mail and the tax department reviews the information. If the taxpayer has paid more taxes than they owe, the tax department will issue a refund... (The Merriam-Webster.com Dictionary, 2020).

There could be several reasons why a taxpayer has a credit due. “Typically, tax refunds occur because employees have too much withheld from their paychecks” (The Merriam-Webster.com Dictionary, 2020). By adjusting the withholding amounts taxpayers can make sure that the correct amount of taxes is withheld for the corresponding year.

In most jurisdictions, estimated tax payments need to be made throughout the year in order to avoid a “failure to estimate” tax penalty. In the case of the United States of America, through quarterly

payments, a taxpayer needs to deposit at least 90 percent of their estimated tax for a given year. These estimates are generally based on the prior year income or on an anticipated increase in the current year.

Very often low- and middle-income taxpayers anticipate refund sums as additional funds they can use for personal reasons (e.g., family vacation). However, in reality what occurs is that they allow the government to use their money interest-free. High net-worth individuals tend to do a bit better at tax planning and generally make the required 90 percent tax deposit before tax returns are due.

4.4.3. Refund

How the refund payments are transferred to the taxpayer varies from jurisdiction to jurisdiction and taxpayer preference. For discussion purposes, we'll focus on general practices exercised by many OECD member countries. If we're dealing with Personal Income Tax (PIT) or Corporate Income Tax (CIT), the taxpayer can elect to have that credit roll over into the subsequent tax year liability (this somewhat equates the making a quarterly tax deposit).

Refunds can be made in the form of a paper check mailed to the taxpayer's home or business address. It can also be a direct deposit to a bank account (the bank account can be a savings or checking account, or a retirement account), or a direct deposit to a pre-paid debit card. (In the United States of America, a taxpayer can request that the refund be directed towards the purchase of U.S. Series I Savings Bonds up to US\$5,000.)

This may be a good opportunity to clarify the difference between a tax overpayment refund and a tax credit. Note that all credits qualifying for a refund are not necessarily from tax payments made for a particular tax year. Tax credits are classified as "nonrefundable" and "refundable." According to the Internal Revenue Service from the United States of America, "A nonrefundable tax credit means you get a refund only up to the amount you owe. A refundable tax credit means you get a refund, even if it's more than what you owe" (Internal Revenue Service, 2019). Again, in the case of the United States of America, examples of refundable tax credits are the Earned Income Tax Credit and the Child Tax Credit:

The Earned Income Tax Credit, EITC or EIC, is a benefit for working individuals with low to moderate income. To qualify, you must meet certain requirements and file a tax return, even if you do not owe any tax or are not required to file. (Turbo Tax, 2019)

The EITC reduces the amount of tax you owe and may give you a refund. One can claim the Child Tax Credit if you have a qualifying child under the age of 17 and meet other qualifications. If a tax return was not filed because wages were below the filing requirement, one "can still file a return within three years of the filing deadline to obtain a tax refund" (USA.gov, 2020) if one is in order.

One type of tax refund is somewhat associated with the tourism industry, and that is the refund of VAT paid by a non-resident shopper. Most of the paperwork is prepared by the merchant which the foreign shopper then presents at a Customs counter (generally) at the airport upon departure. The goods and receipt are verified by the official and the VAT portion of the purchase is refunded to the shopper.

4.4.4. *Transfer and sale of tax Credits*

Some countries have regulations which permit the transfer and/or sale of a tax credit to a separate entity. In essence, it has some characteristics of factoring.¹² The transfer can be made to the acquiring entity in the sale of a particular asset which has a pending tax credit. In some cases, the pending tax credit can be sold to another entity (similar to the factoring of a receivable).

A transferable tax credit provides benefits to the seller and purchaser. The income from the sale benefit the taxpayer even if the taxpayer has a low tax liability.

For buyers, beyond the potential to deliver a high rate of return, transferable tax credits can also help:

- **Reduce total income tax liability.**
- **Lower effective tax rate.**
- **Diversify investment portfolio.**

Promote the arts and film, renewable energy, historic rehabilitation, affordable housing, or other industries they may support. (Moss Adams, 2020)

There are a number of countries in Latin America that enacted legislation permitting the sale/transfer of tax credits from one taxpayer to another entity. Among these are Argentina¹³, Nicaragua¹⁴, Paraguay and Uruguay.¹⁵ Most of these transactions can be done right online through the tax administration's website.

This is an example of Paraguay's website, which through their system named "MARANGATU" these transactions can be completed:

Figure 4.4-1 Online transfer of tax credits (Paraguay)

Source: Subsecretaría de Estado de Tributación (SET) - Paraguay

In the United States of America, the state governments make greater use of laws for the sale of tax credit (e.g., the Film, Television and Digital Entertainment Tax Credit in the State of Georgia).¹⁶ The federal government only allows the transfer and not the sale of certain tax credits. These primarily are: Federal Historic Rehabilitation Tax Credit (for the restoration of historic buildings); Federal Renewable Energy Tax Credit; and, Federal Affordable Housing Tax Credit.

There are a number of tax credits that states generally make transferable or sellable; these can be for renewable energy, entertainment, and real estate development. The film industry is a major beneficiary of transferable film tax credits. “Transferable tax credits aren’t the only way states provide tax incentives to companies that don’t owe much in taxes. Many tax incentives are “refundable”. That means that if a company earns more in tax credits than it owes in taxes, the state pays the difference in a refund check” (Goodman, 2012). Depending on the type of tax credit and jurisdiction, the credit can be purchased anywhere from 70 to 90 percent of its face value.

To put this into some perspective, let’s take the example of a recent transaction between Tesla, the electric car manufacturer, and MGM Grand Las Vegas Hotel and Casino. As a result of setting up a business in Nevada, the state granted Tesla an appealing tax credit, and other incentives, package. Subsequently, Tesla sold approximately US\$20 million in Nevada tax credits to the MGM Grand Las Vegas Hotel and Casino. Tesla had “earned” the credits under its US\$1.3 billion deal with Nevada for building its Gigafactory in the state (Griffith, 2016).

4.4.5. Offset of tax refund

Previously it was mentioned the “voluntary” use of tax credits to be partially or fully applied to a future tax year of an account pertaining to the same taxpayer. But having a right to a refund does not always guarantee that a refund will be received. This is where the tax credit offset program steps in. The transfers of funds in these programs are not voluntary. Many jurisdictions have laws

which allows the government to transfer such credits to other outstanding debts. (These debts are generally social in nature or an outstanding debt from a government program.) The most frequent occurrence is that the refund credits are offset and applied to an outstanding tax liability for a different tax period.

In the United States of America, the Department of Treasury manages the Treasury Offset Program, where funds due the taxpayer can be applied to:

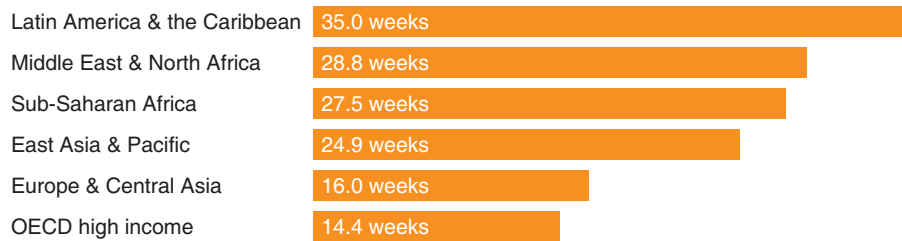
- Past-due child or spousal support;
- Federal agency non-tax debts (e.g., student loan);
- State income tax obligations; or,
- Certain unemployment compensation debts owed to a state (generally, these are debts for (1) compensation paid due to fraud, or (2) contributions owing to a state fund that weren't paid). (Internal Revenue Service, 2017)

In some cases, the offset of a tax credit might be generated by outstanding debts the taxpayer might have with other government agencies.

4.4.6. Refunds timeframes

The refund time periods vary, depending on the type of tax, tax administration and how payment is made. In the United States of America for example, if an individual income tax return is filed electronically and the taxpayer has requested a direct deposit to their bank account, the request will be processed within 21 days of IRS e-file acceptance. In the case of a paper filed tax return where the mailing of a check is requested, processing time can be 6 to 8 weeks from the date the IRS receives the tax return.

Emphasis needs to be made on the issue of tax type when it comes to the average time of tax refunds. Throughout this publication there is reference to this subject depending on the chapter's particular topic. There is reference to a 25-day time period for the average of all tax returns. However, when the subject deals with VAT returns, the average jumps up to 21.6 weeks for a refund. [Chart 4.4-1](#) below gives a good visual of the average VAT refund time per region. Note that in Latin America and the Caribbean the average is the highest with a 35-week refund time.

Chart 4.4-1 Weeks to receive VAT refunds

Source: Time to obtain VAT refund (weeks). From “Paying Taxes 2017,” by WB & PWC, 2017. Copyright 2017 PwC. Copyright 2017 The World Bank and International Finance Corporation.

Reference is made to the information source publication, World Bank and PricewaterhouseCoopers “Paying Taxes 2017” (also known as “Doing Business”), which contains a treasure trove of data on the subject of tax refunds (PriceWaterhouseCoopers & World Bank Group, 2017). Worldwide, 162 economies have a VAT system. As referenced in the WB/PWC publication, “The shortest time taken to receive a VAT refund is 3.2 weeks in Austria. The longest time to receive a VAT refund is 106.2 weeks in Cabo Verde.”

Note that in a number of jurisdictions (e.g., Brazil and the United States of America) a taxpayer may have a right to an interest payment on their refund. In the case of the United States of America, this occurs when the taxpayer timely files their tax return and are due a refund. If the tax administration does not refund the taxpayer within 45 days after the end of the filing date, an interest payment is due to the taxpayer.

4.4.7. Conclusion

A lengthy and convincing argument could be made why Country A will refund taxpayers their VAT credits in a shorter period than Country B. By the same token, Country B can equally justify why their process time is required. The immediate thought that creeps into one’s mind for the extra time required to refund the credits is fraud prevention. We’re all familiar with the numerous schemes that have been concocted to rob the states of millions and millions (e.g., Missing Trader, Carousel Fraud, Fictitious Exports, Identity Theft). One word, technology. What can technology do to prevent fraud, speed up the refund process, satisfy our customer base (taxpayers), and increase the effectiveness and efficiency of the tax administration? Loads! There are several avenues that the tax administrations can pursue to improve their performance in these areas. Of course, one is to have the right current data on the taxpayer’s activities. There is no doubt that electronic invoicing has reaped in major benefits for the tax administrations when it comes to providing timely refunds and preventing fraud. Some, as in the case of Chile, have gone so far as have a pre-prepared VAT form for its taxpayers. There lie the many virtues of having mass data; having the proper manageable data with which to administer the system for the benefit of all. In the table shown below, it’s clear to see that the greatest number of refunds are from VAT.

Table 4.4-2 Percent of gross tax refunds by type of tax

Country	Personal income tax	Corporate income/ profits tax	Value added tax	All taxes
Australia	14.5	10.8	46.1	20.1
Canada	13.2	20.4	n/a	21.6
Hungary	6.4	13.5	42.8	17.4
Ireland	19.1	12.8	24.6	13.9
Japan	4.3	1.6	6.5	12.6
N. Zealand	4.3	3.0	46.1	16.7
Korea	3.6	10.3	41.6	18.9
Slovenia	11.0	9.1	38.1	-
Spain (2006)	14.7	11.2	31.0	18.0
Sweden (2006)	5.0	-	41.0	-
UK	-	-	40.8	13.3
United States of America	18.2	6.8	n/a	11.0

Source: Percent of gross tax collections refunded to taxpayers in 2007. Adapted from “Detailed Guidelines for Improved Tax Administration in Latin America and the Caribbean,” by USAID, 2013, p. 155. Copyright 2013 by USAID

Of course, all of this comes at a cost. And there is the bottom-line. How much of an investment needs to be made? What is the expected return on this investment? Over the years, the CIAT organization has faced this juncture in their technical support projects with member tax organizations. There certainly is no “one-size-fits-all” solution. Each entity is different. But there certainly is a wealth of information that is continuously shared by members that aids in the search for solutions.

The initial hypothesis that we do away with the added cost of operating a tax refund unit in the tax administration doesn’t hold water. At least, not for now. However, it’s very possible that in the foreseeable future the expense of operating a tax refund unit is a very minor cost to the tax department. This can and will be accomplished through technology.

4.5. Current Account

A tax current account is a centralized module of an integrated system that is used to register and manage all financial and monetary elements derived from the obligations a taxpayer has and the interactions regarding those obligations, that could be either a tax return filed, an assessment or reassessment from a tax administration, a payment, a remittance, a tax refund, the decision of an objection process or the result of the application of penalties or interests associated with a non-compliance situation and their cancellation.

The final objective is to have a system that would facilitate both the tax administration and the taxpayer with the balance of its accounts. That balance should also include the monetary values associated with interests and penalties that would be determined for a taxpayer. An example of such an account could be shown in *Figure 4.5-1*.

Not all tax administration systems have a centralized current account module. There are cases where different modules can be used to handle different taxes or that would track individual elements as a separate debt. However, where available, a tax current account has been proven to be a powerful component that would significantly improve various processes including returns processing, payments processing, refunds processing, compliance control, arrears collections, and when available, remission and amnesty programs.

Depending on the tax systems, a balance of an account should be kept for each individual obligation or could be consolidated by tax. In the first case, usually each tuple of taxpayer – tax type – period would have an account as it is shown in [Figure 4.5-1](#), where there are two accounts, each corresponding to one period (2017 and 2018) of income tax for a particular taxpayer.

Figure 4.5-1 Account with a tuple: taxpayer - tax type - period

Heading													
Taxpayer		1234567-8						Combined Balance					
Tax Type		Income Tax						0.00					
Period		2017											
Total credits and debits		700.00		700.00				-		-			
Balance						0.00				0.00		0.00	
Tx Id	Description	Reference	Tx Date	Op. Date	Db. Value	Cr. Value	Balance	DB. Interes	Cr. Interest	Bal. Interes	Db. Penalti	Cr. Penaltie	Bal. Penalti
1085164	Tax return filed	TR469109	18-03-31	18-03-31	700.00	-	700.00			-			-
1093721	Payment received	PY371016	18-03-31	18-03-31	0	700	-			-			-

Source: Prepared by the author

4.5.1. Elements and basic features of the account

The heading part of the account shows the Tax Identification Number (TIN) of the taxpayer; the tax type, in this case Income Tax; the period, in this case the fiscal year 2017; the due date of the obligation (for filing, paying or remitting); the account type (when the system requires that reassessments and other liabilities determined by the tax administration need to be managed separately from self-assessed liabilities; or, the status in terms of enforceability to collect and seize. In the lower part we would see one line for each transaction with a transaction ID identified in the first column. The first transaction comes from the return filed, the reference to the document, the date of the transaction and the date it would have effect, which in this case are the same, and the amount of tax to be paid reported in the return. The second transaction has the payment details. In this example the tax return and the payment were made on time, so no penalties or interests were determined. The extra fields in the heading present the total credits and debits applied for tax, interests and penalties, and the balances. An extra field shows a single balance that considers all sub-balances.

The example in [Figure 4.5-2](#) shows a case when the taxpayer filed a tax return with a reported tax of 790 but the payment was short by 90. In this theoretical tax system, a penalty 100 monetary units (MU) would be imposed automatically to the taxpayer after the due date is reached and a monthly interest rate of 1% would be applied to outstanding balances of tax. The image below shows the account sometime in March 2019, when automatic penalties and interests are computed. The total number of credits and debits are shown as well as the combined and individual balances.

Figure 4.5-2 Example with interests and penalties applied

Heading													
Taxpayer		1234567-8				Combined Balance							
Tax Type		Income Tax				191.80							
Period		2018											
Total credits and debits		790.00 700.00				1.80 -				100 -			
Balance		90.00				1.80				100.00			
Tx Id	Description	Reference	Tx Date	Op. Date	db. Value	Cr. Value	Balance	DB. Interes	Cr. Interest	Bal. Interes	Db. Penalti	Cr. Penaltie	Bal. Penalti
2588681	Tax return filed	TR347645	19-03-31	19-03-31	790.00	-	790.00			-			-
2598941	Payment received	PY754566	19-03-31	19-03-31	0	700	90.00			-			-
2606391	Late filing penalty	TR796037	19-04-01	19-04-01			90.00			-	100		100.00
2614409	Int. April 2019	TR116689	19-05-01	19-05-01			90.00	0.90		0.90			100.00
2620306	Int. May 2019	TR891797	19-06-01	19-06-01			90.00	0.90		1.80			100.00

Source: Prepared by the author

One key feature of the tax current account module is precisely the capacity of computing and recording interest that need to be calculated on outstanding balances and the settings of automatic penalties if and when the tax system so demands.

Another key feature of the module is the imputation of payments in terms of the order in which a payment should be applied to penalties, interests and tax owed. So, for example in the situation described in the example of [Figure 4.5-3](#), a payment of 120 MU was made on June 6, the account should apply the payment, according to this theoretical tax system, first to pay for the penalty, interests owed and the rest would be applied to the tax debt. The situation is illustrated in account shown in the figure below.

Figure 4.5-3 Example of the imputation of payment

Heading													
Taxpayer		1234567-8				Combined Balance							
Tax Type		Income Tax				71.80							
Period		2018											
Total credits and debits		790.00 718.20				1.80 1.80				100.00 100.00			
Balance		71.80				0.00				0.00			
Tx Id	Description	Reference	Tx Date	Op. Date	db. Value	Cr. Value	Balance	DB. Interes	Cr. Interest	Bal. Interes	Db. Penalti	Cr. Penaltie	Bal. Penalti
2587031	Tax return filed	TR773015	19-03-31	19-03-31	790.00	-	790.00			-			-
2598121	Payment received	PY381832	19-03-31	19-03-31	0	700.00	90.00			-			-
2609072	Late filing penalty	TR24808	19-04-01	19-04-01			90.00			-	100.00		100.00
2619561	Int. April 2019	TR257798	19-05-01	19-05-01			90.00	0.90		0.90			100.00
2624732	Int. May 2019	TR478251	19-06-01	19-06-01			90.00	0.90		1.80			100.00
2639070	Payment received	PY183445	19-06-06	19-06-06	0	18.20	71.80		1.80			100.00	-

Source: Prepared by the author

In another hypothetical tax system, particularly one that establishes that payments must be applied to the oldest debt first, the current account could be identified by tax type, regardless of period. The example in [Figure 4.5-4](#) shows such an account: the taxpayer filed a tax return for the fiscal year of 2017 but did not pay the reported taxes. The account system computed penalty and interests until the moment of the next period where the tax return for the fiscal year 2018 is filed with a reported tax of 1000 MU. The taxpayer made a payment of 1,000 MU but the system applied the payment according to the rules of this hypothetical tax system (penalty, interest, tax). At any point in Jun 2019 the account would show the following statement.

Figure 4.5-4 Example of an account by tax type - no period

Taxpayer			1234567-8						Combined Balance							
Tax Type			Income Tax						1,141.24							
Total credits and debits			1,900.00		792.00				141.24		108.00		100.00		100.00	
Balance							1,108.00				33.24				0.00	
Tx Id	Description	Reference	Tx Date	Op. Date	db. Value	Cr. Value	Balance	DB. Interes	Cr. Interest	Bal. Interes	Db. Penalti	Cr. Penaltie	Bal. Penalti			
1085214	Tax return filed	TR330190	18-03-31	19-03-31	900.00	-	900.00			-			-			
1093203	Late filing penalty	TR451061	18-04-01	18-04-01			900.00			-	100.00		100.00			
1103594	Interests	TR17657	18-04-01	19-04-01			900.00	9.00		9.00			100.00			
1115041	Interests	TR807565	18-05-01	18-05-01			900.00	9.00		18.00			100.00			
1128374	Interests	TR946297	18-06-01	18-06-01			900.00	9.00		27.00			100.00			
1134423	Interests	TR47676	18-07-01	18-07-01			900.00	9.00		36.00			100.00			
1148372	Interests	TR733047	18-08-01	18-08-01			900.00	9.00		45.00			100.00			
1158761	Interests	TR166585	18-09-01	18-09-01			900.00	9.00		54.00			100.00			
1164524	Interests	TR869706	18-10-01	18-10-01			900.00	9.00		63.00			100.00			
1172483	Interests	TR830146	18-11-01	18-11-01			900.00	9.00		72.00			100.00			
1181987	Interests	TR249944	18-12-01	18-12-01			900.00	9.00		81.00			100.00			
1190741	Interests	TR179994	19-01-01	19-01-01			900.00	9.00		90.00			100.00			
1201496	Interests	TR647463	19-02-01	19-02-01			900.00	9.00		99.00			100.00			
1218231	Interests	TR633335	19-03-01	19-03-01			900.00	9.00		108.00			100.00			
1227375	Tax return filed	TR939295	19-03-31	19-03-31	1,000.00	-	1,900.00			108.00			100.00			
1230478	Payment	TR736385	19-03-31	19-03-31		792.00	1,108.00		108.00	-		100	-			
1249038	Interests	TR729287	19-04-01	19-04-01			1,108.00	11.08		11.08			-			
1255025	Interests	TR360891	19-05-01	19-05-01			1,108.00	11.08		22.16			-			
1260009	Interests	TR951556	19-06-01	19-06-01			1,108.00	11.08		33.24			-			

Source: Prepared by the author

In tax systems where taxpayers can identify the specific period a payment must be applied to, the option that has a period in a tuple is preferable.

In addition, some tax systems might require additional concepts besides tax, interest and penalties, including items like processing costs or other surcharges. If that is the case, the account should have the corresponding components.

4.5.2. Parameterization

Tax systems are complex and so there is an inherent risk in the implementation of a current account module that derives from that complexity and the possibility to create a system difficult to maintain. To cope with that complexity, the module should be customized by parameters as much as possible.

Elements that should ideally be parameterized include the following:

- **Tax types.** They would include elements like Income Tax, Corporate Income Tax, Value Added Tax, Sales Tax, Excise Tax, Payroll Tax; as well as Withholding Taxes, Prepayment of Taxes, and so on.
- **Periods.** They would include annual periods, monthly, quarterly, and so on.
- **Tax returns, payments and other documents.** They would include tax returns and documents that would trigger transactions to the account, including the identification of the proper tuple and the fields that would indicate the specific concepts and debits or credits to be obtained. These documents would include assessments, reassessments, decisions to objections and appeals and some taxpayer requests.

- Interest rates to be applied for outstanding balances in debt or to be charged when the tax administration exceeds the time to refund taxpayers.
- Penalties values associated with non-compliance situations that would and should be automatically imposed by the system.
- Statutes of limitations for taxes and or computation of interests.

4.5.3. Dealing with non-periodic taxes or concepts

There might be situations where tax administration deals with non-periodic taxes. One example comes with customs operations that should be taxed on a case by case basis.

In these situations, it is possible to design a tax current account module that would have a taxpayer – operation instance as a tuple to identify an account if each operation should be handled individually with its own computation of interests, penalties and payment imputation. It can also be designed with a single account for customs where each custom declaration would generate a transaction, interests would be computed on outstanding balances and payments should be applied according to the order established for imputation.

A similar approach will be used when dealing with concepts not directly related with a tax type, like a penalty regarding a registration update obligation that could not be linked to any particular tax type as it is illustrated in [Figure 4.5-5](#).

Figure 4.5-5 Example of an account for a penalty

Heading													
Taxpayer		1234567-8				Combined Balance							
Tax Type / Concept		Registry related penalties				300.00							
Period													
Total credits and debits		-				-							
Balance		0.00				0.00							
Tx Id	Description	Reference	Tx Date	Op. Date	Db. Value	Cr. Value	Balance	DB. Interes	Cr. Interest	Bal. Interes	Db. Penalti	Cr. Penaltie	Bal. Penalti
3894698	Failure to update reg Res.	01234	19-07-24	19-07-24	-	-	-	-	-	-	300.00	-	300.00

Source: Prepared by the author

4.5.4. Immutability of the account

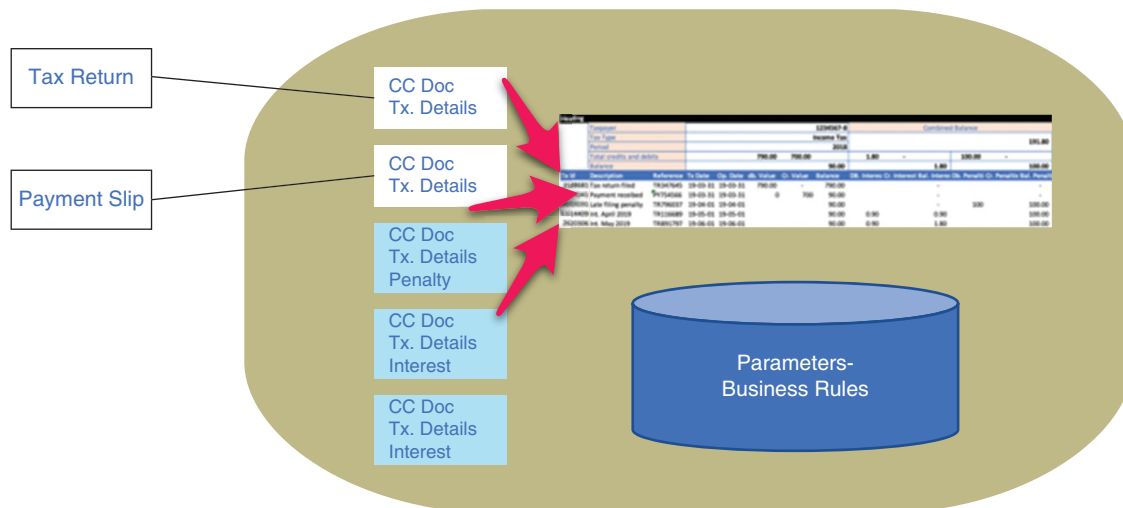
An important feature of the current account module is its read-only¹⁷ character for all transactions that have already been posted.

One way to support this process is to have internal documents that are not visible outside the current account module. The current account need not deal with specificities of the assessment process of each particular tax. Every single transaction that is posted to the account must be supported by a document that could be generated from other components of a tax information system like a tax return, a payment slip, or a reassessment, to mention a few. Each document that should result in

a transaction posted to the account must generate an internal document that mirrors the information relevant for the transaction. Internal documents could also come from an internal process within the tax current account module like automatic penalties or the computation of interests.

These internal documents, that could be implemented in different ways including XML files or master-child tables on a relational database, contain the reference to the originating document and the details as they were at the moment of posting. If for any reason the original document changes in the future the internal document will keep all relevant information safe, even if the originating document is altered or deleted, and will guarantee that if the account is rebuilt, the end state will be consistent. The application of hashing functions or digital signature of documents could be additionally used to further assure this process. This characteristic improves the level of certainty for both, the tax administration and the taxpayer. An illustration of this concept is presented in *Figure 4.5-6*.

Figure 4.5-6 Current Account Sandbox



Source: Prepared by the author

The documentation of the transactions could include also electronic signatures or hashing functions from the documents and other elements that generated the transaction. In the end, these elements could be used to verify that something was altered after the transactions were posted.

Due to the nature of the taxing environment, it is always possible that some event may affect a position in the past. This could come from, for example, from an error in a payment identification details that left an account in a debit position and presumably with the interests and even penalties applied.

As shown in [Figure 4.5-7](#), an account would have the following status when queried.

Figure 4.5-7 Account with missing payment

Heading													
Taxpayer			1234567-8					Combined Balance					
Tax Type			Income Tax					1,446.40					
Period			2018										
Total credits and debits			1,320.00 -					26.40 -			100.00 -		
Balance			1,320.00					26.40			100.00		
Tx Id	Description	Reference	Tx Date	Op. Date	db. Value	Cr. Value	Balance	DB. Interes	Cr. Interest	Bal. Interes	Db. Penalti	Cr. Penaltie	Bal. Penalti
2581008	Tax return filed	TR402918	19-03-31	19-03-31	1,320.00	-	1,320.00			-			-
2595393	Late filing penalty	TR473796	19-04-01	19-04-01			1,320.00			-	100.00		100.00
2605772	Int. April 2019	TR999400	19-05-01	19-05-01			1,320.00	13.20		13.20			100.00
2616196	Int. May 2019	TR379288	19-06-01	19-06-01			1,320.00	13.20		26.40			100.00

Source: Prepared by the author

So, when the payment is identified and posted to the account there is a need to reverse all transactions that put penalties and interests in that account. The following [Figure 4.5-8](#) shows the transactions that would be posted to the account at the same time.

Figure 4.5-8 Transaction list showing reverse entries

Tx Id	Description	Reference	Tx Date	Op. Date	db. Value	Cr. Value	DB. Interes	Cr. Interest	Db. Penalti	Cr. Penaltie
2581008	Tax return filed	TR402918	19-03-31	19-03-31	1,320.00	-				
2595393	Late filing penalty	TR473796	19-04-01	19-04-01					100.00	
2605772	Int. April 2019	TR999400	19-05-01	19-05-01			13.20			
2616196	Int. May 2019	TR379288	19-06-01	19-06-01			13.20			
2620828	Reverse 2595393	TR379288	19-04-01	19-06-17	-	-	-	-	(100.00)	-
2635621	Reverse 2605772	TR379288	19-05-01	19-06-17	-	-	(13.20)	-	-	-
2649812	Reverse 2616196	TR379288	19-06-01	19-06-17	-	-	(13.20)	-	-	-
2653693	Payment received	PY279925	19-03-31	19-06-17	0	1,320.00				

Source: Prepared by the author

That would result on the current account statement that is presented in [Figure 4.5-9](#). It is shown that balances and total credits and debits look exactly as it should have been if the payment was correctly identified at the moment of filing. However, there is clear evidence of the accessories that were calculated and posted to the account after the due date and before the time when the payment was found and posted, leaving evidence of the reasons that cause the reversal of transactions.

Figure 4.5-9 Account statement after processing payments

Heading															
Taxpayer			1234567-8					Combined Balance							
Tax Type			Income Tax					0.00							
Period			2018												
Total credits and debits			1,320.00		1,320.00			-		-		-		-	
Balance			0.00					0.00		0.00		0.00		0.00	
Tx Id	Description	Reference	Tx Date	Op. Date	db. Value	Cr. Value	Balance	DB. Interes	Cr. Interest	Bal. Interes	Db. Penalti	Cr. Penaltie	Bal. Penalti	Cr. Penaltie	Bal. Penalti
2581008	Tax return filed	TR402918	19-03-31	19-03-31	1,320.00	-	1,320.00			-				-	
2590340	Payment received	PY394300	19-03-31	19-06-17	0	1,320.00	-			-				-	
2595393	Late filing penalty	TR473796	19-04-01	19-04-01			-			-	100.00			100.00	
2620828	Reverse 2581008	TR379288	19-03-31	19-06-17	-	-	-	-	-	-	(100.00)	-		-	
2605772	Int. April 2019	TR999400	19-05-01	19-05-01			-	13.20		13.20				-	
2635621	Reverse 2595393	TR379288	19-04-01	19-06-17	-	-	-	(13.20)	-	-	-	-	-	-	-
2616196	Int. May 2019	TR379288	19-06-01	19-06-01			-	13.20		13.20				-	
2649812	Reverse 2605772	TR379288	19-05-01	19-06-17	-	-	-	(13.20)	-	-	-	-	-	-	-

Source: Prepared by the author

The need to rebuild an account might generally appear for other reasons. For instance, a taxpayer could file and amended a tax return modifying the tax reported in the original return, or the tax administration could have filed a replacement filed return in absence of the taxpayer's return, if the tax system allows that, or because of an assessment or reassessment from the tax administration that would modify the position of a taxpayer.

Taxes can be complex systems where those transactions might trigger a chain of consequences in other periods. This is typically the case of VAT where carry forward credit balances might force to recalculate several periods of VAT in the future. For that reason, it is important to keep track of all transactions, including reversed transactions for integrity and transparency.

The current account system could provide a facility to filter the reversed transactions so that a clear view of the account can be offered. This is showed in [Figure 4.5-10](#).

Figure 4.5-10 Current account statement with reversed transactions filtered

Heading													
Taxpayer		1234567-8				Combined Balance							
Tax Type		Income Tax				(26.40)							
Period		2018											
Total credits and debits		1,320.00 1,320.00				(26.40) - - - -							
Balance		0.00				(26.40) 0.00							
Tx Id	Description	Reference	Tx Date	Op. Date	db. Value	Cr. Value	Balance	DB. Interes	Cr. Interest	Bal. Interes	Db. Penalti	Cr. Penalti	Bal. Penalti
2581008	Tax reurnt filed	TR402918	19-03-31	19-03-31	1,320.00	-	1,320.00						
2594756	Payment received	PY692454	1234567-1	19-06-17	0	1,320.00	-						

Source: Prepared by the author

Some implementations of a current account system might adopt a different approach in these situations, actually forcing a re-processing of the current account applying the “right” transactions at they should have been posted at the corresponding time using the new elements of information. That approach, although it might be simpler to implement, lacks the capacity to show all transactions that at some point in time could have been posted to the account. This would result, for instance, in situations where a print-screen of an account statement at a particular time can be completely different from the one that is presented after reprocessing.

4.5.5. Credit / debit transactions

Another functionality of the tax current account is the ability to support transactions that would affect two or more accounts with a debit in one of the accounts and a credit in another. A typical scenario comes with prepayments for income taxes that some legislations might have. [Figure 4.5-11](#) illustrates how a transaction could post a debit entry in one account and a corresponding credit entry in a different account. In the example, a prepayment of 318 MU made in September and is transferred to the Income Tax account on March 31. The prepayment account, that is kind of an auxiliary accounts is closed after the event.

Figure 4.5-11 Accounts with a credit/debit transaction

Heading												
Taxpayer		1234567-8					Combined Balance					
Tax Type		Income Tax Prepayment					(318.00)					
Period		2018										
Total credits and debits		318.00 318.00					-		-			
Balance		(318.00)							0.00		0.00	
Tx Id	Description	Reference	Tx Date	Op. Date	Db. Value	Cr. Value	Balance	DB Interes	Cr. Interest	Bal. Interes	Db. Penalti	Cr. Penaltie
3787683	Prepayment based on TR466371		18-09-30	18-09-30		318.00	(318.00)			-		-
	Prepayment balance	PY807369	19-03-31	19-03-31	318.00		-			-		-

Heading												
Taxpayer		1234567-8					Combined Balance					
Tax Type		Income Tax					0.00					
Period		2018										
Total credits and debits		857.00 857.00					-		-			
Balance		0.00							0.00		0.00	
Tx Id	Description	Reference	Tx Date	Op. Date	Db. Value	Cr. Value	Balance	DB Interes	Cr. Interest	Bal. Interes	Db. Penalti	Cr. Penaltie
4188578	Tax return filed	TR940573	18-03-31	18-03-31	857.00	-	857.00			-		-
4190156	Prepayment balance	PY807369	18-03-31	18-03-31	0	318.00	539.00			-		-
4208907	Prepayment received	PY320165	18-03-31	18-03-31	0	539.00	-					

Source: Prepared by the author

This is particularly useful in instances where a non-compliance situation in terms of the prepayment. If, for instance, the prepayment is not made, the tax system could establish that a penalty must be imposed. At the moment of filing the tax return any available balance in tax would be transferred as a credit to the income tax account, but if penalties (or interests) are still owed that account will stay in place.

The next case illustrates the situation if the prepayment would have been made a couple of days after the due date. A penalty was imposed, the amount of the prepayment was used to first cancel the penalty and the rest would be transferred to the income tax account at the moment of filing. In the example, since the payment of the tax return was not altered the account would show a pending balance of the taxpayer that would eventually end generating interests if no additional payment arrives.

Figure 4.5-12 Accounts with debit / credit transaction, another example

Heading												
Taxpayer		1234567-8					Combined Balance					
Tax Type		Income Tax Prepayment					0.00					
Period		2018										
Total credits and debits		168.00 168.00					-		-		150.00 150.00	
Balance		0.00							0.00		0.00	
Tx Id	Description	Reference	Tx Date	Op. Date	Db. Value	Cr. Value	Balance	DB Interes	Cr. Interest	Bal. Interes	Db. Penalti	Cr. Penaltie
3787783	Late payment penalty	TR306610	18-09-30	18-09-30			-			-	150	150.00
3799809	Prepayment based on TR554715		18-09-30	18-09-30		168.00	(168.00)			-		150
3807523	Prepayment balance	PY807369	19-03-31	19-03-31	168.00		-			-		-

Heading												
Taxpayer		1234567-8					Combined Balance					
Tax Type		Income Tax					150.00					
Period		2018										
Total credits and debits		857.00 707.00					-		-			
Balance		150.00							0.00		0.00	
Tx Id	Description	Reference	Tx Date	Op. Date	Db. Value	Cr. Value	Balance	DB Interes	Cr. Interest	Bal. Interes	Db. Penalti	Cr. Penaltie
4180467	Tax return filed	TR313656	18-03-31	18-03-31	857.00		857.00			-		-
4199956	Prepayment balance	PY807369	18-03-31	18-03-31	0	168.00	689.00			-		-
4206799	Payment received	PY509886	18-03-31	18-03-31	0	539.00	150.00					

Source: Prepared by the author

These type of credit and debit transactions would be of great importance for instalment plans of several taxes and periods that could be consolidated in a new account associated with the plan. Of course, only if the tax system allows such behavior.

4.5.6. Relationship with other modules and subsystems

Many subsystems within an integrated information system may generate situations that would end with a transaction posted in an account. This facility is important enough to highlight the key role the tax current account module plays within the information structure. In addition, the module supports additional services to other subsystems and modules that are of great importance, basically by exposing balances. That facility could be presented via screens available to officers from the tax administration and the taxpayer, but also through an interface that could be implemented in one or more of the following, depending on the architecture of the system, the languages and environment used and the level of coupling: public methods calling, remote procedure calls, API calling, Web services, microservices. Regardless of the technology used, the ability to offer balances for other modules should cover at least the following components.

Taxpayer services

The system must offer taxpayers with queries to the current account. An approach is to allow a dive-in approach to view a general view of all accounts with a consolidated balance first, allowing the taxpayer to select a particular tax type, a particular period with the list of all transactions and finally the details documenting each individual transaction. *Figure 4.5-13* shows, from an actual system, a navigation from the consolidated account by tax type, to a specific tax and then to the details of the transactions of a period.

Figure 4.5-13 Consolidated query of account balances

Current Account Panel

TaxPayer: [REDACTED] Name: [REDACTED] Address: [REDACTED]

Accounts Transactions

Tin: 6003120125 Balance Status

Name	Tax	Interest	Penalties	Balance	Transactions
1 INCOME TAX PREPAYMENT	\$28,181.25	\$0.00	\$0.00	\$28,181.25	
2 INCOME TAX	\$40,614.25	\$0.00	\$0.00	\$40,614.25	
	\$68,795.50	\$0.00	\$0.00	\$68,795.50	

Current Account Panel

TaxPayer: [REDACTED] Name: [REDACTED] Address: [REDACTED]

Accounts Transactions

Tin: [REDACTED] Tax Type: INCOME TAX Balance Status

Name	Tax	Interest	Penalties	Balance	Transactions
1 200812	\$40,614.25	\$0.00	\$0.00	\$40,614.25	
	\$40,614.25	\$0.00	\$0.00	\$40,614.25	

Tax Type: INCOME TAX, Period: 200812

Documento	IdTransaction	Transaction	Period	Effect	Date	Tax	Interest	Penalties
1 649948	8885	PAYMENT	200812	CREDIT	20.10.2008	\$40,614.25	\$0.00	\$0.00

Close

Source: IRD information system screen capture

In terms of taxpayer services, some jurisdictions might require some kind of compliance certificates to be issued and presented in specific circumstances, for instance to participate in a bidding contest for the government. The preparation of such certificates come directly from the current account situation.

Currently we recommend that if needed those certificates must be of the electronic kind only, where authorized interested parties can query the situation of a taxpayer by accessing a service exposed by the current account. The access to this facility would require some kind of authorization and verification before an answer is offered.

Returns processing

A solid trend that is being observed in many tax administrations is the pre-filling of tax returns for some tax types and larger groups of taxpayers. Some populated fields of a tax return might have the balance from an account (a withholding tax account, a prepayment account or a previous period) to setoff that balance in the new account.

Payment processing

The ability to prepare payment slips that taxpayers could use to pay their taxes at a local bank or directly offer the outstanding balances so online payments can be made from within the electronic services of a taxpayer's bank account, that will exactly match all details of such a payment.

Refunds processing

When there are over-payments of any nature as well as credit balances for a particular tax, for instance VAT for exporters, the current account must provide the actual value that could be claimed by a taxpayer or automatically processed by the tax administration so that the refunds process could be completed.

Arrears collection

In addition to the obvious service of identifying outstanding balances that need to be collected, the building block for arrears collection management, the tax current account system can support the preparation and management.

Objections and appeals

In these cases, particularly those that are processes through the courts system, different participants need access to see the outstanding debts. But, more importantly, in some jurisdictions once a case is admitted to the objections or appeals process, the debt loses its eligibility and cannot be subjected to a foreclosure process. The account must have the ability to mark those events, the ending of the proceedings and avoid the arrears collection process to select such an account.

Negotiable certificates and other means

On occasions tax incentives and benefits can be implemented as certificates that can be used as credits to pay taxes. Negotiable tax certificates can also be used as a way to refund taxpayers of excessive credits, that later can be negotiated at a discount value to pay taxes.

Amnesties and regularization programs

Amnesties and other regularization programs are on occasions established, usually for a short period of time, as an immediate source of additional revenue; to help groups of taxpayers affected by natural disasters or other conjunctural situation; to organize and debug a complex situation with lots of very old tax liabilities with low probability of effective collection; or, just as a sovereign policy. Usually, with these programs, accessory elements like penalties or interests could be forgotten, partially or in full, in exchange of the payment of the main tax debt or a commitment for an installment plan. In these situations, the tax current account should support the transactions that would cancel those liabilities.

Mergers and acquisitions

The succession of a taxpayer should trigger a number of processes within the tax administration that would go from the possibility of auditing a company that is going to disappear, usually within a short period of time, to the incorporation of a new taxpayer within the registry. From the perspective of the current account it is necessary to transfer all balances from the taxpayer that is going extinct to the succeeding taxpayer where the transferred balance might appear as a credit or debit depending on the individual situation of each account.

4.5.7. *IT considerations*

In addition to the enabling technologies mentioned throughout this section (API, XML, Web-services), there is a number of technologies and specific tools that have enabled the design and development of tax current account models as were described before. The implementation details depend a lot on the architecture of the system and not all might be applicable to all situations.

In particular to support data persistence, business logic, and services.

Relational Database Management Systems

The tax current account deals with monetary values, so all transactions that are posted to the account must meet what is known as ACID properties of transactions.¹⁸

- **Atomicity.** A transaction should be left partially completed. Either it is fully completed or not. All changes involved in a transaction must be treated like a single operation.
- **Consistency.** All the accounts must be in a consistent state both when a transaction starts and when it ends. For instance, in credit/debit transactions the total balance of both accounts involved must be the same after and before the transaction.
- **Isolation.** Any intermediary state of a transaction cannot be visible.
- **Durability.** The results of the transactions being posted in the current account must be durable even if the system fails or restarts.

In addition, each account can be seen as a heading, identified by a specific tuple (for example, taxpayer, tax type, period) and rows, one for each transaction.

To meet these properties, the best tools for implementation of the data persistence layer of a current account is a Relational Database Management System with support of commit and rollback of transactions. These tools, that have been in successful implementations, include tools like Oracle Database,¹⁹ Microsoft SQL Server,²⁰ IBM DB2²¹ and previously ADABAS.²²

During the prevalence of Client/Service models, a good practice was to leave the business logic of the core of the account within the database, either through the use of triggers and stored procedures

and packages coding in languages like PL/SQL, Transact SQL or CLP, or with a different approach in old mainframe-based environments with Natural/CICS. However, some implementations missed that practice resulting in some business logic coded in the client side.

Application servers

Current N-tier models make use of application servers that are used to run web-based applications, Webservices and currently microservices, that support the business logic. These application servers run “in front” of the database and use connectors to manage data persistence. There are two major flavors in these areas that have been used in successful implementations of current accounts: the .NET²³ platform from Microsoft (code in C#) and the Java EE platform (code in Java) with several options from different vendors with a predominance of JBoss,²⁴ WebSphere²⁵ and WebLogic.²⁶

Presentation layer

In the past, in the Client/Server model the presentation layer, that offers views of the account to officers and taxpayers, was restricted to distributed client applications. In modern systems the presentation layer can be accessed through more than one platform (web-based or mobile) and through the use of API or Webservices directly from within other applications. The majority of web/based interfaces are using responsive JavaScript based frameworks that adapt to different screen sizes like Angular²⁷ or Bootstrap.²⁸

4.6. Good practices in taxation of micro and small businesses

4.6.1. Goals and strategies

The reduction of businesses informality and the construction of tax awareness in the population are among the biggest objectives of any tax administration.

The main objective of tax policy for micro and small businesses is to simplify and reduce business informality. Micro entrepreneurs have a low ability to perform complex obligations as well as make complex calculations to pay taxes.

If the tax administration could send regularly to each micro-entrepreneur payment slips with the tax amounts due, there would be no need for special tax schemes. As this is practically impossible in many countries, given the need to know and interpret all economic transactions in the country, tax administrations have made efforts to simplify procedures, sometimes culminating in special tax schemes for micro and small businesses.

In Latin American countries, especially Brazil, Micro and Small Businesses (MSE) fiscal policy is part of a larger strategy that involves not only taxes but various public policies that affect this segment, such as government procurement, registrations, operating licenses, social security, managerial and professional training, credit and market access.

Especially in the case of Brazil, until 2006 there was an excellent tax scheme for MSE, including taxes and contributions, but the results were not good in reducing informality, because it was thought only about taxes. The results started to get better when other public policies were added, such as registration facilities, public procurements and credit, forming a true “MSE statute”.

The strategy is as follows: If you build a total, harmonious and inclusive policy that does not only involve taxes, it increases the attractiveness for the business to become formal. A micro-entrepreneur will be more attracted to formality if it is extremely easy to register and if, upon registration, the taxpayer feels part of a network that will provide him with differentiated attention in businesses license, public procurement, credit, and training, for example.

For this integration to take place, the tax administration cannot act alone. Stakeholders, other government agencies and MSE representative bodies need to be integrated. The institutionalization of integration must be prioritized and built so that processes and initiatives would have continuity. It is not enough just to arrange some meetings with partners if there is no scheduled periodicity, some structure and responsibility for the administrative part, and some formal act of creation of integration.

Another objective of these tax schemes is to build a tax consciousness and culture in the population, that is, to imbue citizens with the idea of paying taxes, even if the amount is small individually. In the tax regimes in which social security is included, as in Brazil, Argentina, and Uruguay, another objective is the generation and maintenance of formal jobs.

The simplification for taxpayers is so important, making taxation simpler, through the presumed calculation of the operations carried out, fixed quota, percentage of purchases and sales, that determined the base on which it should be taxed and that, in addition, facilitated the fulfillment of the obligations of these taxpayers.

In the other side, another consequence is simplifying control by tax administrations. With these simplified regimes, the tax administration aims to ensure a reasonable collection of this group of taxpayers and control them with standardized procedures, without devoting to it many qualified resources. Reducing the tax burden is not one of the goals, or certainly not the greatest. Simplification is the biggest goal.

The summary of the strategy is this: build easy pathways to formalization, work integrally for tax and extra fiscal attractions, draw a balanced and coherent tax scheme, get the registration, let them come easily, and then control them.

Controls are very necessary for special schemes. It is no exaggeration to say that “no controls, no special regimes”. Without controls, taxpayers will certainly abuse the scheme, or will not even register which one should do so.

One must also know that MSE gains extraordinary political power with the creation of these special tax schemes, and the tax administration will have to deal with that power, especially when attempts are made to misrepresent the objectives of tax policy.

4.6.2. Characteristics of MSE

Micro and small businesses have their special characteristics, contained in [Table 4.6-1](#).

Table 4.6-1 Characteristics of Micro and Small Businesses

Characteristics	Micro	Small
Number of taxpayers	Very numerous	Many
Type of taxpayers	Individuals (small traders or non-specialized service providers); family-owned businesses, few employees	Family-owned business with some employees; highly specialized self-employers
Amount of tax revenue	Often less than 1–2 percent of total revenue	Often 5–10 percent of total revenue
Ownership Structure	Owner, employee(s) and manager are one and the same	The owner(s) are generally the manager
Type of transactions	Mainly cash; high informality	Cash/bank; some informality
Place of business	Frequently non-fixed	Fixed (but maybe volatile)
Business administration	Non-professional (family-run)	Some professional assistance
Accounting Standards	No or few records; very limited understanding	Some records, limited to partial compliance; limited understanding
Market reach	Local	Local/Regional
Life-span of business	Very dynamic; rapid creation and dissolution	Dynamic; may disappear, stay small or grow

Source: International Monetary Fund staff

Given the characteristics of MSE, especially the low ability to control, filing, and payment of taxes, any tax schemes designed for this segment will also have to have special structures.

4.6.3. Characteristics of special tax schemes for MSE

The main features of these special tax regimes involve thresholds, taxes, and contributions included, levels of government involved, calibration of tax rates, tax calculation techniques, and control actions.

Thresholds in special tax schemes for SME

There is no default setting for the threshold in tax schemes for SME. There is a huge disparity between the values adopted between countries. This stems from the political and historical reality of each country.

Table 4.6-2 Thresholds in the MSME Special Tax Schemes in Latin American Countries²⁹

Class	Country	Threshold (USD) ³⁰	GDP per capita ³¹	Ratio
< USD 60,000 (and/or < 20 x GDP per capita)	Brazil – Micro Entrepreneur ³²	21,141	8,920.8	2.4
	Peru NRUS ³³	28,546	6,947.3	4.1
	Uruguay ³⁴	37,000	17,278.0	2.1
	Argentina ³⁵	38,558	11,652.6	3.3
	Ecuador ³⁶	60,000	6,344.9	9.5
> USD 60,000 < USD 500,000	Peru RER ³⁷	157,000	6,947.3	22.6
> USD 500,000	Colombia ³⁸	823,384	6,651.3	123.8
	Brazil SIMPLES ³⁹	1,230,769	8,920.8	138.0
	Chile ⁴⁰	1,955,000	15,923.4	122.8

Source: Prepared by the author with data from sources indicated

Given these disparities, how do you understand these differences and find patterns? How to understand what the purpose of each threshold is, and how each special tax scheme works? So, in this paper I will try to create patterns according to the class of turnovers, the type of taxation and its objectives, as follows:

Table 4.6-3 Goals of SME Special Tax Schemes, by threshold class

Class of thresholds	Normally used taxation mode	Main goals ⁴¹
1 < USD 60,000 (and/or < 20 x GDP per capita)	Lump-sum Tax	Facing Business Informality
2 > USD 60,000 < USD 500,000	Sales or Turnover Tax (Variable Rates)	Generating jobs ⁴²
3 > USD 500,000	Sales or Turnover Tax (Variable Rates); or, it keeps the normal taxation, reducing only compliance costs	Reducing the complexity of the country's tax system

Source: Prepared by the author

Informality is in micro-businesses, in entrepreneurs with very low turnover, whose transactions are mainly cash, with low capacity for controls, calculation, and payment of taxes. So, if a country wants to tackle business informality, that's the focus: entrepreneurs with turnover less than US\$60,000, or/and turnover less than 20 times GDP per capita. They are in Class 1 of [Table 4.6-3](#).

The recommended taxation model for these taxpayers is the lump-sum tax, with a fixed value monthly, quarterly, or annual payment. Lump-sum taxes are regressive, meaning persons with lower income pay more as a percentage of their income (in the same class). This is one of the reasons why the threshold should be low, even to cause less interference with the economy.

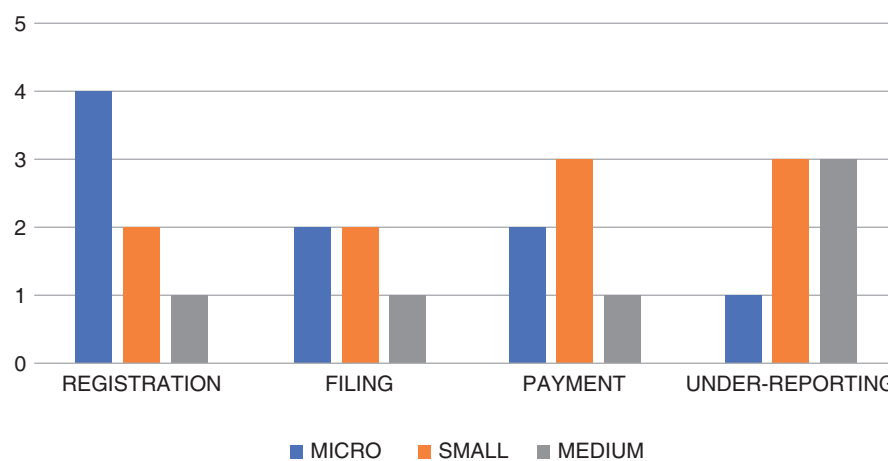
This type of taxation is appropriate for this segment because there are no calculations to make, the amount to pay is the same for all periods, there is predictability in obligations, and the way to

pay is as simple as possible. It is a final tax, with no need for tax returns, except for statistical and cross-checking purposes.

Business informality is not in a high turnover business. Entrepreneurs with high turnover need to be in the tax base. They need to have controls – in order to protect their assets. Their suppliers are in the regular market, and this forces them to be informality as well. The purpose of any special tax scheme for companies with this level of turnover is no longer to reduce informality but to create jobs (until Class 2 of [Table 4.6-3](#)), simplify the country's tax system or even benefit some sectors of the economy. In high turnover businesses, the key risk for tax administration is no longer registration, but mainly under-reporting risks.

The registration process is the critical first step for businesses in achieving compliance. This is why it has to be easy, simple and integrated. The risk of non-registration is higher in the segments with lower sales volume. The risk of informality is almost always found among micro-entrepreneurs. The risk probability diagram can be seen in the following figure:

Chart 4.6-1 Key compliance risks



Source: Prepared by the author

As one can see from the chart, as the turnover goes up, the registration risk became lower, and the attention of the tax authorities should turn to the filing, payment, and under-reporting risks.

Taxes and contributions included in special tax schemes for SME

Special schemes for MSE typically include the following taxes and contributions: Corporate Income Tax (CIT), Value Added Tax (VAT) and Social Contributions.

The most common schemes are, in order, those that replace only CIT, followed by those that simultaneously replace CIT and VAT.

Special tax schemes that replace social contributions are more common in countries where the national tax administration manages these contributions.⁴³ The advantage of including these contributions is the attractiveness of job creation.

Eligibility in MSE Special Tax Schemes

Special schemes for micro and small businesses should be directed towards the end of the production chain, the traders who sell to the end consumer. This recommendation stems from the fact that sales should not generate or transfer VAT credits. If these traders are in the middle of the supply chain, as distributors, they may have difficulty selling because buyers will want to be eligible for VAT credit. But over time this becomes a normal market issue from the fact that, in theory, these entrepreneurs are paying fewer taxes.

In the area of services, it is not advisable to have professional services to be eligible, because these services are personal, and are not really businesses. These are very personal services. Also, they have the contributory capacity and ability to calculate taxes and maintain proper controls.

In summary: it is recommendable that the eligibility may be restricted to end traders and possibly non-professional services.

Levels of Government Involvement in MSE Special Tax Schemes

Special tax regimes for MSE are administered almost exclusively by central governments only. We have only one exception, Brazil, where the special tax regime is jointly administered by the central government and the sub-national governments (states and municipalities). In this case, the scheme also includes state and municipal taxes. Argentina has recently started a regional (provincial) tax inclusion experiment.

For example, in Brazil, power is shared among the three federative levels. In addition to management, control and auditing are performed by all tax administrations, jointly or individually. This sharing increases the power of control over the tax regime. In addition, other government agencies participate in public policy regarding, for example, registration, business licenses, social security, public procurements, and credit (facilitate the access to the financial/banking system).

The complete view of micro and small businesses and the public policies required for them to be born, registered, grown and survived is one of the keys to successfully reducing informality in Brazil.

4.6.4. Tax calculation techniques in MSE Special Tax Schemes

There are two basic models for calculating taxes due in SME tax schemes. The first one is the lump-sum tax, with monthly, quarterly or annual lump sum charges. This model is the simplest, and suitable for low-income taxpayers who have low ability to calculate taxes and keep complex records. As it is a regressive taxation model, a low threshold is highly recommended.

The second model is one in which the taxpayer pays a percentage of his turnover, that is, a sales tax. Because the monthly amounts to be paid are variable as they depend on sales and require calculations, this model is best used for medium or higher threshold tax schemes. The taxpayer must have some ability to calculate rates and maintain slightly more complex controls.

Calibration of lump-sum tax and tax rates in MSE Special Tax Schemes

The values and tax rates to be established under special regimes must be compatible with the country's tax system. It is recommended that there be a smooth progression between special schemes and normal taxation schemes so that the transition between them is easier.

If the tax in the special regime is too low, the consequences will not be good. The transition will be difficult, and taxpayers will want to stay in the special regime illicitly. There will be a tendency to hide real turnover, or even split the company into more than one entity.

This phenomenon, hiding turnover or resisting recognizing business growth, is known as “fiscal dwarfism”, “tax nanism” or “Peter Pan Syndrome.” The company doesn't want to grow (or hides the turnover) to stay illicitly in the special scheme. When it becomes impossible to hide the turnover, because of the tax administration controls, the company splits, creating fictionally more than one legal entity, also to remain illicitly in the special regime.

Another consequence of low taxation in special regimes is the increase in the level of tax expenditures, given the difference in taxation with normal regimes. Reducing the tax burden is not one of the goals, or certainly, not the greatest. Simplification is the biggest goal.

Some countries set very low tax rates for microentrepreneurs, seeking to bring them from informality to the tax base, but they should be aware of the consequences reported above and should consider adopting such taxation in the medium term to minimize harmful effects.

4.6.5. Control actions in MSE Special Tax Schemes

Controls are very necessary for special schemes. It is no exaggeration to say that “no controls, no special regimes”. Without controls, taxpayers will certainly abuse the scheme, or will not even register which one should do so.

Controls then go through the registration phase, seeking to detect and register taxpayers, the filing phase, controlling the requirement for the required declarations, the payment phase, controlling the arrears, the under-reporting phase, and auditing when necessary.

The controls should be massive, crossing-data, electronically made, with notification and procedures over the Internet (preferably). Tax administrations have to make greater use of third-party information and project-based approaches to identify persons operating outside the system or illicitly inside the system.

Crossing data should check whether taxpayer statements are in accordance with internal and external data obtained by tax administrations, such as electronic invoices, purchases, and sales with electronic means of payment (debit and credit cards, mobile payments), payroll data, etc.

Controls must allow the issuance of tax compliance certificate for taxpayers with registration, filing and payment on time. These tax compliance certificates must be required by governments to participate in public procurement as well as to obtain bank credit.

Temporality of MSE Special Tax Schemes

Special schemes for micro and small businesses should incorporate some temporality prediction, i.e. maximum length of stay in the scheme. This temporality limits the duration of the benefit granted and is also a signal for the company to grow and migrate to normal taxation regimes.

4.6.6. *The tax regime as part of a larger strategy*

As already stated in this document, it is not enough to have an excellent special tax regime if other public policies are not added and a true “MSE statute” is built. It is necessary to think about MSE as a whole, supporting it in all areas, such as taxes, registration, licenses, credit and public procurements. This requires integrated work with other government agencies and stakeholders.

For this, it is necessary that, in a micro and small business statute, all the criteria, conditions and public policies for the segment are defined, as well as the government agencies and regulatory committees that will conduct each matter.

A key point is the use of Information and Communication Technology (ICT), as they play a fundamental role with two major objectives. The first of these is to provide MSE with better conditions to exercise their rights and fulfill their obligations more easily, simply and quickly. For this, advanced technology solutions are essential, whether using the computer, smartphones or even ordinary mobile phones using USSD technology. The second objective is to provide integration of technology systems between government agencies and other registration, trade and business licensing bodies. This technological integration is essential for having a unified service point of access, such as company registration, and also for databases to be unified, or at least parameterized with the same criteria.

4.6.7. *Assessment of MSE special tax regimes*

Every special tax regime should be evaluated regarding its suitability to the country’s tax system, its objectives and results.

In [Table 4.6-4](#) we will evaluate these special regimes in theory, addressing only two items: the need or not of their existence, and the calibration and compatibility of tax rates.

Table 4.6-4 Special tax regimes for MSE

Assessment – Special Tax Regimes for MSE		
Item	Strengths	Weaknesses
Existence of MSE Tax Regime	If the special regime is part of a larger MSE support strategy, is compatible with the country's tax system, and controls are in place, it may be a good solution.	If the tax administration could send regularly to each micro-entrepreneur payment slips with the tax amounts due, there would be no need for special tax schemes. As in many countries this is practically impossible, given the need to know and interpret all economic transactions in the country. “No controls, no special regimes”. Without controls, taxpayers will certainly abuse the scheme, or will not even register which one should do so. MSE gain extraordinary political power with the creation of these special tax schemes, and the tax administration will have to deal with that power, especially when attempts are made to misrepresent the objectives of tax policy.
Calibration of tax rates. Tax due	If the values and tax rates to be established under special regimes is compatible with the country's tax system. It is recommended that there be a smooth progression between special schemes and normal taxation schemes so that the transition between them is easier.	If the tax in the special regime is too low, the consequences will not be good. The transition will be difficult, and taxpayers will want to stay in the special regime illicitly. There will be a tendency to hide real turnover, or even split the company into more than one entity.

Source: Prepared by the author

4.6.8. *ICT as a tool for a successful MSE fiscal policy implementation*

The new digital technologies and services may provide important tools to facilitate the tax compliance and control of MSE.

The identification of possible MSE can be done using drones, maximizing the results of the tax administration staff visits for possible regularization / registration. GPS coordinates of a taxpayer's location can easily be obtained from mobile phones, alleviating a major problem of the lack of identification of street addresses in certain areas.

Taking advantage of the high penetration of mobile phones in developing countries, as well as the possibility of making payments through these mobile money services,⁴⁴ especially in the sub-Saharan region (see Chapter 1), basic messaging protocols called USSD can be used to prepare, submit and pay simplified tax returns.

The use of MSE specific portal is essential for the special characteristics of this segment. In this portal, all information and systems must be available and interconnected, easing the procedures and compliance with tax obligations.

The portal should provide data exchange between tax administrations and other government agencies, avoiding the taxpayer to enter in two or more systems to make the same operation, or having to go personally to more than one state office location.

On the other hand, data analytics and artificial intelligence techniques can be applied to the large own and third-party datasets currently available from tax administrations, maximizing control over tax compliance and taxpayer permanence in the MSE category.

These tools may cross data from taxpayers' tax returns with internal and external data, as sales and purchases with electronic invoices, sales with debit and credit cards, sale with mobile money, government sales, financial movement in banks, payrolls values, export and export values, etc.

Controls are very important, mainly in MSE special tax schemes, to avoid abuse and illegal practices.

4.6.9. Conclusions

It is not absolutely necessary to create special schemes for MSE. If the country can avoid its creation by reducing informality by other means, it would be better. But that would require precise controls overall economic activity in the country to gauge the tax amounts due by each business taxpayer.

If informality is very high and the country decides to create a special MSE scheme, some precautions should be considered.

The first of these is to consider the special tax scheme as part of a larger MSE attention strategy. This requires integrated work with other government agencies and stakeholders, such as business registration, licensing, credit, social security and public procurement.

Secondly, the special regime must be compatible with the country's tax system, with rates being calibrated to allow a smooth transition to normal regimes. The focus of the fight against informality is micro-business, with very low turnover, and the best form of taxation in this segment is the lump-sum tax.

Third, the controls are extremely necessary. Even if at first they are difficult, you can never lose sight of them. Massive data-crossing controls are essential, and the use of computational resources is crucial. The availability of new ICT technologies and services can facilitate the identification, register, compliance and control.

Finally, it is necessary to be aware of the political power of this segment, and to be prepared to deal with it, especially when there are attempts to misrepresent the objectives of a correct fiscal policy.

Notes

4. For more information, see: <https://www.irs.gov/businesses/small-businesses-self-employed/employment-tax-due-dates>
5. For more information, see: <https://www.canada.ca/en/revenue-agency/services/tax/businesses/topics/payroll/remitting-source-deductions/how-when-remit-due-dates.html>
6. For more information, see: <https://inlandrevenue.finance.gov.bs/wp-content/uploads/2015/02/2017-01-01-VAT-Guidance-on-Completing-a-VAT-Return.pdf>
7. For more information, see: <https://www.canada.ca/en/revenue-agency/services/forms-publications/publications/rc4058/quick-method-accounting-gst-hst.html>
8. Equivalent to more than US\$ 2,100 million per month.
9. According to Chilean law, taxpayers have a maximum of 8 days to grant acknowledgment of electronic invoices or dispute them. After that period, they are considered accepted, so they are no longer outstanding and automatically switch to electronic register of purchases and sales.
10. The Chilean law allows for deferred payment of VAT for up to 60 days.
11. A score indicating an economy's position to the best regulatory practice. For more information, see: <https://www.doingbusiness.org/en/methodology>
12. Factoring is a financial service in which the business entity sells its bill receivables to a third party at a discount in order to raise funds. For more information, see: <https://efinancemanagement.com/sources-of-finance/factoring>
13. For more information, see: Argentina https://www.afip.gob.ar/genericos/guiavirtual/directorio_subcategoria_nivel3.aspx?id_nivel1=563id_nivel2=566&id_nivel3=731
14. For more information, see: Nicaragua <https://www.dgi.gob.ni/pdfArchivo/3026>
15. For more information, see: Uruguay <https://www.dgi.gub.uy/wdgi/page?2,certificados-de-credito,preguntas-frecuentes-ampliacion,O,es,0,PAG;CONC;1017;8;D;cuales-son-los-tipos-de-certificados-de-credito-que-emite-la-dgi;6;PAG>
16. For more information, see: State of Georgia Web site <https://www.georgia.org/film-television-and-digital-entertainment>
17. This should be read as “write-only” in a sense that after transactions are posted they cannot be deleted or modified.
18. For more information, see: https://en.wikipedia.org/wiki/Relational_database
19. For more information, see: <https://www.oracle.com/database/>
20. For more information, see: <https://www.microsoft.com/en-us/sql-server/sql-server-2017>
21. For more information, see: <https://www.ibm.com/products/db2-database>
22. For more information, see: <http://www.adabas.com/>
23. For more information, see: <https://dotnet.microsoft.com/>
24. For more information, see: <https://www.redhat.com/en/technologies/jboss-middleware/application-platform>
25. For more information, see: <https://www.ibm.com/cloud/websphere-application-platform>
26. For more information, see: <https://www.oracle.com/middleware/weblogic/>
27. For more information, see: <https://angular.io/>
28. For more information, see: <https://getbootstrap.com/>
29. Note that in Brazil there are two special regimes, one in class 1 aimed at combating informality, and another in class 3, aiming at simplifying the tax system as a whole.
30. Based on exchange rate for July / 2019.
31. For more information see: <https://data.worldbank.org/indicator/NY.GDP.PCAP.CD?locations=ZJ-CL>

32. For more information see: http://www.planalto.gov.br/ccivil_03/leis/lcp/lcp123.htm
33. For more information see: <http://orientacion.sunat.gob.pe/index.php/empresas-menu/nuevo-regimen-unico-simplificado-nuevo-rus/3097-01-concepto-de-nrus-nuevo-rus>
34. For more information see: https://www.dgi.gub.uy/wdgi/page?2,principal,_Ampliacion,O,es,0,PAG;CONC;40;1;D;tope-de-ingresos-y-activos-anuales-articulos-3-y-4-del-decreto-no-199-007;39;PAG;
35. For more information see: <https://monotributo.afip.gob.ar/Public/Ayuda/Index.aspx>
36. For more information see: <https://www.sri.gob.ec/web/guest/regimen-impositivo-simplificado-rise>
37. For more information see: <http://www.sunat.gob.pe/legislacion/renta/ley/capxv.pdf>
38. For more information see: https://www.dian.gov.co/Prensa/ComunicadosPrensa/070_Regimen_Simple_de_Tributacion_RST_favorecera_la_formalizacion_empresarial.pdf
39. For more information see: http://www.planalto.gov.br/ccivil_03/leis/lcp/lcp123.htm
40. For more information see: http://www.sii.cl/preguntas_frecuentes/renta/arbol_renta_971.htm
41. Simplification of procedures and reduction of compliance costs must be in all classes.
42. Job creation results are most significant when social contributions are included in the tax regime.
43. Although Brazil already included social contributions in the MSE tax regime even before administering these contributions. The IRS of Brazil collected the contributions and passed the amounts to another government agency. Since 2007, the IRS of Brazil has also managed social contributions.
44. M-Pesa service in Kenya, as an example.

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5. AUDITING TAXPAYERS

5.1. Tax compliance risks

One of the greatest challenges faced by tax administrations at present, deals with the appropriate use of its resources. To this end, it is necessary to count on sufficient information and process it in such a way as to focus its resources wherever necessary, or better still, where they may generate the greatest impact according to their mission. Therefore, the integral management of tax noncompliance risks is an essential process, whose implementation requires a great economic and operational effort, as well as a change in institutional culture. Said approach, adequately implemented, affords significant improvements in the voluntary compliance index as well as taxpayer satisfaction with the tax administration's service, thereby reducing transaction costs through time.

5.1.1. Introduction

We can say that risk is an uncertain event that may create an unexpected situation. In real terms, it is unlikely that an organization may be free of risks, the latter being inherent in any activity. Risks may be classified according to their origin, as intrinsic or extrinsic. The intrinsic ones originate within the organization (for example, the operational risks or those related to the corporate government). On the other hand, the extrinsic ones originate outside its borders but have an impact thereon (for example, a financial crisis in the country where the company operates, customers or suppliers' behavior, etc.). Such common expressions as "no risk, no gain" or "the higher the risk, the greater the profit" are a clear reflection of the behavior of this variable in the entrepreneurial environment, where greater profits would be expected as a result of putting resources at risk.

In public management, in particular the tax administration, the risk concept is somewhat different. Many intrinsic risks could resemble those of private sector enterprises (for example, risks inherent in the staff, corruption risk, the vulnerability of the computerized system, etc.). However, there are some differences in extrinsic risks, since it is impossible for the tax administrations to choose their taxpayers, the latter being those who, according to the regulations, must comply with tax obligations. This lead, for example, to the risk of not identifying taxpayers or affording large amounts of credit to individuals of bad financial reputation under similar conditions to others with a better reputation.

Tax administrations differ from one country to another. Some are in charge of managing only taxes, while others are involved in the control of foreign trade and/or the collection of social security

contributions. Logically, the risks they face vary in accordance with the institutional profile and consequently, with their systems. Tax policy and the context wherein a specific country finds itself determine the level of risk to be managed. A country with an inequitable, confiscatory, complex tax policy or far removed from the general principles of taxation could face a high level of non-compliance. On the other hand, a country with a high quality of public expenditure, reasonable tax regulations and an appropriate level of tax culture could face less noncompliance risk.

If we were to consider a world wherein voluntary compliance of tax obligations would be equivalent to 100% and not expect that other variables would alter this result, the tax administration would only have to collect taxes; that is, process their collection. The real world is somewhat more complex, and for different reasons, achievement of total voluntary compliance is a utopia. Therefore, tax noncompliance risk management becomes an essential task for the tax administrations, which is part of almost all its processes.

The current scenario imposes on many governments the challenge of “doing more with less” in an ever more complex context. This evidences the importance of managing risks in order to focus resources in situations that deserve it and to develop preventive and corrective strategies that may allow for treating them. For example, one of the most relevant tax initiatives in recent years is the Base Erosion and Profit Shifting (BEPS) initiative, promoted by the G20 and developed by the Organization for Economic Cooperation and Development (OECD). Its objective is to prevent by means of the tax policy, inadequate behaviors of taxpayers operating at the international level, for avoiding taxes, fighting evasion by those taxpayers in specific action areas and responding to new compliance risks originating from new forms of business such as the digital economy.

All tax administrations manage tax noncompliance risks. However, not all do so in an always planned, integral and systematic manner, through the extensive use of technology. This section will be focused, in general, on the main techniques used by the tax administrations and promoted by several international organizations for managing registration, filing, information and payment risks.

Fundamental aspects to be considered for designing an integrated tax noncompliance risk management system for the tax administrations

The structure of the tax administrations and the context wherein they perform may radically vary from one country to another. Therefore, one cannot simply propose one single way of designing a noncompliance risk management system that will be perfectly adapted to all of them. These systems must be custom-made and according to the needs of the organization. However, it is important to point out the fundamental aspects of the risk management process that are inherent in the basic competencies of a standard tax administration.

The most widely diffused risk-based management models that are adapted to the “business” of the tax administrations are those of the OECD, European Union, Australian Tax Office (ATO) and the one promoted by the ISO 31000:2018 standard. The Inter-American Center of Tax Administrations (CIAT) has developed a manual on this subject, mainly based on the experience of the Internal

Revenue Service of Chile, which has been a pioneer in the region implementing an integrated tax compliance risk management model which includes many of the tools that will be described throughout this section. Area two of the Tax Administration Diagnostic Assessment Tool (TADAT) establishes an “effective risk management” evaluation methodology, which defines a point of reference to the subject which is useful to identify areas for improvement. All of these tools are or will be publicly disseminated, for which reason its specific characteristics and differences will not be considered in greater depth in this section, thus allowing for the schematic and summarized description of the main elements of a risk management system.

5.1.2. *Main approaches*

Risk management may be considered from a focused or integral viewpoint. The first one seeks to optimize specific processes of a tax system. Under this approach each taxpayer is assigned an optimum tax compliance level and a specific treatment action according to their risk level. The limitation of this approach is that it could affect equity in the treatment of taxpayers, and that the risk level assigned to a taxpayer might not respond to technical criteria.

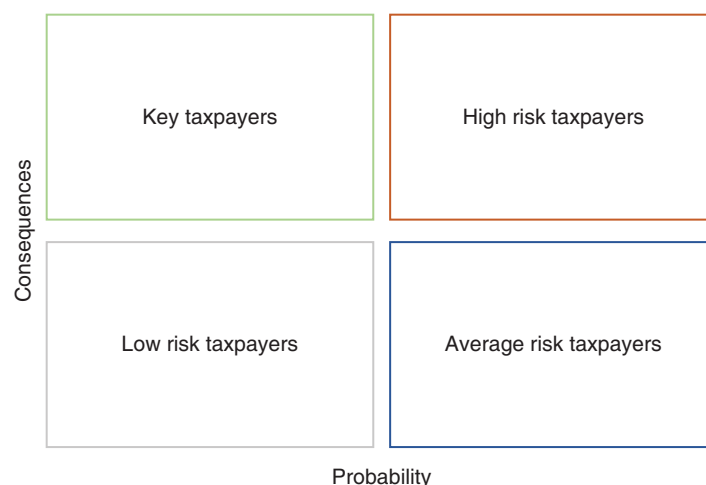
The integral risk management approach seeks to optimize the total efficiency of the system. The integral compliance risk management could be defined as “...a structured process for the identification, assessment, classification and treatment of compliance risks of the tax legislation ...”. This is the most recommended approach, considering that it allows for better use of resources and provides more precise results.

5.1.3. *Specific aspects*

Classification of the taxpayer's risk

A taxpayer's risk is directly related to his willingness to comply with the tax obligations, (registration, providing information, filing and payment) and the respective consequences of his non-compliance. To evaluate the taxpayer's willingness to comply with his tax obligations, one uses as indicator the “Probability” that the taxpayer complies, while the “Consequence” of noncompliance is evaluated by estimating his individual contribution to the tax system.

In general, tax administrations evaluate the level of compliance through the use of four risk categories: high, medium, low, and “key taxpayers”. These levels are structured through the combination of the aforementioned variables: probability and consequence, as shown in *Figure 5.1-1* appearing under this paragraph. For example, high risk taxpayers are those who, having high probabilities of failing to comply and with certain particular characteristics (such as large size, high levels of revenue) may generate significant consequences for the tax system. The taxpayers of the ‘High’ and ‘Average’ segments have a similar probability of noncompliance vis-a-vis a tax system, but their consequences are different.

Figure 5.1-1 Compliance level

Source: Prepared by the author

The “attributes” play a significant role in this analysis, by allowing to distinguish the taxpayers’ behavior in relation to their obligations. Through the “attributes” one may identify situations which, not being noncompliance at first sight, turn out to be anomalous or irrational. The purpose of the “attributes” is to permit a better interpretation of the behavior. Some examples of attributes could be, none declaration of income although the obligation exists and there are observations in the income return in the past years. Within the framework of this analysis one must combine the importance of the variables and the temporality of occurrence during the taxpayer’s life cycle.

There are several models for calculating the probability of occurrence of the risks. The “Frequency of simple attributes model”, tends to be effective but does not use variables with determined specific weights, which would imply an estimation with error to be evaluated. The positive aspect is that this methodology allows for making simple calculations with set processing times. The following equation is used for its calculation:

Frequency

$$X = (\sum_j \text{Attributes})_i / \text{Max} (\sum_j \text{Attributes})$$

The “Model of frequency of attributes with weights” can be applied if there is a minimum level of interaction with the taxpayer. The attributes to be considered within the framework of this model may be submitted to a ponderation for determining the specific weight of each item.

Grouping factor

$$F_j = \sum_i^n \beta_i X A_i$$

Compliance dimension

$$Dk = \sum_i^m \varphi_j X F_j$$

Assessment of probability

$$P = \sum_L^P W_k X D_k$$

The “Predictive models” tend to be very useful. Experience has shown that the neuronal networks predict with greater certainty. However, when using “black box” type algorithms, one cannot obtain the rules that determine the prediction.

As for the application of Neuronal Networks in detecting tax fraud, there have been developments implemented in the tax administrations of Spain, Peru, Netherlands and Chile, among others. The decision trees and the regressions consider specific rules and weights associated to the relevant variables that could be explained and complemented by qualified officials. The high cost of the predictive models is compensated with the results they afford.

The “Model based on the taxpayers’ perception” allows for generating an instrument of a qualitative nature and associated to the knowledge and experience of the officials that interact with the taxpayer. It consists of the “cluster” analysis and relevant variables for the business. This type of instrument may be applied to the extent there is a minimum contact or knowledge of the taxpayer. The “Willingness toward tax compliance model” may be applied as long as there is precise information regarding the taxpayers’ attitudes and constant monitoring thereon, with respect to them, their economic cycles and the industry wherein they perform, among other factors.

To measure the consequences of the taxpayer risk, it is necessary to determine a variable that may allow for estimating the relative harm which such violation could cause to all taxpayers, in case the taxpayer would fail to comply with his tax obligations. These consequences may be measured in accordance with the revenues or the taxpayer size, or by using data mining techniques. For example, one result could be the under declaration of fees, with the consequence variable being determined by considering groups according to Profession, Age and Gender. Thus, according to age, 4 categories may be generated: (≤ 30 ; $30 < \leq 40$; $40 < \leq 50$; > 50 years). According to gender, 2 categories could be determined, while in the case of professions, there could be 18 categories. The possible combinations are 144 groups; however, the calculation would provide information only for 100 groups of the Group, Age, Gender Item. The average income is calculated by adding that received by independent professional taxpayers declared in the VAT form for specific fiscal periods, plus the withholdings reported in the respective year’s Return and divided by the number of taxpayers of each group. This average is compared with each taxpayer’s individual information and the difference between that declared by the taxpayer and the average of the objective group is assigned as consequence.

Taxpayer segmentation

Within the context of the tax administrations, the segmentation of the population is a disaggregation of taxpayer subpopulations with similar characteristics and behaviors which allows for a more precise identification and classification of noncompliance risks. Through these homogeneous characteristics, the tax administration may also identify with greater precision, adequate treatment strategies and determine their application. Taxpayers may be classified according to size, net worth or other attributes such as: “with or without activity”, according to seniority, alive or deceased, background, those subject to special regimes, etc.

Obligations and gaps

Tax obligations may be classified into four groups:

- Register: obligation to provide basic information (identification, corresponding taxes and obligations, location, etc.), at the time of registering and keeping it updated.
- Inform: obligation to provide information –taxpayer’s own or third party- with respect to tax obligations.
- File: obligation to file tax return in time and form.
- Pay or consign: payment of tax obligations in time and form.

The level of taxpayer compliance with respect to the aforementioned obligations may be classified into the following categories: noncompliance with the obligation, out-of-term compliance, erroneous compliance of the obligation or others. These categories allow for simplifying and ordering the level of compliance, as well as evaluating different levels of compliance for designing guided actions.

Tax gaps originate when the information available indicates that a taxpayer did not comply or ceased to comply with a specific obligation. The difference between a gap and a tax risk is certainty. Tax gaps are indicators that allow for quantifying the problem to support decision making on how to focus resources or actions.

After structuring the tax gaps, they are systematized by means of a tool called “Gaps Map”. The latter corresponds to an application of the information system, whereby one may graphically represent the tax gaps available by providing the user different views at the aggregate level for making decisions. For example, gaps are developed according to taxpayer risk level, economic sector, item, among others. Below is an example obtained from the experience of the Chilean tax department (SII), which shows the list of tax gaps available and their evaluation in a specific period, classified according to different dimensions:

Figure 5.1-2 Risk Gaps Map

RISK CLASSIFICATION	HIGH		AVERAGE		LOW	
	Greater than 30%		Between 10 and 30%		Lower than 10%	
REGISTRATION GAPS						
Domicile	10.25		27.75		5.60	
Registration of Accounting Operations	43.56		87.88		96.33	
INFORMATION GAPS						
Purchases Return	18.86		22.11		15.06	
Sales Return	19.21		29.78		18.33	
DECLARATION GAPS						
Income Tax Declaration	9.47		91.50		22.34	
VAT Declaration within term	5.45		56.90		12.73	

Source: Prepared by the author with data provided by Servicio de Impuestos Internos (SII) - Chile

Information

Since information is an essential element, it is necessary to devote resources and make use of specific techniques for ensuring its availability, access, quality, integrity and timeliness. It is very important to avoid multiple storage of the same data in different places. Regardless of the source, it is important to count on tools whereby the information may be transformed into knowledge. The protection of confidentiality is a key issue.

Systems

There are at least three types of systems:

- Compliance management systems: these systems comprise the process that begins with the identification of risks and concludes with the planning of treatment actions for mitigating them. In addition, they permit the management of prioritization and risk evaluation processes.
- Inquiry systems: they facilitate a taxpayer's integrated view, with respect to his behavioral background, applied historical treatment actions and main attributes, segments to which he belongs, noncompliance risks and risk classification.
- Case system: used to undertake audits or refunds or massive attention processes.

Structure

The tax administration's structure constitutes a relevant factor with a direct impact on noncompliance risk management, on conditioning the way in which the organization's resources interact. The structures went from focusing on the "type of tax" to orienting themselves on the "functions". In some cases, the structure has been focused on "taxpayer segments", while in others, this structure has been considered in greater depth, by providing services adjusted to taxpayer segments. The approach according to "type of tax" may generate duplicity of functions, some other inefficiencies and high operational costs. The "function" approach allows a higher level of understanding and

standardization of the working processes, thereby simplifying information processing and taxpayer procedures, thus contributing to operational efficiency. The “taxpayer segment” approach recognizes that each taxpayer group has different characteristics and represents dissimilar risks, and thus this approach allows for more efficiently implementing differentiated strategies.

5.1.4. Main subprocesses for managing noncompliance risks

Tax noncompliance risk management implies, identifying, analyzing, prioritizing, treating and evaluating risks. These processes are linked according to the aforementioned order of precedence and the flow operates in a circle, where following the evaluation subprocess, one may again give rise to the identification of risks.

Risk identification

This process involves the search, recognition and description of tax noncompliance risks, whose materialization could prevent compliance with the strategic and operational objectives of the organization. To carry out this process, it is necessary to clearly determine the tax obligations, potential noncompliance risks, the mechanisms or elements for identifying the risks –support from society, information from other tax administrations, third-party information, experience in the control area, the analysis of trends by means of macro-level indicators, among others. The result of the risk identification stage is the list of potential risks, which provides information on specific risk areas, groups of taxpayers that constitute risk or economic risk sectors. This list, which represents the risk map, may facilitate options for the following phase, which is the analysis of risks that particularly indicate the areas that should undergo such analysis.

Analyze and assess risks

In this stage an analysis is made of the noncompliance risks that were identified in the previous stage. The first step is to describe the risks. This implies considering the information that supports them, analyzing the external causes that favor noncompliance, analyzing the internal causes, describing the direct consequences of noncompliance and designing and implementing actions aimed at solving them. A “Risk File” is used for purposes of structuring this analysis.

The risk assessment depends to a great extent on the knowledge and judgment of the officials involved, who must understand the potential events and their context. The risk assessment involves systematizing the estimate of the probability of occurrence and the consequences in case it is materialized.

All of the aforementioned elements are necessary inputs for an adequate assignment of treatment actions aimed at mitigating said noncompliance risks. The treatment actions comprise different activities related to facilitation, simplification, assistance and examination. In order to classify the different treatment actions according to their scope and purpose, treatments are classified as: structural, preventive and corrective.

Prioritizing risks

Prioritizing risks implies selecting those on which actions will be displayed, to then establish a priority order. The methodology to be applied is described further on.

Consolidation consists of identifying the risk levels and designing the potential treatments to be applied, according to the taxpayers' profile. The **stock dispatch and administration** is the subprocess wherein the treatment assignments and dispatch or application are scheduled. The aforementioned subprocesses allow for determining how the tax administration will use its resources.

Treating risks

Involves the execution of actions in response to the risk determined in the previous stage, which should be validated and supervised. The actions included in the treatment programs should promote the principle of proportionality, by describing in detail the criteria for outlining their scope and the different modalities under which said actions may be carried out. The timely moment for carrying out actions in each operational area is determined in this stage.

Evaluating risks

This is an essential stage, which may be divided into three levels:

- In the first one, consideration is given to the macro measurements, for example, evasion, informal trade or fraud;
- The second level deals with general tax compliance indicators, such as the evolution of gaps, risk level, composition of the taxpayer pyramid and risk classification; and,
- Treatment actions are analyzed in the third level. That is, if the design was planned, if the quantitative or qualitative objectives were fulfilled, if the output was sought, if there were trends associated with the business, if they respond to the taxpayer's learning, if lack of knowledge decreased. Various methodologies may be used for such purpose: control groups, random audits, surveys, etc.

The evaluation facilitates knowledge management, supports organizational learning and allows for generating feedback on risk identification and analysis, its priority level, its execution and treatment actions. This stage has a high opportunity cost.

5.1.5. Conclusions

Following the description of the basic processes to undertake tax noncompliance risk management and of the minimum necessary elements for their effective functioning in a model tax administration, it is possible to determine the complexity for implementing in a tax administration, an integrated risk approach that may make "intelligent" use of the information coming from all the relevant processes. Such "intelligent" use facilitates efficient decision-making with respect to how

the resources available will be used for providing each taxpayer the treatment he deserves according to his characteristics and behavior.

The design and implementation of a working approach based on risks, requires sufficient, adequate and complete information, which constitutes a challenge for most tax administrations, even in the so-called “information era” of multidisciplinary teams and of an intensive use of advanced technology for capturing, processing and protecting the data.

The massive availability of inputs, of an internal and external origin, deposited in data bases and in Big Data systems, allows the use of data analysis techniques and artificial intelligence, in particular, predictive analysis for risk management.

One may detect specific patterns based on the analysis of historical data, by using a supervised machine learning model, or regrouping individuals or companies in clusters, through the use of a non-supervised machine learning model. As an example, the Tax Authority of Singapore (IRAS) uses social network analysis for determining relationships between persons, organizations and various entities, to improve its capacity for defining risk profiles (OECD, 2017).

Its implementation requires abundant resources and an organizational culture in keeping therewith; that may appraise transparency, the low levels of discretion, the rigorous follow-up of procedures, efficiency in the management of resources and the habit of providing systematic feedback on the results achieved, among others.

The potential benefits of an adequate implementation of the integral approach based on risks should have a significant and positive impact on the efficiency and effectiveness of the tax administration, thereby bringing about future savings of resources, as a result of the intelligent use thereof.

Many initiatives which are currently trends or best practices can only be adequately implemented if the taxpayer compliance risks are perfectly known. For example, said risk is a determining factor for a taxpayer to be eligible for a cooperative compliance initiative in particular.

Likewise, in the enforced collection process, the risk approach is essential for determining the rules for managing the credit portfolio and applying the precautionary measures for safeguarding the assets of the tax debtors.

In the control sphere, thanks to the risk approach, it is possible to audit specific operations instead of carrying out integral audits, thus resulting in lower transaction costs and greater taxpayer satisfaction. This approach is also of great relevance in implementing refunds and granting of tax benefits systems, including those arising from double taxation agreements.

In the taxpayer service sphere, an integrated approach allows for designing services that are better adapted to their needs and which provide the necessary information thus avoiding the duplication of tasks. There are countless examples related to the successful use of this approach.

Some examples of advances being achieved by the tax administrations in this field and which should be complemented with modern data analysis techniques are: New or relatively new tools such as the “Country-by-Country Report” proposed by BEPS Action 13; the obligatory disclosure of tax planning schemes according to the terms of BEPS Action 12; developments for the control of the Digital Economy according to the terms of BEPS Action 1; the international financial information exchange standard –CRS– and regarding access to the ultimate beneficiary, the techniques for processing “big data”; the systems that provide access to relevant international public information; the potential uses that can be made of the “blockchain” technology and electronic invoicing.

It is clear that tax administrations which do not gradually adopt this approach will face serious problems for complying with their commitment in the current context, which is characterized by greater complexity and scarce resources.

5.2. Auditing with technological support – methods, techniques and the experience of the Tax Administration of Spain

5.2.1. Introduction

Definitions

The difference between potential tax revenues and what is actually collected is known as tax gap. The International Monetary Fund (Crivelli et al., 2015) has estimated it at 600 billion dollars annually, that is, between 2% and 3% of total tax revenues. The Organization for Economic Cooperation and Development (OECD) sets the interval at 100-200 billion US dollars, associated to a loss that ranges between 4% and 10% of corporate tax collection. It exists at varying levels in all the administrations. In the United Kingdom, HM Revenue & Customs has estimated it at 35 billion pounds (HM Revenue & Customs, 2019), that is, about 5.6% of potential revenues, while the Tax Office of Australia has set it at US\$8.7 billion (6.4%). In low revenue countries it ranges between 6 and 13%, and the United Nations Economic Commission for Africa has estimated it, for all of Africa, at 50 billion US dollars.

One of the missions of the tax administrations, perhaps the most important, according to the TADAT (Tax Administration Diagnostic Assessment Tool) methodology, consists of minimizing these losses. In order to do so, they adopt two types of measures. Simple auditing activities (which in some countries are known as examination or inspection), such as verifications, or more complex ones, where documents are revised and data are crosschecked, or even arriving at tax audits. The second type consists of proactive initiatives of taxpayer assistance and support.

Auditing may be classified according to different criteria (OECD, 2006):

i. Intensive and selective versus extensive

The first ones carry out an in-depth audit of taxpayers selected because of their risk, while the second ones verify discrepancies observed in collective actions;

ii. Substantial verifications versus inspections

In the first ones, the accuracy of a specific declared data is verified, such as the value of an export prior to a VAT refund, while in the second ones, complex and extended verifications are carried out;

iii. Auditing of individuals versus auditing of corporations

The first ones are generally simpler, because of the nature of the activity as well as the existence of income withholding mechanisms; the second ones are more complex, because of the technical difficulty of the tax and the specialization of the defenders of the enterprise interests who, on occasions, make use to their advantage of the weaknesses of the legal framework;

iv. Documentary versus field reviews; and,

v. Complete audits versus those limited to the verification of a specific risk area or a single issue.

All of them have a common characteristic: they are all supported by technology.

The auditing function

The auditing function is not a mere abstraction that conceptually groups actions for controlling certain taxpayers. It consists of a managed and structured process, aimed at an objective, which is the minimization of the loss of revenues caused by the omission or inaccuracy of the tax returns.

Its conceptual framework is risk management, subject on which there is an enormous bibliography. In the different approaches which develop Edwards Deming's pioneer idea, planning and iteration are always present. In the TADAT method, which uses the performance areas (PA) concept, the second deals with risk management, in general, and the sixth with auditing. It is thus evident that, even though the administration may apply a general structured risk methodology in different spheres, such as customs, human resources or auditing, the display of the process has its own characteristics in each case and requires specialized training of the officials and specific practices (OECD, 2006).

Relevance for the Administration and the taxpayer

The effective and efficient development of the auditing function provides benefits (OECD, 2004), that exceed, by far, those derived from their net effect on collection. It has dissuasive effects, identifies the forms of noncompliance and the risks therewith, provides data regarding the soundness of the tax system, contributes to determine strategies for taxpayer education and identifies the rules that require clarification. As counterpart of such great potential benefit, the resources required for carrying out this activity are valuable and scarce and imply an economic and emotional burden for the entrepreneur.

The proportion of the auditing staff with respect to the declared total (OECD, 2006) varies much between countries (5% - 58%) partly because the limits of the audit function are not determined, but also because the tax systems and the strategies used are very different. The International Monetary Fund has estimated that this function uses between 14 and 19% of the resources, while the

Organization for Economic Cooperation and Development notes that, on average, it uses 32% of the resources (OECD, 2017) with the tax function being dominant and providing data according to the countries.

Spain has 42.08 million national inhabitants and 4.5 million foreign residents. In the fiscal census of the State Agency of Tax Administration there are 71.08 million taxpayers of which 7.365 million are corporations. Its staff (2017) consisted of 25,152 persons, of which 7,236 were devoted to Tax Management, 4,850 were in the Auditing Department (19.2%), 4,193 in Collection, 3,622 in Customs, 1,795 in Information Technology and 3,318 in Others (Economic Administration, Human Resources, etc.).

Extensive and intensive control actions are carried out. Every year the first ones exceed 1.5 million given their reduced cost, the dissuasive effect resulting from their immediacy and the low level of litigation they generate. Of these, one third is aimed at the “Individual Income Tax” (IIT). In 2017, there were 512,652, which represented 491.2 million Euros. They are carried out by Tax Management through a procedure different from that of the intensive audits carried out by the Inspection (auditing) Department which uses a more complex and guaranteed procedure: the intensive ones involved 26,984 taxpayers and concluded with 60,445 reports or assessments in the amount of 5,378 million Euros. The number of taxpayers subjected to this intensive control was 24,178 in Value Added Tax (VAT); 21,239 in IIT and 17,310 in Corporations. These activities were carried out by 2,142 auditors, whereby it was determined that every auditor, fully devoted to the extensive audit task concluded approximately 30 reports per year for 11 taxpayers.

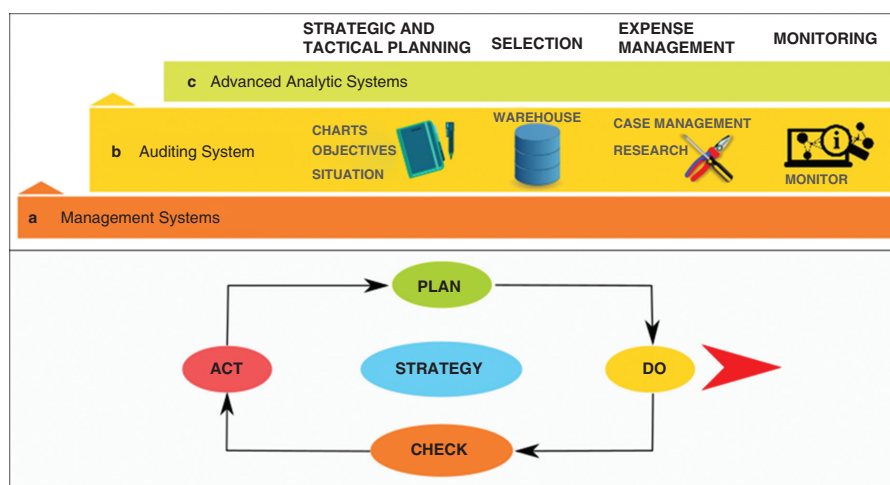
The data published by the United States of America tax administration (IRS) show that with a staff equivalent to 73,519 persons, it devoted almost half of its human resources to the review of the tax returns, collection, administrative and judicial management of appeals (of which audit tasks are a part) and 37.9% to taxpayer assistance.

As approximate reference, it may be estimated that 20% of the staff was devoted strictly to external auditing and another 20% to verifications, many times initiated through computerized means given the existence of errors and in balances from which assessments may be derived. That is, 40% devoted to the review of the tax returns, collection administrative and judicial management of the appeals.

5.2.2. Architecture of the process

Layers, functions and systems

Figure 5.2-1 shows the chain value of the auditing process. Within it, there are two areas. The inferior one shows the components of the Deming Cycle, which is reiterated through time according to the organization’s strategy. The upper part shows the subsystems that implement these activities in the tax sphere, and which must be supported by subsystems of the information system. Their names appear in the upper part of the diagram:

Figure 5.2-1 Chain value and auditing tools

Source: Prepared by the author

- a) **Structured planning.** The subsystem supports the creation and maintenance of audit planning. It is structured because it is integrated with other plans such as Actions, the Annual Objectives Plan, among others.
- b) **Selection.** Series of tools used to quantify the risk and select the cases that will be audited with respect to each tax and taxpayer segment for each competent unit.
- c) **Case management.** Set of tools, some of which are the same as those used in the previous phase. They are used to compile information during the investigation phase, integrate it with the existing one, visualize, analyze it and guarantee that the development of the auditing process may have the appropriate quality and traceability.
- d) **Monitoring.** Obtains and shows the results and estimates whether its effectiveness is, as anticipated; not only because the established number of actions was achieved, but because the tax gap was reduced to the extent and for the reasons anticipated and, if not, it helps to shape the corrective actions for achieving it by applying the lessons learned.

All these subsystems may be organized in three strata. The upper ones are based on the lower ones.

- a) **Management systems.** These are formed by the computerized transversal, common subsystems that are necessary and prior to the auditing function and in general, to all the business functions. This infrastructure is formed by the servers, operational systems, the security system, the necessary infrastructure for receiving the taxpayer data, corporate mailing systems, electronic filing system, etc.
- b) **Auditing system.** Includes the necessary tools for risk management, for the selection and management of audited cases and the tools to assist the investigator. It has interphases with the management and analytical layers. It is the subsystem we shall specifically analyze in the following section.

- c) **Advanced analytical systems.** It includes the multivariate analysis tools, (SPSS, R; SAS), for modeling, analysis of networks, detection of patterns, Artificial Intelligence in its case, etc. It is most useful for auditing, although it has other uses, such as the estimation of future tax revenues, future VAT refunds, thereby allowing for guaranteeing compliance with the legal terms, the effects of fiscal changes, etc.

The auditing process

In the auditing process, which extends in the central layer, five moments in time are distinguished: 1) obtaining the data; 2) analysis of risks and selection; 3) investigation; 4) execution of the auditing procedure; and, 5) monitoring the results and quality control. They are carried out successively and reiterated, duly modified, in successive exercises, managed in accordance with the Deming Cycle.

Obtaining, debugging and loading the data

It is a preceding and necessary phase in auditing a taxpayer. The decision is adopted according to an established procedure, to avoid arbitrariness, based on the information received or for lack thereof. It is adopted by analyzing the data available, past and present, declared or attributed to the taxpayer. The general use of the Internet has allowed for requesting third parties for more data on the taxpayers and that they be received efficiently, for example, with solutions based on JavaScript. Electronic certificates are used (in the case of AEAT X-509 v3) to prove the presentation.

In 2019, the State Agency of Tax Administration received a total of 464,178,350 information items from third parties, which were first used for pre-filled Income tax returns and subsequently in Auditing. The largest return included 35,543,350 information items and the system had a yield of 140,000 registries validated and processed per minute by the Large Volumes of Information Transmission system (LVIT), whose specification is public.

The audit task begins with the validation. It's possible that the taxpayer be notified of errors or omissions. Also, alerts may be generated that may lead to the initiation of different procedures. Through the web page, the taxpayer may interact, by replying, paying or appealing an issue. When the virtual site of the State Agency of Tax Administration was created, 2,830 transactions were possible in 459 procedures (referring to returns, appeals, in the different tax and customs categories). This requires an electronic file system containing a map of the processes and which may permit the safe interaction and without possible repudiations of all interested parties and access to a catalogue that may identify in a unique manner every object contributed in these relations (images, pdf, spreadsheets, justifications, etc.), all of it associated to the adequate security system.

Planning

The auditing process must be managed and structured. In keeping with best practices, there is multiannual strategic planning of the tax administration, which includes annual planning indicating the areas of priority interest, such as recovery of delinquency or improvement in the quality of taxpayer service and the objectives of the period.

An Action Plan is added, which quantifies the previous one and indicates how much and where certain activities should be done (central services, Large Taxpayers Offices, etc.). The Annual Plan and the Action Plan are broken down by areas, among them is Auditing. The Annual Auditing Plan is associated to the one on Objectives with collection indicators (gross and cash), results of fraud prevention and control (number of actions and revenues derived from the control actions, as well as reduction of refunds), taxpayer assistance actions, (average times of transaction and solution of appeals), extensive verification actions, management of delinquency, struggle against smuggling, etc.

Its implementation requires an interphase with the tax management system, which is shown in [Figure 5.2-1](#) that connects both functional layers, since it must have access to the census, the obligations first of all, to develop the plan and then to easily and timely update it.

The planning subsystem includes two main modules:

- **Actions and objectives control.** Any unit may have quantified objectives; from telephone assistance centers up to juridical services. Some are quantitative, others qualitative. Some must be carried out by central services, others by the peripheral units, some are expressed in values and other in account units. There are dozens of them, if not hundreds.

One should avoid consuming valuable resources, by manually obtaining these data to prepare charts in the different offices and then consolidate them. It is unnecessarily laborious and imprecise, because of the resulting errors and gaps to have dozens of workers involved consulting the data, at times the same ones, at different moments or with different criteria.

Its achievement calls for a significant computerized effort, since all the management systems involved must take into account the actions and values shown in the objectives. If there are dozens of objectives, many are the programs that must be modified in order that the statistics may be updated. Since part of the objectives change every year, the adaptation process is recurrent. As reference, in 2010 the Information Technology Department of the State Agency of Tax Administration carried out 8,874,961 processes by batches (more than 24,000 each day), generally in a night shift, so that every time the information consulted would be updated with the due periodicity, the statistics would be updated and the data safeguarded.

Although the technology has currently changed and many of the batch processes have disappeared or are recorded differently, there is still the need to automate the preparation and dissemination of the necessary charts for management purposes.

- **Scoreboards.** There are tools that allow for graphically showing in a spectacular manner the progress and the level of compliance with the objectives by bringing the data from the management subsystem. The State Agency of Tax Administration has used MicroStrategy®, one of the many solutions existing in the market such as Tableau®. One must be aware that the design of quality graphs, different from those prefixed in the tools, and regardless of their quality, their adaptation to each case's reality is laborious and calls for the training of specialized staff.

Case management

The auditor, once the established procedure has been initiated, carries out his task in two phases. In the first one, investigation, he accumulates evidence and studies the case. In the second one he notifies the interested party with whom the inspection begins and thus starts the calculation of the established terms.

Investigation

The auditor should not simply react vis-a-vis the unbalances and omissions, but should rather investigate the reality, since in taxes with a complex technique, there may be such problems as inadequate transfer pricing or aggressive tax planning actions that may require an in-depth analysis. For such purpose, he will request invoices, study contracts, analyze comparables, will carry out verifications in the stores, will request banking information and accounting data. To efficiently consult and integrate this information, he should have available three types of tools:

- a) Data bases with external information on comparables such as ORBIS from Bureau Van Dijk.
- b) Import and data analysis tools. They allow for receiving massive data from the taxpayer and integrate them to the information available in order to analyze them. Whether the auditor is provided market tools such as IDEA[®], or if one opts for constructed DWH solutions, as is the case of the State Agency of Tax Administration, one should be able to receive information in such formats as txt, CLV or XLS, then format, import and integrate the data. In the case of the State Agency of Tax Administration, there is available, on the one hand, PANDATA (an import tool) and PROMETEO. They are available to all the auditors. The first one allows, in a manner similar to when a text file is placed in a spreadsheet, for indicating how many columns there are in the data delivered, their format, which data appear in those columns, etc. It then integrates them in PROMETEO, which uses resources from DWH to analyze the data received without restrictions with respect to volume.

On the other hand, the Computerized Auditing Units which, through judicial mandate (600 cases annually) make copies of the taxpayer systems, have available concurrent IDEA licenses, assessing in particular their function as Report Reader and NUIX as forensic analysis platform. For this task, use is made of dedicated web servers, Java and NUIX (Rests, Workstation and Management Servers). This allows especially authorized auditors, to access through a Citrix environment, isolated and changeless data to perform their forensic audit. For these tasks which exceed administrative control, use is also made of AID4MAIL, for analyzing intervened electronic mails and UFED 4PC and UFED Touch 2 for analyzing the intervened mobile devices.

- c) Search tools. When analyzing documents or contracts it is useful to have OCR tools that may be capable of structuring them, for example, from a pdf, grammatically analyze the information, index it and offer the users search tools.
- d) Tools for visualizing complex relations. Allow for analyzing the relationships between taxpayers. One example is I2 Analyst Notebook[®]. In the case of the State Agency of Tax

Administration, a tool has been developed on DWH using Graphx libraries, which is called TESEO and allows the analysts to build graphs whose nodes are the taxpayers, visualize the 49 types of existing relationships, operate with the relationships and detect fraud patterns.

Case management

Upon initiating the inspection procedure, which is regulated, multiple tasks must be undertaken in an orderly manner: the notification to the interested party, the sending of requests via none rejectable electronic media, the preparation of documents required for each procedure, and always, the follow-up of the case. Ideally, there should be assistance for all these tasks, it being desirable to have a tool that may allow access to all of the system's data, but which, at the same time, may afford the auditor Independence to work outside his office and conclude certain actions in the taxpayer's office.

Four requisites must be fulfilled in order for the solution to be effective: a) Ubiquity; b) Security and auditability; c) Scalability; and, d) Specificity

- a) **Ubiquity.** The auditor should have available a platform that may allow him to do his work outside his office, without further connectivity requirements than those which could be offered by a regular taxpayer. The traditional solution allowed access to the mainframes via telephone by means of a modem. Today, it is sufficient with access to the Internet through Wi-Fi. The auditors of the State Agency of Tax Administration currently have Surface or HP-X2 equipment with 4G connection for carrying out these tasks.
- b) **Security and auditability.** It is not advisable to provide laptops with simple tools for remote connection to a server or mainframe. The regular practice requires that the working sites of the tax agencies' computers have blocked ports and that only data may be extracted or introduced therein, according to an established procedure and with the participation of a responsible security official. Likewise, to avoid information leaks, there is generally a protocol that regulates the use of the electronic mail. In the facilities, there remains a copy of the files sent out by each employee, who has previously accepted that his mail be audited.

If the adequate measures are not established, it could occur that the auditor, after consulting the personal data in the central facilities, could take them from the navigator and keep them in his laptop or the cloud, or even forward them through a wide diffusion mail such as Gmail or a Messenger system such as WhatsApp, from a telephone to himself or third parties. This would imply an inadmissible breach of security, not only because the laptop could be lost, but because in the case of dissemination of compromised information, the security administrators would be unable to find the one responsible for the leak and prove his action.

In the case of the State Agency of Tax Administration, the corporate personal computers have the ports blocked and information can only be introduced or withdrawn with the authorization and intervention of those responsible for the security. The laptops are prepared by the State Agency of Tax Administration and access to the corporate data has been carried out through CITRIX ®. When the connection is requested, this virtualization solution allows the

auditors' laptops to be connected to some servers where a "virtual laptop" is created for each user. Thus, even though the user is in a remote place, he works with the same environment as that of his office, with the same resources and subjected to the same access and auditing control. He cannot extract from this environment the taxpayers' personal data nor from the data storages, since he is working in this virtualized protected environment.

The purpose is to provide the auditors the best of two worlds. On the one hand, he may have access to all resources available from his regular working site with enormous scalability and to the corporate data storage. On the other, he has available a case management platform with Pc offimatic assistance and tools and connectivity in the taxpayer's facilities.

Tools such as VMWare Workspace ONE®, Guardium® and Thycotic® are part of the solution implemented and of those that are in display to guarantee security.

- c) **Flexibility.** The auditor should not experience limitations regarding the number of registries or the type of verifications he may make with the data received from the taxpayer, but the price to be paid should be reasonable. The technical solution given him should be scalable and independent, of which there are two options. The first consists of offering the auditors data analysis tools, such as the IDEA tool. The advantage is that it is a quality package, but the inconvenience is that the administration must pay the price of the dissemination, training, administration of the products and solve the security problem, which is not small. The alternative consists of developing its own solution that may integrate the data storages with the functionality of these packages and others required by the tax inspection experts in the servers, using as base the DWH tool available with the elevated price for developing it. However, the advantage is that the management is simpler and scalability greater, inasmuch as the auditor ceases to be limited by the capacity of tools conceived for a personal computer.
- d) **Specificity.** The auditor should have available not only generic tools, such as calculator, spreadsheet or text editors, but other specific ones such as interest or sanctions calculators, templates of the documents that must be completed, an agenda for controlling the terms according to procedure, process maps, case libraries.

An example is Private Affairs Analyzer, which examines the credibility of the revenues declared by the taxpayer after crosschecking them with his expenses and what has been charged, or the ones developed by the New Zealand Inland Revenue, which has developed a Compliance Based Auditing framework to facilitate the preparation of cases and assist the auditors so that they may interact with their data storage through the Tax Audit Selection System [TASS]. Another best practice is that of Australia where laptops are used to facilitate auditing, by ensuring that a homogeneous format and styles are achieved for all taxes and taxpayer segments. Some of the aids are the process maps, as well as the possibility for downloading policies and technical documents.

The advantages of having these specific tools are: (1) Reduction of the administrative burden inasmuch as the system automates the milestones of the process; (2) reduction of errors in the terms and assessment, since the applications take into account the rates that must be applied in each case

and period; (3) ease for controlling objectives since the data bases are updated in the successive procedures; (4) security because all the documents of the record are automatically filed according to standard rules; and, (5) standardization and improvement of quality. Through the use of templates the auditor at least carries out the verifications that have been established, drafts the documents according to the best practices, having access whenever appropriate, to the reasonings of auditors with greater expertise in success cases, facilitates the transfer of information and simplifies for the directors the follow-up of plans and objectives. Its existence simplifies the task of the Technical Offices or Quality Control Groups in structuring quality.

The tools avoid out-of-term actions, generate alerts, transfer the file in case of absence or illness, include checklists of the controls and verifications which as a minimum must be carried out all the time, contribute calculators such as those of interest due to delay to avoid errors, incorporate templates of best practices and updated juridical reasonings that must be used in every case.

Monitoring

In addition to entering in the accounts the number of actions and revenues, the effectiveness of actions by segment and type of tax must be monitored. It could happen that if the taxpayers would become aware that the coverage is low and that once their company has been verified the possibility of control in successive years were minimum, they would compensate the sanctions by committing fraud. As well as it could happen that certain controls were not efficient, with their cost being greater than their benefit. Measuring effectiveness is more difficult than measuring efficiency, inasmuch as it not only requires counting, but also requires modeling and responding to violations. It requires advanced analytics.

5.2.3. *Advanced analytical systems*

The development of multivariate statistical techniques and advances in Artificial Intelligence (AI) have promoted the interest for applying advanced analytical techniques (example: “deep learning”) in the struggle against fraud. If a bibliographical review is made of the techniques used in the different countries, for example the paper called “**characterization and detection of taxpayers with false invoices using data mining techniques**”, we may identify the following blocks:

- a) Traditional statistical and econometric techniques. Obtaining extreme values (outliers) to create alerts in relation to prices, values or ratios. Simple or logistic regression to obtain estimates and risk indicators, analysis of temporary series (ARIMA and SARIMA) in the estimation of the future volume of VAT refunds, etc. They are implemented with any statistical tool, from the free ones such as R up to the sophisticated ones such as those offered by SAS.
- b) AI Techniques. When their development began, there were two competing approximations. One that attempted to capture the knowledge of experts in the form of rules (expert systems) and the other (neuronal networks) which sought to reproduce the way in which the brain adopts intelligent decisions.

The neuronal network's strategy was initially successful. It experienced years of darkness in the '70s and has had a revival that is evident in the recognition of images, in the use of Adverse Neuronal Networks and techniques such as those used by AlphaGo to win in the Go game, wherein different networks compete among themselves, thereby improving their performance.

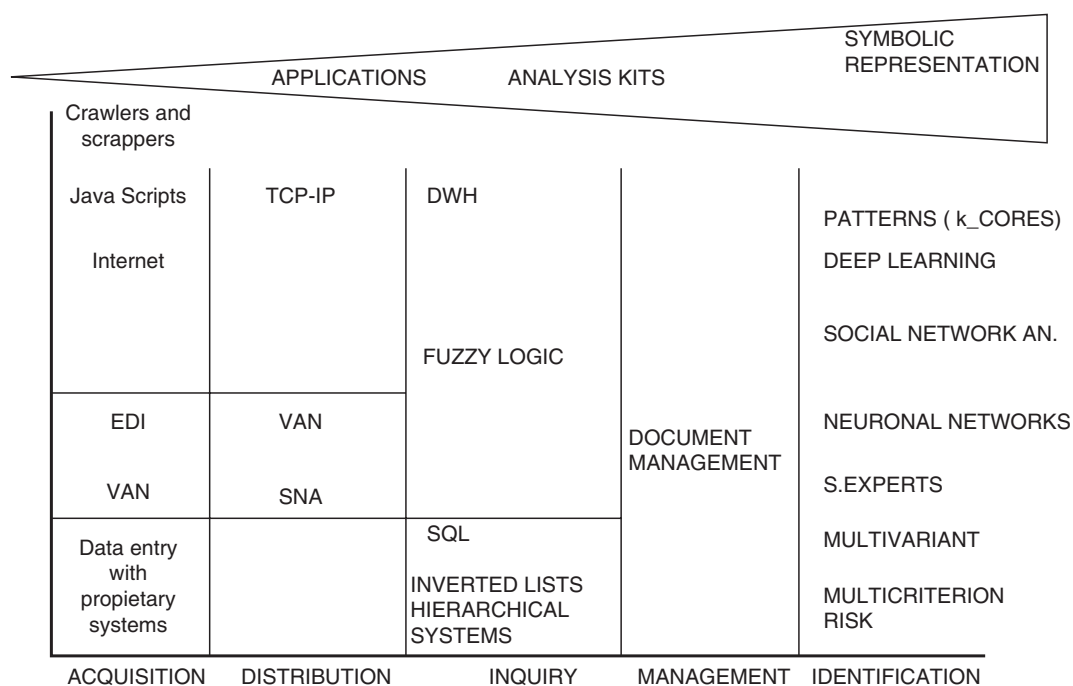
In the '80s, the State Agency of Tax Administration developed the SERENE system, to select candidates for auditing whose results, in principle, were impressive. There were over 99% successes, but the problem was that these were black box techniques. The auditor knew that there was something strange in the selected candidate, but the system did not provide information on what was strange.

Currently there are dozens of open source tools that allow for carrying out these investigations (R, TensorFlow), but its current use in the tax sphere is very limited.

- c) Decision trees, SVM (Support Vector Machine), multivariate techniques, SEM models. They permit such tasks as classification (defrauder/non-defrauder) and offer the analyst more information than the previous ones regarding the reasons that have led to the decision. There are problems such as voice recognition in real-time wherein this is not important and therefore the previous ones are used. However, in the case of struggle against fraud, as in medicine, it is important to know the illness. Although one may use free tools such as R, use is very frequently made of specialized tools such as SPSS, if not advanced environments such as SAS.
- d) SNA (Social Network Analysis) Tools. The effectiveness of searchers such as those used by Google, render evident the effectiveness of tools that find a desired node in a network, the store which has the product we are looking for, but which may also be used to detect who is the defrauder in a traders' network. Algorithms similar to those used by NETFLIX to recommend films based on the assessments by those having common tastes may be used to find common patterns among defrauders. The strategies used to visualize and control becoming infected with epidemics, may be used to understand the way in which fraud is disseminated. The possibility of dealing with taxpayer networks also allows for analyzing wealth through the treatment of ownership relationships among taxpayers and businesses and then, the participation of some businesses in others. The visualization tools are part of this group. Python is generally used as a programming language and also libraries such as Graphx.

5.2.4. *Components of a computerized examination system*

In *Figure 5.2-2* we have represented in the horizontal axis, the functions of an information system for auditing, and in the vertical axis, the technologies which may be used for carrying them out, thus showing how they logically follow one another.

Figure 5.2-2 Technology-function relations

Source: Prepared by the author

From a functional perspective, the display must be from left to right. The tax administration should, first of all, *receive* the necessary data in an efficient manner, before *sharing* them among its officials, which in turn takes precedence of simply being consulted by any dimension. One can only manage by consulting the data and only on this basis, can one start thinking about modeling and carrying out advanced analytics, since using analysis kits or symbolic systems on incomplete or erroneous data would be useless.

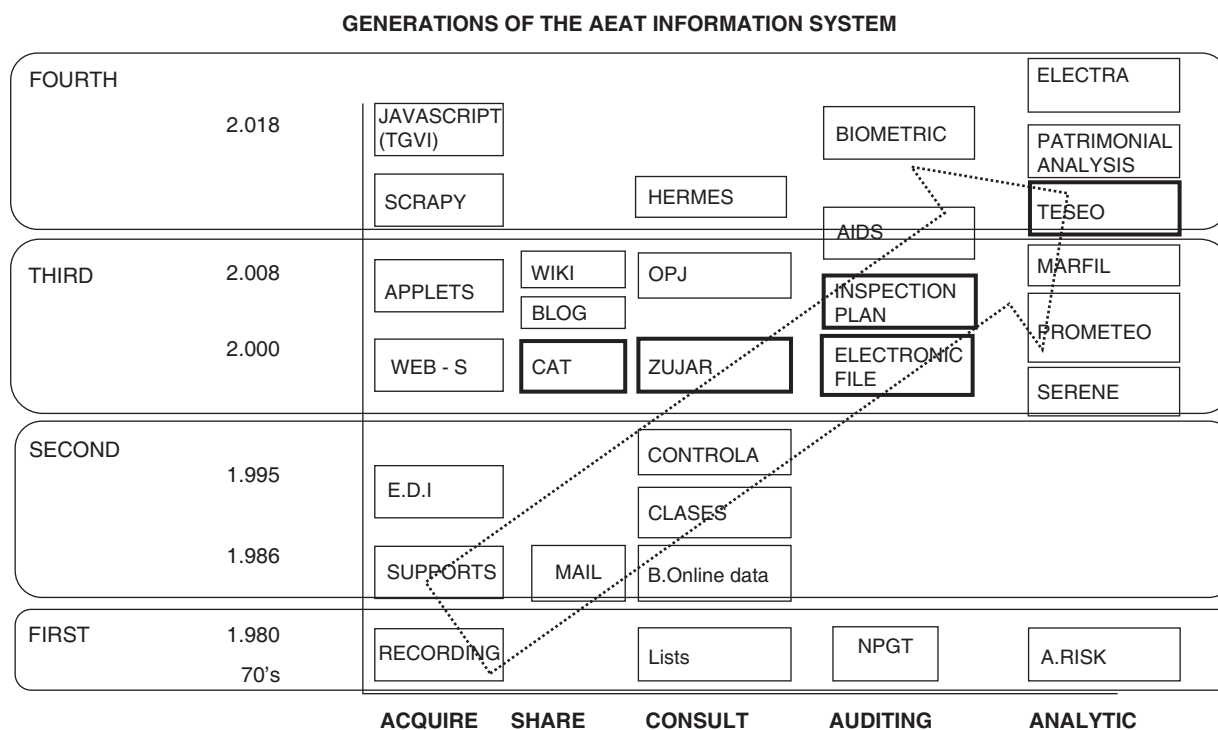
The vertical axis shows various technologies for acquiring data. In the past, lower part, the data were recorded using proprietary systems. They were complemented with value added networks (VAN), which allowed, for example, the consignees to send the manifests to the Customs Office. The dissemination of the Internet and its technologies, such as the Web Services or JavaScript strengthened the inter-operability and currently “crawlers” are used to capture data from the Internet through the use of such libraries as Scrappy.

There has been an evolution in the consultation of data from the hierarchical data bases (IMS-DB) to the inverted lists, (ADABAS). The SQL standard was disseminated and there emerged the data storages (DWH).

The multivariate analysis techniques were developed in the 60s. Then there emerged the SEM models, the expert systems, the neuronal networks and further on, advanced Artificial Intelligence techniques.

In *Figure 5.2-3* we show the way in which successive tools have been developed in the State Agency of Tax Administration, with the arrow indicating the technological advance. Those appearing further up and to the right are supported by those located further down and to the left.

Figure 5.2-3 Applications involved in the auditing function



Source: Prepared by the author

The first generations of the Information System of the State Agency of Tax Administration

The AEAT developed, with the technology existing in the 80s, the second generation of its Information System. It consolidated all its systems in a central computer which, up till then had been impossible because of the limitations of the systems and teleprocessing, with a solution integrally developed by its analysts on mainframe.

The auditing selection system allowed the inspector to use with great flexibility pre-established data crosschecks (CLASES), like the one selecting taxpayers with luxury vehicles and low income or farmers who consumed diesel oil with discounts, without declaring income. When these crosschecks, always pairs of variables, became thousands, the daily preloading of indexes so that the system would respond in real-time every possible behavior, required many resources, evening processes to pre-calculate and accumulate, because otherwise the tens of thousands of users would have had to undertake the execution of “lists” (reports) simultaneously, which would have been unsustainable. Systems based on diffused logic were developed to access the data (CONTROLA).

It was a very common problem in the 80s. The Information Technology Departments reacted in two ways:

- a) Creation of Information Centers. Making the data available to some users trained in the use of tools (FOCUS® was used for preparing reports). Its inconvenience was the withdrawal of scarce resources which were distributed through the organization and generated islands of information in the Departments.
- b) Creation of small inquiry programs which could be parametrized. The inconvenience was that it kept the Information Technology Department making small inquiries and resulted in a tremendous evening workload.

At that time there arose the possibility of using databases oriented toward columns, a new technology with products such as SYSDATABASE® which used AIX servers and customers in personal computers.

Third generation

Its use marked the beginning of the third generation of the AEAT Information System. The system then had two components. A transactional system which recorded the data received and supported inquiries (similar to that of an airline) and another system, in another platform on which the system's data were copied and wherein the users saw "cubes" of information. The many solutions that have appeared in the market, in general, have two components: the first one called ETL which extracts data from the transactional databases, transfers them and uploads them in a database intended for multidimensional inquiries (cubes).

From the auditor's perspective, when selecting an inquiry in the table mode, for example, taxpayers according to the geographical zone may very freely choose the columns that may be useful to them. Then, according to the values of the cells they may break them down, as necessary, by applying filters and being able, at the end, to obtain the details of the taxpayer data that are grouped therein and consult any data about them in the system.

In any case, these are general-purpose tools which may be used to analyze any type of information; accounting information, payrolls, accesses to control privacy and certainly the taxpayer returns to undertake risk analyses. When it was created in the year 2000, information from 49 million taxpayers was uploaded, with 23,962 dimensions and 11,388 data per taxpayer.

One should not think that having the technology available will in itself solve the problem. A data storage, much like a book storage must be organized. There are shelves for taxpayers, others for current accounts, others for urban real estate, others for the organization's equipment. Each of them is known as "datamart". In the case of the State Agency of Tax Administration there are 1,400 "datamarts" that are called ZUJARES, different components of the ZUJAR system, of which one fourth are used by auditing. These storages must be periodically updated, some of them daily.

On conceiving each of them, the analyst chooses from among the data available of each taxpayer (over 25,000) which are the variables that should appear when consulting. Otherwise there would appear thousands of columns, for which reason the organization and loading of each of them implies a small programming task. On the other hand, the servers, as well as the customer part of the personal computers must be updated. The maintenance of the system involves a team of 60 persons in the State Agency of Tax Administration. Currently there are 560,000 million lines that provide information on over 71 million taxpayers, 1,300 million on the evolution of the current accounts, and 500 million of cadastral data. The data may be analyzed in more than 29,000 dimensions (by province per period, by type of tax, by activity, etc.), with over 25,000 different data for each taxpayer and year.

In other words, the number of technicians required is equivalent to the employee for developing and maintaining the Collection (recovery) system or the one for Customs and double that of the Human Resources or Financial Economic systems.

The access data to the taxpayer information are registered in the State Agency of Tax Administration; whether it is the access to a specific data or in the case wherein the inquiry consists of a filtering carried out on the data marts. The use of such powerful inquiry tools results in the exponential increase in the number of data preserved for auditing. In 2004, there were over 450 million registries, in 2009, over 900. Currently, there are over 3,400 million per year, which implies that over 136,000 data per employee and day are stored, which include information on all that has been done, thereby guaranteeing the traceability and demand for responsibility, if required. The figure gives an idea of the difference in the complexity involved in the control of accesses when the user makes inquiries in a transactional database, vis-a-vis the situation wherein he filters enormous cubes of data, thus being able to take advantage of that path to access undue data.

Since the 60s, statistical techniques were being used for risk and econometric analyses (use of SAS). Once the data storage was created it was used to determine alerts by building two systems thereon: a) SAIT: *Tax Information Analysis System*, whose purpose is, given a group of taxpayers and a series of ratios, to offer a “typified vision of each ratio” in order to determine the level of difference of the value of each ratio for each taxpayer, with respect to the mean of the value of said ratio in the group being analyzed; and, b) MARFIL: *Fiscal Risk Assignment Method* which consolidates the former data by offering a “typified vision of the taxpayer” by means of a “singularity” value with respect to the “average taxpayer or employer in his segment”.

The SERENE system was developed. It is a neuronal network according to the McCulloch-Pitts model with sigmoidal or gaussian neurons. In its first application, use was made of the general data of the State Agency of Tax Administration’s National Data Base, that is, the historical data of the five years prior to the investigation, as well as data from the VAT records from 1996 through 2001. It was a supervised learning network with *backpropagation* consisting of 421 entry variables and two hidden layers with 243 in the first and 6 in the second, with good results in the classification as defrauder or not of 98.76% in the validation set. The system was discontinued because in spite of the good results, it did not afford the inspector clues on the admissible reason for fraud.

The OPJ (Judicial Expert Opinion Office) system was developed. When there is a judicial or administrative mandate, it allows for entering the data from the taxpayer's facility to a virtual machine where they are analyzed with forensic auditing tools (BUSCON). The tools developed, which allowed the OCR treatment of the taxpayer's files, *parsing* and indexation of his data for carrying out relevant information searches, were then used in administrative auditing, not only to assist the auditor in finding the desired terms in the information provided by the taxpayer, but also to find references in the documents that describe the best practices.

A catalogue system was built that allows for dealing with every type of object, not only data but also images, spreadsheets, etc. Based thereon, a new version of the Inspection Plan was created (supported by the electronic filing system and with access to the data storages) where the planning and management of cases takes place and which is equipped with the previously mentioned aids (templates, assistants for making assessments, access to comparables, risk analysis, etc.).

Fourth generation and trends

Its basic elements in the different functional areas are:

- a) Data capturing. Real-time validated massive receipt of large volume files (TGVI) using JavaScript and capacity for accessing and massively capturing data in Internet with SCRAPY.
- b) Creation in the data storage (SAP) of a system for the meta-analysis of risks. The data storage is not only applied to the data but also to the risk rules, which allows for its easier application and monitoring of results. HERMES system. There is a trend toward the processing of data in the memory with HADOOP.
- c) Use of biometric systems for accessing and recognizing the signature when the auditors, in virtualized environments (VMware Onespace), sign the documents at the premises of the interested party.
- d) Development of the TESEO system, which allows auditors to visualize the networks of taxpayers with SNA techniques as was done by traditional products such as PAJEK, using SPARK and Graphx technology. Through it, the relationships between taxpayers and enterprises may be visualized, by filtering the relevant ones, detecting anomalies, calculating the net worth of large fortunes and their control by family groups. It begins with the declared relationships, some personal, as that of the relationship between parents and sons and daughters declared in the IIT return form or the juridical ones, such as that of the partner or administrator in corporations. There are others which, although not having to be declared, may be deducted such as that of "brother" or "brother-in-law" or "mother-in-law". On doing so, one has gone from 60 million declared personal relationships to 170 million and they have been used to complete the multigraph of commercial and juridical relationships (49 types) in the Networks of High Value Patrimony project (2016). The trend is to use SPARK with Graphx with the Pregel algorithm and also GraphFrames and HADOOP.
- e) Treatment of multigraphs for detecting fraud patterns with such techniques as the search through k-cores in the ELECTRA project. AI techniques have been used with Python.

All the information deducted and obtained enriches the basic layers of the system, which continue to be the ZUJAR data storage and the electronic file.

5.2.5. *Lessons learned*

- The auditing function is critical. Since it is the one using most human resources in the tax organizations, up to 50%, it is important to subject it to structured planning, manage it according to a risk management model, which includes monitoring the effectiveness of the different control strategies.
- Two types of “enforcement” should coexist; the extensive one, with cases automatically selected by the Information System through the application of rules and the intensive one. Each Administration must decide the percentage it will devote to one or the other; however, the procedures should be differentiated, and auditors should be specialized in one or the other.
- As seen in the Chapter: “*A Tax Administration Framework*”, the auditing function is a high level one and its operation requires sound foundations in such aspects as security, infrastructure, registration, reception and validation of third-party information, current account, etc. Without these foundations, risk analysis is precarious.
- The key issue which conditions risk selection as well as the investigation by the auditors is the availability of a quality data storage tool. It is necessary for an appropriate selection and investigation, but not sufficient. There is a need for expert auditors who may determine the suitable datamarts that may prepare effective prefixed inquiries and an information technology team which may create these inquiries. This may require up to 10% of the total developers’ staff.
- The statistics, series analysis and multivariate techniques (analysis of conglomerates, discriminant analysis, regressions and logistic regressions) are necessary, have proved their effectiveness and may be used with any type of tools, some free such as R and Python, others design-based for personal computers such as SPSS or forming advanced suites such as SAS.
- The search for fraud with Artificial Intelligence techniques, through expert systems as well as through neuronal networks, have had extraordinary advances in the perception and learning areas. However, because of the nature of the data used, they have not yet shown useful results in fraud persecution and, for the time being, are not a sound basis for the selection and above all, it is the main auditing problem.
- The development and use of tools for managing cases in personal computers is very convenient. However, it is critical that they be used in platforms having adequate security and traceability mechanisms.
- It is essential to adapt the tools that have been used up till now for controlling access and use of the detailed personal tax data, to the systems that allow for massive inquiries.

- It is ever more necessary to create high performance systems for the receipt of massive data, such as electronic invoices or those from third parties. Trends should be reconciled for receiving data from personal computers such as Javascript, or machine to machine communications, with capacity for validating data in the memory, which requires the implementation of new algorithms. It will become ever more frequent to access the Internet with crawlers in order to learn about undeclared data from the economic reality.
- The economic reality is shown in the form of a social network and use should be made of SNA tools, for example, on SPARK and Graphx or GraphFrame technology or in its stead for visualization, like 12 Analyst's Notebook to represent the many types of relationships existing between the taxpayers, allow the auditor to understand the merchandise payment flows and detect fraud patterns.

5.3. Selection for auditing – the Brazilian Tax Administration experience

5.3.1. Introduction

Tax administrations have always been concerned about a share of taxpayers that do not pay their taxes correctly. This taxpayers' share may vary across different countries when compared to active economic population for several reasons: cultural aspects, citizenship awareness level, level of organization and maturity of the tax administration itself, legal framework establishing punitive measures to be taken against noncompliant taxpayers, legislation complexity, level of tax burden in relation to the Gross Domestic Product, as well as unequal distribution of tax burden.

Those who do not pay their taxes correctly due to financial difficulties or complexity or lack of knowledge of the law must be distinguished from those who deliberately avoid paying taxes, with a view to obtaining economic and competitive advantages in the market. It is quite true that this distinction between different types of noncompliance does not always portray differential treatment by tax administrations. An important factor in such situations is the timing of the required action to be taken by the tax administration.

Collecting old debt is more costly and less effective than collecting new debt. Action against tax fraud must be swift to produce remedial effects on a noncompliant taxpayer, and to serve as an example to others, including the group of complaint taxpayers. Another important point to be taken into consideration is in the precise identification of each tax base(s) and the tax administration's level of knowledge about the economic transactions that take place in a society, whether in relation to production, consumption, income, wealth and financial transactions.

Information has always been and will be the main input of a tax system. In the recent past, paper documents, tax records kept in physical books, and visual inspection of goods and products, were the only means to ascertain a tax base. This reality has changed and continues to change with incredible speed. Invoices have become electronic, accounting has become digitalized, and transactions commonly occur over the internet. We have already entered an age characterized by de-materialization

of documents, receipts, and records of economic and financial operations. Technological innovations are emerging every day to transform the relationship between people and markets, with less bureaucratic obstacles, with greater agility in operations. Technologies like Artificial Intelligence and “Blockchain” will not be mere expectations for the future - they already play a role in the world of corporations, businesses, and people. The physical currency no longer circulates as in the recent past and the virtual currency, cryptocurrencies, are already being experienced.

Therefore, all these technological advances require tax administrations to rethink their methods and work routines and even the structures of tax systems. This is the challenge: public administrations and, in particular, tax administrations must be prepared to absorb this technological revolution to improve their work processes, including tax rules and regulations. Using these technologies can be an excellent opportunity to quantify and qualify information as to better identify those taxpayers who are not in compliance with the tax laws.

Identifying or selecting a noncompliant taxpayer requires the application of all available information, with extensive use of technological tools for data-crossing and the use of behavioral studies on groups and economic sectors. A well-planned selection process ensures the success and effectiveness of the tax audit.

5.3.2. Objectives of the tax audits

An essential area in the structure of a tax administration is the “auditing” process. Indeed, the tax administration imposes its power over noncompliant taxpayers through the actions carried out within the scope of tax audits (or inspection). There are four main results that arise from audit actions:

- **Generating risk perception through fiscal presence** – the actions taken against noncompliant taxpayers, identified in the selection process, pose risks to those who commit such illegal actions. The accuracy of the selection process inhibits tax fraud. Additionally, the penalties imposed for infractions resulting from a taxpayer audit should pose a serious burden, in order to create a genuine sense of risk.
- **Encouraging voluntary compliance with tax obligations** – another result expected by the inspection actions is to encourage voluntary compliance with tax obligations, in relation both to the payment of taxes and the provision of information through tax returns and other obligations.
- **Identifying unreported taxes** – the selection of noncompliant taxpayers should quantify the economic significance of the tax evasion. The collection of the evaded tax, in conjunction with all applicable charges and penalties, is a necessary measure to offset the loss of public revenues. Tax evasion ultimately removes public resources from the wider society for the benefit of one singular agent, the noncompliant taxpayer. Recovering these resources is therefore a necessary and fair action undertaken by the tax administration through its inspection work.

- **Bringing criminal charges against tax evaders** – in addition to the economic damage to the public treasury for not collecting the public revenue, tax evasion in many countries is considered a crime. Punishment of tax crimes is important as such actions cause damage to society by subtracting resources from the state budget. The tax audits can also identify the situations that characterize these crimes and support the criminal prosecution of these evaders.

5.3.3. *Planning of tax audits*

Activities undertaken by public administrations should, in general, be organized as to maximize successful implementation. Tax administrations must have a comprehensive plan of their activities, since they are essentially interacting directly with society.

As previously mentioned, information is the primary input of any tax administration. It is impossible to conceive controlling the tax collection or the tax debt of both regular and non-regular taxpayers without elements that indicate such aspects. That is, data must be collected and processed beforehand in order to obtain information necessary for tax system management. With such information, it is possible to:

- Monitor the taxpayer to verify compliance with lawful tax obligations, both ancillary and principal obligations;
- Gather and investigate signs of non-compliance with tax obligations;
- Interact with noncompliant taxpayers for self-regularizing their situation;
- Punish deviations and non-compliance of tax laws by:
 - ❑ Issuing tax assessments resulting from audits (inspection).
 - ❑ Imposing restrictions regarding registries, operations and assets.
 - ❑ Filing criminal charges as a result of tax crimes.

5.3.4. *Structuring information*

If information is an essential input of the process, the tax administrations must take specific actions to obtain it. The following topics will focus on the importance of a well-structured information system to support an effective tax management. Much like private corporations pay special attention to understand their customers and their business, tax administrations must do the same to understand both good and bad taxpayers.

Understanding the taxpayer base requires obtaining and storing information on the registration of individuals and legal entities, economic sectors (commerce, industry, services, financial intermediation, and others), types of transactions and operations that characterize taxable events, tax

bases, payments and installments, offsets, suspensions, and third-party information for data cross-checking.

All this information should be stored in one or more databases. To this end, tax administrations should invest in information technology, application systems, and transaction processing environment, unstructured and data mining. Such framework will provide the basic foundations for understanding the universe of the taxpayer, and to more accurately select those that deviate from the compliant behavior. This way, proper action can be taken for each specific case.

5.3.5. *The case selection process for audit – structure*

The primary objective of the **selection** process is to monitor and study taxpayers' behavior, and thus to identify the practices and techniques used by those who attempt to evade or reduce their taxes. Non-compliance may be due to mistakes or lack of knowledge of the tax legislation on the taxpayer's part, or even to financial difficulties. When such cases are selected, they should be addressed through monitoring, notifications encouraging the taxpayer to regularize the situation, and the use of enforcement collection.

In addition to recognizing cases of non-compliance, the **selection** process also serves to identify common practices of money laundering or currency evasion. As such, it is necessary to identify situations of irregularities, non-compliance, and aggressive tax planning in taxpayer behavior, with an end goal to correct, curb, and punish such illegal actions.

To achieve these goals, the **selection** process encounters several challenges, with the most pressing obstacle being to successfully solve the “demand vs resources” equation, both for the selection process itself and for auditing the selected cases.

5.3.6. *Demand for the taxpayer selection process*

The tax administration is a public agency that possesses law enforcement power granted by the State, in order to ensure compliance with current tax legislation and tax collection, processes that ultimately finance the State itself. Tax administrations have the power to support adequate tax legislation elaboration, monitor taxpayer behaviors, collect and facilitate voluntary tax obligations payment, and punish deviations and illegal actions. Thus, demand for the taxpayer selection process is influenced by several factors relating to tax management:

- The quality and simplicity of the existing tax structure insofar as aspects of equalization of internal tax competencies (national, regional, and local), non-fragmentation of taxable events, and ease to calculate tax bases and to control the taxes. The lower the quality and simplicity of the tax structure, the greater the difficulties in complying with and enforcing the tax laws, thereby increasing the demand for audit selection.
- The quality and simplicity of legislation and regulations regarding their clarity and ease of understanding. In cases of divergent viewpoints, it is crucial to have agile and effective forms

of rulings and resolution. The lower the quality and simplicity of legislation and regulations, and the longer the process of clarifying divergent interpretations of the tax law, the greater the amount of doubts, legal loopholes, legal uncertainties, and non-compliance actions, which will conversely increase demand for audit selection.

- The quality and simplicity of ancillary obligations to provide information that is easy to comply with, is simple, non-fragmented, reasonable, and digitalized. The lower the quality and simplicity of these ancillary obligations, the greater the difficulty in fulfilling them, leading to failures and deficiencies in obtaining and analyzing information, thereby increasing the demand for audit selection.
- The quality and efficiency of the legislative and punitive process of tax offenses regarding the existence of adequate fines and penalties, the criminalization of tax evasion, the application of interest rates on tax debts compatible to market rates, and the agility in imposing penalties. The lower the quality and efficiency of the legislative and punitive process, the greater the sense of impunity and the possibility that taxpayers will opt for non-compliance, even as a tax planning mechanism, thereby increasing audit selection demand.

In addition to the factors listed above regarding tax system management, there are other general aspects that may also impact the demand for audit selection. The values and attitudes of that society may be more or less conducive to complying with the tax legislation. Low taxpayer approval of the effective and fair use and social return of taxes levied by the State may discourage voluntary compliance with such obligations.

The tax administration can exercise influence and control over some of the factors that affect audit selection demand. Therefore, it is necessary to seek permanent improvement of such factors and reduce their negative impacts.

5.3.7. *Human resources*

The importance of human resources is related to two processes: the selection of taxpayers to be audited, as defined and discussed above, and the audit of identified and selected taxpayers.

- Resources for carrying out the selection process: experienced employees with a thorough and complete understanding of the entire tax process are needed. In this group, there ought to be generalists, who are familiar with the norms and the structure of the country's tax system, and specialists in specific tax types and processes, who are able to investigate cases and perform cross-checking analyses on taxpayer information, in order to identify irregularities or non-compliance.
- Resources for carrying out the selected audit actions: employees with knowledge to perform the audits (inspections) are required, in order to identify the facts that support the evidence indicated by the selection. The tax assessment report prepared during the audit should thoroughly describe the case facts, and provide evidence garnered during the selection process. In addition to underpinning taxpayer misconduct correction regarding the noncompliance

with the tax law, the evidence collected during the audit supports the application of other penalties, including criminal charges. The employee should be able and competent to verify the facts through evidence gathering.

- Existing human resources may be augmented when necessary and possible. However, the efficiency of such resources should also be improved by better structuring the work processes, investing in training, and extensively using information technology systems and applications, i.e., by increasing their productivity.

Continuing and structured training should prioritize courses that focus on:

- Tax laws and regulations relating to existing taxes and tax processes, and administrative and judicial proceedings, including liability issues;
- Tax laws and regulations relating to ancillary obligations, with emphasis on the data contained within each one of them;
- Accounting and auditing;
- Investigative and interviewing techniques;
- Specific fields of knowledge, understanding economic foundations, the structure of economic sectors (legal, operational, and commercial), and the financial system and its instruments;
- Usage of IT systems at a basic level, for users who will make structured data queries and basic cross-checking and treatment on the resulting data;
- Usage of IT systems at an advanced level, for users who perform both structured and unstructured queries, and complex data cross-checking and treatment, essentially entering the data science field. That is, for those who will make heavy use of Information Technology.

The human resources who work on the selection process are highly impacted by the quality of available information. Conversely, human resources who work on the selected tax audits are more impacted by the quality of the selection made, and the evidence gathered therein. The greater the amount of information available for selection, and the more reliable and accurate it is, the more the selection process can help identify noncompliance, reducing the burden for the tax audit to collect evidence.

Thus, it is clear that there is a direct relationship and a desirable balance between the human resources allocated for the selection process and those allocated for the audit process. These are directly linked and complementary, and so it is important to distribute them in the most productive manner, i.e. as many employees as possible should be placed in case selection, with regard to the number of employees able to carry out the audit of the selected cases. However, it is always good to point out that employees must have, in addition to the necessary knowledge, the profile to carry out their activity.

It is important to highlight that, in order to achieve this desirable balance between selection processes and tax enforcement processes human resources, it is necessary to structure a methodology

for measuring the time spent on the work related to each of these processes. Typically, such measurements are stratified by taxpayer type and size, and by the complexity of analyses to be performed. The more structured this measurement methodology is, the more effective the allocation of human resources can be.

5.3.8. *Demand vs. resource equation challenge*

Resources allotted to tax administrations are always scarce, thus it is important to manage “demand vs resources” challenges’ equation in order to obtain the best possible outcomes from available resources.

The first step to solve this difficult equation is to structurally reduce demand, as to diminish negative factors that encourage its growth. The second step is equally as important: simultaneously reduce demand and increase the productivity of available resources, thus producing a double positive effect.

However, given that resources are always scarce and demands typically greater than the capacity of available resources, often there is a need to implement further actions to better meet demands. Thus, it is important to establish criteria and rules for prioritizing the list of potential tax audits identified by the selection process.

Finally, a fourth step, characterized by a more recent trend in tax administrating, is to allow and encourage self-regularization and voluntary compliance of obligations by the noncompliant taxpayer, once the wrongful behavior is identified.

5.3.9. *Execution prioritization rules*

Execution prioritization rules are usually based on risk management and take into account:

- Degree of certainty of the evidence gathered – greater risk;
- Identified loss of revenue value;
- Time limitations for carrying out the audit action.

In addition to these risk management general rules, other factors may be used to establish criteria for prioritization, including:

- Strategic importance of the evidence and/or thesis to be audited (inspected);
- Strategic importance of the tax audit to enable further investigation on the taxpayer, including criminal prosecution;
- Prior existence of guarantees and/or known or potentially known assets that support the tax collection and the future identified uncollected amounts recovery for a particular taxpayer.

Permission and encouragement of self-regulation

In accordance with OECD compliance pyramid recommendations, tax administrations have recently been allowing and encouraging taxpayers to regularize their tax problems prior to any effective tax enforcement actions, even if noncompliance has been identified. This leverages the resolution of nonconformity demands for audit, allowing scarce audit resources to be better applied to those taxpayers who do not want to comply and regularize their tax problems, or those who have used criminal practices.

Generally, in concrete cases where potential taxpayer non-compliance has already been identified during selection process, permission to regularize is usually granted only to:

- Taxpayers who are deemed to have good behavior by the tax administration, following pre-established criteria made transparent to the public;
- Taxpayers whose non-compliance does not incur criminal practices.

A good practice to encourage compliance is to disclose, to all taxpayers, these types of identified non-compliance. This will impose a greater risk perception and encourage taxpayers to comply and regularize. This communication should be made in a strategic manner. It may, on a case-by-case basis, be made to all taxpayers, or by specific groups, such as taxpayers from the same economic sector, or from the same geographic region.

However, the permission to self-regularize is an important premise to be respected in compliance processes, as it enables the completion of the regularization process. Thus, in a compliance procedure, once the taxpayer has (or a group of taxpayers have) been notified that noncompliance has been identified during the selection process, a regularization period should be granted, without prejudice to the necessary follow-up by the tax administration.

If tax regularization does not occur, or occurs only partially, the tax administration must then continue to carry out the audit and impose the required enforcement actions. Otherwise, this would imply loss of credibility and could potentially compromise the entire compliance improvement process.

Since audit resources are scarce, planning compliance actions should ensure that these resources are readily available in case regularization does not occur as expected. If the resource availability for a potential enforcement action cannot be guaranteed, the tax administration should not initiate the compliance action.

Importance of Selection for Tax Action Execution

The discussion above stresses the selection process importance for the audit function. With a solid selection process that properly addresses “demand vs resources” challenge, tax administrations can:

- Establish their fiscal presence as strong as possible through appropriate resources distribution and most relevant and strategic tax cases selection, with a greater certainty degree in evidences identified by the selection process;
- Strategically encourage compliance and regularization actions. Such actions will enable non-compliance regularization through encouraging taxpayers to comply through a strategic communication process, without risking demoralizing the enforcement actions.
- Ensure the effective resources used for the enforcement (audit) actions by focusing on the most relevant or strategic cases of non-compliance, especially regarding taxpayers who have opted to not regularize themselves, or for whom regularization is not allowed, or for those who have committed criminal practices. Such measures can amplify the risk perception imposed by the enforcement actions and by the implementation of a strategic communication process.
- Provide the most effective enforcement actions as possible to existing demands of non-compliance, thereby imposing a greater risk perception to non-compliant taxpayers and discouraging non-compliance in general.

5.3.10. Selection process prior structuring

As outlined above, proper selection process execution requires an established structure to obtain information on taxpayers, as well as availability of an information technology platform that allows for processing, crossing, and analyzing this information to identify cases of non-compliance and irregularities.

The process of obtaining necessary data – definition of ancillary obligations

The selection process fundamentally requires a set of qualified and reliable information on taxpayers and their economic, financial, and property transactions. This should include information on their economic group, and on the economic sectors in which taxpayers conduct their activities. This information should be gathered, in part, from taxpayers themselves, but also from their customers, suppliers, service providers, financial institutions, and partners. Additionally, this information can also be obtained from state agencies, regulatory or notary bodies, or even from exchanging information with other tax administrations. Presently, it may be possible to obtain such information from social media or the Internet. Relevant information may be structured into the following categories:

Registration information

Registration data must contain certain fundamental information for the tax administration to identify individuals and legal entities that are taxpayers or potential taxpayers:

- Individuals
 - ❑ **Identification:** taxpayer identification number, name, parents' names, place of birth;
 - ❑ **Location:** address, e-mail, telephone number, social media;

- ❑ **Economic activity:** occupation, stock holdings, income bracket, wealth bracket;
- ❑ **Tax data:** size, tax regime, risk category, special conditions, family ties.
- Business entity
 - ❑ **Identification:** taxpayer identification number, name/company name, legal nature, parent/branch establishment, legal representative;
 - ❑ **Location:** address, telephone number, social networks;
 - ❑ **Corporate composition:** identification of partners (up to beneficial owner), economic group and equity interests (parent company, subsidiaries, and branches and affiliates);
 - ❑ **Economic activity:** economic activities, business sectors, relevant revenues, turnover bracket, patrimonial bracket;
 - ❑ **Tax data:** size, taxation regime, risk category, special condition, special regimes.

Existing Tax Data

Existing taxes in a country's tax legislation should be mapped, but can be structured into the following main categories:

- **Income taxes:** of individuals and businesses.
- **Consumption/sales taxes:** of goods and services.
- **Property taxes – sale/donation/inheritance:** of movable property, immovable property, and rights.
- **Social security taxes:** of individuals – employee and self-employed, and of the business entity – employer.
- **Financial and capital market taxes:** financial investments, loans, and financial transactions.
- **Trade taxes:** import of goods and services, and export of goods and services.
- **International taxation:** on transfer pricing, worldwide taxation – resident businesses with transactions abroad, remittance of currency, and non-resident taxpayer transactions.

Debt and credit generating facts data

After mapping the existing taxes in the tax legislation, each tax must be mapped according to those data necessary for defining and identifying their formative elements, which in general are:

- **Taxable event.** As defined in the legislation of each tax.
- **Subjects.** Tax administration, taxpayers, withholding agents.
- **Tax base.** Economic value, calculation formula, and necessary elements.

- **Amounts** of transactions, tax bases, debits, credits, and deductions.
- **Tax rates.** Applicable in accordance to the legislation.
- **Dates** of the taxable event occurrence, of debt constitution, of tax due date.
- **Tax benefits.** Exemptions, special regimes, amnesties.

External Data

In addition to data relating to the taxpayer's specific characteristics, economic activities, and taxes, the selection process also seeks to gather external data from third parties or sources other than the taxpayer, to perform analyses, cross-checks, and to validate information provided officially by that taxpayer. This external data is obtained mainly from:

- Customers.
- Providers.
- Service Providers.
- Financial institutions.
- Partners.
- State, Regulatory, Notary and Registration Bodies.
- Economic Studies – sectoral.
- Markets – sectoral.
- News, Media, and Social Networks.
- Transactions abroad - information exchange.

Ancillary obligations definition

Once the tax administration has mapped out data on the taxpayer, taxes levied, and elements necessary to calculate main tax obligations, it should also define how all these data may be gathered. Usually, tax administrations require this data from taxpayers and other economic agents through the issuing of tax documents, invoices, book-keeping, and by providing other standardized and periodic information. These requirements are denominated “ancillary obligations”. The layout of such ancillary obligations should be of high quality and designed with simplicity in mind, limiting data collection to only those categories that are strictly necessary for taxpayers proper monitoring and control.

Ancillary obligations quality and simplicity should be assessed in terms of ease of compliance, non-fragmentation of reporting, information requested rationality, and digitalization of the process. Any complexities in the ancillary obligations requirements will generate unnecessary work for all involved parts, generating additional bureaucracy for taxpayers to comply with tax procedures,

and may lead to deficiencies in obtaining and analyzing the information provided by the taxpayers. This lowers the selection process quality.

Ancillary obligations can be grouped according to type and relationship to the taxes to be controlled:

Issuing tax documents for business transactions

Invoices, receipts, and documents relating to business transactions are one of the most important controls used by tax administrations. Ideally, these documents should have their number controlled by the issuer and should be made electronic (see section 5.3.14 – SPED). In this way, they can be made readily available for the tax administrations. These documents are as follows:

- Invoice, receipt, or proof of trading of goods;
- Invoice, receipt, or proof of trading of services;
- Invoice, receipt, or proof of trading of rights.

Furthermore, documents relating to the transport, shipping, or return of goods may also be required. These are as follows:

- Invoice, receipt, or proof of transportation of finished goods;
- Invoice, receipt, or proof of shipment or return of semi-finished goods, sent for processing or industrialization.

Foreign Trade Operations Forms

It is in the tax administration's interest that all import and export transactions of goods and services be recorded and controlled. The tax administration must have information on the transaction itself, on the importer and the supplier, on the exporter and the customer, and on the transportation services (for goods), currency exchange, and payment operations. Foreign trade operations should be controlled by tax administrations in advance and electronically (see section 5.3.14 – SISAM), with the necessary information being readily available or online. They are as follows:

- Import declaration form on goods or services;
- Export declaration form on goods or services;
- Currency of exchange declaration form.

Bookkeeping

Another basic and very important instrument for control of tax administrations is the Accounting Bookkeeping, that must be done in accordance with legal determinations. Usually, the guidelines

for bookkeeping should follow international standards. Bookkeeping should be digitalized and should be made regularly available to the tax administration immediately after the end of the fiscal year (see section 5.3.14 - SPED).

Tax returns and tax accounting

When registration data, business transaction documents, and bookkeeping data is made digitally available, much of the tax bases calculation will already be done, which can relieve the taxpayer from presenting other ancillary obligations. This, of course, is the ideal.

However, in reality there may be situations in which the calculation and control of taxes may depend on additional, more detailed information that goes beyond what is included in regular accounting. In such cases, tax forms, tax returns, and tax books to be filed by taxpayers at consistent and established periods may be required. These forms, tax returns, and books should be digitalized and made regularly available to the tax administration immediately after the end of established calculation periods (see section 5.3.14 - SPED). Declarations and books examples are as follows:

- Entry of goods registration, services, and assets;
- Exit of goods registration, services, and assets;
- Inventory registration and control;
- Non-cumulative taxes calculation – control of debts and credits;
- Income taxes calculation – adjustments, withholding, deductions, and offsets;
- Social security taxes calculation – employee, employer, companies, and self-employed;
- Determination of taxes on property – adjustments, withholding, deductions, and offsets;
- Registration of movable and immovable property transactions – sale, donation, or inheritance;
- Registration of withholdings made on behalf of third parties;
- Registration of payments received that entitle third parties to deduct;
- Registration of debt settlement through payments, installments, or offsetting, and registration of debt suspension through administration or judicial appeal;
- International shipping records or receipts – currency exchange control.

Financial and capital market statement forms

It is in the interest of tax administrations that all financial and capital market transactions are recorded and controlled. The tax administration should have information on financial investments and loans made. Depending on the law of each country, it is beneficial to have access to information

on financial transactions in bank accounts, including investment funds. Ideally, such information should be digitalized and periodically reported to tax administrations (see section 5.3.14 - SPED). They are as follows:

- Fixed income securities transactions;
- Variable income securities transactions;
- Loans and issuance of debentures;
- Financial transactions;
- Remittance or receipt of foreign currency.

Information exchange agreements

Tax administrations should enter into information exchange agreements with other official bodies. These agreements should grant digital access to the databases of interest. Examples of such agreements include:

- State bodies of the executive and judiciary branches;
- Police and military bodies;
- Regulatory bodies;
- Notary and registration bodies;
- Economic and business association bodies;
- Professional associations;
- Agencies and governments to exchange information on transactions held abroad.

Special controls for sensitive or highly taxed sectors

Tax administrations typically should impose greater controls on more sensitive sectors, such as those dealing with highly taxed goods (e.g. cigarettes, beverages, fuels, etc.). In such cases, given the high level of taxation embedded in the selling price of these products, problems of noncompliance, evasion, and fraud are more likely to occur. Thus, tax administrations should establish special and additional ancillary obligations as to better monitor and control these sensitive sectors. These can be established as follows:

- Controls of input suppliers;
- Production controls – production meters and/or stamping of products;
- Circulation or transport controls;
- Inventory controls of traded products in wholesale outlets and/or retailers.

Information technology – data collection, storage, processing, cross-checking, and generation

Once the dataset necessary for the tax administration's work has been properly studied and structured, in fact, alongside this data structuring, the information technology area should also be organized.

Though we will not deal with the details of this structure, it is worthwhile to note that the effective use of electronic and digital systems should be present in all work processes done by tax administrations. Work is based on data obtained from taxpayers, enforcement and controlling entities, and other economic operators in the market. By building on proper data treatment, in which analysis and cross-checking is conducted, it is possible to monitor and control tax issues.

The better the structure of a tax administration's information technology systems, the more effective the audit and selection work will be. To this end, the information technology framework should provide a technological environment that allows for a selection process to perform agile structure and unstructured queries, cross-checking and data process in large scale, enabling the construction of effective and accurate rules and filters to analyze non-compliance (see section 5.3.14 – ContAgil and FAROL).

The transactional environment – transaction systems – structured queries

The aforementioned transactional systems, consisting of systems and solutions for work processes digitalization, structured data processing, and interaction with taxpayers, are very important for tax administrations.

Through these systems, which should have adequate information data processing and exchange capabilities, a multitude of processes involving taxpayer data can be computerized, including:

➤ Processes of data collection and ancillary obligations

As we have outlined in previous items, there are numerous opportunities for establishing ancillary obligations, which should be electronically and quickly collected to facilitate their fulfillment and submission. Therefore, it is imperative to develop and offer applications that, for each ancillary obligation or for a group of them, allow the taxpayer to submit the requested data, preferably over the internet.

The applications should also: control data reception by tax administrations; perform complete consistency analyses; and manage the entire interaction process with taxpayers, including communication, correction/rectification of any inconsistencies in the tax submission, which may include controlling non-filing or non-reporting of ancillary obligations and any penalties that follow.

➤ Work processes that utilize structured data treatment routines

Comprises most of tax administrations' internal work processes, in which data collected regularly, via ancillary obligations or payments, are processed and analyzed, and become the

basis for the tax control actions. This work generates interactions between tax administration and taxpayer whenever necessary, including information exchange, corrections, and rectification.

These processes support the operational process, including areas such as taxpayer services, registration, tax collection, tax audit, customs clearance, tax credit analysis, litigation, human resources management, and logistics.

Each one of these work processes should use one or more applications to support their routine operations, and to communicate with taxpayers when necessary, such as to obtain data for carrying out the activities.

➤ **Work process for interacting with taxpayers**

Comprises of work processes that involve interactions with the taxpayer, whenever this is necessary. These processes are supported by systems that enable and manage the communication with taxpayers, and that are capable of storing past and current interactions. Such interactions provide important taxpayer data for the administration.

These interactions' legal validity can be limited or comprehensive, ranging from simple taxpayer information to notification, and serving as both a tool for sending notices, responses and appeals. These interactions can occur in several ways:

- ❑ **Documentary route:** in this case, it is best to have the documents delivered digitally, via electronic processes or mailbox. If they are delivered on paper, it is recommended that they be scanned or digitalized;
- ❑ **By e-mail:** in this case, depending on the authorization given over email by the taxpayer, documents, notifications, and responses may be handled on this channel;
- ❑ **Face-to-face:** in this case, the application, along with storing the interactions, will also manage the scheduling and office visits.

Information Handling Environment - Unstructured Queries - Data Mining

Non-transactional systems go by many names, but fundamentally they are applications and environments capable of storing and handling a large quantity of data in an agile and non-structured manner, adapting to the needs of the analysis.

In addition to the data and support provided by transactional environments, the complementary usage of a non-transactional environment is necessary for a proper audit work. Non-transactional environment functionality and flexibility are fundamental for the selection work process to take place, especially in cases of the largest taxpayers. The non-transactional environment should have the ability to:

- Quickly read, store, and index large amounts of data within an appropriate backup and security framework. Preferably, it should conceptually operate as a data lake.

- Be flexible and support the use of appropriate database managers. Preferably, it would allow other types of database managers use, such as commonly used NoSQL databases.
- Quickly process, handle, match, and consolidate all necessary data, preferably within a scalable processing framework;
- Possess appropriate reporting tools, preferably, including graphing tools;
- Ideally, possess data mining and artificial intelligence tools.

5.3.11. *Selection process structuring*

Once the required data set and the information systems used to process this data have been foundationally structured, the tax administration can embark upon the next step and structure the audit selection process.

It should be noted that selection process structuring depends on the “demands vs resources” issue outlined previously, and how the tax administration can deal with this challenge in practice. This should include the process to prioritize the demands and the incentives for taxpayers to regularize.

The following sections will address the motivations behind taxpayer noncompliance, and the methodologies that can be used to monitor, control, and select non-compliant companies or individuals.

Basic motivations dealt with by the selection process

As discussed earlier, the selection process seeks to identify taxpayer irregularities, non-compliance, and aggressive tax planning by taxpayers, in order to correct, curb, and punish these illegal behaviors through well-designed tax actions.

Factors that influence taxpayer behavior to opt, or not, for tax non-compliance have also already been touched upon above, as this creates demand for audit selection. As such, one can uncover the motivations behind non-compliance through studies that serve as a springboard for understanding and reforming this type of behavioral conduct.

Among these motivations, the revenue loss may be caused by errors or misinterpreting the legislation on the taxpayer’s part, or even due to financial difficulties. These cases, when selected, should be handled through processes of monitoring, regularization, and collection.

The main reasons for non-compliance boil down to: first, the taxpayer’s intention of non-paying his taxes or paying a reduced amount than what is due; and second, engaging in money laundering and currency evasion schemes.

Therefore, apart from error, misinterpretation, or financial difficulties situations, the research work for audit selection starts already being aware of the motivation for the non-compliance, which greatly facilitates the investigative work.

Non-payment or partial payment

The first reason for non-compliance with the tax law is the taxpayer seeking non-payment or payment of a reduced amount than what is due. These goals are sought through the use of somewhat sophisticated practices and maneuvers.

Money laundering and currency evasion

The second reason for tax non-compliance is money laundering and currency evasion practices. These criminal practices may or may not be accompanied by the objective to avoid tax payment or making a partial payment. It is possible for a money laundering scheme to occur with correct taxation, as an attempt to disguise or legitimize the criminal conduct. In these cases, the problem is not in the tax value, but in the origin and/or declared holder of the resources and transactions.

Money laundering and currency evasion practices typically use interposed persons, such as residents and/or non-residents, foreign currency exchange agents, companies that simulate fictitious income and transactions, and/or the use of business transactions made with misreported values, and/or misuse of transfer pricing.

5.3.12. *Selection process strategies*

To summarize what has been discussed so far, the main objectives of enforcement or audit actions are to generate risk through fiscal presence and encourage voluntary compliance with tax obligations. To accomplish this, the audit actions should be structured and carried out in the following way:

- Monitor compliance with obligations – ancillary and principal – as defined by law;
- Investigate and gather evidences of non-compliance;
- Encourage regularization by taxpayers themselves;
- Punish misconduct and non-compliance, through tax assessments, imposition of certain limitations to carry out business (registration, operational, and property), and prosecution.

The audit process includes selecting taxpayers for the subsequent audit actions, which are centered around monitoring and studying the behavior of taxpayers. Such actions allow for identification of practices that result in non-compliance, including non-payment, or reduced payment, as well as money laundering and currency evasion practices identification.

The robust tax audit function depends on a selection process that is properly structured. Thus, the selection process aims to:

- Enable the best possible fiscal presence, through the appropriate distribution of resources and prioritization of the most relevant and strategic cases with the greatest confidence on the evidence gathered;

- Strategically encourage compliance and self-regularization actions;
- Maximize the use of effective tax audit resources to address most relevant or strategic non-compliance cases;
- Give the strongest possible response to the existing non-compliance demands, imposing a greater risk perception on non-compliant taxpayers.

Thus, the strategies used to structure the selection process should seek to achieve the results described above. It is important to stress that, in all the proposed tax procedures, the pursuit of tax compliance through regularization should always come before enforcement actions use. Moreover, putting emphasis on prevention and regularization is less costly to both tax administrations and taxpayers, as opposed to the more expensive alternative of using tax enforcement actions.

As resources are always scarce in the face of existing demands, the proposed overall strategy to best achieve the intended results should:

- Try to cover, as best as possible, the entire universe of non-compliant taxpayers, as to generate a broad fiscal presence;
- Classify the taxpayers into groups, primarily by relevance and, within each group, sub-classify them by risk criteria. Other subsets and classification of interest may be established as necessary;
- Adopt different monitoring, analysis, selection, and enforcement procedures for each taxpayer group, so that some will be quicker yet less detailed, which would be applicable to all groups, and other slower but more sophisticated, applicable to only relevant or higher-risk groups;
- Strive to prioritize the work according to relevance and risk;
- Encourage compliance and self-regularization actions;
- Strategically communicate the actions of the tax administration, from initiatives that enable self-regularization to those that result in punishment and prosecution.

Taxpayer classification by interest groups

Once taxpayers have been divided into different groups, the tax administration can apply different sets of tax procedures for each group according to greater or lesser relevance or risk. Thus, the first step is to arrange taxpayers by relevance and size. Then, within these groups sorted by relevance and size, further subdivision by risk level should occur. Thus, risk management should be used to prioritize and refine the solutions applied to each group that was established by relevance and size.

Classification by size – legal entities and individuals

Classification by size is analyzed separately for legal entities and individuals. A statistical study should be done to determine the distribution of individuals and legal entities by income or turnover

bracket, or by wealth/property bracket, with respect to the reality of the specific country. This information would allow for further sub-classification. Other factors may be considered if necessary, such as: total tax amount paid, number of employees, etc. The following classification is suggested for legal entities and individuals:

➤ Legal entities – classification by size based on turnover

Classification by legal entities (companies) size is established according to the company's turnover, with an additional criterion of relevance on the ABC curve.

- ❑ **Top companies:** group of companies that present turnover equal to 60% of the total turnover of all companies in the country;
- ❑ **Large companies:** group of companies, excluding those that belong to the previous category (top companies), that present turnover equal to 25% of the total turnover of all remaining companies;
- ❑ **Medium companies:** group of companies, excluding those that belong to the two previous groups (top and large companies), that present turnover equal to 10% of the total turnover of all remaining companies;
- ❑ **Micro and Small companies:** group of companies remaining that are not included in previous groups (top, large, and medium companies).

➤ Individuals – classification by income size and wealth

Classification by individual's size is based on their annual income and wealth, with an additional criterion of relevance on the ABC curve by levels of these two parameters (income and wealth).

- ❑ **Top individuals:** group of people with the highest annual income and wealth. It is suggested that this group include individuals who, all together with regard to income and wealth, hold 10% of the total income and 10% of the total wealth in relation to all individuals in the country;
- ❑ **Large individuals:** it is suggested that this group include individuals who hold all together 30% of the total income and 30% of the total wealth in relation to all individuals in the country, excluding those included in the previous group (top);
- ❑ **Medium individuals:** it is suggested that this group include individuals who all together hold 50% of the total income and 50% of the total wealth in relation to all individuals in the country, excluding those included in previous groups (top and large);
- ❑ **Small individuals:** with regard to previous groups, it is suggested that this group include individuals who all together hold 10% of the total income and 10% of the total wealth in relation to all individuals in the country, excluding those included in previous groups (top, large, and medium).

Risk classification – risk indicators

Risk classification should be based on studies and statistical data regarding taxpayer behavior, according to economic group and sector. This classification can be obtained through the construction of indicators that reflect tax behavior. Usually, an indicator is constructed for each of the work processes run by a tax administration and the aggregation of these indicators will represent the general risk of the taxpayer and his economic group and sector.

This risk classification methodology should establish risk categories within which taxpayers and their economic groups and sectors will be classified as high, medium, and low risk, with respect to their behaviors for each work process and in general.

Other classifications

The tax administrations may require additional classification methods in addition to the ones outlined above. Such additional classification methods may be used in isolation or in conjunction with relevance and risk classification. The following are examples of such supplementary classification methods:

- For legal entities: if they pertain to the private or public sector, to sensitive sectors, to the third sector (non-profit entities), or if they are tax exempt or immune;
- For individuals: if they are political exposed persons (PEP), if they are business partners – entrepreneurs, if they are self-employed or civil servants.

Work methodology for selection applied to different groups

Once taxpayers are classified by group of relevance and risk level, as discussed above, the tax administration may define how these groups will be treated in the selection process.

The objective is always to achieve the highest level of effectiveness in the selection process, by applying a different set of tax procedures for each group, according to their defined relevance or risk.

Groups considered to be of lower interest and risk will undergo faster, less thorough procedures; but as relevance and risk increases, so does the amount of resources allocated to their tax treatments, so that high risk and relevance groups receive detailed and thorough procedures. Such a methodology is detailed below.

Treatments for groups of all sizes and levels of interest – broad tax presence

As was previously discussed, tax administrations must establish a broad fiscal presence in the taxpayer universe to reduce non-compliance. Given the natural scarcity of resources, such a presence will never reach 100% of taxpayers. However, the tax administration can achieve good results if its

work processes are simple, agile, and totally or partially digitalized, so that it can easily administer large numbers of taxpayers at low cost.

These procedures are denominated tax screening, consisting of basic automated cross-checks of taxpayer information that is already known. These procedures can identify non-filers, check basic consistencies between information provided by the taxpayers and third parties, analyze compliance in relation to reported taxes, identify irregularities and outstanding payment, issue notices to voluntarily regularize outstanding issues, and apply appropriate penalties to taxpayers who fail to regularize.

These screening procedures do not include more complex consistency checks or analyses regarding tax bases and under reporting. If more complex and relevant irregularities are identified through the screening procedure, the case should be sent to another area so it can receive proper treatment through different procedures, such as comprehensive tax audit.

Ideally, all cross-checking calculations should be made entirely by electronic systems designed for this purpose, and they should rely on acquired information pre-defined by ancillary obligations. In this context, manual intervention is usually not needed, which minimizes resource consumption and allows for essentially all taxpayers with relevant indices to be reviewed.

In these broad procedures, the use of strategic communication is very important to amplify tax administration fiscal presence.

➤ Screening ancillary obligations, including under-reporting and consistency:

The tax law may require the taxpayer to comply with certain ancillary obligations, with respect to his assigned category, and to file tax returns with the authorities. The first step of the screening process is to ensure that the taxpayer has fulfilled the necessary ancillary obligations. This is a vital step, as this information, when provided in a timely and consistent manner, is the basis for further cross-checking procedures, and more complex analyses later on.

Special attention should be given to the submission (or non-filing) of tax returns, to the submission date, and to whether the economic and financial information were reported in the proper format. It is also important to maintain a consistent base for the information provided.

All identified irregularities should be informed and charged to taxpayers. If they are not properly addressed within the deadline, appropriate measures and penalties should apply.

Such cross-checking procedures should range from receiving ancillary obligations (tax returns) to identifying anomalies and requesting the taxpayer to correct them.

➤ Screening payments of current self-assessed taxes, obligations assessed by the tax administration and in installments – collection

Tax law may impose on each taxpayer, in accordance with their assigned category and operational activities, the periodic compliance with their main tax obligations. In other words,

tax law determines the tax events, the frequency of tax payable, amount due, and respective due dates of each tax levied on taxpayers, imposing upon them a regular and periodic tax schedule.

According to the norms, these current taxes may be assessed on the tax authority's own initiative or self-assessed by the taxpayers. In the event that taxes not reported in due time or omitted are identified, or other applicable penalties exist, the tax administration will, on its own, perform all the calculations, which will include amounts, penalties, additions and due dates. In addition, there may be outstanding installment debts for old unpaid balances.

The first procedural step of this screening is to check whether the taxpayer has fulfilled and paid, in whole or in part, all of his overdue principal obligations, whether self-assessed, calculated by the administration or installment payments. This is a very important treatment, as the agile verification and collection of defaults brings improvements in the State's regular cash flow and, if applicable, in the executive and judicial collection flow.

All identified irregularities must be collected from taxpayers and, if not by voluntary compliance, within the time frame granted by the tax administration, should be referred to the executive and judicial collection phase, imposing the applicable penalties.

In this screening, the automated procedure should include the determination of the tax situation of taxpayer non-compliance, with the cross-checking between the outstanding debts and the payments made, forwarding of the calculated debts to the taxpayer for collection and, if the collection does not succeed, forwarding of the debts to other special collection or executive and judicial collection processes.

► Screening debts suspended by court order – sub judice

Most countries' tax laws give specific treatment to tax debts that are under judicial discussion and with suspended liability. In such situations, the court ruling may or may not determine that, as long as the discussion lasts, prior bank deposits or other assets as collateral for the State are required.

The first procedural step of this screening is the verification of the conditions of the lawsuit brought by the taxpayer which resulted in the reported tax debt enforceability suspension. It should be checked whether the lawsuit exists, whether the taxpayer was the one who brought it, whether the discussion deals with that specific reported debt, whether liability's suspension was granted by the decision, and whether or not it is required that guarantees in advance must be lodged for the amounts discussed. If deposits or other guarantees are required, consideration should be given to whether the amounts are appropriate.

These screening procedures are important, since the agile verification and collection of inconsistencies in court-ordered suspensions of enforceability also brings improvements in the regular state cash flow, prevents risks of collection rights limitation and even regularizes the guarantees, with special attention to bank deposits.

All irregularities identified that affect the validity of the suspension of enforcement of the tax liability shall be clarified by the taxpayers and, if not explained or voluntarily settled, within

the time frame granted by the monitoring process, debts shall be reinstated and forwarded to the executive and judicial collection phase, with applicable penalties imposition. If the pending case relates to insufficient guarantees and, once billed, the taxpayer does not settle, the case should be referred to another working process that deals with debt issues *sub judice* in a more comprehensive way. This other, more thorough work process is the follow-up of litigation, not the screening.

The follow-up of litigation should deal directly with the Court regarding this regularization of guarantees. Similarly, any other more complex indications that may be identified in the *sub judice* cross-checking, such as issues of calculation, legitimacy of the party, new ruling against suspension, etc., should also be referred to the litigation follow-up.

➤ Screening debts suspended by administrative appeal

Most countries' tax laws give specific treatment to be applied to tax debts that are under administrative appeal. In such situations, the administrative appeal process may or may not suspend the enforceability of the liability under deliberation and may or may not require prior bank deposits or other assets as collateral for the State for the duration of the appealing process.

The first procedural step of this screening is the verification of the conditions of the administrative appeal brought by the taxpayer which resulted in the suspension of enforceability of the reported tax debt. It should be checked whether the administrative appeal exists, whether it is related to the taxpayer, whether it deals with that specific debt, whether that type of appeal suspends the enforcement of the liability, and whether or not collateral is required through bank deposits of part or all of the amounts under discussion, or other type of guaranty permitted by law. If bank deposits or other collateral are required, it should be examined whether the amounts are correct and equivalent to the debt value.

As is the case with other screenings, this one is also relevant, as the agile verification and collection of inconsistencies in administrative suspensions of enforceability also brings improvements in the regular state cash flow, prevents risks of limitation of collection right and even regularizes the eventually insufficient guaranty.

All pending issues that affect liability suspension validity, including insufficient guaranties, should be explained or voluntarily settled by the taxpayer, within the time frame established in the follow-up procedures; otherwise, debts must be reinstated and forwarded to the executive and judicial collection phase, with applicable penalties imposition. Any indications of a more complex nature eventually identified in the administrative discussion screening treatment, such as the need to evaluate partial values of a legal debt that were not included in the discussion, new decision in the process against suspension, etc., should be forwarded to another working process that deals with administrative appeal in a more comprehensive way.

➤ Screening credit claims - for offsetting and/or refund

There are countries where the legislation establishes specific treatment to be applied in the taxpayer credit rights calculation. Such tax credits are usually derived from undue payments,

payments made in excess of due amounts, court decisions, non-cumulative tax assessment processes and tax benefit programs such as those that aim to provide incentives at the regional and sectoral levels, for exports, etc.

Legislation may also define specific treatment for such credits use, either in offsetting tax debts related to the taxpayer or to third parties indicated by the taxpayer, or in refund procedures in kind.

The first procedural step of this screening is claimed credit conditions verification. It must be analyzed if the right to the credit is granted, that is, the screening must verify if the responsible administrative area analyzed claimed tax credit existence and if it granted, in whole or in part, the requested amounts. These analyses to grant credit rights can vary in complexity, and the parts that are considered less complex can even be automated, analyzed and granted by electronic systems, and can therefore be in the screening process.

Erroneous payments or overpayments analysis, for example, are considered less complex hence a candidate to automation. The other cases, where the analysis of the requested credit rights is considered complex and not subject to automation, should be forwarded to another more complete area that deals with the subject in depth, leaving the screening area only with the task to grant, or not, the claims and their amounts.

Once confirmed that the credit claimed has been granted, the use of such credit, as requested by the taxpayer, should be verified. If an offsetting was requested, be it for the taxpayer own use or for a third party indicated by the taxpayer, it should be examined whether the offset is allowed, if credit amount is sufficient to settle the referenced debts and finally whether there will still be a balance to collect, regarding debts that have not been cleared, or a balance to refund.

If, instead of an offset, a refund is requested in cash, before the refund is approved it should be checked if the taxpayer does not have other outstanding debts with the tax administration. If there are any, the offset should be made and any remaining balance refunded, if country's law allows.

Credit rights treatment is very important, as the agile inconsistencies verification and collection in claims for offsetting and refund also brings improvements in the regular cash flow of the State and the taxpayer and prevents risks of collection rights limitation.

All identified irregularities shall be clarified by the taxpayers and, if not explained or voluntarily settled, within the time frame granted by the monitoring process, the credits should not be refunded and the debts should be reinstated and forwarded to the executive and judicial collection phase, with imposition of applicable penalties. Any indications of a more complex nature eventually identified in the screening process regarding offsets and refunds, such as the need to better assess the source of payments indicated as erroneous or overpaid, should be forwarded to another working process that deals with the subject in a more comprehensive manner.

➤ Screening assets disposal for tax liability coverage

Country laws may give specific treatment to be applied in the case of tax debtors, with outstanding debts, suspended or in installments, which show evidence of assets disposal. In these situations, tax administrations may take administrative measures, if allowed by the law, or impose precautionary judicial measures to secure assets to cover existing debts. Garnishment may be used or, where appropriate, even reversal of improperly made disposals.

The first procedural step of this screening is the monitoring of the taxpayer's guarantee equity, in comparison with the existing tax liability, which may or may not be growing. The monitoring process should establish parameters to detect when this change in negative equity may be considered risky or fraudulent, alerting the responsible area to seek appropriate precautionary, administrative or judicial measures.

This is a very important monitoring process, as verifying the situation and taking precautionary measures in cases of evidence of taxpayer's assets disposal also improves the State's regular cash flow and reduces the risks of failures in the executive or judicial collection processes by better guaranteeing existing tax debts.

➤ Other screening processes - high performance tax operations

In addition to all the procedures of cross-checking proposed so far, it is interesting that tax administrations always seek to identify new situations of non-compliance that can be dealt with by screening processes, i.e., in a direct manner, with selection and execution fully automated and applied to the largest possible universe of taxpayers while consuming low resources.

These operations to counter non-compliance in large scale, known as "high performance", should ideally have the following structure:

- ❑ It must be fully possible for the operation to be fully automated, and any need for manual intervention by the employee should be minimal;
- ❑ The rules for selection of non-compliant taxpayers, the rules for determining the due values arising from the non-compliance, and obtaining the necessary evidence to support the request for regularization must be executed via automation;
- ❑ The notice to the taxpayer for the voluntary settlement of the pending issue, within a deadline established by the tax administration, must be sent and have proof of receipt in an automated form;
- ❑ The verification of the correct fulfillment of the notice sent, shortly after the deadline for self-regularization, shall be automated and, if the taxpayer does not settle, the action to collect the due debt shall be automatically generated and the notification sent to the taxpayer for information, all in an automated fashion, including notification proof of receipt ;
- ❑ In the case of tax assessment notice, having the deadline for voluntary appeal been expired, in case of non-payment and non-submission of the appeal, it shall be automatically selected and sent for collection, all in an automated manner.

Processes that can be automated using artificial intelligence

Another way to carry out audit actions to generate broad fiscal presence combined with low resource utilization, is to utilize artificial intelligence to conduct analyses and produce automated outputs. Such opportunities can be widely used, such as:

- Appeal processes with low complexity, where defense arguments can be standardized and tabulated. This method can handle the appeal cases related to high-performance inspection actions;
- Risk analysis processes for analyzing more complex tax credit requests;
- Risk analysis processes for analyzing import and export declaration forms;
- Taxpayer services and orientation processes;
- Processes to analyze relationships between taxpayers to identify hidden or disguised relationships or networks of potential high-risk tax non-compliance, which can generate new information sources for non-obvious selection rules.

Treatment for medium, large, and top taxpayers

The monitoring of micro and small companies should be done through the screening and cross-checking processes explained above. In this section we will describe the selection process for medium, large, and top taxpayers.

Once the cross-checking processes are complete for all or most taxpayers, the potential irregularities identified by the selection process may be used to identify non-compliance through the use of money laundering or currency evasion.

A partial list of the principal practices and situations related to these non-compliance cases includes:

Non-reporting or under-reporting: in this case, the tax value reported is less than the amount owed or none at all. This may occur in commercial transactions both made domestically or abroad (worldwide taxation basis);

Unauthorized or overestimated deductions: in this case, when calculating the tax base, the claimed deduction is either not authorized (not allowed) or calculated incorrectly at a higher value than its correct value;

Unauthorized or overestimated credits: the two situations in which this case may occur are – the use of credit to calculate a non-cumulative tax, or the credit is used in a refund or compensation request. In both situations, the credit may be not authorized (not allowed), or calculated incorrectly at a higher value than its correct value;

Concealment of assets: in this case, the taxpayer purposefully hides his assets so that they are not reachable for taxation nor can be used as a debt guarantee. This is usually done, through fraud schemes, by concealing or selling assets, which are then transferred or sold to third parties or interposed persons;

Interposed persons: in this case, a particular taxpayer operates on behalf of interposed persons, who may or may not be country's residents. This taxpayer controls all transactions, but the transactions are carried out through third parties, and so the taxpayer never formally appears in the documentation. This situation occurs in cases where the beneficial owner does not or cannot appear as the holder of the assets or transactions, for various undue reasons, or in cases where the beneficial owner does not intend to pay debts or obligations;

Fictitious exports: in this case, the taxpayer simulates the exportation of goods, but does not actually ship them out of the country. Goods are then diverted and sold internally without reporting such internal transactions. What makes this approach advantageous is that exports are usually tax-exempt or benefit from lower taxation.

Undervalued imports: in this case, imported goods are declared at a lower price than their real value at customs clearance, in order to pay less taxes on importation;

Transfer pricing: in this case, transactions between related companies are compared to market prices, i.e., prices that take place between unrelated companies. Normally, this comparison aims to avoid, during the import process, that goods that are imported from related companies are reported at a higher value than their market price, thus incurring an indirect non-taxed remittance of foreign currency. This is only possible if the traded goods have low taxation on imports. During the export process, the tax administration should to avoid the export of goods at artificially low prices to related companies, which would lead to lower taxable income in the country by transferring income abroad, usually to tax havens.

Aggressive tax planning: in this case, the taxpayer stretches the boundaries of the law by artificially reducing the taxable base. Though this scheme remains in the scope of the law, the transactions do not normally have economic substance nor a true negotiation meaning. The only purpose is to achieve reduced taxation, which usually goes against the spirit of the law.

Abuse of preferential tax regimes: in this case, preferential tax regimes (which grant tax benefits or concessions under special requirements or circumstances) are misused and tax reductions are used without the fulfillment of the agreed-upon requirements;

Treaty shopping: in this case, a resident taxpayer engages in economic transactions with a non-resident taxpayer. The latter deliberately resides in a country that has signed a double taxation treaty with the former's country. This type of treaty shopping involves artificial arrangements that lead to non-taxation of the transaction in both countries. The treaty would allow income taxation only in the non-resident's country, but artificial arrangements would transfer this income to a third

country outside of the treaty with the resident, usually a tax haven, where the income is not taxed or is taxed at a reduced level, circumventing intended treaty rules.

Use of non-residents: this case deals with investors that self-report as non-residents to operate in a country under beneficial taxation rules. Misuse occurs when the non-resident investor lacks economic substance, and so he is not identified as the beneficial owner of the transaction. This can generate several channels of illegal conduct in the use of taxation regimes, the control of treaties to avoid double taxation, and the control of financial transactions in and out the country.

The purpose of this phase is to create rules for data-crossing encompassing all available information, in a more complete and complex way than the basic screening process allows for. This would promote identification and selection of cases that harbor strong evidence of any of the above illegal practices and occurrence.

Selection and audit actions rules should be based on non-compliance possible scenarios and contexts technical analyses. It may also be possible to uncover illegal conduct during a tax audit's course that is not yet capture in a selection rule.

Selection rules can be applied to analyses of both single taxpayers and subsets of taxpayers, or similar taxpayers, in order to increase the communication between these taxpayers so to raise the risk perception and fiscal presence. This can apply to economic sectors, economic groups, specific locations, etc.

These more complete rules should be regularly processed, revised, and updated, given the dynamics of tax context. In practice, there may be more cases selected than resources available for subsequent audit actions. This scarcity of resources is further compounded by the greater complexity and depth of this selection and audit work, which naturally requires an even greater utilization of resources.

Therefore, despite the fact that this phase is restricted only to medium, large, and top taxpayers, it is still necessary to make cuts and apply prioritization criteria by relevance or risk.

After selection rules application, priority cases should be further reviewed and refined, through deeper analysis, to check for the effective occurrence of irregularities, so as to avoid audit actions being undertaken on false positive cases.

Encouraging compliance and self-regularization actions importance cannot be understated, especially before carrying out audit actions. It is worth mentioning that the fiscal presence generated by the selection actions can and should be expanded by the use of strategic communication, on all parts of the process from regularization initiatives to effective punishment and prosecution.

Treatment for top companies

This topic will cover most relevant taxpayers, which require most time-consuming, comprehensive, and sophisticated processes regarding monitoring, selection, and analysis of non-compliance and

irregularities. Top companies are those that altogether hold more than half of the total turnover of all companies in the country, and as a result make up an equally significant portion of the tax collection.

In addition to this phase involving deeper analysis, the top companies are also subject to the two previous treatment phases: screening and rules analysis. This would allow for better and more complete tax monitoring of this important group of taxpayers.

Typically, top companies are part of important economic groups and may carry out diverse activities pertaining to one or several economic sectors simultaneously. Therefore, in addition to engaging in potential practices of tax planning aiming at reducing or avoiding tax payment, for these top companies these type of practices are commonly related to aspects of the company's economic sector and economic group.

Accordingly, monitoring and audit selection processes for top companies must be very well-structured, with a broad and full view of the taxpayer and its tax procedures. These processes should take place as closely to the taxable events as possible and consider factors relating to the individual taxpayer and to the economic sectors and economic groups in which the company operates.

Tax administrations should structure specific monitoring and selection processes for top companies and their economic groups that include the following main objectives:

- Conduct studies and sectoral analyses to determine the potential tax burden

Tax administrations should conduct studies that seek to identify the expected tax burden in relation to the company's turnover. This should be a reference value, calculated as precisely as possible. We recommend that this study be done by economic sector, so that it may be more robust and may take into consideration relevant information such as legislation, regulatory provisions, and eventual beneficial tax regimes that are currently in place for that respective sector. If a company's activities arise from multiple sectors and such segregation is not possible, the preponderant type of turnover of the company should be used.

The study should take into account the "core taxes" that are levied on the companies belonging to a certain economic sector (or subsector), discounting any existing tax benefits. By "core taxes" we mean those that are collected by the taxpayer in relation to their own activities, excluding those taxes that are eventually withheld and collected by them on behalf of third parties.

- Analyze deviations between the actual tax payment and the potential tax burden, in comparison to other companies of the sector

After estimating the potential tax burden, as a percentage of the turnover for the sector (or subsector) the company belongs to, the tax administration can compare the actual taxes collected from that company with the estimated collection indicated by the potential tax burden in order to identify deviations. Further comparisons can be made using relative behavior of peer companies in the sector.

- Identify and select the key motivations and practices that may explain identified deviations

Once the deviations are identified by comparing the company's actual tax payment to its potential tax burden, or by comparing its behavior to that of its sectoral peers, the tax administration must analyze in detail how the company calculated its tax payment and must re-do the tax calculation in its entirety. In other words, the tax administration should re-do and analyze each tax calculation item and subitem, trying to understand all reported items, such as turnover, debits, and credits, until the under-estimated payment.

This step-by-step recalculation will allow for the identification of the main items or subitems responsible for the anomaly or deviation. If there exist other sources of information on the company's turnover or receipts, such data should be added to the overall study.

- Analyze in detail the items and subitems that seem to be responsible for the anomaly

Once we have identified the items and subitems responsible for the anomalies in the company's collection, an in-depth analysis and audit should be made, as to identify legal and operational explanations for this behavior. If no adequate justification is found, the tax base should be corrected through the tax assessment to recover the unpaid dues.

This audit should seek for explanations about the company's practices behavior.

- Encourage compliance through self-regularization of the identified non-compliance

After the tax administration identifies the adjusted tax base so to recover the unpaid amount, the taxpayer should be given the opportunity to justify the behavior underpinning the deviation in relation to the expected collection, or to self-regularize through identified differences payment. These steps should take place before any formal inspection actions are initiated.

- Carry out punitive audit actions if the company does not regularize

If, after the given deadline, the company fails to justify deviations causes and does not regularize the non-compliance, the tax administration should immediately carry out the appropriate punitive tax audit actions.

Treatments for top individuals

Similar situations occur for top individuals as for top companies – that is, the work necessary to identify anomalies and select taxpayers is admittedly time-consuming and complex. Top individuals include those that combined hold 10% of the total income and 10% of the total wealth of the country, and so necessarily make up an equally large portion of tax collection.

Top individuals must also undergo three phases of monitoring processes, namely screening, rule analysis, and deep and thorough analyses.

Top individuals usually have ties to corporations and large economic groups, sometimes even operating as fictitious companies. Therefore, as with top companies, the monitoring and selection processes must be well-structured and well-integrated to be truly effective.

Top individuals monitoring and selection processes, similarly to the approach proposed for top companies, should compare the reported income (the tax base) to external data such as financial transactions, credit card operations, and changes in asset values. Identifying the linkages between individuals and their expenses and their assets is extremely important to investigate compliance deviations.

Regarding top individuals, certain specific and sensitive groups must be underscored as deserving of special monitoring:

- Politically exposed persons (PEP);
- Large companies and large economic groups shareholders;
- Large financial investors;
- Celebrities, from artistic or sports fields.

5.3.13. Conclusion

Summarizing all that has been discussed in this chapter, we can draw important conclusions to support the strengthening of tax administrations, a key public policy for controlling tax collection in any country.

Simplification of tax legislation and tax systems: simplifying tax rules and the tax system, without compromising necessary controls, reduces costs for both taxpayers and the tax administration. A simple system with simple rules leads to better understanding of the tax obligations to be met, creating an environment that encourages good tax behavior, resulting in a fair tax collection.

Structuring of information gathering: the raw material of the tax administration is the knowledge about the taxpayer universe and its economic and financial information. As such, tax administrations should focus in gathering and processing this information to rapidly identify taxpayers with any misconduct behavior and administer appropriate measures.

Investments in Information Technology – systems and databases: as information is the raw material, information technology is the basis for obtaining usable knowledge from this taxpayer information. The usage of information technology offers endless opportunities and should provide support to the taxpayer and the administration. It is an essential element for the simplification of processes, to increase agility and quality of information. Modern digital technologies, such as data analytics and artificial intelligence, will increasingly play a key role in tax auditing processes. Information obtained from social networks is a novel source of knowledge that offers great potential, one that is already being used by some tax administrations.

Quality of the selection process – relevance and certainty: the collection of usable information on the taxpayer, through the submission of tax returns and other ancillary obligations, and through third parties information (suppliers, customers, financial institutions, credit card administrations, information exchange agreements with other public agencies and foreign tax administrations), in conjunction with the use of information technology, underpins a robust process for identifying taxpayer misbehavior. Improving quality in the selection process helps support a better usage of the limited resources available to public administrations. Selection process quality increases the fiscal presence in society in a broad and fair manner.

Screening – rules for all taxpayers: screening is a core process with broad coverage and capillarity; and should be the first stage of contact between the tax administration and the non-compliant taxpayer. This procedure should be automated, in order to have wide impact and efficiency, covering all taxpayers that fall within the pre-established parameters.

Specific studies to control the most relevant taxpayers: other types of wrongful behavior of taxpayers, especially those that represent a significant portion of the country's tax revenue, can be identified through deeper studies and analysis. As mentioned above, the screening process should be extensive, broad, and automated. However, in the case of the most relevant taxpayers, the selection process should be more focused and accurate to identify behaviors that deviate from the tax law, which many times involve sophisticated tax planning. In this case, the selection process should indicate the need for further investigation through proper audit procedures.

Incentives for taxpayers to self-regularize: it is well-accepted that allowing taxpayers the opportunity to regularize and correct their wrongful behavior is in the interest of both the tax administration, which collects the tax revenue, and the taxpayer, who avoid inconveniences and litigation. As such, we recommend that this play an active role in the tax administration's management.

Administering punitive rules to the non-compliant taxpayer: allowing the taxpayer to correct his behavior should not be confused with renouncing the power of the tax administration to strictly apply the laws. On the contrary, the tax administration should be relentless in applying the laws when the taxpayer, after being given the opportunity to regularize, does not correct his behavior.

Sustaining permanent monitoring and control: Monitoring and control processes, as exercised by tax administrations on good or bad taxpayers, is not temporally or geographically limited. On the contrary, these processes are continuous and dynamic. At every moment, there is new information to be collected and new technologies to be used. Thus, data gathering processes are always being refined, generating better tools and indicators for the selection of non-compliant taxpayers. Tax administrations should keep updating themselves, even so because the same technological innovations are also available and used by taxpayers. The digital economic world is already a reality, and tax administrations must be prepared for it.

5.3.14. Summarizing the use of new digital technologies in the Brazilian tax administration

The Brazilian Tax Administration (Receita Federal do Brasil - RFB) has always invested a lot of resources in better structuring its IT environment, with a focus on solving “demand vs resources” equation. Examples of such new technologies follow.

➤ SPED - Public Digital Bookkeeping System:

SPED was originated from the legal provisions contained in the Constitutional Amendment No. 42/2003, which established that the Brazilian Tax Administrations, at the three levels (federal, state and municipal) should act in an integrated manner, sharing tax records and information. Thus, in 2007, the system was legally instituted and has been implemented since then, aiming:

- ❑ To promote the integration of tax authorities by standardizing and sharing accounting and tax information;
- ❑ To streamline and standardize ancillary obligations for taxpayers by establishing the single transmission of distinct ancillary obligations from different supervisory bodies;
- ❑ To expedite the identification of tax offenses, with improved control of processes and faster access to information.

Through SPED, in an electronic and unified way, Brazilian taxpayers provide information regarding commercial transaction tax documents (invoices), tax and accounting bookkeeping, transportation of goods, and financial transactions, enabling data cross-checking processes and electronic auditing.

To emphasize the magnitude of this system, over 22 billion electronic invoices and tens of millions of other tax documents have already been issued by SPED. More information and statistics on this system can be obtained at the *link* <http://sped.rfb.gov.br/>.

➤ ContAgil:

The ContAgil system, meaning “agile accounting”, was initially developed by the RFB to support, *streamline* and enable the inspection task of cross-checking high volume of taxpayer data, as this is necessary for potential tax offenses identification. The system, which today has become a processing environment, boasts a number of features, including:

- ❑ Graphic visualization of company accounts;
- ❑ Easy creation of queries, cross-checking and reports, allowing automated and flexible processing and cross-checking of taxpayer data, which include registration, accounting, tax, assets, financial information, and also the use of graph analytics;
- ❑ Use of optimized combinatorial analysis algorithms and mathematical/heuristic theories in the context of inspection;

- ❑ Providing a generic machine learning environment for the use of artificial intelligence applications;
- ❑ Availability of an environment for sharing collective knowledge among users.

The ContAgil System is used by all areas of the RFB and is available to thousands of users. It works seamlessly with SPED and RFB's data lake on a *Hadoop* platform, enabling it to engage with various IT tools, including artificial intelligence and data mining.

➤ **SISAM - Customs Selection System via Machine Learning:**

Since 2014, SISAM has analyzed all import declaration forms (IDs) registered with Brazilian customs. It is an artificial intelligence system that learns from the history of declaration forms and estimates the probability of about 30 types of errors that may occur in each item of each new import declaration form, calculating the expected return value (in national currency) for every possible detected error.

SISAM has an interface that allows tax auditors to merge information from the system with information they have, including information from their practical experience. More than 30% of all IDs forwarded for custom inspection come from SISAM referrals, which have already contributed to a measurable improvement in the behavior of Brazilian importers.

➤ **Project FAROL:**

The Farol Project was born in a context of decreasing RFB staff combined with an increase in society's demands for quantity and quality of services, asserting itself as a creative and innovative proposal by bringing IT solutions to work processes and not to activities, as is the case with large systems.

Farol's functionalities are developed essentially by using ContAgil system framework, and they enable work processes that were previously segmented and time-consuming to be executed automatically and in batches.

For illustrative purposes only, with administrative collection procedures automation, billions of *reais* (Brazilian currency) related to default of installments were identified and recovered, and the processing of such identification of irregularities was made by about 3 servers over a period of 2 weeks.

➤ **SCC - Credit Control System**

Since 2003, taxpayers with federal tax credits have been able to file computerized requests for refunds or offsets of these taxes, in accordance with legal provisions. To identify and validate these requests, the Credit Control System (*Sistema de Controle de Créditos - SCC*) was developed, which consists of several applications for data processing.

The SCC receives orders, generated and sent electronically, and performs credit rights analysis, interacting with the taxpayer if discrepancies are identified, allowing self-regularization. Once the credit right is granted, SCC finalizes its routine by issuing the order with the amount of credit determined and, if applicable, makes the payment, executes the

offsetting or proceeds with the collection of improperly offset debts. All these procedures are performed automatically, including the interaction with the taxpayer. Progress and records at each step of the process can be tracked electronically in the system.

Since its implementation in 2003, the SCC handles automatically more than 12 million documents annually, equivalent to more than R\$ 700 billion, resulting in 800,000 notices sent to taxpayers, 950,000 decision orders and 19,000 taxpayer public notifications.

➤ Customs recognition systems:

Brazilian Customs has a traveler face recognition system used in the airport arrival areas, and a new analysis system for X-ray imaging of containers, the AJNA, is under development. This novel system will employ sophisticated techniques, such as regressions based on random forest and deep neural networks, to improve detection of concealed goods and/or errors in reported goods quantities.

5.4. Fiscal intelligence and control

In the first book of the *Foundation Trilogy*, Isaac Azimov explained the distinction between modeling groups as opposed to an individual by using the analogy of a gas: it is difficult to predict the behavior of an individual molecule but entirely possible to predict how a large cloud will behave. This approach to data analysis and handling is possibly the first attempt to describe something that we call today *Big Data*.

Tax administrations are increasingly making use of a large number of sources of information deriving both from taxpayers' declarations, from third-party (institutional and other, international cooperation), or from proceedings of another nature (criminal, civil, bankruptcy, etc.). The volume of this information represents a valuable source of knowledge for tax institutions and, at the same time, requires the use of appropriate analysis techniques to convert such data into information that can be useful in the processes of auditing and investigation as well as for political decision makers.

As is mentioned by Moinet & Marcon (2006), this is the reason why, a modern tax institution should consider to create an Intelligence function, with autonomous capacity of providing useful information to feed other processes within the administration (for example, the selection of taxpayers to be subjected to an audit) or external (i.e., amendments to tax legislation aim to challenge avoidance schemes). In fact, a modern tax administration must know its taxpayers and be as predictive as possible with respect to their present and future conducts in order to improve efficiency, fairness and minimize evasion and avoidance risks, at the same time improving the level of cooperation with the correct taxpayers without any burden or bureaucracy.

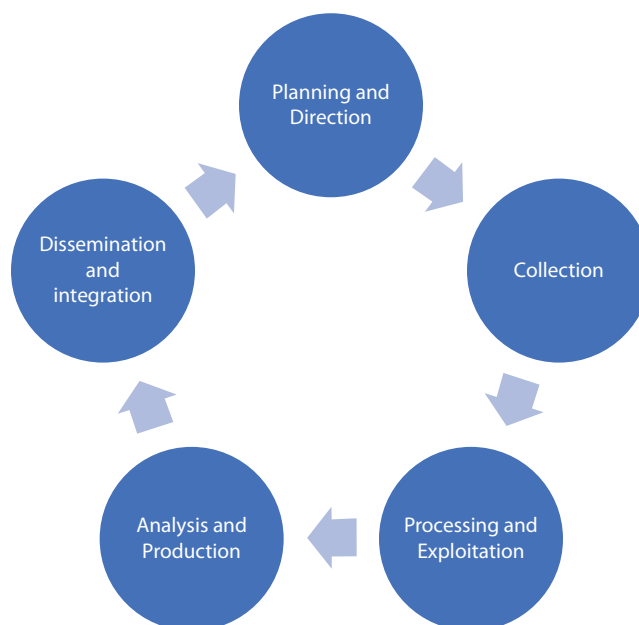
For setting up an adequate tax intelligence function,⁴⁵ administrations must therefore equip themselves with human and technological assets capable of:

➤ Organizing and making available all the data held by the administration in a uniform format;

- Activating the corresponding intelligence cycles, aimed to transform such data into useful information for decision making;
- Manage the feedback relating to the information disseminated, for activating further processes.

These activities are summarized in the following figure:

Figure 5.4-1 Intelligence cycle



Source: Prepared by the author based in Kasewere

Planning and direction. This is the first step. It's here where the requirements and priorities are set. The capabilities to produce Intelligence are limited as any other resource which means we want to maximize its production with a constant number of resources. Among others, a methodology to define the requirements might be using the "Five W's". It's also in this step where we define which areas the intelligence produced will have the most impact and make to most contribution. During the planning it is fundamental to specify which categories of Intelligence will be gathered, i.e. OSINT (Open Source Intelligence). In addition, the processes, people and technology to support the different steps in the cycle need to be established with clear roles and responsibilities.

Collection. The second step includes all the different activities, mainly research, that involves the collection of data to satisfy the requirements that were defined. The collection can be done either via technical or human means and involves gathering data from a variety of sources. In the military and intelligence community the sources normally used are people, objects, emanations, and records. These sources span the different collection disciplines named as HUMINT, IMINT,

MASINT, SIGINT, OSINT and others. Once collected, information is correlated and forwarded for processing and production.

Processing and exploitation. Third step, the collected raw data starts to be interpreted, translated and converted into a form suitable for the consumers of the intelligence. The raw data becomes information.

Analysis and production. This step would be the refinement of the information that was produced in the previous step; the fusion of the different information that was processed from the different intelligence disciplines. These are key tasks performed during this step. The analysis consists of facts, findings and forecasts that describe the element of study and allow the estimation and anticipation of events and outcomes. The analysis should be objective, timely, and most importantly, accurate. To produce intelligence objectively, the analysts apply four basic types of reasoning: induction, deduction, abduction, and the scientific method. Furthermore, because bias and misperceptions can influence the analysis the analyst should be aware of the different analytical pitfalls. The outcome is value-added actionable information tailored to a specific need.

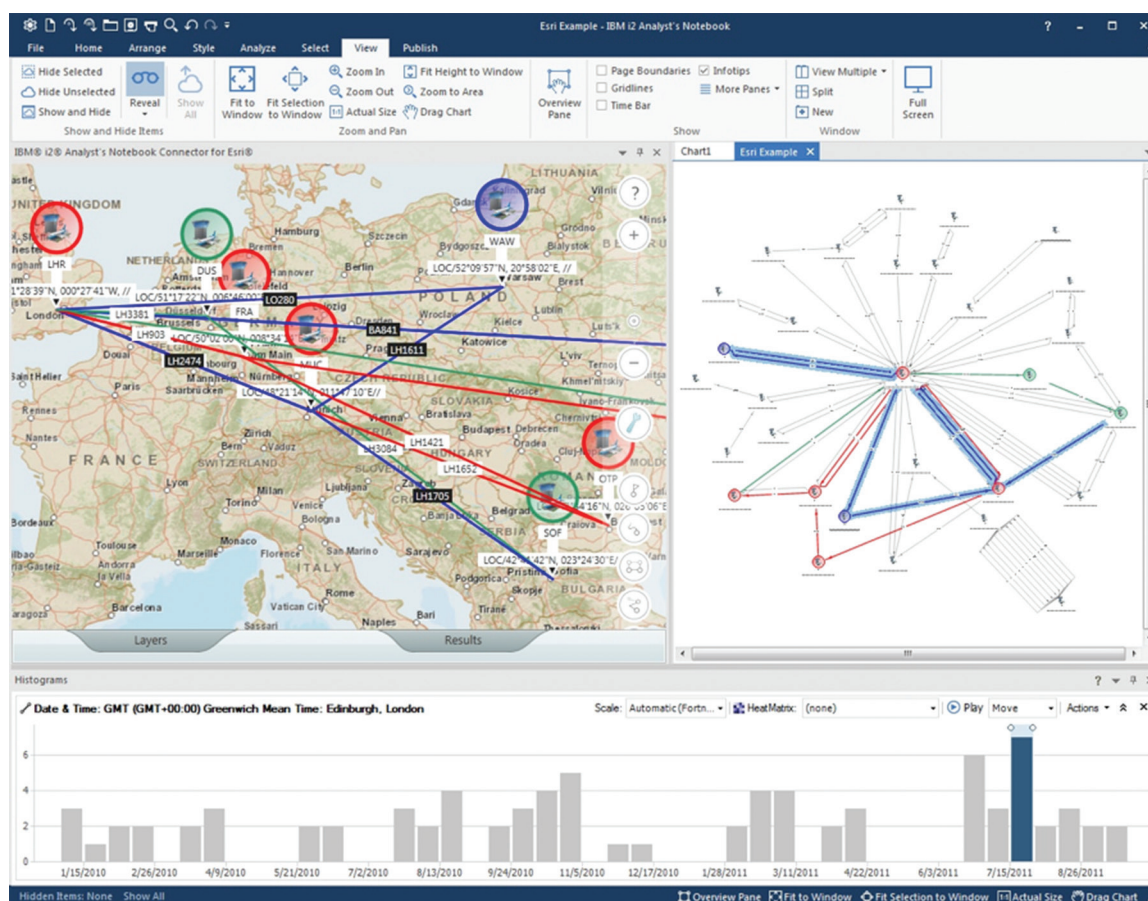
Dissemination and Integration. Essentially, this step consists in delivering the finished product to the consumers who requested the information. This can be done using a wide range of formats and in a manual or automated manner.

During these five phases, a tax administration can extensively use information and communication technology (ICT) means in order to take the greatest advantage of the use of the available data and make its own intelligence as predictive as possible.

In particular, it will be able to make use of social network analysis techniques through specific programs that highlight the relationships between information entities (individuals, bank accounts, companies, telephone numbers, etc.). It can also make these analyzes available to other institutions, which are shared for the purpose of prosecuting tax crimes, such as tax fraud and large cases of evasion, in a consistent manner with the whole of government approach advocated by the initiatives relating to the Oslo Dialogue.⁴⁶

This is because such software (e.g., IBM i2 Analyst's Notebook) is widely used by law enforcement agencies and prosecution bodies in various countries and is considered a standard even in courts of justice.

Figure 5.4-2 IBM i2 Analyst's Notebook



Source: Product images. Adapted from “IBM i2 Analyst's Notebook,” by IBM, 2019. Retrieved November 11, 2019, from <https://www.ibm.com/us-en/marketplace/analysts-notebook>. Copyright 2019 by IBM

The importance of organizing and analyzing the results obtained through social network analysis techniques, also for tax assessment purposes, is even more important as the use of these methods, applied to relevant masses of information from different sources can highlight possible “inconsistencies” in the tax behaviors of individuals or groups of taxpayers that can often represent useful inputs for further auditing activity or, in the case of more complex tax crimes, for criminal investigation and prosecution. The different sources referred to can be archives related to tax returns, purchases/sales of goods, real estate, bank accounts, vehicles, financial and currency flows, customs declarations, etc.

For this reason, a modern tax administration that intends to attack the most harmful tax evasion and fraud cases must necessarily develop the ability to process large amounts of pieces of information originating from different sources and not necessarily consistent in terms of format, language, etc. It can also analyze them with software capable of geo-localizing data and subjecting them to artificial intelligence processes for subsequently generating products that, subjected to analysts, can be a valid aid to manage taxpayers' risks and feed the auditing/investigation function. The information can be exchanged with other institutions (such as Public Prosecutor's Offices, FIUs, Police,

Customs, Financial Regulators, etc.) for complex investigations into the subject of illicit financial flows and combating the financing of terrorism.⁴⁷ These programs can be either acquired on the market or produced by the tax administration through its ICT area.

This last solution appears preferable in all circumstances in which it is intended to create a product that takes into account the peculiarities of the already existing databases and wish to create a tailored product to the final customers of such intelligence products both internal (tax auditors) or external (investigators, prosecutors, etc.). In such cases, it is also preferable to create software that can natively use the data obtained during auditing activities using computer forensic techniques, so that this information is not lost by the administration but can be subsequently analyzed and included in intelligence products even useful for external clients, where permitted, of the ongoing tax verification process.

In this sense, the information obtained may also be appropriately disseminated to other tax administrations, where the conditions for engaging an information exchange based on a bilateral or multi-lateral convention are fulfilled, considering that the new article 26 of the OECD Model Convention states that data obtained as a consequence of a mutual tax assistance, may also be used for other proceedings, with the aim of being able to deal with the criminal conducts according to the “Whole of Government approach” characteristic of the focus on “Tax and Crime”.

The role of the tax administrations is rapidly changing, moving from being an instrument of tax policies with a view to the mere collection of taxes, to acquiring a leading role as a garrison of legality, free competition and an actor of policies, including international ones, focused on contrasting more complex phenomena of tax fraud, corruption, money laundering and terrorist financing, in an harmonic action with other institutions.

In order to be ready for these tasks, in today’s world, it is necessary to push for more intelligent analysis and intelligence processes that make possible to make the best use of the vast mass of data available in a productive way in order to take decisions supporting tax audit functions and criminal investigations when necessary.

As Azimov said, perhaps it is easier to predict where a cloud of particles is going than what a single particle does. The same cloud that often the dishonest taxpayer wants to create to prevent the disclosure of their illicit activities, and that instead, through all the existing tools, must be exposed and prosecuted by a modern efficient and, even more important, “intelligent” tax administration.

Notes

45. For an introduction to intelligence doctrine and an in-depth explanation and examples of the intelligence, cycle refers to the book *Securing the State* of David Omand.
46. The OECD Oslo Dialogue is a whole of government approach to fighting tax crimes and illicit flows. For more information, visit <https://www.oecd.org/tax/crime/Oslo-Dialogue-flyer.pdf>

47. Links between organized crime, terrorist groups and finance/tax industry are described in the book *Criminal Capital: How the Finance Industry Facilitates Crime* of Stephen Platt.

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6. PROVIDING SERVICES TO THE TAXPAYERS

6.1. Digital Services and CRM in tax administration

This section refers to the manner in which Digital Services offered by tax administrations to taxpayers may be designed, developed and provided, as well as the manner in which the relation with the taxpayer called CRM (Citizen Relationship Management) is managed.

With the use of information technology in tax administration, there is no doubt that there has been a change in the way taxpayer information is managed or administered to fulfill two of its great purposes, among others:

- Increase and promote voluntary compliance and its control.
- Make effective and immediate perception of risk due to lack of compliance.

It is important to state that we will focus on the manner in which a tax administration may relate with taxpayers for the fulfillment of their obligations and how risk perception plays an important role for services offered by tax administration to be used.

Technology evolution and availability of new tools for the development of services, and the decrease in costs has allowed to provide more and better services to taxpayers. Moreover, availability and use of information delivered by taxpayers gives a development potential aimed at easing voluntary compliance and creating risk perception in case of lack of compliance.

6.1.1. Services in tax administration

For the development of this section, we will begin with a definition of what a service is for a tax administration so that it allows to understand its impact both for taxpayers and the inner part of the organization that carries it out.

In this sense, Service to Taxpayer in tax administration is any binding or nonbinding contact through available attention channels that allow the taxpayer to establish a relation with the tax administration with the ultimate purpose of complying with a tax obligation.

Services to taxpayers may be classified in two manners:

- Person-to-person services (face-to-face).
- Electronic or digital services (offered through e-devices).

In this section we will refer, indistinctively, to digital or electronic services, as they may be developed and implemented to set contact with the taxpayer. We will also refer to some of the schemes with which the relation with the taxpayer may be managed.

6.1.2. *Evolution of services in tax administration*

E-services have evolved in a rapid manner as there have been more and better technological tools. It is enough to mention that in the '90s, Internet started to be used in tax administrations, basically with information services for fulfillment of obligations and in the two following decades, this changed to interaction services with taxpayer identification, such as the pre-filled statement proposals. We can mention that, in the following years, with the development of artificial intelligence, especially machine learning, we will have the possibility to forecast and predict taxpayer behavior and help to fulfill obligations with more and better pre-filled statement proposals, which may give an end to the need to submit statements.

However, offering services in electronic means poses great challenges for tax administrations, apart from the costs it implies. These digital services, without being exhaustive, must comply with the following requirements:

- Offering services 7 days a week, 24 hours a day.
- Levels of services that try to be close to 99.99/100 ("four 9").
- The answer of the tax administration to the taxpayer must be immediate in time.
- Explanation of how to use the service must be made in "citizen language".⁴⁸
- There must be technical and legal support service.
- It includes consulting, storage and follow-up services for each and every transaction made by taxpayers.
- Offering simplified services to certain taxpayers based on the definition of risk profiles.
- Economic and transparent services for taxpayer that reduce the possibility of corruption acts.

6.1.3. *Changes in culture*

Offering e-services implies another great challenge: managing cultural change both for the taxpayer and the tax administration so that this does not pose an obstacle to overcome in order to be able to implement it.

The process of cultural change starts within tax administration as it requires great effort from staff involved in order to view this new manner in which services may and must be offered to reflect the impact of the change in tax and management processes in flow information and, above all, to manage the most important impact that will take place in the factor “persons” that must be adapted to take them to a different and automated process.

The taxpayer, as user of the e-service, maybe the most critical part of the implementation process of electronic services as, naturally, they may reject the change making it necessary for an adaptation process to the new reality until it is accepted.

A successful implementation process has to include a scheme for taxpayers or user segmentation, established pursuant to their features and profiles and must measure impact with respect to these segments.

One of the characteristics of taxpayers’ segmentation is the possibility to identify behaviors and preferences in the use of electronic means, as well as channels through which the taxpayer fulfills their obligations. It also allows to indirectly identify, in approximate figures, fulfillment costs and its economic and administrative capacity.

Fulfillment costs are commonplace to which taxpayers resort to compare electronic services to face-to-face services as in light of the possibility to produce change, there may possibly be greater costs and immediate benefits must be identified to avoid service projects to be rejected by taxpayers. This is without mentioning that the cost of the initial investment will help taxpayers to have savings in the future and, also, improve their productivity. That is, this must be an evaluation for the medium and long term.

In a context of geographical dispersion, the possibility that taxpayers that live in areas far from offices of the tax administration avoid moving and time costs, especially for those that would have to move to other offices in different places.

With the technological revolution, also tools that allow for the management of the relation with the taxpayer (CRM) have evolved to ease management of taxpayers’ contacts through different channels, there being different types of CRM with which they may be identified.

Another factor that positively contributed to the acceptance of digital services is the inclusion of new generations, that use mobile phones and digital applications, in the universe of taxpayers for all types of formalities, to interact with banks and social networks or to schedule other obligations. For this reason, the design of digital services of the tax administration must take advantage of the experience of users with these services.

6.1.4. *Types of CRM (Citizen Relationship Management)*

Below we will describe the ways in which CRM may be found in the market. It is necessary to be careful in the election of the tool that may help tax administration as some tools are more convenient for a private company and cannot necessarily be applied by a tax administration. Moreover, it is always necessary to estimate the total cost of ownership (TCO) of the tool.

The philosophy of a CRM that has the purpose of complying with the needs of a tax administration must fulfill the following requirements:

- To know the features, behavior and needs of taxpayers to carry out actions that allow for the fulfillment of tax obligations and exercise of rights.
- Prepare actions to perceive risk of lack of compliance.
- Guide tax administration processes towards the taxpayer, creating an infrastructure of human capital and technology that allows offering services that are rapid, efficient and focused on their needs.
- Register interaction of tax administration with the taxpayer and create a knowledge base of their behavior to help with risk administration, campaign development and, based on, the information generated, define strategies that allow making improvements in electronic services.

Types of CRM

- **Operational CRM.** It is responsible for the automation of electronic services offered to taxpayers as well as for the integration with different systems existing in the organization.
- **Analytical CRM.** Comprises programs that analyze taxpayer data presenting them in a structured manner to help in the decision-making process. It allows to create groups in segments of taxpayers, customize, monitor events and identify scenarios as well as to establish prediction or risk models as from behavior of transactions carried out by the taxpayer.

As a whole, data that can be generated and their analysis are a continuous and iterative sequence that allows for decision-making supported by early feedback of the electronic services that improve decision-making.

One of the features of CRM is to supervise rendering of electronic services, allowing to measure their quality, efficiency and effectiveness, providing information that helps to carry out prevention and/or correction measures that increase taxpayer satisfaction.

Some of the reports that may be generated in a CRM are the following:

- Customized analysis of services used by the taxpayer.
- Compilation of service evaluation metrics.

- Determination of alarms and preventive monitoring that supervise electronic services.
- Determination of inquiries and specific reports to check service level.
- Determination of services that need to be improved.
- Support, through simulation, of possible improvements to be included.

6.1.5. Strategy and coverage of services in the digital era

For the development and implementation of digital services, it is advisable to have a strategy that allows articulating the manner in which services are to be rendered and offered to taxpayers.

This decision must take into consideration the following:

- Segment of the taxpayer.
- Tax process.
- Formalities carried out and services taken.
- Impact on collection and risk perception.
- Transaction volume.
- Request of taxpayers.

Coverage of services would be carried out through different channels of contact with the taxpayer (both current and those that in the future allow for the development of information technologies) and through different devices or means of contact that may be developed.

6.1.6. Importance of the portal

The tax administration portal is the main contact point with taxpayers and the main tool to offer digital services.

In general, tax administration puts or creates content for sections defined on two sides: on the one side, public section, private section of taxpayers on the Internet, and on the other side, open and customized section of tax administration through an intranet.

One of the main requirements is safety in access to information that is classified as reserved and confidential in which there are regularly binding transactions made with legal effects for the taxpayer. Therefore, it is a condition to control access to private sections and any type of application of tax administration which conducts access profiles and safety levels to be included.

Tax administration portals present the following functions and services:

- Site map.
- Search engine.
- Inbox, customized per taxpayer.⁴⁹
- Customized section per regime, taxpayer segment or service offered.
- Collaborative work and online support (notices, alarms, etc.).
- Contact options: e-mail, chat, inbox, subscription, experts in the subject.
- Integration with workflow administration engine.
- Responsive web design that refers to the capacity of a site or web design that adapts to the size of any device (smartphone, tablet, laptop or computer).

6.1.7. Integration of digital services to tax processes

Considering mission and vision as well as the strategic plan which the tax administration has, the authorization of one or more sections of the portal in which it is possible to carry out formalities, transformed into digital services, has become an efficiency condition.

Thus, we can mention some of the tax processes that may be authorized in the portal:

1. Registration of taxpayers and information update.
2. Identity management for digital signature.
3. Calendar for customized tax compliance.
4. Presentation of returns and payments.
5. Consulting checking's account.
6. Invoicing scheme.
7. Tax refund.
8. Electronic notices.
9. Management of electronic auditing.
10. Tax on foreign trade (when it is part of tax administration).
11. Tax checking's account.

It is worth mentioning one of the services which has greatly transformed the tax administration and that has wide acceptance in Latin America is the: e-invoice.

By nature, e-invoice has much information as to the taxpayer's transaction and has become one of the pillars over which it is possible to build new digital services that allow for voluntary compliance of obligations.

In some countries, such as Mexico, it is an essential element of tax administration to generate risk perception and detect and punish in a severe manner lack of compliance as it prevents issuance of invoices when the taxpayer is found to have evaded, avoided, unfulfilled repeatedly or not located.

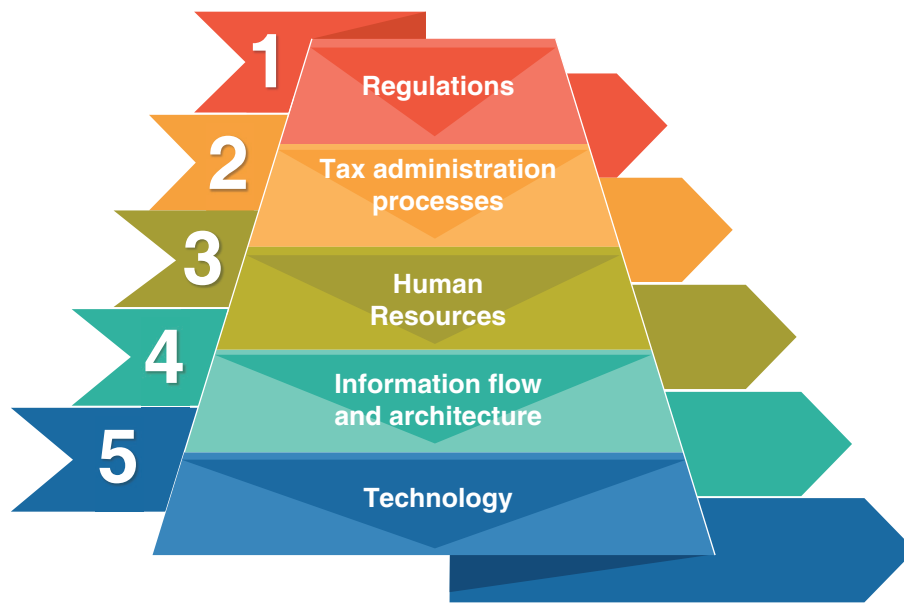
6.1.8. *Information and design of services with the use of technology*

Another critical aspect for the development and implementation of digital services is the manner in which these are designed to be offered to taxpayers as it is necessary to have analysis of legal provisions that rule actions of tax administrations and the needs to improve with services that are efficient for tax administration.

To do this, it is necessary to:

- a) Analyze the impact of the existing legal framework related to the service improvement proposals.
- b) Define and design solution proposals to improve the tax process and regulations that support service operation.
- c) During implementation, it is necessary to supervise the correct functioning of existing and new services and implemented changes.
- d) Analyze and manage changes in rules, identify their feasibility and create proposals for legal changes to guarantee that digital services comply with the existing regulations.
- e) Supervise the performance of implemented services and develop practices that turn changes into opportunities to render better services.
- f) Predict capacities and technological volumetrics potentially required considering the formalities or possible users.
- g) Measure impact on the short, medium and long term as to the fulfillment of taxpayers' obligations and costs this implies to the eventual transition.

There may be different schemes or ways to implement digital services; however, it is essential to be able to view in an integral manner the group of elements to be considered for the design, implementation and information flow with a graphic such as the following:

Figure 6.1-1 Aspects to be considered for the design of Digital Services

Source: Prepared by the author

6.1.9. Experiences in digital services

Use of CRM in Kenya

Through a press release dated September 10, 2018, the Kenya Revenue Authority (KRA) informed the results for the implementation of its CRM, that was launched into operation at the end of the year 2017. This release stated that experience of taxpayers has improved as well as the rendering of services and operational efficiency.

Data that allow to show a better experience of taxpayers are related to ***the rate of interaction in social networks***, that has doubled from 300 to more than 700 inquiries a day and the response time of inquiries from clients in all platforms that has improved at an average of 15 minutes unlike the average response time that was of an hour some time before.

Implementation of CRM is a commercial software solution stored in the cloud with interfaces in social networks. According to KRA, the benefits of storing CRM in the cloud are scalability, accessibility, flexibility, efficiency and strategic value. Apart from tax laws and as CRM has taxpayer data (clients' database), it is also governed by the laws of data protection in force in the country, such as the General Data Protection Regulations (GDPR).

The portal of the KRA also has a chat session that allows for interaction in real time with taxpayers. Moreover, if taxpayers present an inquiry or service request, they will be issued an e-ticket to allow them to track their inquiries.

For more information, see section 6.3.

Submission of online returns. Statements in the Web DGI – Uruguay

Preference of taxpayers to present their returns through the web is clear in the news section of the Uruguay Revenue General Direction Portal (DGI, in its Spanish acronym), in which by means of a release dated June 24, 2019, the following is stated:

“On Monday 17th, we have made available in the website of the DGI both the online form with pre-filled data to make IRPF statements, and the draft statement for taxpayers of the IASS. A week after the campaign started, DGI has received a total amount of 47,546 returns of IRPF, 45,413 of which have been sent through the web and the rest has been presented in collection networks.

On the other hand, 3,200 taxpayers of the IASS have submitted their returns, 2,800 of which have used the draft tax return available in the DGI website”.

Assistance to the taxpayer with artificial intelligence. Spanish Tax Agency (AEAT, in Spanish)

The State Tax Administration Agency was recognized within the framework of the 22nd Ordinary Meeting of the Intra-European Tax Administrations Organization (IOTA) held in June 2018 as it showed three digital assistance tools in the area of Value Added Tax, in particular:

- Term calculator developed in the framework of the new VAT management system based on the Information Immediate Supply (SII, in Spanish);
- The finder of the tax event for the VAT; and,
- The VAT Virtual Assistant (AVIVA, in Spanish), based on the use of artificial intelligence.

According to the AEAT (2019) “all these projects have been created with a clear intention to assist in the correct fulfillment of tax obligations, but also with the philosophy of getting knowledge and legal safety closer to the taxpayer.”

The AEAT has won the best digital solution shown and received the award from the President of the IOTA.

Use of digital documents. Integrity of digital documents / Mexico

With the advance of technology, it is also possible to create digital documents that allow to check who the author is for the benefit of taxpayers and this is a practice developed by the Mexican Tax Administration Service (SAT, in its Spanish acronym) and published for taxpayers through its news section on March 14, 2018, in which the following is informed:

“Electronic documents issued by SAT have safety mechanisms that allow to verify that the document you received is authentic.

Some may have a bidimensional bar code (QR code) that, through an electronic device, can read and validate data and to compare the document received.

Documents that do not have the bidimensional bar code may be validated in the section of related contents accessing the application to verify integrity and author of documents notified personally”.

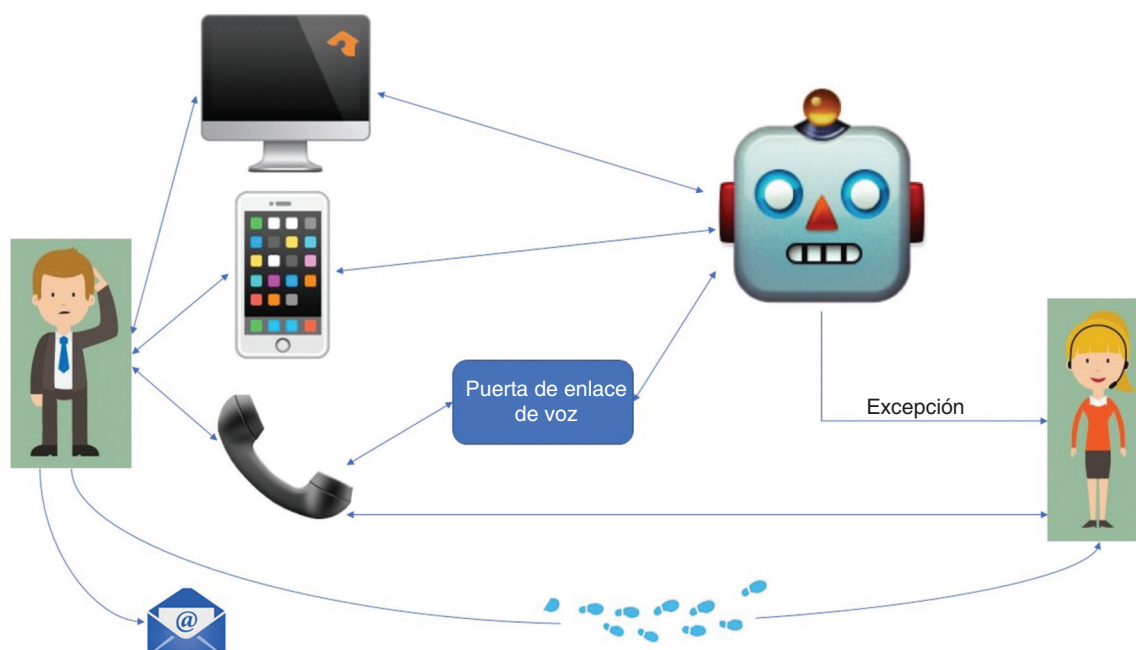
Safety mechanisms that the document received has are the following:

- Bidimensional bar code.
- Advanced electronic signature.
- Verification safety code.
- Original chain.
- Digital stamp.

6.1.10. Integral attention to taxpayers and role of digital channels

In a modern tax administration, integral attention to taxpayers is essential. Currently, the digitalization process does not reach everyone (particularly in developing countries) and a significant number of taxpayers still prefer personal, direct or phone contacts. Therefore, inclusion of digital services cannot disregard traditional channels, including face-to-face ones.

Figure 6.1-2 Modern scheme for integral assistance to taxpayers



Source: Modern scheme of integral attention to the taxpayers. From “Asistentes conversacionales virtuales en las administraciones tributarias: Principios, modelos y recomendaciones,” by A. Seco, & Andrés M, 2019, September, Database *Inter-American Development Bank*, p. 7. Copyright 2019 by Inter-American Development Bank

In a work document of the Inter-American Development Bank (Seco & Muñoz, 2019), there is an analysis of the advance of digital attention channels to taxpayers and their impact on tax

administrations and on taxpayers. Therefore, for example, we can see that the resources assigned to each attention channel will mainly depend on how receptive they are for taxpayers.

However, it is also foreseen that with growth of economy and hyper-connectivity of society, as well as the appearance of new generation of taxpayers (for example, millennials), digital channels, especially the digital channel assisted by intelligent robots – called Virtual Conversational Assistants (ACV, in its Spanish acronym) – may become the most used option.

In fact, some specialists consider ACV will increasingly replace human operators in the user attention centers. A survey made by consulting company Accenture with taxpayers from 12 countries in Europe, Asia and North America showed that 2/3 (67 percent) indicated that, if offered, they would use a “tax virtual assistant” that may approach any tax question with a conversation language, and with time, be more intelligent and personal as to the personal and professional tax situation of each taxpayer (Accenture, 2018).

Nowadays, some organizations have started to get experience with solutions of higher level than ACV, called “digital avatars” that are grounded in emotional intelligence to recognize nonverbal behaviors through face recognition techniques.⁵⁰

This change in the importance of digital channels, compared to traditional channels, will have significant consequences in strategic, organizational and human capital aspects of the tax business, in particular, releasing officers of the company to carry out greater value tasks for tax management or administer the rest of the assistance channels.

Moreover, the evolution of these services foresees the integration of ACV with other online services provided by tax administrations, for example, to make payments and check tax files. To do this, it is necessary for these integrated services to be available digitally. Tax ACV could also be integrated with other state ACV allowing for inquiries to be made in any public ACV and to be derived to another specialized ACV. This technique is called “orchestration”.⁵¹

Chapter 15 of this book called “*New Disruptive Digital Technologies and Services – Opportunities and Challenges*”, presents details as to the advance in the implementation of ACV and their use in pioneer tax administrations.

6.1.11. Where services to taxpayers in the digital era go

As it has been made clear in this section, the use of technology to render digital services has become a sign of efficiency in tax administrations. However, it is necessary to be careful as to how this changes tax processes and to consider all aspects related to their implementation.

Development of digital services during the following years presents the following trends:

- Integration of multi-disciplinary teams formed by experts in the legal subject, in tax proceedings, specialists in information technologies, among other specialists for the design of services.

- Development of standards that allow for interoperability through digital documents.
- Integration of electronic services of tax administrations with administrative, accounting and tax information systems used by taxpayers.
- Ongoing development of interoperability among tax administrations to go from a local context to share information online at international level.
- Machines will carry out more tasks that require more time and resources from tax administrations and taxpayers to fulfill and to administer compliance and management of risk to be detected.
- General acceptance of taxpayers of the use of technology and good reception to take advantage of benefits of this implementation over traditional mechanisms.
- Use of Virtual Conversation Assistants (ACV, in its Spanish acronym) to assist taxpayers based on artificial intelligence techniques interacting with them through text and voice messages.

The trend for 2020 and the following years in business is a better integration to social networks from client attention services (CRM, Virtual Conversation Assistants and other digital services).

According to the consulting company Accenture (2018), 90% of the companies estimate they will use social networks to provide services to their clients. The rest of them, 42% of users, that use social networks wait to get an answer in less than one hour (according to the same source, the usual average response time of companies is 5 hours). Another important aspect is customization: 91% of users prefer to use sites that recognize their interests, know their preferences and offer information that is relevant. Of these users, 83% would be willing to share their data if they get a more customized and relevant experience.

These statistics were obtained from surveys to commercial businesses, but tax administrations must consider these trends in the definition of strategies for their attention plans for taxpayers.

6.1.12. *Is it possible a unique identification to access all government electronic services?*

LA countries use to adopt much more restricted definitions. In Mexico So, each citizen needs to remember a lot of user-id/passwords (the most common electronic authentication schema), one for each government agency, and also one for each private company with which it maintains business relationships.

The advantages of a unique identification for citizen access to all government electronic services is easy to understand but difficult to implement, mainly due to the need for coordination between agencies, the definition and approval of national electronic identification standards and the availability of an entity capable of implementing and operating a system of such magnitude.

But some countries are advancing in this area, and exploring different strategies, as shown in the following examples:

Australia:

myGov is a secure way to access government services online with one login and one password. Agencies like the Australian Taxation Office (ATO), Medicare, Department of Health use this schema. Additionally, myGov provides a mailbox valid for communication with government agencies. Changes in the myGov account details will be reflected to the participant agencies. The myGov app generates a one-time code as a second factor that complements login/password to access a government service. A video explains how to use myGov and how to connect it to the ATO application.⁵² The system has 14 million registered accounts. The government is introducing a new approach to this system, named **myGovID**, that will also use some biometrics features typical of mobile devices, like fingerprints and face recognition (Easton, 2018).

Denmark:

NemID (“*easy identification*”) is a national electronic identifier developed in close collaboration with the banking sector and the civil society. It’s operated by a private provider on behalf of the Danish government and the banking sector. The system offers a common identification method to the citizens access to public and private electronic services and it’s provided free of charge to all citizens. Whether accessing banking services or tax services, the login procedure is exactly the same. In addition, several businesses use NemID as an access identifier to their web portal. It’s based on a two-factor authentication schema: user-id, password and a one-time code as a second factor, obtained from an individual paper table, a token (electronic device) or an App.⁵³

France:

The French government adopted a strategy named “**government as a platform**”, to make all public information safely interoperable and break down the administrative silos, with a better user experience (“tell us once” policy). The French tax administration (DGFIP) will be in the heart of this strategy, acting as the “identity provider” to all government agencies, based on the tax number/password. The DGFIP will also be the “data provider”, supplying application program interfaces (API) to access data. And finally, DGFIP will be the “provider of payment methods” for any online public services. This very interesting arrangement is presented on (Le Baron, 2018).

6.2. Taxpayer’s view

Tax administrations employ significant resources to develop services for taxpayers, currently on a multi-channel approach, trying to make compliance easier for taxpayers while, at the same time, get the necessary information to fulfill their mandate. However, the user of those services is on the other side of the desk. It is important to get the view of an actual user of those services, understand their position in terms of the benefits they are getting from electronic services and the additional burden of providing more information in an increasingly complex environment.

To get this view, we invited a taxpayer lawyer with actual experience using this kind of services for herself and on behalf of companies of different sizes, sectors and complexity. Dr. Ana Utumi develops her practice

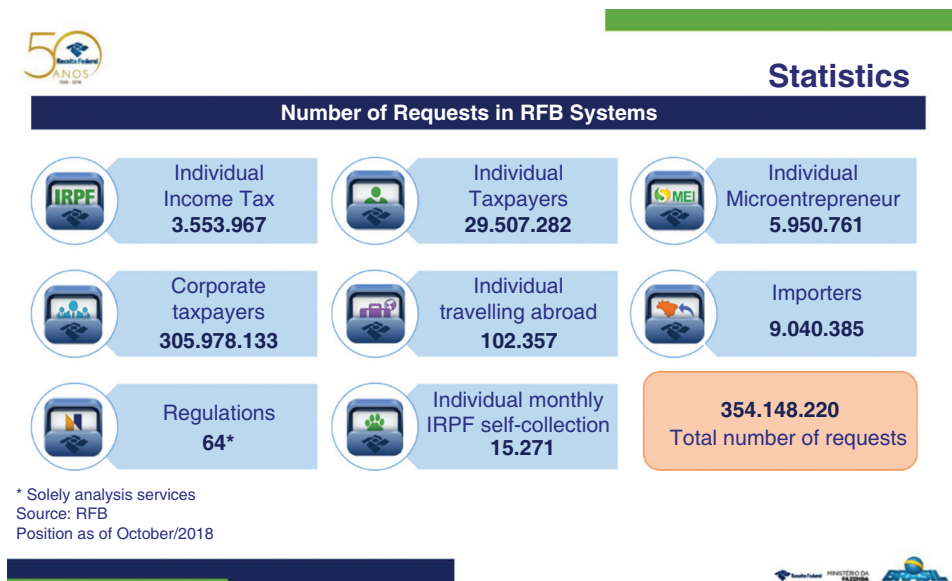
in Brazil, one of the leading nations in the provision of electronic services to taxpayers. The following is her vision on the matter.(Raul Zambrano, CIAT)

There is no question that it is necessary for tax authorities in different countries to advance towards the digitalization of their controls and services. Understanding the impact of these advances in the lives of individuals and corporate taxpayers is crucial for governments when structuring their strategies.

Brazil is one of the most advanced countries in the world in relation to the digitalization of ancillary obligations; so, nothing better than looking at the Brazilian experience in this field. All these advances have proven necessary to combat and reduce tax evasion, which is significant in Brazil and, unfortunately, “socially accepted.” Oftentimes tax evaders praise themselves as smart businessmen, who make the best use of their money; instead of paying their fair share to the government, they keep it in their pockets or business, or even use as an excuse that their businesses “would not be viable if they paid all taxes due.”

This section intends to bring an overview on the impacts of digitalization of tax controls for corporate and individual taxpayers in a country – Brazil – that has, with no doubt, the most advanced systems to receive taxpayers’ information, monitor their activities and tax collections, structure tax inspections and supply digital services. Just to give an idea of the magnitude of the Brazilian tax system, the chart below shows impressive statistics of the number of online requests that taxpayers made in 2018 (January to October 2018) through the Receita Federal do Brasil (“RFB”) portal:

Figure 6.2-1 Online requests made by taxpayers (January to October 2018)



Source: Number of requests in RFB Systems. From “Seminário Internacional Transformação Digital nos Serviços Públicos: A entrega de serviços públicos digitais no Brasil,” by J. Brito da Justa Neves, 2018, November 05, ENAP, p. 8. Copyright 2018 by ENAP

This section is divided in three parts: a) Individual taxpayers and digitalization of tax obligations; b) Corporate taxpayers and digitalization of tax obligations; and, c) brief conclusions.

6.2.1. *Individual taxpayers and digitalization of tax obligations*

Developing electronic systems to allow taxpayers to comply with their obligations electronically started many years ago, in the very beginning of the '90s. For individuals, in the year 1991, the Federal Revenue Secretariat (RFB by its Portuguese acronym) created the first electronic Income Tax Return, which was optional. The taxpayer needed to prepare the return in his/her own computer, save the file in an 8-inch floppy disk, and deliver this disk at one of the RFB's office. According to RFB in 1991, only 3% of taxpayers filed the return in an electronic format. In 1997, taxpayers started to have the possibility of sending the return via the internet, and in this particular year, the number of returns received electronically surpassed, for the first time, the returns filed on paper. As of 2010, 100% of the Individual Income Tax Returns have been filed electronically, with no longer possibility of filing on paper.

In relation to individual taxpayers, RFB receives information from various sources, which allows RFB to cross-check electronically, in a system called "Malha Fina" ("thin mesh"), the information provided by taxpayers. The sources of information include:

- a) *Electronic tax invoicing system*: there is the inclusion of information of the taxpayer's number of purchases of any products or services, so the authorities receive information on how much each taxpayer spends on such purchases;
- b) *E-financeira system*: financial information supplied by banks and other financial institutions about the balances of financial investments and bank accounts, as well as amounts transited through bank accounts. This system is also the base for information exchanged under CRS and FATCA;
- c) *Credit Cards*: companies that operate credit card payment means must inform the RFB on individual taxpayers that spend more than BRL 5,000 per month, and corporate taxpayers that spend more than BRL 10,000 per month;
- d) *Real estate transactions*: real estate registry notaries, real estate brokers, construction companies, developers, etc., must inform the RFB all transactions performed with individual or corporate taxpayers involving real estate properties;
- e) *Health expenditures*: as medical expenses are fully deductible, the RFB receives information from doctors, dentists, healthcare insurance companies, hospitals and clinics about expenses incurred by individual taxpayers with their health;
- f) *Withholding tax*: companies must inform the RFB about all the amounts paid to individuals for any reason, and the amounts of withholding income tax collected;

- g) *Automatic exchange of information:* since 2015, Brazil has received information from the US under the FATCA program, and since 2018, Brazil began to exchange information under CRS.

Besides, since the year 2014, the RFB makes available to individuals, in an encrypted portal, the so-called “prefilled tax return”, in which the RFB makes available the forms almost ready to be filed, containing information that the RFB received from these various sources:

In 2014, the RFB offered a new tool to taxpayers. It is a file containing information sent by employers and information already available on the RFB database related to income, deductions, assets, rights, debts and liabilities. It is the prefilled e-File, available for download on the Virtual Taxpayer Service Center (e-CAC), designed for taxpayers with a digital certificate or for tax intermediaries with an electronic power of attorney. The file should be imported into the Tax Return Generator Program. (Receita Federal do Brasil, 2014, p. 17)

Since 2013, taxpayers may also fill in and file income tax returns through an application (app) made available for both Android and iOS mobile devices. Also, the RFB launched other apps to help taxpayers comply with their tax obligations, such as the “Carnê-Leão” App (an app to help taxpayers control and pay monthly self-assessed individual income tax, in case of income is received from other individuals or from foreign sources) and the “Viajantes” app, created to help residents and visitors to electronically declare goods, cash exceeding BRL 10,000, and other valuable assets upon their entry into or departure from Brazil. As a general rule, travelers have quotas of importation free of charge, and the excess is subject to a flat 50% import tax. A cash declaration is also mandatory for both resident and non-resident travelers.

So much technology has worked in favor of the tax authorities, but also in favor of taxpayers, through an online portal called E-CAC (Electronic Center of Assistance to Taxpayers). In such a portal, individual taxpayers find a number of services and functions that reduced significantly the situations in which any of them need to go to an RFB office. To better illustrate, please see below the initial page of the portal, accessible by digital certificate.

Figure 6.2-2 Initial page of the e-CAC portal

Receita Federal

eCAC
CENTRO VIRTUAL DE ATENDIMENTO

Para cadastrar um procurador, o contribuinte pode utilizar:

- a opção "Procuração Eletrônica", disponível no Portal e-CAC (o contribuinte e seu procurador precisam ter certificado digital);
- a opção "Solicitação de Procuração para a Receita Federal", disponível fora do Portal e-CAC (apenas o procurador precisa ter certificado digital).

ATENÇÃO:
As informações contidas nos sistemas informatizados da Administração Pública estão protegidas por sigilo. Todo acesso é monitorado e controlado. Ao dar continuidade à navegação neste serviço o usuário declara-se ciente das responsabilidades penais, civis e administrativas descritas na Política de Privacidade e Uso

CÓDIGO DE ACESSO

CPF/CNPJ

CÓDIGO DE ACESSO

SENHA

Avançar

Saiba como gerar o código de acesso

CERTIFICADO DIGITAL

Se você já possui certificado digital, clique na imagem abaixo




Saiba mais sobre Certificado Digital

Source: Website of the electronic center of assistance to taxpayers. e-CAC: Receita Federal do Brasil, 2020. Retrieved January 27, 2020, from <https://cav.receita.fazenda.gov.br/autenticacao/login>. Copyright 2020 by Receita Federal do Brasil.

The main areas of this portal are (a) taxpayer basic information ("Cadastro"); (b) tax clearance certificate and tax situation ("Certidão e situação fiscal"); (c) collection and inspection ("Cobrança e Fiscalização"); (d) returns and reports ("Declarações e demonstrativos"); (e) debts enrolled in the Federal List of Tax Debts ("Dívida Ativa da União"); (f) legislation and administrative processes ("Legislação e processos"); (g) payments and instalment programs ("Pagamentos e parcelamentos"); (h) Refund and offset ("Restituição e compensação"); (i) passwords and powers of attorney ("Senhas e Procurações"); and, (j) others ("Outros", which include scheduling visits to an RFB office, services available via chat, mailbox, etc.).

In (a) taxpayer basic information, it is possible to update taxpayer information such as address and e-mail, to make sure that the authorities have accurate contact information. Under (b), it provides for serves for taxpayers to consult if there are any outstanding tax debts, or if their situation is fully compliant. If so, they can request and issue electronically a tax clearance certificate, attesting to their tax compliant status. At (c), taxpayers may find copies of notices of tax assessments or ongoing tax inspections.

Item (d) above contains information on tax returns filed in the last 10 years (even though the statute of limitation is 5 years), including copies of such returns in PDF format, or editable files in case the taxpayer wants to amend any of the information provided. In relation to the latest filed tax return, there is information on whether there is any pending or inconsistent information, or if the tax return was fully processed, which means that, electronically, RFB computers did not find any inconsistencies or errors. The fact of someone having the tax return fully processed does not impede the RFB from inspection and requesting additional information. During the statute of limitation period, the authorities have the right to request information on any income, gain or expense reported by taxpayers.

Sector (i) provides information on taxpayer's outstanding tax debts, which may be taxes declared and unpaid, or taxes resulting from a tax assessment with final administrative decision favorable to RFB. The enrolment of a tax debt in the Federal List of Tax Debts implies acknowledging certainty of the debt and increasing it by 20% due to the inclusion of Federal Attorneys' fees. After this enrolment, Federal Attorneys may start a tax foreclosure lawsuit at any time, aiming at obtaining payment of the corresponding debt, or blocking assets equivalent to the amount under dispute. If the taxpayer disagrees, the taxpayer may defend him/herself in court, explaining the reasons why he/she does not owe the amounts under discussion. In case of a final decision in this lawsuit against taxpayer, he/she can pay the debt, or the authorities may request foreclosure and auction of the assets to liquidate the tax debt.

On (f), taxpayers may find information on current legislation about use of electronic certificates and electronic services, and information on ongoing administrative tax processes (i.e., disputes initiated by tax assessments or denial of refund or offset requests), on power of attorneys granted and received to access processes, on notices related to these processes, and a page to file various requests related to tax collection, importation of goods, refunds, tax benefits, rectification of tax collection, etc. Taxpayers can also file documents within existing administrative tax processes in this part of the Portal E-CAC.

Section (g) pertains to information about taxes paid and installment programs in process, as well as permit the request of new installment programs. Depending on the tax and on the specific situation, taxpayers request authorization to pay outstanding tax debts in up to 60 monthly installments, including monthly interest based on the official federal interest rate called "SELIC".

Section (h) contains information on refund requests in process and allows taxpayers to present new refund requests. The electronic system to obtain tax refunds or to use tax credits to offset tax debts is called PER-DCOMP ("Electronic Request of Refund – Electronic Declaration of Offsetting" – "Pedido Eletrônico de Restituição ou Ressarcimento – Declaração Eletrônica de Compensação"). Whenever a taxpayer identifies that he/she paid federal taxes in excess or undue, he/she can file an electronic request of refund for RFB's system to acknowledge such tax credit. With this first filing, the taxpayer can either wait for the actual refund in cash or can use the tax credit to offset other federal taxes due, using the electronic declaration of offsetting. If the authorities disagree, then they issue a notice rejecting the request, and the taxpayer has the right to present his/her defense on the grounds to support his/her request, initiating an administrative process.

Part (i) of the portal allows any taxpayer to appoint attorneys-in-fact for a specific purpose (for example, for a specific administrative process), or with different levels of authority, including power to act in full on behalf of the taxpayer. This attorney-in-fact needs to access the portal with his/her own digital certificate, and after logging in, he/she changes the access profile to the one belonging to the power of attorney grantor.

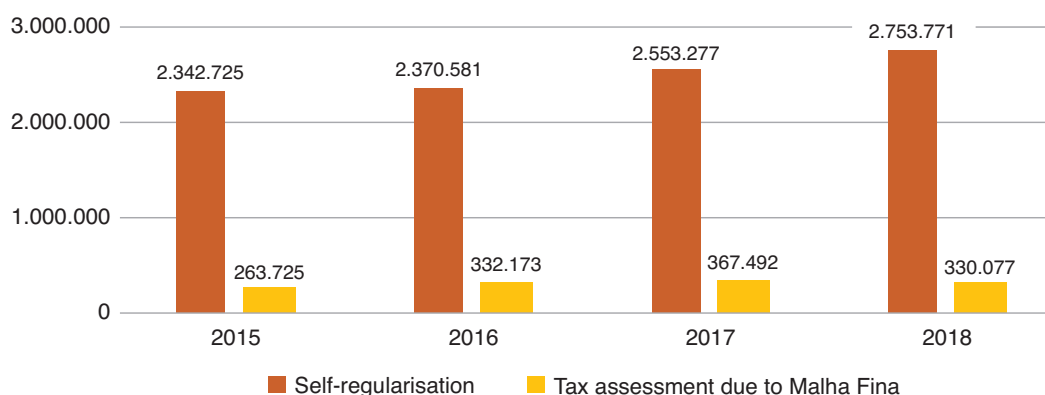
Before the creation of E-CAC portal, for a taxpayer to access any of the information contained therein, or any of the requests, it was necessary to visit one of the RFB offices. Nowadays, visiting

RFB offices only occurs if the taxpayer cannot solve his/her problem or request via E-CAC, which is rare; or, if the taxpayer needs to present documents to a tax inspector that was requested to certify the accuracy of information presented in tax returns. Otherwise, personal assistance for taxpayers is no longer necessary.

In addition, the E-CAC portal allows taxpayers to correct errors beforehand, as taxpayers can consult inconsistencies or errors found by the Malha Fina system. As an example, if John Doe reports income of BRL 150,000 and his employer informs payments of BRL 155,000, it is likely that this difference resulted from error when John was entering the income amount in the tax return form. So, when John access E-CAC, he will be able to see that there is an inconsistency in his tax return, identify such inconsistency and correct it before any tax infraction notice.

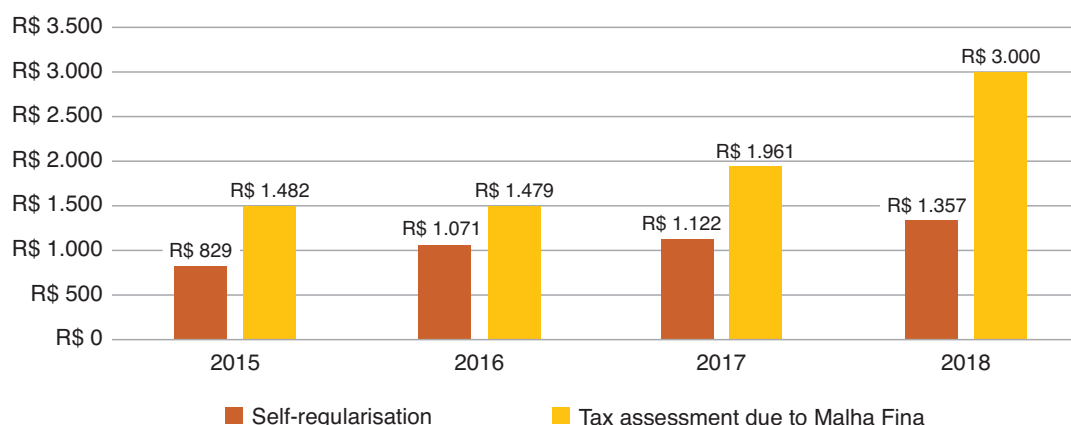
RFB informed, in their 2019 Annual Inspection Plan, that in 2018, most cases of inconsistencies or errors identified by the Malha Fina system resulted in self-correction (“autorregularização”), without the necessity of imposing tax assessments (“autuações”), as follows (Receita Federal do Brasil, 2019, p. 19):

Chart 6.2-1 Self-corrections and assessments – quantity, by year



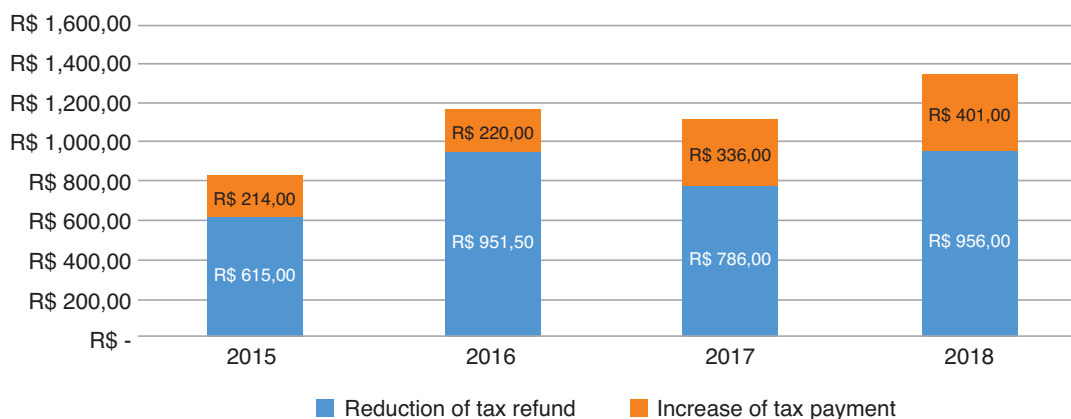
Source: Self-regularization and Tax Assessments. From “Plano Anual da Fiscalização da Secretaria da Receita Federal do Brasil para o ano-calendário de 2019,” by Receita Federal do Brasil, 2019, p. 19. Copyright 2019 by Receita Federal do Brasil

Even though the number of taxpayers that decide to self-correct is greater than those who wait for tax assessments, in terms of amounts involved, the situation is exactly the opposite, as shown in the chart below (Receita Federal do Brasil, 2019, p. 19):

Chart 6.2-2 Self-corrections and assessments – value, by year

Source: Self-regularization and Tax Assessments. From “Plano Anual da Fiscalização da Secretaria da Receita Federal do Brasil para o ano-calendário de 2019,” by Receita Federal do Brasil, 2019, p. 19. Copyright 2019 by Receita Federal do Brasil

In this 2019 Annual Inspection Plan, RFB observes that self-correction is good for taxpayers, but it is also good for the Government, who recovered BRL 1.36 billion (approximately USD 350 millions) with self-correction, with BRL 956MM of reduction of requested refunds, and BRL 401 millions corresponded to additional income tax paid. The chart below shows the evolution of this recovery (Receita Federal do Brasil, 2019, p. 20):

Chart 6.2-3 Self-correction results – value, by year

Source: Result of self-regularization. From “Plano Anual da Fiscalização da Secretaria da Receita Federal do Brasil para o ano-calendário de 2019,” by Receita Federal do Brasil, 2019, p. 20. Copyright 2019 by Receita Federal do Brasil

Thus, the E-CAC portal served to reduce lines of taxpayers in RFB’s offices, since most of the services required by individual taxpayers may be requested electronically. It also contributed with transparency, as taxpayers can verify any errors or inconsistency before tax assessments; and contributed with reduction of litigation to the extent that this transparency induce taxpayers to self-correct before any action of the authorities.

In terms of ancillary obligations, RFB has done everything possible to make life of individual taxpayers easier, including an app to prepare and file tax returns. Even though the Brazilian tax return is detailed – in addition to information on income and expenses, there is a comprehensive and detailed statement of assets – the programs are user-friendly, in such a way that, in most cases, it is not difficult for taxpayers themselves prepare and file the return.

Most taxpayers only request assistance of accountants or tax practitioners in relation to their tax returns if they have more complex situations, such as agribusinesses, foreign sourced income and/or assets, trade of stock and other financial income, sale of business or company, etc.

In relation to the tax burden, currently, Individual Income Tax rates are progressive, up to 27.5%. For capital gains, a different progressive table applies, with rates varying from 15% to 22.5%, depending on the amount of gains. Financial income is subject to income tax withholding, varying from 15% to 22.5%, depending on the term of investment (except in case of variable yield investments that are subject to 15%).

6.2.2. Corporate Taxpayers and digitalization of tax obligations

The Brazilian tax system is probably one of the most complexes in the world. The Doing Business (2018) publication, mentions Brazil is the country where corporate taxpayers take more time to comply with tax obligations; while the average hours spent per year in Latin America & Caribbean for such purposes correspond to 317.1 hours per year, in Brazil the time spent corresponds to 1,501 hours per year – almost 5 times more. Bolivia is in second place, with 1,025 hours per year, i.e. practically 32% less time spent than Brazil. This complexity had already been greater. Until 3 years ago, the total hours per year used to be 2,600. Thus, there has been a reduction of 42% in total time spent in relation to prior years. But why so complex?

Complexity of Brazilian corporate taxes results from, among other factors, (i) large number of taxes that companies are subject to; (ii) large number of ancillary obligations to comply with; (iii) Federal, State and Municipal laws and different types of regulations (decrees, normative instructions, official tax opinions, regulations, etc.) to be observed; (iv) wording of laws and regulations that allow different interpretations; (v) high level of tax disputes; etc.

Corporate taxpayers pay the following taxes at the Federal level, depending on type of businesses developed: (a) 2 social contributions on total revenues (PIS and COFINS); (b) federal excise tax (IPI); (c) contributions on payroll (INSS); and, (d) 2 corporate income taxes (IRPJ and CSLL). Companies may need to pay other taxes depending on the transactions performed, such as tax on credit transactions (IOF/Credit), tax on foreign exchange transactions (IOF/FX), or special contribution on services and royalties (CIDE/Royalties).

At the State level, companies are mainly subject to ICMS, which is state value-added tax, administered by each of the 26 States and by the Federal District, totaling 27 similar, but different ICMS legislations, with impacts on transactions involving more than one State. Even though there is a national guidance to ICMS – Supplementary Law no. 87, as amended – the States must have their own ICMS laws.

At the Municipal level, companies are mainly subject to municipal service tax (ISS). Like ICMS, there is a national guidance, Supplementary Law no. 116, but each Municipality must have its own ISS legislation. Oftentimes, the law of a certain city contradicts the rules of another city, which may cause double ISS taxation on services involving a service provider located in one municipality, and a client in another municipality.

Corporations have been dealing with digital tax obligations for a long time. Since 1997, companies file their Income Tax Returns electronically. At the Federal level, they need to comply with a number of other filings, which have been electronic as well for more than 20 years. At the State and Municipal levels, other filings apply, and all are electronic as well.

A big milestone was the creation of the SPED system – “Sistema Público de Escrituração Digital” (“Public Digital Bookkeeping System”) – in 2007, implemented in phases along the years; there are new developments every year. SPED is a powerful system that combines information useful for authorities in Federal, State and Municipal levels. The RFB presents the SPED as follows:

Created by Decree no. 3,022, of January 22, 2007, the Public System of Digital Bookkeeping (Sped) is part of the Growth Acceleration Program of the Federal Government (PAC 2007-2010) and is another advance in digitalization of tax authorities and taxpayer relationship.

- In general terms, [Sped] consists in the modernization of systems to comply with ancillary obligations, filed by taxpayers to tax administrations and supervising boards, using digital certification to sign electronic documents, thus assuring their legal validity in digital format.
- [Sped] Started with three big projects: Digital Accounting Registration, Digital Tax Registration and NF-e [Electronic tax invoicing] – National Environment.
- [Sped] Represents an integrated initiative of tax administrations of the three governmental spheres: federal, state and municipal.
- [Sped] Developed partnership with 20 institutions, among public bodies, professional councils, associations and civil entities, in joint construction of the project.
- Signature of Cooperation Protocols with 27 private sector companies, participants in a pilot project, aiming at developing and organizing joint work.
- [Sped] Permits partnerships of tax authorities-companies, planning and identifying solutions to comply with ancillary obligations, in view of requirements imposed by tax administrations.
- [Sped] Makes effective the participation of taxpayers in defining means of complying with ancillary tax obligations required by tax legislation, contributing to improve these mechanisms and giving these instruments a greater degree of social legitimacy.
- [Sped] Establishes a new type of relationship, based on mutual transparency, with positive outcomes for the whole society. (Receita Federal do Brasil, 2020)

Various parts (called “modules”) form the Sped system, and each taxpayer needs to verify which of them apply to its activities. The main modules that are currently in place are:

- a) Electronic tax invoicing (NF-e and NFC-e for goods; NFS-e for services in general; CT-e and MDF-e for transportation services);
- b) ECD - digital accounting registration;
- c) EFD Contribuições – calculation of PIS/COFINS;
- d) EFD ICMS IPI – calculation of ICMS and IPI;
- e) eSocial – registration system of employees and of calculation of social contributions on payroll (INSS);
- f) ECF – digital accounting and tax registration (replacement of Income Tax Return);
- g) EFD-Reinf – digital registration of withholding taxes and other tax information; and,
- h) e-Financeira – financial information of taxpayers supplied by financial institutions to RFB, which serves, as mentioned before, as base to exchange information under CRS and FATCA.

Depending on the module, taxpayers may provide RFB with information on monthly, quarterly, semi-annually or annually. For example, since 2009, companies must send on a monthly basis their accounting registrations under the ECD module. Companies must also supply, on a monthly basis, information under EFD-Contribuições and EFD-ICMS. ECF is an annual obligation, while e-Financeira is semi-annual.

The process for Sped to reach the point that it is today was not easy, as companies needed to adapt their systems to be able to comply with their tax obligations. On the other hand, RFB worked in collaboration with representatives of taxpayers and information technology (IT) companies to set up the systems, listening to their concerns, their possibilities and limitations, etc. This collaboration occurred in each new module that RFB implemented in Sped.

Opening space to listen to taxpayers’ concerns and limitations was positive in Sped development, taking into account that, while digitalization of tax obligations creates more dynamism and effectiveness in supplying and processing information obtained from taxpayers, of course that there are implementation costs that companies have to support, since this implementation requires assistance of IT companies to develop new systems or to adapt existing systems to RFB’s requirements. Once implemented, the systems to comply with ancillary tax obligations demand maintenance costs, which, in general, are much less expensive than implementation costs.

In relation to modules that involve states and municipalities, as the case of electronic tax invoicing and EFD-ICMS IPI, the collaboration was even broader; in addition to taxpayers, RFB worked closely with representatives of several states and municipalities.

For years, even with implementation of Sped, RFB continued to require companies to provide information in other digital formats, as it was the case of DACON – Declaration of Social Contributions, and DIPI – Declaration of IPI, in such a way that corporate taxpayers needed to provide RFB with the same information again and again. To the extent that Sped system proved to be viable and reliable, along the years RFB decided to concentrate information supply through Sped, discharging the obligation of some other Declarations.

One evidence that this discharge had positive impacts for companies is that, as of 2016, instead of demanding 2,600 hours per year to comply with tax obligations, companies started to use, on average, 1,501, as shown The Doing Business (2018) publication.

With so much technology and information in place, RFB can better monitor the performance of Brazilian companies in terms of operational activities, tax collection, and it can also establish strategies to inspect the companies. Besides, RFB can identify, practically in real time, errors and inconsistencies in taxpayers' information. RFB explained as follows:

10. Monitoring of RFB's largest taxpayers

In addition to focusing on combating significant mechanisms of evasion, the RFB Undersecretary of Inspection is responsible for monitoring the behavior of their largest taxpayers, those with greater economic capacity and, due to this large economic potential, exercise significant influence in levels of federal collection.

Thus, taking into consideration the principle of efficiency of the public administration, such taxpayers are subject to constant monitoring, through actions based on internal and external information, aiming at inducing them to actually pay their taxes, in accordance with national tax legislation.

To ensure the objective of providing the State with funds, the activity of monitoring different taxpayer segments is structured with the following focuses: monitoring of collection; analysis of potential distortions; analysis of sectors; and, analysis of economic groups. (Receita Federal do Brasil, 2019, p. 15)

In addition to the Sped system, RFB makes available to corporate taxpayers the E-CAC Portal - the same one applicable to individual taxpayers, but with different options in view of the specifics of corporate taxation.

In E-CAC, taxpayers have access to a significant amount of information about their compliance status (taxes paid, outstanding tax debts, payment in instalment programs, compliance with ancillary obligations, etc.), ongoing inspections, and administrative processes in course (it being possible to file defenses, documents, evidences, etc.). In addition, corporate taxpayers may file requests for refunds, offsets, payment of instalments, tax clearance certificates, formal consultations, etc. So,

Portal E-CAC allows RFB to provide a significant number of services to taxpayers electronically, without the necessity of physically visiting an RFB office.

In the past – until few years ago – most of the requests needed to be presented on paper at one of the physical offices of RFB. This necessity of going to RFB's office used to be time consuming for taxpayers and burdensome to RFB, who needed to have many more tax auditors in taxpayers' services offices. The online E-CAC portal improves transparency of information from RFB to taxpayers as they have online access to all information that RFB has on them.

Currently, visits to RFB offices only occur in situations that cannot be solved electronically, and it is possible to schedule online the date and time of a visit. The online services facilitate much of taxpayers' lives in relation to day-to-day requests, such as refunds, offsets, tax clearance certificates, etc.

Online tax systems also improved tax compliance. Before the implementation of electronic tax invoicing, it was necessary to issue tax invoices manually – meaning handwritten or printed. The control of issued tax invoices was far much more difficult, since it used to require the authorities to compare physical tax invoices with the amounts declared by taxpayers.

So, before electronic tax invoicing, taxpayers used to adopt different strategies to evade taxes. This was done by omitting or artificially reducing revenues and sales, such as: (a) lack of issuance of tax invoices and, consequently, underreport of sales revenues; (b) use of the same tax invoice in more than one transaction to artificially reduce the total revenues; (c) as vendors needed to have carbon copies of tax invoices issued, carbon copy showing an amount smaller than the one shown in the original tax invoice delivered to the buyer; (d) and, other illicit strategies.

With improvement of information RFB obtains from various sources about individual and corporate taxpayers, it is possible to perform several cross-checks to identify discrepancies, errors, and other problems, improving significantly the risk for those who insist on evading taxes.

It is fair to say that tax evasion creates many other problems in addition to reduction of tax revenues; it creates incentives to bribery, money laundering schemes, evasion of funds sent abroad, and related crimes. Tax evasion also distorts corporate competitiveness, as the tax evaders can certainly charge lower prices than companies that are duly compliant. So, use of digital means to control taxpayers contribute to the improvement of the market as a whole and avoid distortions resulting from evasion. In its report about 2018 inspections, RFB pointed out that:

Monitoring tax collection consists in analyzing the performance of monthly payments, as well as in chasing potential tax collection of different taxpayer segments.

In 2018, with the objective of identifying signs of tax evasion, [RFB] investigated 1,882 collection distortions by means of assessment of information supplied by taxpayers confronted with information from external sources.

The effort related to this action generated a result of BRL 27.52 billion. In this result, there is inclusion of various means of tax recovery, such as: taxes paid upfront or in instalments; taxes owed due to tax assessments; denial of offsets; and, reactivation of debts sent to priority actions.

The amount of BRL 27.52 billion corresponds to the biggest result obtained by Receita Federal's large taxpayers monitoring area. (Receita Federal do Brasil, 2019, p. 16)

With all ancillary obligations in digital format, RFB has also helped corporate taxpayers to be compliant by sending notifications (prior to any tax assessment) alerting taxpayers about inconsistencies or errors identified via cross-checking and giving taxpayers the opportunity to personally correct this information before starting a tax inspection.

As penalties imposed in tax assessments are high – the general rule is 75%, and in case of tax evasion, 150% – having the opportunity to voluntarily amend ancillary tax obligations and, if necessary, pay taxes due before any tax assessment is important for companies to avoid tax contingencies and/or tax disputes that may easily last 10 years.

Whenever RFB imposes a tax assessment, the taxpayer has 30 days to electronically file its defense, together with documents that evidence the arguments contained therein.

This initial defense, called “Impugnação”, is judged by one of the RFB’s Regional Judgment Office (“DRJ”), in a panel formed by 3 tax inspectors. Normally, one of them is assigned as reporting judge. RFB informs the taxpayer electronically about the result of DRJ analysis.

If DRJ rules unfavorably against the taxpayer, there are additional 30 days for the taxpayer to electronically file an appeal (“Recurso Voluntário”), which will be judged by the Administrative Court of Tax Appeals (“CARF”), by a panel formed by 8 members (4 tax inspectors, and 4 judges appointed by the private sector). In case of a tie, the President of the panel, who is always from RFB, has the preferential vote. Even though all documents, arguments and summaries to this judgment are electronic, the taxpayer’s counsel may appear at the Court to orally present the arguments.

When the decision rendered by this 8-member panel of CARF is contrary to a decision taken by another panel on identical or similar facts, the losing party – either the taxpayer or RFB – has the right to a new appeal, in 15 days, to the CARF’s Superior Chamber of Tax Appeals (“Câmara Superior de Recursos Fiscais”). At this level, a 10-member panel (5 tax inspectors and 5 judges appointed by private sector) judges the case, with a preferential vote for the President of the panel. CARF’s decision is final for RFB, but the taxpayer may start a judicial lawsuit against a tax assessment, requiring the presentation of guarantees or court deposit of the full amount under dispute.

The electronic monitoring of administrative processes is available to taxpayers at the E-CAC portal in a detailed manner, or by means of an iOS or Android app (“E-Processo App”) in a summarized

manner. In the E-CAC portal, the taxpayer is able to grant power of attorney for the lawyers to have full access to the processes and to file petitions and documents.

In relation to tax compliance, the next step that has been under discussion and expected by taxpayers is the creation of cooperative compliance program (called “Pró-Conformidade”). RFB submitted the draft regulations for public consultation in October 2018 and has not issued final regulations yet. In this program, based on several criteria, RFB will perform a risk assessment on corporate taxpayers and create an ABC curve of taxpayers.

Based on such a program, taxpayers with better grades will have advantages in their relationship with RFB, such as more information about tax infractions identified by a tax auditor prior to a formal inspection procedure; priority in taxpayer assistance at RFB’s offices; priority in the analysis of taxpayers’ requests, etc. The implementation of “Pró-Conformidade” program as proposed is only possible due to digitalization of tax obligations, as all necessary information to rate taxpayers is available online.

6.2.3. *Conclusions*

Even though digitalization of tax obligations implies implementation costs for both authorities and taxpayers, with the time, it has proven important for reducing bureaucracy, facilitating taxpayers’ lives, and improving tax authorities’ controls.

From the eyes of taxpayers, the negative aspect of digitalization of tax information is additional costs to implement and maintain the necessary systems – once implemented, systems amendments and updates are part of the normal operation of any company. However, these additional costs may be compared to a bitter medication that one has to drink - nobody likes to drink bitter medications, but it may be necessary for better health.

On the other hand, one may say that benefits surpass the costs, such as: reduction of tax evasion implies a reduction of competitive distortions and better business environment; online tax services reduces bureaucracy, saving a lot of time (and, of course, money) and speeding up responses; cross-check of information may help taxpayers to be alerted about errors or inconsistencies that may result, if not amended, in tax assessments; simplification of tax obligations; and, other benefits.

Digitalization of tax information allows tax authorities to cross-check information in an optimized manner, to improve the combat against tax evasion and tax risk assessment and, eventually, results in an increase of tax revenues, which eventually benefit the whole society.

6.3. *iCare Project: Providing services to the taxpayers in Kenya*

Customer Relationship Management System (CRMS) and Contact Centre Management System (CCMS)

6.3.1. *Background*

The Global trends are shifting, the organization's needs are changing, customer tastes and preferences are also evolving; these result in an ever-changing environment hence calls for the evolution of the overall service delivery framework. The business environment and customer's needs and preferences necessitated the change and alignment of KRA's processes & service delivery to match international best practice. Consequently, the Authority has become a modernized, efficient and effective revenue administration; with an even greater promise as a driving force towards realization of the Vision 2030. The need for an efficient way of managing customer issues/concerns, therefore, cannot be repudiated.

The Authority's 6th corporate plan was geared towards implementation of strategies to address the shortcomings in service delivery to foster a collaborative and inclusive service environment by advancing business processes and systems to a more front facing, customer focused approach. In this regard, there was need to re-engineer processes, re-align structures and implement tools that would integrate Customer Interaction Management thereby offering simplicity, convenience and efficiency in service delivery hence improving Customer Satisfaction Index. In addition, there was need for harmonization of all service points to ensure seamless and consistent service delivery across all points of contact with the taxpayers.

6.3.2. *Definition*

Undoubtedly, the customer/taxpayer needs are ever-changing, leading to the need for an optimal approach as they increasingly expect excellent services pegged on transparency, convenience, ease of compliance, quick turn-around times and conclusive query resolution.

The Frontline (Contact Centre & Service Centers) has become the Authority's critical touch points by providing a platform whereby taxpayers' interaction with KRA empowers them to be compliant through adherence to their tax obligations thereby promoting voluntary compliance that leads to increased revenue streams.

As a single point of contact between the Authority and its various stakeholders with respect to taxpayer service delivery; uptake of services through the Front-Line has resulted in an extension of the functional mandate to information broadcast and narrowcast as well as enhancement of KRA's knowledge base across all tax heads.

With the aforementioned, the Authority embarked on a journey to implement the Customer Relationship Management Solution to enable business to achieve full electronic Customer Service and enhance operational efficiency in service delivery in line with good practice and consequently, generate insights that will allow the authority to connect with individual customers at every touchpoint effectively, and maximizing value with each interaction.

The Project objectives are highlighted below:

- Improve customer satisfaction index.
- Consistency and seamless service delivery across all touch points.
- Provision of a well-coordinated complaint management framework.
- Efficiency in service delivery.
- Service accessibility through self service.

As a result of the implementation of the CRM solution the Authority has achieved the following:

- Reduced turnaround time;
- Centralized Customer Interaction Management;
- Increased access to required information;
- Improved the First Contact Resolution (FCR); and,
- Consolidated Customer Information on a single platform.

Implementation of CRM application led to the realization of the following value addition:

- Reduced cost and compliance effort.
- Catering for the needs of taxpayer in an efficient and effective manner.
- Provide an environment that will lead to continuous innovation improvement and sustainable cross-functional approach.

Improved customer satisfaction as a result of improved service delivery: Compliance Information is readily available on the CRM Customer Portal, which has contributed to a reduction in the cost of compliance. There are several channels through which compliance information is disseminated including targeted campaigns, which are periodically sent to the various taxpayer segments. Taxpayer service expectations are met in an increasingly efficient way as depicted by the improvement in the Customer Satisfaction Index. Further, the CRM solution is deployed in the cloud, a platform that allows continuous innovation and improvement. The iCare project combines CISCO and Oracle products that have been deployed in alignment with the Customer Relationship Management Framework and the Authority's business strategic goals.

It is envisioned that CRM will be fully integrated with internal transactional systems (iTax and iCMS, DWBI and ERP-iSupport) ensuring a cross-functional approach and data exchange between the various systems. This is to provide a holistic view of a taxpayer from a single platform.

6.3.3. *Relevance to the taxpayer*

The implementation of a Customer Relationship Management (CRM) has had a positive impact on Taxpayers in the sense that it has provided a platform through which enquiries, service requests, complaints and compliments can be lodged and tracked from the point of entry into the system to closure. It also provides an end- to-end issue resolution and escalation framework for conclusive issue resolution.

The Customer Satisfaction Index has significantly improved by 6.9 points from 65% to 71.9% in the year 2017/2018. The solution has contributed to 49% of this improvement.

In addition, the Authority has unveiled a diverse number of channels of communication such as voice (telephone), email, chat, customer portal, social media (Facebook, Twitter, YouTube) and self-service options (Web portal and Interactive Voice Response) through which taxpayers (Customers) can communicate and receive immediate feedback from KRA. Of great importance is the assurance that taxpayers' can reach the Authority from any channel of their choice and that their queries or complaints are conclusively resolved within the shortest times possible.

The CRM tool also allows for consolidation of all these channels to enable single view of taxpayers' queries and keeping a record/history of taxpayers' interactions to ensure service excellence.

CRM solution has also enabled fostering trust through facilitation, shifting from minimal relationship with the taxpayers to creating deeper relationship with them through a personalized service.

Consequently, the systems have allowed a "single view" of a taxpayer to some extent regardless of the communication channels they use to interact with the Authority as it offers an Integrated Customer Service Environment that integrates all the touch points thereby ensuring seamless service delivery.

The expected outcomes are; Improve customer satisfaction, lower cost of service and allow access to tax information through the Knowledge Management component.

6.3.4. *Relevance to the tax administration*

Previously, the service delivery channels and processes adopted by the Authority did not adequately support the time-cost value of doing business for both KRA and its customers/taxpayers. The taxpayer experience was that delivery of services was rigorous, time consuming, delayed turn-around-times added to the fact that some processes manifested duplication of roles.

The Customer Relationship Management (CRM) project was anticipated to create a platform of seamless service delivery thereby reducing the cost of compliance for both KRA and taxpayers. This platform was to be utilized to ensure that the Authority sufficiently caters for the needs of taxpayers effectively and efficiently. In addition to providing an environment that will lead to continuous

improvement, sustainable cross-functional approach and knowledge transfer that will enhance sustainability of service provision and delivery.

The CRM project is aligned to ensuring that the Authority can widen the scope of service with the intention of instituting best practices in Customer Service specifically in its core revenue service delivery mechanisms. In essence, improved service delivery is expected to increase customer satisfaction, which translates to supporting taxpayers in voluntarily complying with their tax liabilities and obligations.

With the implementation of the first phase of CRM, the Authority has been able to have personalized interactions with taxpayers thereby creating a positive relationship with taxpayers.

Further, the system has also enabled tracking of Email Campaigns, Customer Behavior and Digital Body Language. The Authority is now able to monitor who opens a certain email campaign, who forwards the same and other actions performed on a particular email by the recipient. These insights have enabled the Authority to send out targeted campaigns to taxpayers.

The Social Relationship Module on the hand allows social listening and sentiment analysis of the social media platforms (Facebook, Twitter and YouTube) which goes a long way in enriching Social Media engagement with Taxpayers. In addition, the System has a feedback mechanism, which enables the Authority to obtain and incorporate taxpayer feedback during decision-making. Taxpayer feedback informs the Authority on areas of improvement and/or prioritization.

This initiative has put KRA ahead of its peers in the region and among Kenyan Government agencies by being the first agency to invest in such a system, which has seen KRA receive recognition and win two global awards (Super Nova and Markie awards).

6.3.5. Strategic business alignment

The strategic business alignment is an intense hands-on business redesign approach that has facilitated the alignment of the CRM's strategic goal to the business model and processes, organizational culture with the Authority's key business purpose and core values.

iCare Project focuses on the following areas of alignment with redesigned service delivery model:

- Customer intimacy.
- Operational excellence.
- Service excellence.
- Technology optimization.

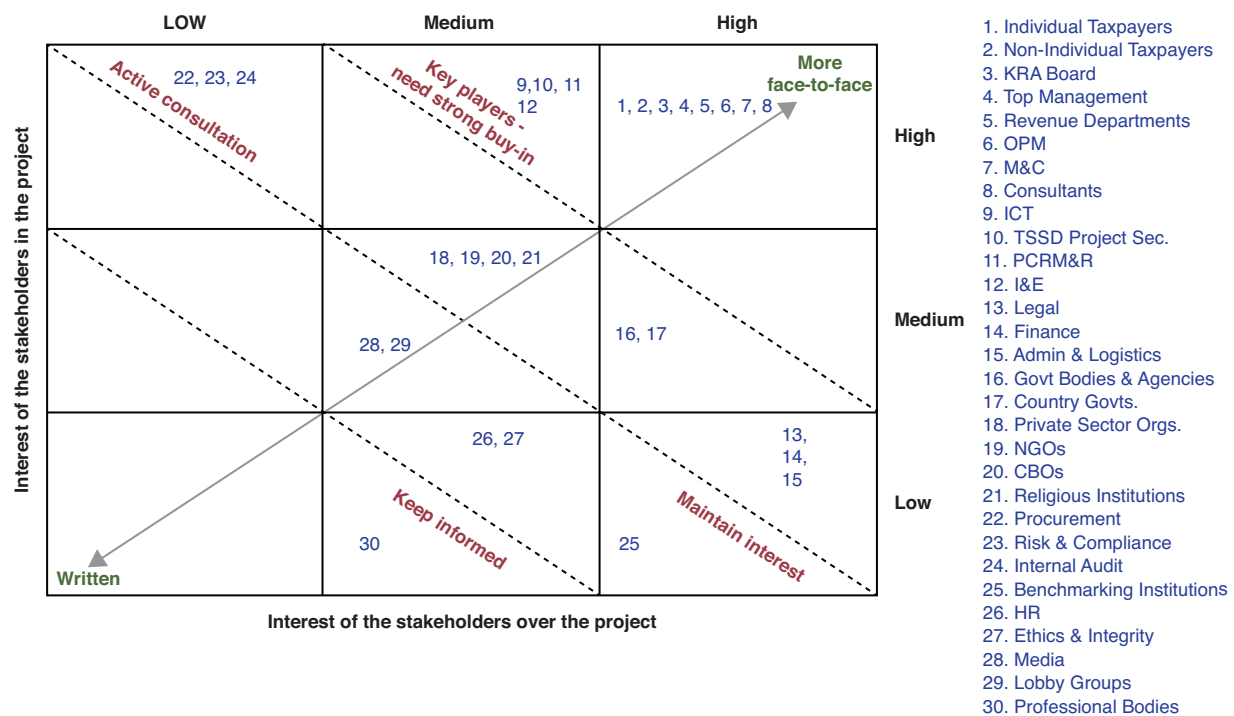
The iCare project is aligned:

- To ensure quality stakeholder experience through operational excellence that will augment the Authority's reputation in regard to best practices in service delivery.
- To implement a learning platform that supports better decision making in creating viable solutions that meet customer/stakeholder needs.
- To establish a multi-service platform that provides a quick resolution and quality response mechanism leading to increased uptake of services and customer satisfaction.

6.3.6. iCare project stakeholder assessment matrix

Stakeholder identification and analysis has been key in driving the stakeholder communication and engagement plan.

Figure 6.3-1 Stakeholder Matrix



Source: Prepared by the author

6.3.7. Legal/administrative requirements

The CRM solution is expected to be used within the confines of the stipulated Acts/laws that the Authority operates under. In addition to the tax laws and by CRM Solution containing taxpayer

data (Customer Database), it is also governed by the prevailing data protection laws such as the Kenya Data Protection Act and the EU General Data Protection Regulations (GDPR).

“The GDPR broadly applies to any Company, whether based both inside or outside of the EU, that collects and handles personal data from EU-based individuals” (Oracle, 2017). KRA falls under the category of an institution outside EU, which handle EU-based individuals’ data. The Authority being cognizant of the requirements that may be of particular relevance as far as cloud computing is concerned, such as Managing personal data, rectifying and erasing personal data.

The CRM solution is packaged with a set of built-in privacy and security features that enables the Authority to be in control of the taxpayers’ personal data.

6.3.8. Technological best practices

Kenya Revenue Authority (KRA) embraced cloud computing by deploying a cloud solution. CRM is a subscription-based solution hosted in the cloud. Management of this solution is therefore not resource intensive since there’s no direct active management by the user organization. Benefits of hosting CRM on the cloud are scalability; accessibility, flexibility, efficiency and strategic value.

Figure 6.3-2 CRM & CCM areas design



Source: Pictures from the Kenya Revenue Authority offices (adapted)

Notes

48. A style of clear and concise language to describe government formalities, services and processes focusing on access and use of information, reducing references too technical or instructions to regulations direct consultation.
49. See section on electronic tax domicile in this book.
50. For more information, see: <https://www.cmo.com.au/article/648607/going-beyond-chatbots-avatars-next-stage-ai-cx/>.
51. “Orchestration” is the automated setting, coordination and management of information and software systems (Wikipedia).

52. For more information, see: <https://www.youtube.com/watch?v=1t7shuGoNL8>
53. For more information, see: <https://www.nemid.nu/dk-en/>

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7. INVOICES AND ELECTRONIC DOCUMENTS

7.1. Electronic Invoice in Latin America

This chapter presents a series of comments on strategies that have been used for several countries to adopt electronic invoicing.

It does not cover a single country experience, and some ideas are even extrapolated from various testimonies, building new concepts from different experiences in several countries.

Latin America (LA), largely recognized as the world leader region on electronic invoice, is presented as an example for several aspects.

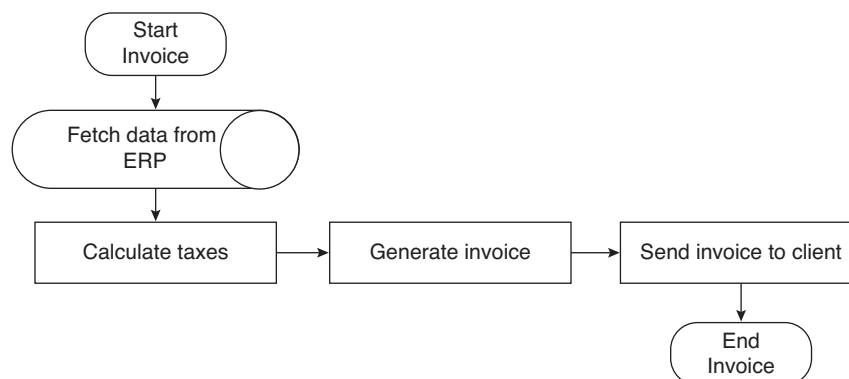
7.1.1. e-Invoicing and e-Reporting

CIAT uses the expression “electronic invoice” (or e-Invoice) to describe a structured electronic document which supports a commercial transaction.

Although invoice-relevant data can be exchanged using the same technological solutions, and following the same schemes and models, it is useful to distinguish between (i) e-Reporting to tax authorities and (ii) e-Invoicing.

Figure 7.1-1 shows a simplified process of invoicing.

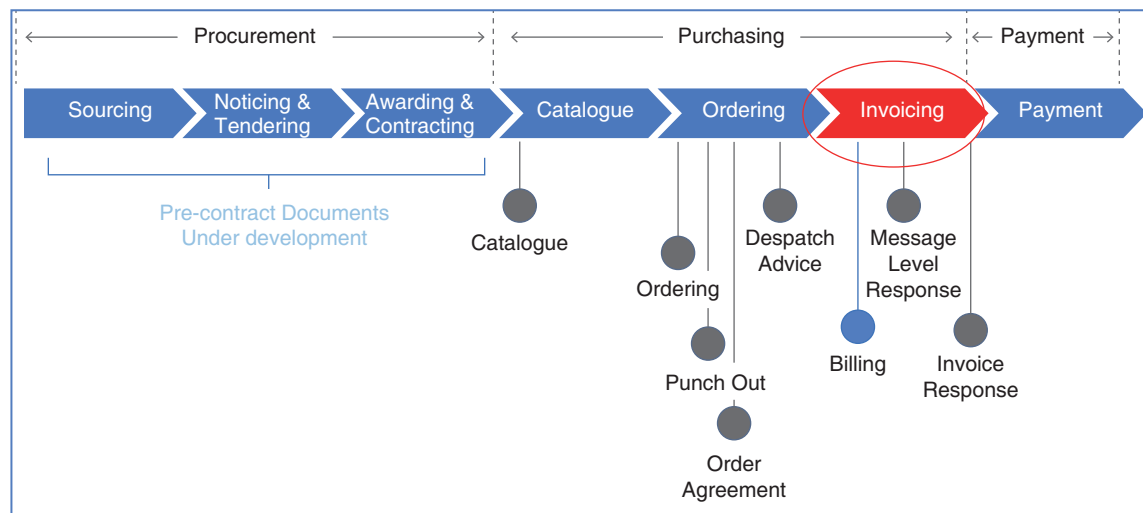
Figure 7.1-1 Simplified Process of Issuing an Invoice



Source: Adapted by the author from Freitas, 2019

A more realistic invoicing process can be seen in [Figure 7.1-2](#).

Figure 7.1-2 Example of an Invoicing Process



Source: Adapted from TAY, Robert. Nationwide e-Invoicing Initiative

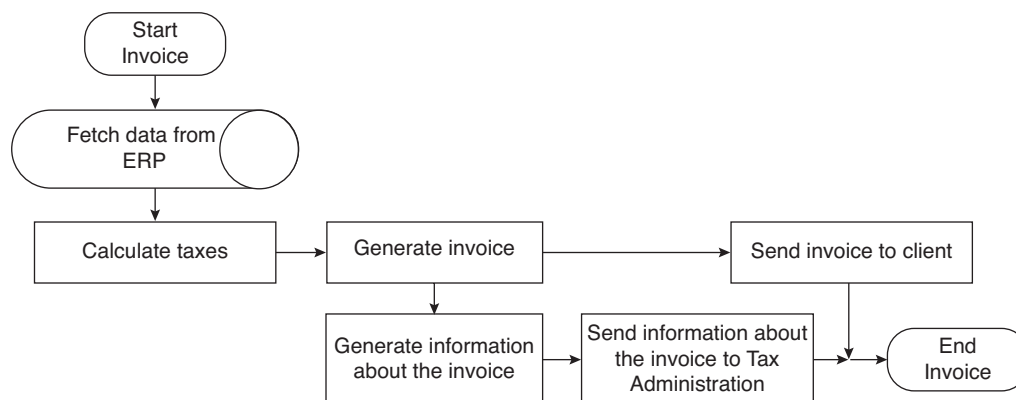
e-reporting

e-Reporting to tax authorities, or electronic information about invoices, include reports of business transactions, extracts of invoices, declarations of any other fiscal data, and Value Added Tax (VAT) records. It is designed to speed up processing of VAT statements and returns.

In the e-reporting strategy, that can be viewed in a simplified flow on [Figure 7.1-3](#), only the supplier has an electronic invoice, and can choose to send to the buyer either the original e-invoice, an extract of it, or its representation in paper form.

An alternative scenario, where the parties exchange just an extract of the invoice electronically is also suitable for tax reporting and audit purposes.

Figure 7.1-3 e-Reporting, Simplified View

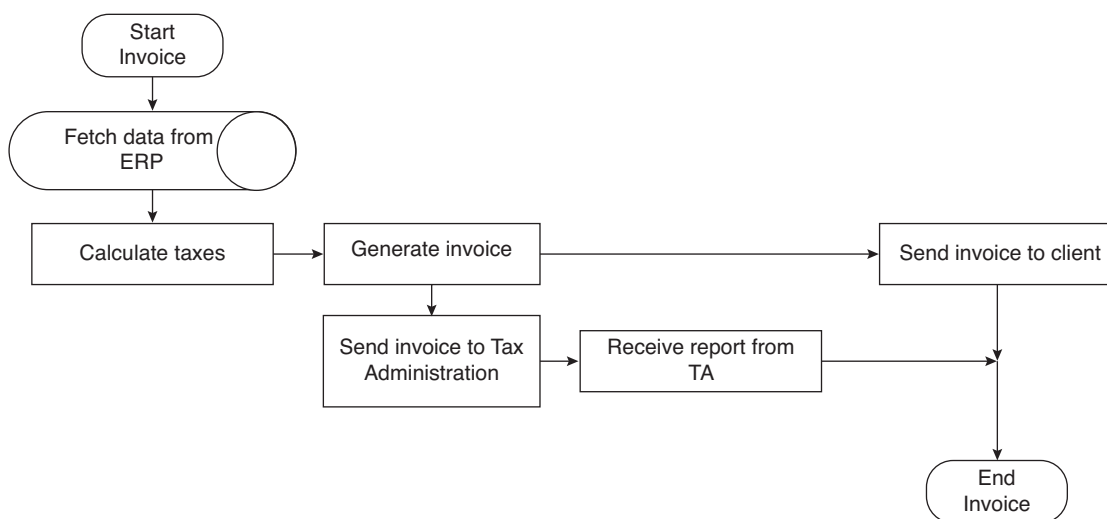


Source: Adapted by the author from Freitas, 2019

e-Invoicing

In e-Invoicing the three actors: issuer, buyer, and tax administration, share the same electronic document that supports the operation, and which is, for all commercial, financial, tax and juridical purposes, THE invoice, containing the full information about the operation. These invoices may consist of one single document, or several documents, one of which contains all the core information relevant for tax purposes, with separate extensions that are more relevant to suppliers and buyers.

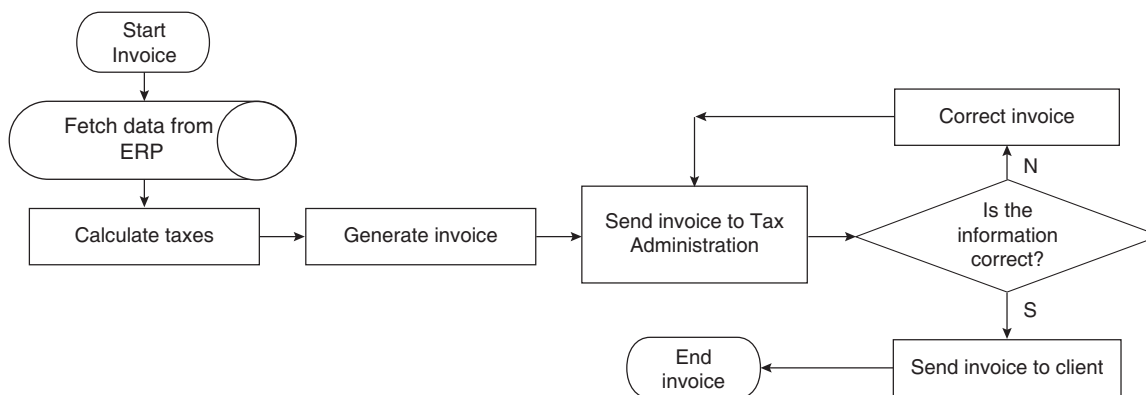
Figure 7.1-4 e-Invoicing in the Post-Audit Model, Simplified View



Source: Adapted by the author from Freitas, 2019

Figure 7.1-4 illustrates e-Invoicing in the post-audit model, and *Figure 7.1-5* presents e-Invoicing in the clearance model.

Figure 7.1-5 e-Invoicing in the Clearance Model, Simplified View



Source: Adapted by the author from Freitas, 2019

Some Different Uses of the Expressions

Mainly in Asian publications, e-Reporting from cash registers and virtual printers to tax authorities is often translated into English using the term “e-Invoicing”; according to the previous exposition, and the proposed definitions, it would be better translated as “e-reporting”.

The same can be said of some Latin American publications, which classify periodically transmitting the full contents of all the invoices issued by a taxpayer, without any kind of validation of the contents of those invoices (normally invoices of communication services and electric bills), as “e-Invoicing”. Also, according to the previous exposition, and the proposed definitions, it would be better classified as “e-reporting”.

Electronic Fiscal Registers

A cash register is a mechanical or electronic device for registering and calculating transactions at a point of sale (POS), normally attached both to a drawer, for storing cash and other valuables, and to a printer, for printing out receipts or invoices.

The first cash registers date back to the late XIX century and were created to help business owners not only to keep track of daily sales, but also to better control employees’ activities – and that control purpose keeps its importance to the companies nowadays.

In the second half of the 20th century tax administrations started to rule out the use of special cash registers, or, more specifically, the printers attached to cash registers, to better monitor POS registers for tax control purposes, forming what is now known as *Fiscal Registers*, *Fiscal Printers* or *Fiscal Machines*.

Those regulations usually specify a device called *Fiscal Memory*, where each and every sale is registered in a way that cannot be erased, and accessible to the tax administration for tax control purposes.

In some countries, tax administrations went further ahead and, besides ruling this kind of equipment, also test them and only allow taxpayers to use models certified by the tax administration, tracking down the serial numbers of those equipment, who sells, who buys, who use, and who gives maintenance to them, and when, and where.

- **Fiscal Registers and e-Reporting:** in the beginning of the 21st century new technology allowed fiscal registers to automatically send information to a tax administration,⁵⁴ simplifying the tax administration’s task for controlling them, as, from that moment on, depending on the tax administration’s strategy, either the daily resume of sales (commonly known as *Z lecture*), or the total of each sale, or, even, all items of every sale, are sent to the tax administration in an automatic way, that cannot be disabled by the taxpayer.⁵⁵

- **Fiscal Registers and e-Invoicing:** there are more advanced models (obviously, quite more expensive) capable of generating, digitally signing and transmitting not only excerpts of the information about POS operations, but a full electronic invoice to the tax administration in an online model, managing automatic contingency strategies for possible periods where communications are down, still keeping the information used to generate the electronic invoice on its fiscal memory.

Most recently, after 2010, in some countries where electronic invoice use has already reached maturity,⁵⁶ tax administrations have decided to cease the obligation of the use of fiscal registers whatsoever, since those tax administrations already have information about all the purchases of retail stores, and for the country is much less expensive to use only electronic invoice, even on B2C operations, than the potential increase on revenue result for using expensive cash registers capable of transmitting every detail of every sale, or even electronic invoices, automatically to the tax administration.

As it was to be expected, those countries had ruled first voluntary replacement of fiscal registers by electronic invoices, with a strategy such as in some years, as those registers are becoming obsolete, or fail altogether, total replacement by electronic invoice.

7.1.2. *Why e-Invoicing? Expectations from a National e-Invoicing Program*

There are different and multiple drivers that lead to the adoption of e-Invoicing, depending on the perspective of the various stakeholders involved.

Latin American e-Invoicing programs were basically put in motion by tax administrations, with the objective of enhancing tax compliance, whilst on the other hand, the European Union⁵⁷ (EU), due to the restriction present in the Directive 2010/45,⁵⁸ for the same objective had chosen the path of e-Reporting.

The following items describe the expectations applicable to a national e-Invoicing system, driven by the tax administration. In the end of this section there are regarding these expectations and the adoption of e-Reporting using Fiscal Registers.

Society's Perspective

e-Invoicing is a reality that is independent of uses restricted to tax purposes, and a society can expect the following benefits:

- Reduction of paper consumption: the most obvious benefit, by far neither the more important nor monetary valuable for companies;
- Drive e-commerce and the use of new technologies: the availability of standard, accessible technologies of e-Invoicing allow increase on the electronic commerce of all types, not restricted to the commerce of digital goods;

- Compliance costs reduction: possibility of use of the information registered in invoices in a structured and standard way allow companies to comply both with fiscal and non-fiscal rules in more efficient ways;
- Enhance tax compliance and stimulate formality: when the same document is used both in the relationship between companies, and between companies and tax administration, it becomes cheaper to comply than not to;
- Impulse local IT capacity: although small businesses tend to adopt free solutions made available by the tax administration, medium business need more functionalities normally absent from those solutions, and at the same time are not able to support costs and fees of solutions offered by international suppliers; this reality generates demand for locally developed solutions; and,
- Standardization of electronic relationships among companies, stimulating interoperability: where there is no national standard, both big sellers and big buyers will impose their own standards to their respective supply chains. In this scenario if small sellers and small buyers (which are, at the same time, the actors with less economic resources) want to operate in different supply chains, will have to both to comply with big buyers' standards, and to accept big sellers' standards.

Tax Authorities' Perspective

It should be highlighted that even if from the point of view of the common citizen, the most perceived frauds on VAT are those related with retail operations (B2C). In most countries operations where the buyer is also a taxpayer (business to business operations, or B2B) account for 85 to 90% of the total VAT revenue. Therefore, the effort to achieve the same result on increasing VAT revenue usually is much smaller if the strategy adopted focuses only in B2B operations, instead of including in B2C operations, an area where e-Invoicing is crucial to improve results. The benefits derived to the tax administration are:

- Better reliability and opportunity on the information received from taxpayers;
- More extensive information, allowing fiscal and economic analysis, apart from just tax control;
- Reduction of cost on the control of transit of goods, both on internal and external operations (imports and exports); and,
- Decrease of tax evasion and increase of revenue, because of the natural formalization of commercial operations due to the fact that tax authorities use for control purposes the very same documents businesses use in their mutual relationship.

Taxpayer's Perspective

Issuer's vision:

- Cost reductions on printing and paper acquisitions;
- Facilitate processes of shipment; and,
- Selling processes reengineering, optimizing times and resources.

Buyer's vision, received invoice data availability in an electronic, structured way, allowing:

- Goods receiving logistic planning prior to their reception;
- Elimination of typing related costs and errors; and,
- Acquisition accounting automatization.

Common (issuer's and buyer's) vision:

- Fiscal documents storage costs reduction or elimination;
- Accessory tax obligations simplification;
- Reduction, or elimination, of tax reports preparation costs; and,
- Impulse to electronic relations among companies.

Implementing Only e-Reporting from Fiscal Registers

Of all the previous expectations listed so far, the implementation just of e-Reporting from fiscal registers will allow the fulfillment of the following expectations:

- Society's Perspective: limited enhancing tax compliance, with very limited, and restricted to B2C operations, stimulus to formality.
- Tax Authorities' Perspective:
 - ❑ Some enhanced reliability and opportunity on the information received from taxpayers, restricted to B2C operations; and,
 - ❑ Some decrease of tax evasion and increase of revenue, due to a certain degree of formalization of commercial operations, because the chosen strategy does not involve enhancing the processes of doing business, but only reporting data to the tax administration.
- Taxpayer's Perspective: none.

7.1.3. e-Invoicing in Latin America

Table 7.1-1 shows the year of adoption of e-Invoicing in Latin America, whilst *Figure 7.1-6* brings a graphic view of the right most column of that table.

Table 7.1-1 Years of Adoption of e-Invoicing in Latin America

Country	First model	Second model	Adoption
Argentina			2006
Bolivia		2008	2018
Brazil			2006
Chile			2004
Colombia	2006	2012	2018
Costa Rica			2017
Dominican Republic			2019
Ecuador		2011	2016
Guatemala			2018
Mexico		2005	2011
Panama			2018
Paraguay			2018
Peru			2016
Uruguay			2012

Source: CIAT e-Invoice Network of Tax Administration Professionals, consolidated

Figure 7.1-6 Years of Adoption of e-Invoicing in Latin America



Source: e- CIAT e-Invoice Network of Tax Administration Professionals, consolidated

It can also be seen in [Table 7.1-1](#) that some countries have changed their e-Invoicing models once, or even twice, since the first year of adoption. The reasons for that are listed on [Table 7.1-2](#).

Table 7.1-2 Reasons for Changing Operation Models

Country	Reason	Year of change
Bolivia	Low scale of adoption	2018
Colombia	Low scale of adoption	2012
Colombia	Low quality of the information	2018
Ecuador	Technical and technological problems	2011
Mexico	Low quality of the information	2005

Source: e-CIAT e-Invoice Network of Tax Administration Professionals, consolidated

details the percentage of Latin American countries that adopted e-Invoicing

Table 7.1-3 GDP of Latin American Countries That Adopted e-Invoicing

e-Invoice	GDP		#Countries	
Yes	5,153,586,220,872	87.14%	10	41.67%
No	760,398,668,419	12.86%	14	58.33%
Total	5,913,984,889,291	100,00%	24	100,00 %

Source: World Bank Group World Development Indicators, and CIAT data

As for a measure for the volume of invoices processed in LA countries, [Table 7.1-4](#) shows the volume of e-invoices received, processed and successfully cleared by Brazil's Rio Grande do Sul State both in April 30, 2019, and in the whole month of April 2019. The column "Number" contains the total of e-invoices cleared,⁵⁹ whilst the column "Value" shows the total, in USD millions, of the operations documents by those invoices, in the corresponding period.

Table 7.1-4 Example of Volume of Reception

Period	Number	Value
April 30, 2019	37,509,633	12,259
April 2019	915,200,000	155,493

Source: Rio Grande do Sul State (Brazil) Revenue Sub-secretariat

This volume represents about 40% to the total number of e-invoices issued in the whole country, and is, also, roughly equivalent⁶⁰ to the total volume of e-invoices issued in Mexico.

The mean time for clearing an e-invoice was measured up as 80 ms, counted since the completion of receiving the information sent by the taxpayer, until the transmission of the correspondent answer message. The down time of the system during the entire year of 2018 was less than 18 hours, all of them dedicated to programmed maintenance, previously announced to the taxpayers.

World Leaders in e-Invoicing

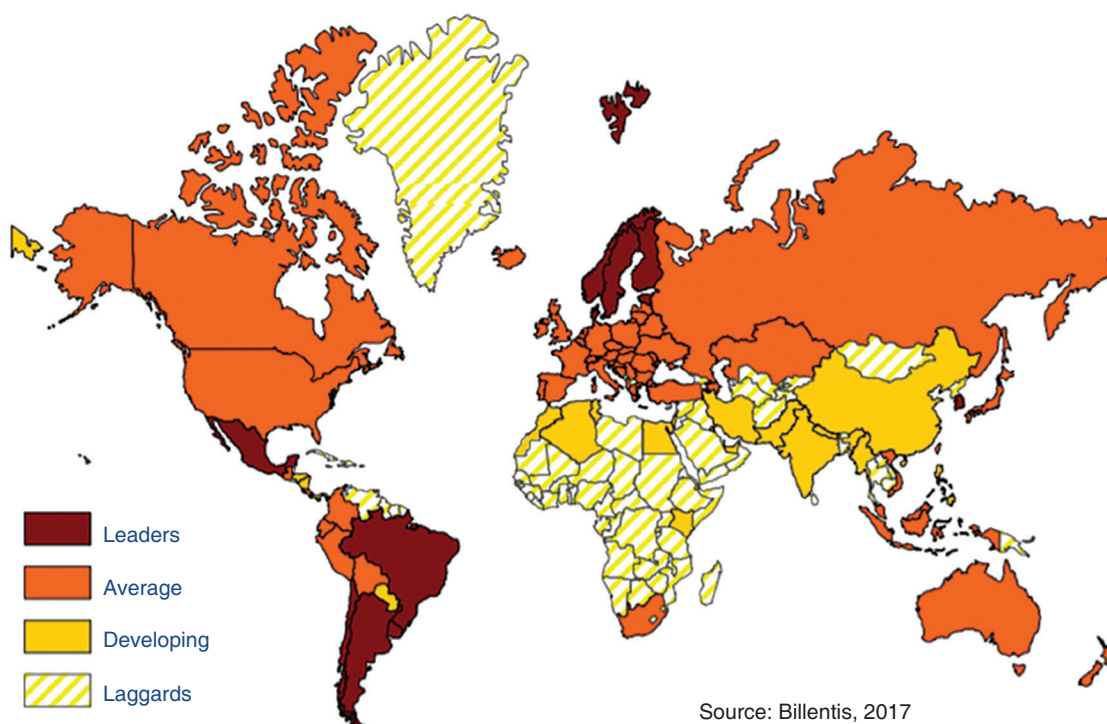
Since its first version, the Koch reports (Koch, 2017, 2019) states that Latin America is the leading region in the world regarding the adoption of e-Invoicing, followed by Nordic countries and, lately, by some other European and Asian countries, as we can see in [Figure 7.1-7](#).

CIAT uses to point out the following differences in the strategy of adoption by those countries, resultant of significant cultural roots:

- In Europe (except for Italy, which is the only European country that to date has adopted e-Invoicing as a national project) and in Asian countries, basically e-invoice involves only companies and their mutual relationship, and the tax administrations only receive an extract of the information registered on the invoices.
- In Latin American countries, without exceptions, e-Invoicing is a national project, written, directed and co-starred by the tax administration. The tax administrations receive all invoices issued by taxpayers; e-Invoices comprise all information of the registered operations, and e-invoices can be used by taxpayers only after cleared by the tax administration.

Latin American models of e-Invoicing have these factors in common:

- Usage of XML signed files (paper has no value anymore), transmitted with web services;
- XML formats are proprietary; even the few countries that adopt an international standard have introduced local modifications;
- Tendency to mandate the use of electronic invoices in 100% of operations; and,
- Tax administrations are responsible for technical and juridical definitions regarding electronic invoice, and, with different strategies, approve (clear) e-invoices as a condition for validity for all purposes.

Figure 7.1-7 World Leaders in e-Invoicing Adoption

Source: Market maturity for electronic invoices. From "E-Invoicing/E-Billing," by B. Koch, 2017, May 18, Billentis, p. 18.

Copyright 2017 by Billentis

Defining e-Invoicing

There are many possible definitions in use in many countries.

The Directive 2010/45/EU of the European Parliament and of the Council of 13 July 2010, amending Directive 2006/112/EC on the common system of Value Added Tax, about the rules on invoicing procurement states that:

For the purposes of this Directive, "electronic invoice" means an invoice that contains the information required in this Directive, and which has been issued and received in any electronic format.

This definition lacks some crucial details, as it can be seen when it comes to the Public Administration as a client, in the Directive 2014/555/EU of the European Parliament and of the Council of 16 April 2014 on electronic invoicing in public procurement (underlined by the author):

'electronic invoice' means an invoice that has been issued, transmitted and received in a structured electronic format which allows for its automatic and electronic processing;

LA countries use to adopt much more restricted definitions. In Mexico:

The taxpayer who chooses to issue digital fiscal documents by Internet shall generate them according to the following XSD standard, and the XSD complements that may be necessary, validating its form and syntax in an XML file, being this the only allowed format to represent and store those documents in an electronic or digital format.(SAT,2017)

While in Brazil, an electronic invoice is a:

Document electronically issued and stored, which exists only on its pure digital form, with the aim to document operations, and which juridical validity is guaranteed by the electronic signature of the issuer and the use authorization by the tax authority, before the occurrence of the taxable event.(Confaz,2005)

A possible definition of electronic invoice, which congregates necessities of all stakeholders is:

An electronic structured fiscal document that supports operations regarding goods and/or services, grants legal validity and tax support to those operations, exists only as an electronic file, is issued by electronic means and is transmitted to and validated by the tax administration.

This definition presents a series of particularities, as follows:

- **Electronic document [... that] grants legal validity**: a digital signature grants an electronic file the status of electronic document, with juridical effectiveness to all purposes, hence assuring that this file complies with the intrinsic legal requirements that the juridical texts use to associate with a document, regardless of its physical format, known as authoring, authenticity, and non-repudiation.
- **Structured document**: the information is stored in a way easy to be retrieved.
- **Fiscal document [... that grants] tax support**: a document regulated by the tax administration, which is needed to support tax purposes; consequently, must contain, encompassed by the electronic signature, all the information to be registered covering the supported operation.
- **Which exists only as an electronic file**: it can have graphic representations for easiness of reference or to be read by people, but, for all legal purposes (consumer rights, and commercial, economic, financial, and fiscal purposes), the digital file must be used.

- **Supports operations regarding goods and/or services:** for any kind of operation, even non-commercial ones.
- **Validated by the tax administration:** the positive manifestation of the tax administration over the file transmit to the possible user of the document (the referred commercial, economic, financial, fiscal, and consumer rights purposes) that this invoice not only truly exists supporting an operation, but also complies with all the technical formal requirements of an invoice, including, among others:
 - ❑ The file format;
 - ❑ The presence of all mandatory information;
 - ❑ That there are no inconsistencies between information (for instance, that the buyer's address is not located in national territory if this is an operation of exportation);
 - ❑ Etc.

Post-Audit Model and Clearance Model

In most countries where a Value Added Tax is used, invoices are key instruments to provide evidence for tax compliance. Many, maybe most of those countries still practice a post-audit model, which means that tax audits happen considerably later than business transactions.

In some countries, due to the availability of the information of the invoices on real time or near-real time, the tax administration can act with much more speed, effectiveness and correctness.

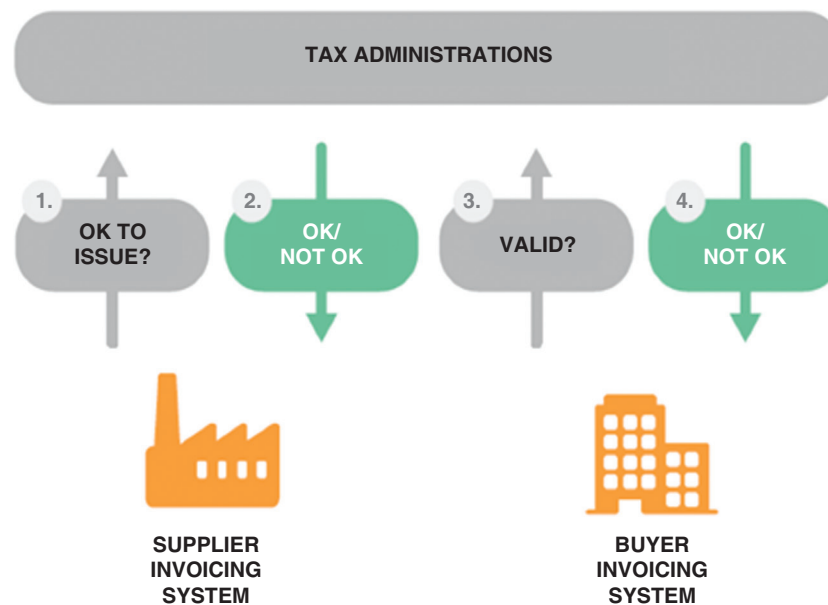
This post-audit model has many disadvantages for taxpayers and for the tax administration and facilitates tax evasion. Hence, we see a rapid change towards real-time or at least near real-time clearance models.

In this case, organizations are required to exchange invoices via tax authorities, or to submit at least key invoice data in electronic format.

Latin American, Asian (Kazakhstan) and some European countries (Spain, Italy, Portugal, Hungary, followed by many others) were pioneers on implementing the clearance model.

The model is growing in adoption, and it is expected to be the dominant control method globally from 2025 (Van Der Valk, 2017), even though, as it was to be expected, there are many differences in the implementation from country to country.

Figure 7.1-8 shows several high-level features and processes that many clearance systems have in common. It should however be noticed that many variations exist on this reference model in practice; many countries with a clearance system have implemented extensions on these (a priori) standard processes.

Figure 7.1-8 A Basic Clearance Model

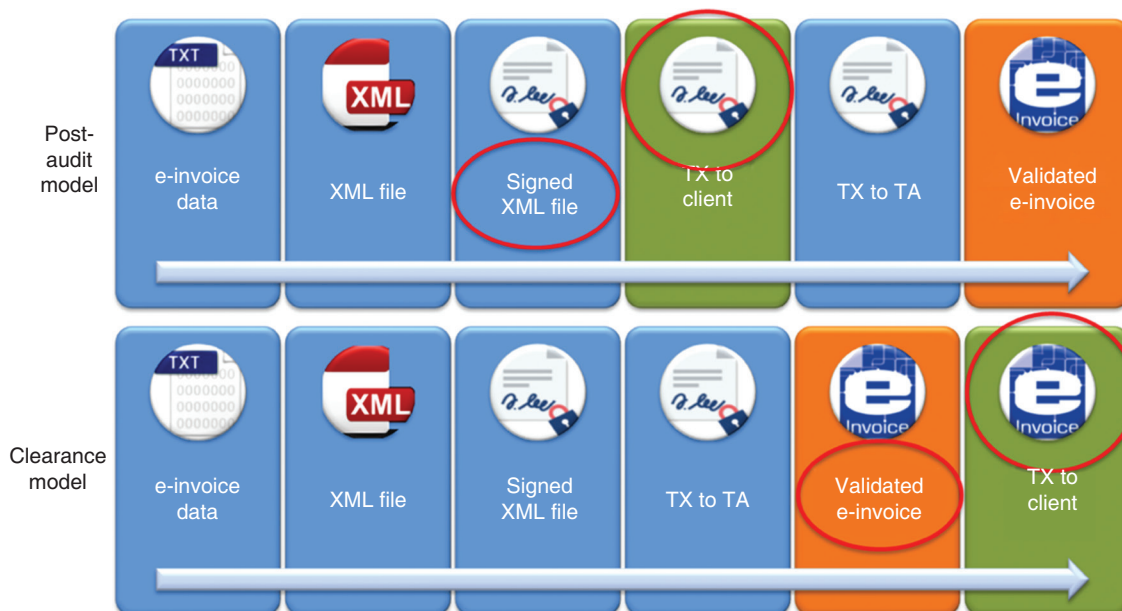
Source: Van Der Valk, 2017

1. **OK to issue?** Typically, the process starts with the supplier sending the invoice in a specified format to the tax administration or a state agent licensed to act on its behalf. This invoice is ordinarily signed with a secret private key corresponding to a public certificate issued to the supplier.
2. **OK/NOT OK:** The tax administration or state agent (e.g., an accredited or licensed operator) will typically verify the signed supplier invoice and clear it by registering it under a unique identification number in their internal platform. In some countries, a proof of clearance is returned, which can be as simple as a unique transaction ID possibly with a time-stamp and, in some cases, is digitally signed by the tax administration/state agent. The proof of clearance may either be detached from the invoice or added to it. In some alternative “lite clearance” cases, no proof of clearance is returned, just a system response that the invoice has been accepted.
3. **Valid:** Upon receipt of the invoice, the buyer is often either obligated or encouraged to check with the tax administration or its agent that the invoice received was issued in compliance with applicable requirements. In general, the buyer usually handles integrity and authenticity control using crypto-tools, which can also be used to verify a signed proof of clearance. In other cases, the clearance check is done online at the tax administration or agent.
4. **OK/NOT OK:** If the buyer has used an online system to perform the validation described in the previous step, the tax administration or state agent will return an OK/Not OK response to the buyer.

In [Figure 7.1-9](#) it becomes clear the advantage of the clearance model for the buyer, since in this model what the issuer transmits to the buyer is the electronic invoice with the statement of the tax

administration that this document complies with all the technical requirements to be considered an electronic invoice, whilst in the post-audit model buyers do not have this assurance.

Figure 7.1-9 Differences (simplified) in Clearance Model and Post-Audit Model from the Point of View of the Buyer



Source: Adapted by the author from Freitas, 2019

7.1.4. Premises of an e-Invoicing Implementation Project

A project, as all project management good practices agree, must have, among many other characteristics, limited resources, and, most important, a conclusion date, as well as key process indicators to measure if all is occurring according to planned.

That said, we conclude that e-Invoicing is a Program that begins with an e-Invoicing implementation project.

Why e-Invoicing? Why start such a project?

Some answers were given in section 7.1.2 and, as commented, must be taken into consideration for forming the Key Decisions referred to further on in this item.

Additionally, a Program of e-Invoicing should depart from a series of premises, that shall include the following:

- **Simplification:** an e-Invoicing system must bring simplification of processes both to taxpayers and tax administration.

- **Non-interference**: the process of adopting e-Invoicing must, as much as possible, not change any of the processes and practices regularly adopted by a taxpayer.
- **Minimum possible investment**: it must be pursued that adopting e-Invoicing represents as minimum investment from the taxpayer as possible.
- **Reduction of costs**: e-Invoicing must be cheaper than the use of paper.
- **Value of proof**: e-Invoices must have at least the same value as a proof in the court of law as paper invoices.
- **Open standards**: e-Invoicing must not favor any private owned technology.

These premises will be the source of inspiration for all and every decision to be made in defining both the implementation project and the final system.

7.1.5. *Key Decisions in Adopting a Model*

Keeping in mind the expectations discussed in section 7.1.2, and also considering how much it will cost for a taxpayer to modify its current system, there are some decisions to be made when considering the adoption of either electronic invoicing, or strategies of receiving information about the transactions regarding VAT in an electronic way.

Key Decision 1: The Information

It must be established either one of the following systems, or a mixed model with some or all the following systems:

- e-Invoicing (example: Latin America and Italy)
- e-Reporting based on information transmitted by the taxpayers regarding invoicing (example: Spain and Portugal)
- e-Reporting based in fiscal devices with automated transmission (example: some East European and Asian countries)

Key Decision 2: The Opportunity of the Transmission

When the invoice must be transmitted to the tax administration, and the role of the tax administration regarding the validity of the invoice, are formed by three other independent decisions:

- Is the validation from the tax administration required as a condition for the very existence of the e-invoice?.
- If the answer is yes, then this validation⁶¹ must occur before the commercial operation, or can occur after the operation (minutes, hours, a couple of days...)?.
- Which model will be adopted: Post-audit model or Clearance model?.

Key Decision 3: Governance of the Implementation Project:

Will the decisions about the project be restricted to the tax administration, or will other government agencies or departments be involved (such as customs, Ministry of Industry and Commerce, and so on)?

Key Decision 4: Legal Course of the Electronic Document:

- How to sign
 - ❑ Technical aspect: different models and algorithms support digital signatures.
 - ❑ Legal aspect: juridical support for electronic documents.
- How to deliver certificates (if an asymmetric cryptography model will be used for signing).

Key Decision 5: Technology

- Format of the files.
- Transmission of the files.

Key Decision 6: Strategy of implementation

These issues occupy the entire Section 7.1.6:

- Pilot project.
- Massification.
- Mandate of use.

Key Decision 7: Regulation of Providers

In a model e-Reporting based in fiscal devices with automated transmission:

- Hardware providers must present their equipment to be certified and approved by the tax administration.
- The tax administration must have conditions and resources, both human and material, to enforce the correct use of those equipment.

In a model with e-Invoicing, some the tax administration of some countries:

- Outsource validation of the invoices to certified providers.
- Mandate that the activity of preparing e-invoices only can be outsourced by the taxpayers to certified providers.

Key Decision 8: Construction of tax administration's Solution for Receiving the Files:

- Internal resources.
- Outsource of development.
- Acquisition of a solution.
- Use of cloud solutions, on any of the three previous possibilities.

Key Decision 9: Construction of a Free Solution to Small and Medium Businesses

- Internal resources.
- Outsource of development.
- Acquisition of a solution.

7.1.6. Massification of e-Invoicing**Uses of an Invoice**

An invoice has the following main uses, among others:

- Register of a right to receive payment: the seller uses it to demand fair retribution for a good or service sold.
- Instrument for demanding delivery: the buyer demands the deliverance of had been paid for.
- Source of information:
 - ❑ The buyer uses the data of the invoice for planning of reception logistics and of payments, and as input for accounting systems.
 - ❑ The tax administration uses the data for enforcing, especially for VAT and for income tax.
 - ❑ Many other regulatory agencies need the data for their own uses.
- Mean of proof: for instance, to demand service from authorized third parties (who had not participated in the original business between seller and buyer) for repairing, during warranty period.

Consequently, an electronic invoice must be a document capable of delivering all those functionalities.

Digital Documents

As presented, it must be possible the use of an invoice as a proof, either

- In private relationships among companies, among companies and individuals, or among companies and government agencies, or
- In a court of law.

The present section presents some aspects to be taken in consideration to allow that an electronic file, and, consequently, both an electronic invoice and an electronic information about invoicing, to be efficiently used for those purposes.

For the sake of simplifying the text, only the expression “electronic invoice” will be used throughout this section, but, by extension, it is logical that all the discussions and ideas can be equally applied to electronic information about invoicing, provided that this information, as well, consists of electronic files that must be given the status of electronic documents.

Defining Document and Electronic Document:

A document⁶² has various functions, such as:

- Guarantee tangible evidence of the contractual will of the parties;
- Anyone must be able to read it;
- Remain unchanged over time and provide a permanent record of a transaction, allowing its reproduction by means of the extraction of copies;
- Allow authentication through a signature;
- Allow easy file archiving in a tangible way; and
- Make control and auditing easy for accounting, taxation and other regulatory purposes.

Legal doctrine generically agrees on the acceptance that the following requirements express the fundamental, sometimes also referred as intrinsic, characteristics of a document:

- **Authenticity.** The signature must indicate with certainty the identity of who has produced the document;
- **Exclusivity.** The signature must be the product of a combination of techniques that prevent third parties from reproducing, falsifying or using it without authorization;
- **Authentication of the document.** The signature identifies what is signed, associating the content of the document with its author;
- **Positive act.** The signature testifies to the manifestation of the will, with its reflexes of legal imposition; and,
- **Efficiency.** The method of creation and verification of the signature must guarantee the authenticity of the person who produced it and the document, with the minimum cost.

The use of a unique expression of a person, the manuscript signing of a document, which is the way hers or his own name is drawn on a piece of paper containing printed information, is universally understood and accepted as the manifestation of this person's will, or, in other words, that this person agrees with and/or subscribed to this information.

The action of making this drawing is called signing the document, and this drawing is what is universally accepted as an assurance of the five above described fundamental characteristics of a document.

An electronic file is a set of bytes, so for an electronic file to be accepted and recognized as a document, an electronic document, requires the use of a set of techniques which can assure that such electronic file presents those five fundamental characteristics of a document.

The next section contains one of the possible solutions to this requirement, the solution adopted in almost all countries where electronic documents have legal course for all purposes.

Digital Signature

Most countries accept a digital signature that uses cryptographic algorithms to join a secret to a set of bytes (the electronic file, in this case also called the message to be signed). The guarantee lies in the fact that only those who know the secret can reproduce the same result, which is the digital signature.

A good description for this kind of digital signature is:

A digital signature scheme is typically used by a signer and a set of potential verifiers. The signer begins by running some key-generation algorithm to produce a pair of keys (pk,sk), where pk will be called the signer's public key and sk is the signer's private key. The signer then publicizes its public key, and we will assume that any potential verifier is in possession of (or can obtain) an authentic copy of the public key pk associated with the signer. (Katz,2010, p. 3)

The verification process of the digital signature, similarly to the traditional signature recognition in paper documents, uses public information extracted from the original message to verify if the aforementioned person actually signed the message, in an identical manner to that of the manual signature: private signature and public verification.

The digital signature processes based on public and private key algorithms, also known as asymmetric cryptography, use hash algorithms to assemble that signature, which, therefore, represents the hash of the document to be signed, being this hash encrypted using the signer's private key.

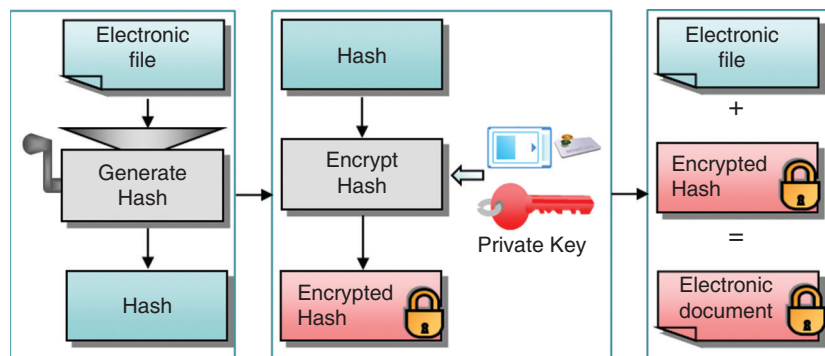
The public key algorithm guarantees that a message that has been encrypted with a private key can only be decrypted with the corresponding public key. As the private key is unique knowledge of the

owner of the key pair, the coding of the hash using this private key can be considered the digital signature of this person, given that the hash algorithm must guarantee the statistical impossibility of the existence of two identical hashes for two different messages, and only somebody who had knowledge of the private key may have generated the encrypting of that hash.

Figure 7.1-10 represents the entire digital signature process, in three stages: 1) generate the hash; 2) encryption of that hash with the private key; and, 3) add the encrypted hash to the original document to form the digitally signed electronic document.

Encrypting the whole file would make it difficult to guarantee integrity: how to check that there was no alteration in the contents of the file?

Figure 7.1-10 Digital Signature Process



Source: Adapted by the author from Freitas, 2019

Therefore, it is neither practical nor safe to have only the encryption of an electronic file for the signature process. The process consists in calculating the hash of the file, and encrypting this hash, and not the entire message. The benefits of this strategy are:

- Allows the size of the signature to be small and independent of the size of the message;
- Allows the encrypting time to be minimal, even if the process is executed inside a token or smart card; and,
- Makes the process of verification of integrity much simpler.

The verification process consists of (i) decrypting the hash using the public key of the signer and (ii) calculating the hash of the message again.

As the algorithm used for this calculation is known, it can be determined that the message was received without any alteration; in other words, if the result of operation (i) is identical to that of operation (ii), it will be certain that:

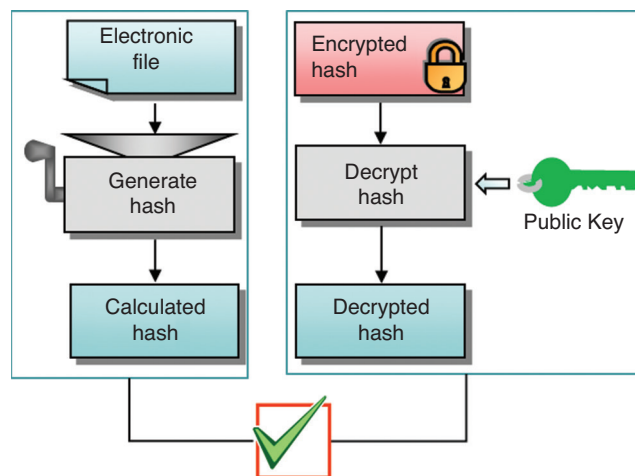
- There has been no alteration in the message, because the summaries are identical; and,

- Who signed the message (calculated and encrypted the hash that had been sent) was really the person who is the owner of the key pair; if the decryption was done with the public key of this person, the encryption could only have been done with his correspondent private key.

The verification process of the digital signature, illustrated in *Figure 7.1-11*, consists of:

- Receive the message together with its signature (the electronic file);
- Obtain the hash of the message using the same algorithm used by the signatory;
- Decode the signature and obtain the hash calculated by the signatory; and,
- Compare the two summaries (if they are the same, the signature is valid).

Figure 7.1-11 Verifying a Digital Signature



Source: Adapted by the author from Freitas, 2019

The described process using asymmetric cryptography and hash functions can assure to an electronic file the five fundamental characteristics to be considered a document, and is, by far, the most used process throughout the world.

The next item discusses distributing the public key in a secure way.

Digital Certificates and PKI

How to be sure that a certain public key really belongs to a particular person?

In a small group of people each one can personally pass on his or her public key to others, and thus all individuals have the conditions to verify the signatures of each other. This is impossible in an environment such as the Internet, in which people do not know each other.

The process of public and private key cryptography by itself does not guarantee in any way that the recipient knows, a priori, that the public key really belongs to the person who claims to be the signatory.

The solution is to work with delegation of trust. In this process, a second person accepts the public key of a first person, whom he or she does not know, because there is a third party, whom the second person trusts and knows the first person, that guarantees that the public key actually belongs to the (first) person, whose signature needs to be verified.

This is the purpose of a Public Key Infrastructure (PKI). There is a trusted entity, called the Certifying Authority (CA), that issues the digital certificate, which is a file digitally signed by it (CA) and that contains all the necessary information to identify an entity (individual, program, team, component, product, etc.), including the public key.

As the public key of the CA is widely known and trusted, any person or application can (i) be sure that the public key contained in a digital certificate signed by this CA belongs to the person named in it and, therefore, (ii) verify a signature produced from the corresponding key pair.

Figure 7.1-12 shows a simplified structure of a standard X509 Digital Certificate Structure.

Figure 7.1-12 X509 Digital Certificate Structure

Digital certificate
Version
Serial number
Signature algorithm
Issuer CA
Validity period
Owner name
Public key identification algorithm
Public key
Identifier of the issuer
Owner identifier
Extensions
CA digital signature

Source: Adapted from Internet X.509 Public Key Infrastructure Operational Protocols: FTP and HTTP (www.ietf.org)

The CA is responsible for positively identifying the person issuing a digital certificate, through the Registration Authority (RA), which is an entity responsible for the interface between the user and the Certifying Authority (CA). The RA is linked to a CA and its objective is the reception, validation, sending of requests for issuance or revocation of digital certificates to the CA and identification, in

person, of its applicants. It is the responsibility of the RA to keep track of its operations. It can be physically located in an CA or be a remote registration entity.

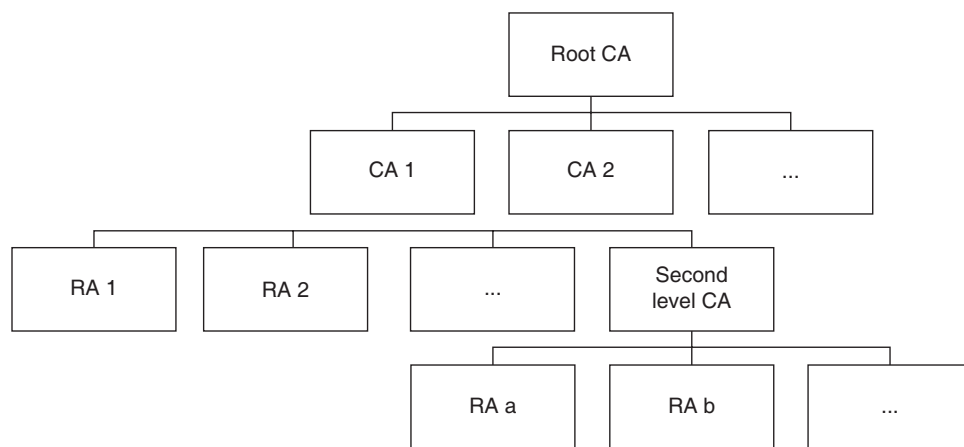
Therefore, to verify someone's digital signature, it is only necessary to have the CA's public key and, whenever a person's signature needs verification, the person who verifies will only need the digital certificate of the signatory issued by the CA: Instead of saving a large number of public keys on your computer, it is necessary to save only the public key of the CA.

How to receive the public keys of a Certifying Authority

PKI are usually represented as an upside-down tree (with the root at the top), forming a certification chain, as can be seen in [Figure 7.1-13](#).

The base of the chain of trust is the Root CA, which determines all the confidence in the branches of the tree.

Figure 7.1-13 Graphic Representation of a PKI



Source: Adapted by the author from Freitas, 2019

The Root CA:

- Self-signs its own certificate;
- Signs the certificates of the first level AC (the most important of all);
- Many have their public key integrated in the operating systems (Windows, Mac OS, others) and in Internet browsers (Edge, Chrome, Safari, others) by the software manufacturer.

As the public key of the Root CA is integrated into the operating systems and Internet browsers, the digital certificates of the first level CAs, which are signed by the Root CA, can be verified. This is how a first level digital certificate can be trusted.

Most national PKI have their Root CA accepted by the aforementioned operational systems and Internet browsers; it is not a complicated process to store a digital certificate of a non-standard PKI, though.

A digital certificate of a second level CA is signed by a first level certification authority, and the same is valid to the digital certificates of the RA associated to that first level CA.

The digital certificate of the first level AC is searched throughout the chain of trust, which is, in the end, verified by the signature of the Root CA.

With the established chain of trust, any digital certificate issued within the PKI can be verified, that is, any public key can be trusted in belonging to the entity identified in that digital certificate, and all digital signatures can so be verified.

7.1.7. A National PKI

Countries' realities are significantly different when it comes to the availability of a PKI for the common taxpayer to use. More technologically advanced countries for sure will have even several different commercial options, whilst small countries most probably won't have a single national option.

A national option may be needed if the country has in place a commercial law on electronic documents which rules that a national root authority is required for a digital signature to have full legal course.

Given that reality, there are three possible strategies for taxpayers to digitally sign electronic documents, while there is no possibility to use certificates under a national PKI: to accept certificates issued abroad, in two different approaches, or tax administration assuming the role of root certification authority.

Alternative Solution 1: Accepting International CA for All Documents

This is the easiest and fastest solution: a national regulation stating that electronic documents will be recognized if digitally signed using a certificate issued by a foreigner provider while there is no possibility to use certificates under the national PKI, since the RCA of such certificate is recognized as valid by major adopted computer operational systems, such as Microsoft Windows or Apple MacOS.

Advantages of this approach:

- There is no necessity of any kind of investment in a national PKI.
- Certificates are immediately available.

- Certificates are interoperable and can also be used by transnational companies established in the country for overseas uses.
- There is no necessity of creation of a network of RA for the distribution of the certificates (although international CA would probably be interested on establishing this kind of activity in the country, should the volume of demanded certificates be enough).

Disadvantage of this approach:

- Most probably will not comply with national established communications, information technology (IT) or commercial plans of future development.
- May be too expensive for many small and medium companies.

Alternative Solution 2: Accepting International CA for Fiscal Documents

A less powerful alternative in the same way could be a tax regulation that requires fiscal documents to be recognized if digitally signed using a certificate issued by a foreigner provider, in the same conditions depicted above.

Advantages of this approach (all the advantages of Solution 1, plus):

- Tax administration has full governance of the process of determining how international certificates can be used for signing fiscal documents.
- Most probably will not defy national established communications, information technology or commercial plans of future development.

Disadvantage of this approach:

- Most probably would only apply to fiscal documents (hence, for fiscal uses of electronic invoices), for a tax administration regulation may be not recognized for other uses (for instance, financial uses of the electronic invoice).
- May be too expensive for many small and medium companies.

Alternative Solution 3: tax administration as the Root CA

In a few Latin American countries that faced a situation similar to the above described, that is, the lack of possibility of distributing digital certificates under a national PKI, even though a legal regulation regarding it is in place, cumulated with a scenario where the tax administration was conducting a project of implementing electronic invoicing, the tax administration decided to assume the role of Root CA.

This is not a technical complication for taxpayers, for when the RCA of a PKI is not pre-installed in the operating system, its corresponding certificate can be imported in a fairly simple procedure.

Advantages of this approach:

- The necessity of investment in the PKI is minimum, for all the necessary applications are part of Operational Systems that run on computer servers.
- Certificates are immediately available.
- There is no necessity of creation of a network of RA for the distribution of the certificates, since this activity can be performed by local agencies of the tax administration.
- Tax administration has full governance of the process of using digital certificates.
- Most probably will not defy national established communications, information technology or commercial plans of future development.

Disadvantages of this approach:

- Certificates are interoperable, but cannot be used by transnational companies established in the country for overseas uses.
- Would only apply to fiscal documents (hence, for fiscal uses of electronic invoices), for a certificate issued on a PKI where the tax administration is the Root CA most probably would not be recognized for other uses (for instance, financial uses of the electronic invoice).

7.1.8. Recommended Phases of Adoption

The adoption of electronic invoicing must follow an implementation plan that makes it possible for companies to enter this world gradually and safely, without compromising their business processes. A close collaboration between the companies and the tax administration must be sought from the beginning, so that the definitions of the conceptual model are at the same time useful and feasible for both.

Being a system designed to reach all taxpayers, or at least an important number of them, it is necessary to proceed step by step, with the following phases: preliminary studies, pilot phase, voluntary adoption phase and mandatory phase.

Preliminary Studies

During this first phase is where key decisions are to be taken, consolidated and implemented:

- Establish the premises of the system.
- Identify the necessary changes in the laws and regulations regarding fiscal documents.
- Define the operating model, especially:
 - ❑ File format.
 - ❑ Extension of the information contained in the file.

- ❑ Transmission technologies.
- ❑ Contingency strategies.
- Investigate technological feasibility, especially:
 - ❑ Communication conditions in the different regions of the country.
 - ❑ The IT development, response time and availability capabilities of the tax administration.
 - ❑ The implementation of the PKI structure, or the necessary modifications to be introduced in the existing structure.
- Produce the technical documentation that will serve as a guide for the construction of the information systems of the taxpayers and the tax administration.
- Plan the other phases of implementation.

It is recommended that the following actors participate with the tax administration in the definition of an electronic invoice project: taxpayers, tax entities, financial entities and information technology companies.

Taxpayers, who are the main affected as users, must:

- Understand what are the process improvement opportunities that the adoption of an electronic invoice system can bring as a by-product.
- Have enough time to adapt to the system, especially to carry out the necessary implementations in their invoicing information systems; and last, but not least.
- Influence the development of the system, so that it is also useful for companies, and not just for the tax administration.

The suppliers of technological solutions will surely be among the most interested in the project, since it opens up a wide range of business opportunities.

Financial entities should also have opportunities, as they may make applications available to their clients for issuance of the electronic invoice as part of their services, including the solution of secure storage of electronic invoice files, and that will be especially useful for those clients with low level of invoice issuance.

Organizations specialized in the provision of standards are also important partners and surely very interested, because the implementation of the system can both represent a great opportunity or a great threat to their work, while at the same time they have the conditions to add extensive experience and knowledge.

The tax administration must be careful when interacting with any of those actors, in order to avoid undue or unwanted benefits, or difficulties to either of them. For that reason, the role of the

associative entities is of fundamental importance, for they should be the representatives of the companies during the contacts and in joint work with the tax administration, because this is the easiest way to be sure that they and the whole sector desired is being dealt with, and not just a privileged group of companies.

Pilot Phase

This phase starts when the model is already defined, and aims to:

- Build the applications of the companies and the tax administration, based on the technical documentation produced during the definition phase (preliminary studies);
- Perform tests over the established model, especially the correct operation of those applications with respect to:
 - ❑ Assembly and interpretation of XML files;
 - ❑ Digital signature;
 - ❑ Exhibition and consumption of web services;
- Verify if the response times of the tax administration's system are acceptable for the companies.

Pilot Group Formation

It is necessary to start with a group of companies for whom it is of interest that the new system be successful. Taxpayers that already use e-invoice are natural candidates to this group.

It may be advantageous that:

- Some of the most representative companies in the market be invited, mainly from economic and industrial sectors that are very sensitive to tax evasion; and,
- Include some supply chains, because of the interaction among participant companies would be of great contribution to the development and tests.

It is important the group is formed by a close set of companies, with the following characteristics:

- In small numbers (from ten to thirty companies), so that the debate and the participation of all are not harmed, and at the same time with enough different companies to ensure a good sample of the national environment;
- Technology providers can be admitted to the group, preferably as taxpayers, but the most expressive number should be constituted by user companies:
 - ❑ So that the tax administration can really be aware of the operational difficulties that exist in the implementation of the electronic invoice process;

- ❑ Experience shows that the main difficulties are not technological (of systems implementation) but, instead, of adapting the company's invoicing processes to the new reality of electronic invoicing;
- ❑ Companies determined that the project be successful, having in mind the commitment of the top management is essential.

The group of companies must appoint a spokesperson and a deputy, preferably of companies from different branches, who will have the role of establishing the contacts with the tax administration, either to transmit the positions of the companies, or to receive communications addressed to them.

If there is an excessive number of taxpayers who are candidates to participate in the pilot, the tax administration must decide whether to accept everyone, to the detriment of free debate at meetings, or if a selection process will follow, which must be objective, public and transparent.

The Development of the Pilot Phase

The pilot phase will be successful after the development and testing of taxpayer and tax administration applications.

There should be frequent and periodic meetings (at least one per month), to present the results and discussion of possible paths. It is recommended that two- day meetings occur: on the first day the companies meet to exchange their experiences and agree to positions to be communicated to the tax administration, and on the second day the group of companies meets with the tax administration.

It is natural, since the main purpose of the pilot phase is to test the definition of the model, that as a result of these meetings some changes in the technical documentation are due, resulting from:

- The accumulated experiences by companies and tax administration in the implementation of their respective systems; and,
- The performance tests of the same systems and their interactions.

Once the pilot phase has begun, the entry of new companies into the group should not be allowed, since being a stage of construction and consolidation of concepts, it would be harmed by the entry of new participants who, without having the history of this construction, will probably delay the works, whether asking for explanations, or questioning decisions already taken and consolidated.

The End of the Pilot Phase

The pilot phase can come to an end when there is an acceptable number of taxpayers (some 20% or 40% of the entire pilot group) issuing e-invoices in the production environment, what normally occurs in a timeframe of four to eight months, counting from the beginning of the phase.

Voluntary Adoption Phase

The Voluntary Adoption Phase occurs after the end of the Pilot Phase, when it is expected that tax administration systems of reception are mature and stable enough to receive information from every and all taxpayers who may be willing to use the system.

Application Certification

Tax administrations could adopt a practice to certify applications that taxpayers may use to prepare, sign, submit and deliver electronic invoices. This practice could restrict only to applications offered by third parties for taxpayers to buy or use (as a service), with a guarantee seal from the tax administration.

This practice requires a significant effort from the tax administration in terms of human resources and procedures. The effort could be greater if the process should extend to new versions of the software or the adoption of any changes in terms of formatting, web service specification or operational procedure.

In general, we think that certifying individual taxpayer's applications brings almost no added value and should not be included. A tax administration may consider to verify the output and interoperability of software that is commercialized in the country either as an ERP, an accounting package or a stand-alone solution, but should avoid trying to certify if the software do not have any hidden mechanism to defraud the tax system or that is not susceptible of hackers.

Access to the System

It is recommended:

- Taxpayers should be allowed to voluntarily apply as an issuer of electronic invoice which will automatically open the testing environment.
- Only after the taxpayer has successfully consumed all web-services in the test environment will they be allowed to request access to the production environment.

This mechanism will stop faulty applications from harming the operation of the production environment since access would be granted only after all tests have passed.

The testing environment should always remain open for taxpayers to test any modification in their applications or systems.

- Probable amendments to the model and documentation

The pilot phase involves a limited number of taxpayers, so it is to be expected that during the first months of the voluntary adoption phase the need of correcting aspects of the model becomes evident, either in the formats of the files, or in other technical aspects, or even in the legal framework.

Although that is normal, and the companies must be warned about it, tax administration should adhere to the following guidelines:

- ❑ Concentrate all the changes in the minimum possible number of modifications changing packets.
- ❑ Except for critical corrections, allow the maximum period possible for each modification changing packet to be implemented, in order not to harm companies that are already in full use of the system.

Possible Bottlenecks and Correspondent Actions

In some countries the beginning of the voluntary adoption phase attracted an unexpected large number of taxpayers, leading to unpredicted, unforeseen bottlenecks.

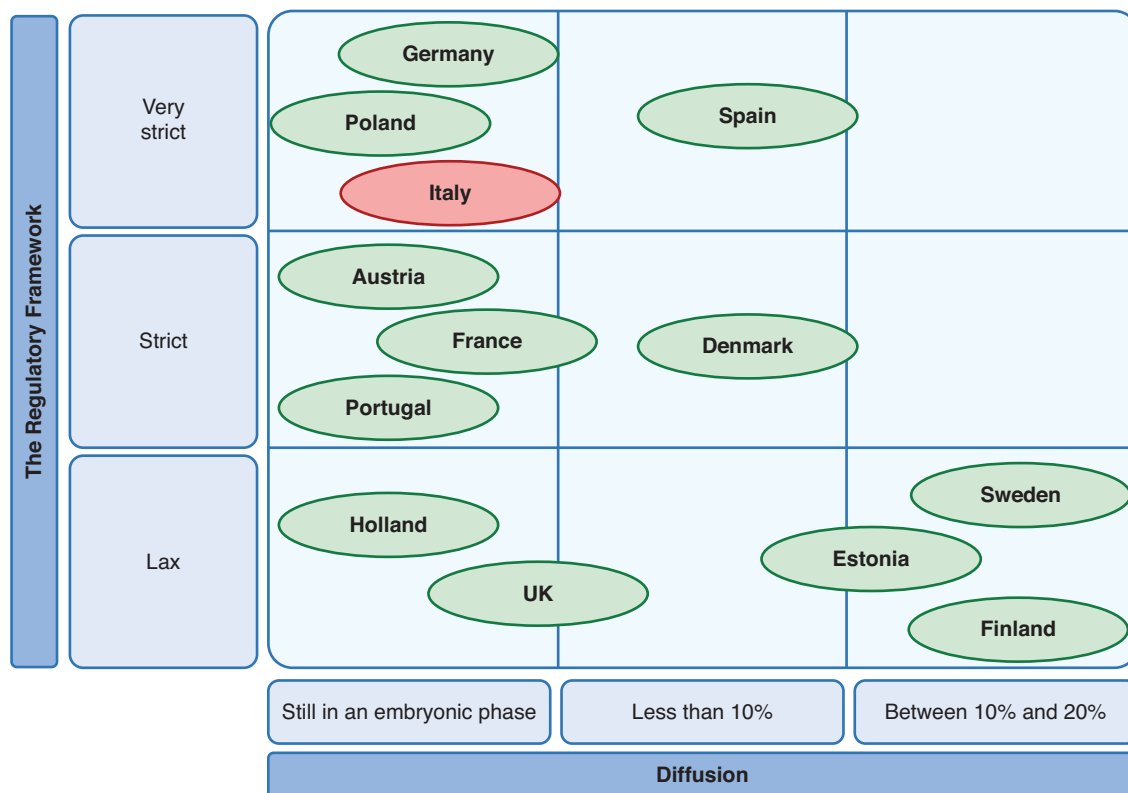
To avoid this kind of problem, mainly because it can affect in a very negative way companies that are already in full use of the system, the tax administration must be ready to, if needed, limit the access to the system to new taxpayers, while corrective actions are taken.

Duration of Voluntary Adoption Only Phase

There is no rule for the duration of the voluntary adoption only phase. Some countries, like Brazil, began the mandatory phase in less than two years after beginning the voluntary adoption; others, like Chile, took more than ten years to reach the conclusion that it was time to initiate the mandatory use of the system.

One conclusion is unanimous though: without mandating, there are a number of companies that will not become users of the system, for many different reasons.

In [Figure 7.1-14](#) we can see the conclusions of the Dipartimento di Ingegneria Gestionale del Politecnico di Milano (DIG, 2010): in voluntary environments, even those in which there are apparently no problems of formality of business registration, there are no significant percentages of adoption of electronic invoice; unclear benefits and management of removals, followed by unclear or very complex laws, unfavorable cost/investment ratios and lack of knowledge, are the causes pointed out in that report.

Figure 7.1-14 Level of e-Invoicing Adoption in Europe, as in 2010

Source: From "Electronic invoicing in Italy: reporting from the field," by Dipartimento di Ingegneria Gestionale (DIG), 2010.
Copyright 2010 Politecnico di Milano

The main reasons given by companies for not to voluntarily adopt electronic invoice are usually found in at least one of the following situations:

- **Customer pressure:** clients prefer to receive paper invoices, and state that they will stop buying from suppliers that use IE; or,
- **Competition:** the economic sector in which the company operates is highly informal, and the formality required to use IE may make it impossible to compete in this informal environment.

Both these most commonly presented reasons are related to environments where there is a high rate of tax evasion, either by omission of purchases (pressure from customers), or by omission of sales (competition); that is the reality of environments in which paper invoices favors informality.

Mandatory phase

The previous item contains some comments on the experience spread out in many countries, specially, but not restricted to, on those where there are high rates of informality and VAT evasion,

where it was concluded that it is necessary to mandate the use of e-Invoicing in order to achieve better results on enhancing tax revenues.

The tax administration must, in addition to promote extensive publicity with months of antecedence, open the production environment for all taxpayers reached by some legal obligation on the same date that this obligation begins, and the test environment 15 days before this date, independent of requirement by the taxpayer. The purpose of this is to move away from possible allegations in court that the tax administration has not proceeded with all activities within its reach to allow the taxpayer obligated to do so electronically.

The Periods for Beginning of Obligations

Extra care must be taken with the starting dates of obligations.

Critical commercial periods, such as Christmas, Mother's Day, and so on, and critical accounting periods, such as change of fiscal or civil year, must be avoided, since information technology departments of the companies usually freeze the possibility of any change in invoicing systems a number of months before this periods, with the objective that possible problems as a result of changes in information systems do not affect the financial results of the company.

Who to Begin With?

The considerations discussed on section 7.1.2, Why e-Invoicing? Expectations from a National e-Invoicing Program, must also be taken in account to define the strategies for mandating the use, especially if this obligation will begin with operations where the buyer is also a taxpayer (B2B) or if operations where the buyer is a final consumer (B2C).

Some countries, such as most of European countries, have chosen a completely different path, and mandated first, or only, operations where public agencies are buyers; obviously, this strategy will not be effective on VAT revenue, but only for enhancing control over public acquisitions.

Normally taxpayers who operate only on B2C are around 80% of the total number of VAT taxpayers, and the total number of invoices issued on B2C operations are 8 to 10 times greater than the number of invoices issued on B2B operations.⁶³

Given that reality, usually the cost of the effort to achieve the same result on increasing VAT revenue is much smaller if the strategy adopted focuses first on B2B operations – although, if a political aspect is present, B2C operations have, by far, much more visibility, and the adoption for this sector will give the society the impression of much better control of the evasion (even though controlling B2B before B2C is normally much more efficient in terms of improving VAT revenue).

Separating Mandatory Phase in Different Stages

It is recommended that the mandatory phase of adoption to be gradual, mainly due to the following reasons:

- Planning of the infrastructure of the tax administration: Investments in equipment, systems, licenses and communication channels needed can be planned according to implementation needs, given that from one year to the next it is possible to have a better idea of the financial needs for the next period.
- Capacity of service by solution providers: The IT market must adapt to the demand for systems:
 - ❑ Phasing the obligation favors the progressive arrival of different solutions, in different market niches, for the different needs of companies, as well as new solution providers;
 - ❑ To establish simultaneously the obligatory nature for all the companies can demand from the market of solution providers a non-existent attendance capacity, provoking, according to the law of supply and demand, an unreal increase in the implementation costs, thus possibly leading many companies simply not to initiate to invoice electronically within the legal term.
- Adequacy of communication infrastructure: For the same reasons presented in the two previous items, communication providers must have time to make investments based on a sustained growth of traffic and to provide access under competitive conditions, maintaining prices at a real level.

Criteria for Establishing Companies Affected by Each Stage: B2B

The following basic rules should guide the gradual implementation in operations where the buyer is also a VAT taxpayer (see an example of B2B mandating strategy later in this chapter).

- When a company is obligated, its entire sector should ideally be reached at the same time:
 - ❑ The simultaneous implementation in an economic sector eliminates the possibility of any company from continuing in an informal environment while the competition must adopt electronic invoice;
 - ❑ The obligation must reach all the companies that practice the regular operations of that economic sector; the legal rule must: (1) forbid that the buyer accepts goods or services supported by paper invoices, where supply chains reached by the obligation are considered; and, (2) provide sanctions for both the issuer and the buyer in case of non-compliance with the obligation, since both must know that in this sector it is mandated to invoice electronically for all the operations.
- A second criteria, to define the mandatory sequence of adoption, has been in various countries the size of the company (expressed by turnover) defining a threshold that separates those who need to adopt the system. The threshold could be reduced every year causing

that every year smaller taxpayers should adopt the system until the full target population is reached.

- ❑ It should be noted that, in the end, the full target population should be reached. Leaving a range of small taxpayers out of the system will be a perverse incentive for companies to either artificially stay small (maybe by splitting activities between new companies) or by operating in the informal economy.
- ❑ Probably some companies of an economic sector will present a significant growth in their level of turnover after entering the electronic invoice requirement, but this growth will not be homogeneous in the sector. This increase would be a direct effect of the greater transparency of operations that otherwise would have been not reported. The studies conducted in Argentina (Artana & Templado, 2018), Ecuador (Andino et al., 2018), Mexico (Fuentes Castro et. al., 2018) and Uruguay (Bergolio et. al., 2018) confirm these effects.
- All establishments of a company should be included simultaneously with the sole exception of locations with no access to Internet service.
- The company reached by the obligation should completely stop using paper invoices; the rule that deals with obligatory nature must define the destination to any pre-printed forms authorized by the tax administration.
- The beginning of the obligation must be published sufficiently in advance to allow companies to:
 - ❑ Schedule the process of development or acquisition of the information system that will support electronic invoice; and,
 - ❑ Not have to discard a relatively high number of pre-printed forms.
- When establishing the economic sectors reached by the obligation, socio-economic factors and well-known practices could require that some sectors will be left out, for example:
 - ❑ Semi-industrial activities executed by artisans;
 - ❑ Individual farmers and fishers.

Criteria for Establishing Companies Affected by Each Stage: B2C

B2C operations, different from B2B operations, usually don't have significant differences regarding economic sectors. Additionally, as commented before, the number of taxpayers is by far much bigger than in B2B operations.

These two aspects suggest that the best approach for staging the mandatory use of electronic invoicing in B2C operations is to adopt the economical size of the taxpayer.

Another aspect to be considered is that in retail operations, in opposition to industrial and distribution operations, it is also usual that most taxpayers are small and medium businesses (SMB); consequently, it is very likely that there will be a threshold of economic size below that where there will not be mandatory use.

B2B Strategy: Example

This item contains a possible strategy for mandating the use of electronic invoice for B2B operations, in stages separated by six months from each other, starting on May of a generic year 20xx.

- May 20xx:
 - ❑ Industry and imports petrol fuel and lubricants.
 - ❑ Industry and imports medicines.
 - ❑ Industry and imports cigarettes.
- September 20xx:
 - ❑ Distribution petrol fuel and lubricants.
 - ❑ Distribution medicines.
 - ❑ Distribution cigarettes.
 - ❑ Industry and imports motor vehicles.
 - ❑ Industry and imports building and construction materials.
 - ❑ Industry and imports sodas and alcoholic beverages.
 - ❑ Services above desired threshold.
- May 20xx+1
 - ❑ Distribution motor vehicles.
 - ❑ Distribution building and construction materials.
 - ❑ Distribution sodas and alcoholic beverages.
 - ❑ Industry and imports, vehicle parts.
 - ❑ Industry and imports, chemical products of all nature.
 - ❑ Industry and imports, processed foods.
 - ❑ Services above 50% of desired threshold.
- September 20xx+1:
 - ❑ Distribution, vehicle parts.
 - ❑ Distribution, chemical products of all nature.
 - ❑ Distribution, processed foods.
 - ❑ Export operations.
 - ❑ Communication services.

- ❑ Electric bills.
- ❑ Services above 25% of desired threshold.

7.1.9. *Other stages...Communication Strategy*

Before talking about communication, it is necessary to define “what” is wanted to communicate.

Two very different lines of communication can be identified:

- One of explanation to the general public and to taxpayers in particular, about “what is” an electronic invoice; and,
- Another, more specific, with messages addressed either to certain specific publics, or to people who search for more detailed information.

Generic Message of Explanation to the Society

When the option to adopt electronic invoice is a free choice for taxpayers, as is the case in the United States of America or in most European countries, the main reason for adopting the electronic invoice is economic: savings by the issuer. This applies in exactly the same way before starting the mandatory phase.

Therefore, the tax administration must establish a communication program that basically consists of the expectations discussed in section 7.1.2., explaining in a very abridged, generic way, the reasons for adopting electronic invoice.

Extended Generic Message

For those who are looking for more information a longer message of general content is recommended, explaining with more detail, albeit still in a simple language, adequate to communicate ideas to the common citizen:

- The advantages of electronic invoice for the taxpayer and for society in general;
- The legal framework including aspects that go from the very definition of electronic invoice, to the procedures a taxpayer must observe to join the system, issue an invoice, accept an invoice, keep the books or deal with events.
- The operational model of the electronic invoice and guides and manuals for the prescribed procedures, the locations and means to access documentation and support contact, the locations of examples of well-formed electronic documents and code to access the system for queries or consume web-services, and so on.
- If the country adopted some kind of authorized third parties to support or sell solutions of electronic invoicing, the list and details of these authorized third-parties.

Messages for Tax and ICT Professionals

The messages for tax professionals and for information and communication technology (ICT) professionals, of course, depart from the extended generic message, but go much deeper.

Other specific materials must be produced, oriented to specialized audiences and using various ways of communicating, such as:

- Focused events;
- Institutional videos;
- Internet (traditional pages and social media);
- Flyers;
- Presentations;
- Technical documentations such as manuals and information systems specifications;
- Publicity campaigns focused in different publics;
- Among others.

Creating an “e-Invoice Brand”

It is suggested the creation of a visual identity, so that it is immediately identified that a document, a presentation, a page on the Internet, or any piece, is related to electronic invoicing. Some LA examples (Brazil, Panamá, México and Colombia, left to right, top to bottom) can be seen in [Figure 7.1-15](#).

Figure 7.1-15 Examples of “e-invoice brand”



Source: Internet pages of referred tax administrations

7.1.10. Recommendations

Begin with B2B

- Taxpayers who operate only on B2C are around 80% of the total number of VAT taxpayers;
- The total number of invoices issued on B2C operations are 8 to 10 times greater than the number of invoices issued on B2B operations;
- In B2C operations most taxpayers are small and medium businesses, and will face financial difficulties for implementing any kind of electronic strategy; and,
- It takes much less effort for the tax administration to obtain the same increase on VAT revenue if the strategy of adoption begins with B2B operations than if it begins with B2C operations.

These are some reasons that emphasize focusing on B2B:

- Will bring quicker results on improving VAT revenue; and,
- Will not face opposition arguing the cost of implementation to small and medium retail taxpayers.

Adopt e-Invoicing Instead of e-Reporting

As discussed on section 7.1.2., a program of e-Invoicing, as widely adopted in Latin America, presents much more advantages for the country in general and for the tax administration in particular, and, as a consequence of that, with much more impact in VAT revenue, than a program of e-Reporting.

Another aspect to be taken into consideration is the cost of adopting a program based on hardware modules, which is normally significantly higher than a program based only on software (for the first one also demands modifications in the taxpayers' software).

Finally, a program of e-Reporting based on fiscal equipment attached to taxpayers' invoicing system is:

- Expensive for the country as a whole: if paid by the sellers it will mostly be a financial burden supported by the final consumer, taking resources out from the families, because it is logical that the taxpayers' implementation cost will be included in the final price of goods; if paid by the government via tax credits it will have a significant impact in the revenue budget.
- Not an assurance that all retail operations will in fact be reported to the tax administration, because the incentive to sell and buy without an invoice in cash-based operations might still be present.
- Not suitable for B2B operations.

For the country, a software-based solution for electronic invoice is in our opinion a good solution under current technological conditions. Cash registers and fiscal printers will only bring results if they transmit data securely to the tax administration which an electronic invoice system will also do, using a common computer or smartphone over the Internet or mobile network. Those who want to cheat should in both cases alter the information transmitted to the tax administration, not only in the local repository which would give an advantage to the cash registers. Finally, neither one nor the other would do much to make people that would sell and buy without an invoice to adopt the system. The additional cost of cash registers and fiscal printers brings little extra to the equation.

Establish Different Models for Different Situations

Experience shows that there is no single operational model that suits well for every situation. Hence, it is a good practice to establish different models for different situations, regarding the role of the tax administration in validating the information of the invoices and the use of this validation by the buyer, and the moment of this validation in what relates to the actual occurrence of the commercial operation.

Adopt One of the Alternative Solutions for PKI

For the commercial relationships among taxpayers it is very important that electronic invoices have the legal status of documents.

The most common solution is to use digital signatures as discussed earlier in this chapter.

Section 7.1.7. presents three different alternatives that can be adopted in a very short period of time to provide that legal status.

7.2. An alternative approach: public and private cooperation

The implementation of electronic invoice in Latin America has been a success. The billions of documents that have been prepared, authorized or validated by tax administrations in the region are proof of the viability, both technically and legally, of a direct and closer exchange of detailed information from taxpayers and the tax administrations.

In our opinion, it has been good for the governments, of course, but also for the private sector. We recognize that there are taxpayers that might have, or still have in other parts of the word, doubts about that possibility and a reluctance to accept such close interaction with the tax administration, with information flowing when things occur as opposed to periodic reports or declarations.

The taxpayers' perspective has been already presented in Chapter 6, but there are other participants in what is a public – private cooperation effort towards a modern business-tax ecosystem with higher levels of information exchange and inter-operability.

This is precisely why we invited a relevant player from the private sector to make a contribution to this book. In Mexico the implementation of the national system for electronic invoices is supported by a network of private companies that act on behalf of SAT in the clearance process. While CIAT may have an alternate perspective on certain aspects of electronic invoicing, it nevertheless considers the following contribution an interesting complement in order to perceive the private sector view of a mandatory approach that implements a national electronic invoice system. Nelly Maldonado is the Managing Executive at AMEXIPAC, the association of those private companies in Mexico, and the following are her thoughts on the subject. (Raul Zambrano, CIAT)

7.2.1. Background of electronic invoicing in Latin America.

Electronic invoicing started in Latin America at the beginning of the XXI Century, with the first regulations appearing between 2000 and 2005. According to the Economic Commission for Latin America and the Caribbean (ECLAC) tax evasion is one of the greatest challenges facing tax administrations in Latin America; progress in combating tax evasion requires administrative changes in countries' tax structures (CEPAL, 2019). Electronic invoicing allows for continuous controls on value added tax (VAT) and income tax.

Electronic invoicing is also a fundamental element for promoting a formal economy. A conscientious and responsible citizen, aware of the negative impacts of informal markets, will find electronic invoicing to be fair competition, through automation within organizations, and thus, more efficient businesses for prosperous economies.

Furthermore, electronic invoicing is generating enormous amounts of data that speak to the dynamics of economies in the region. The data available thanks to electronic invoicing is now a potential for the development of electronic government services that can significantly contribute to improve citizen transactions with state agencies.

In the task of collecting taxes, broadening the tax base, and promoting voluntary compliance, technology has become an invaluable tool for tax administrations in Latin America. Through the use of digital services, tax administrations have found an effective medium to establish a closer communication with taxpayers, deliver solutions that simplify the fulfillment of tax obligations, and manage audit controls.

Regulations in Latin America regarding Electronic Invoice have developed as shown in the following table:

Table 7.2-1 Year and source of electronic invoicing regulations in Latin America

Country	Year when electronic invoicing regulation begins	Tax Administration	Sources of regulation
Argentina	2006	 AFIP Administración Federal de Ingresos Públicos https://www.afip.gob.ar/sitio/externos/default.asp	Resoluciones Generales: 2485/2018; 2758/2010; 2904/2010; 2926/2010; 3067/2011; 3411/2012; 3749/2015.
Barbados	2001	 BARBADOS REVENUE AUTHORITY Barbados Revenue Authority	Chapter 308B Electronic Transactions 2001-2
Bolivia	2014	 SIAT Servicio de Impuestos Nacionales	Resolución Normativa de Directorio (RND) N° 10-0021-16 de Sistema de Facturación Virtual (SFV) de 01 de julio de 2016 emitido por el Servicio de Impuestos Nacionales, esta norma ajusta y consolida la RND N° 10-0025-14 de 29 de agosto de 2014. <u>RND 101800000026</u> . Anexo Técnico 1.
Brazil	2006	 Receita Federal Receita Federal do Brasil	Ajuste Sinief 07/2005, Ajuste Sinief 07/2009, Convênio ICMS 115/2003
Chile	2003	 SII Servicio de Impuestos Internos	Ley del IVA, Resoluciones emitidas por el Servicio Impuestos Internos 11,18 y 45 de 2003. Obligatoriedad: Ley N°20.727 del 31 de enero de 2014.
Colombia	2015	 DIAN Dirección de Impuestos y Aduanas Nacionales	Ley 223 de 1995, Ley 527 de 1999, Decreto 2242 de 2015, Resolución 019 de 2016.






(continued)

Table 7.2-1 Year and source of electronic invoicing regulations in Latin America (*continued*)

Country	Year when electronic invoicing regulation begins	Tax Administration	Sources of regulation
Costa Rica	2003	 MH Ministerio de Hacienda Costa Rica	Resolución N° 04-03, 23 de enero de 2003, publicada en la Gaceta N° 42 de 28 de febrero de 2003. Resolución N° DGT-22-07 del 17 de septiembre de 2007, publicada en la Gaceta N° 188 del 1 de octubre de 2007.
Dominican Republica	2019	 Impuestos Internos	Norma general 05-19 sobre Tipos de Comprobantes Fiscales Especiales. Decreto 254-06.
Ecuador	2012	 SRI Servicio de Rentas Internas	Ley Orgánica de Régimen Tributario Interno, Código Tributario, Ley de Reforma Tributaria, Ley Reformativa para la equidad tributaria en el Ecuador.
Guatemala	2007	 SAT Superintendencia de Administración Tributaria	Acuerdo de Directorio Número 024-2007 Acuerdo de Directorio Número 008-2011
Honduras	2010	 SAR Servicio de Administración de Rentas	Decreto 17/2010, Ley de Fortalecimiento de los Ingresos, Equidad Social y Racionalización del Gasto Público. Acuerdo 184-2014.
Mexico	2004	 SAT Servicio de Administración Tributaria	Código Fiscal de la Federación
Nicaragua	2007	 DGI Dirección General de Ingresos	Disposición Técnica Número 09-2007, aprobada el 23 de mayo de 2007.

(continued)

Table 7.2-1 Year and source of electronic invoicing regulations in Latin America (*continued*)

Country	Year when electronic invoicing regulation begins	Tax Administration	Sources of regulation
Panama	2017	 DGI Dirección General de Ingresos	Resolución N° 201-5784 / Ficha Técnica Agosto, 2018. Publicada en la Gaceta Oficial Digital el 10 de septiembre de 2018.
Paraguay	2017	 SET Subsecretaría de Estado de Tributación	Decreto 7795 Ministerio de Hacienda
Peru	2010	 SUNAT Superintendencia Nacional de Aduanas y de Administración Tributaria	RS 097- 2012/SUNAT y modificatorias, RS 182-2010/SUNAT y modificatorias, RS 300 - 2014/SUNAT y modificatorias.
Uruguay	2012	 DGI Dirección General Impositiva	Ley-Decretos y Resoluciones.
Venezuela	2008	 SENIAT Servicio Nacional Integrado de Administración Aduanera y Tributaria	Providencia Administrativa N°/SNAT/2008/0257 Caracas, 19 de agosto de 2008. 198° Y 149°. Gaceta oficial 19 de Agosto de 2008.

Sources: AMEXIPAC, 2016; Barreix & Zambrano, 2018; Latin America tax administrations websites

It is worth mentioning that before regulations for electronic invoicing appeared in Latin America, as of 1999 Mexican entrepreneurs came together to identify and develop solutions for transforming taxpayer invoices into a digital format and presented the tax administration with a useful model to explore (Kotler, 2015). By the year 2000 the Ministry of Finance and Public Credit in Mexico,⁶⁴ promoted the use of advanced electronic signature, electronic invoicing, and the taxpayer's virtual office.

7.2.2. Beginnings of the public and private collaboration.

Third parties began collaborating with tax administrations first as authorized printers of invoices. Countries such as Mexico, Chile, Ecuador, Argentina, and Guatemala, with the aid of private sector investments, resources, and support began to develop networks that provided extensive distribution of official paper formats and folio numbers for invoicing purposes.

Post audit systems allow the delivery of an invoice between parties without the tax administration receiving notice of the transaction in real time (Sovos Basware, 2019). Paper invoicing implies a post audit system where preservation of invoices together with accounting records are required as proof for tax statements and audit processes that might occur in the future, usually up to 5 or 10 years according to regulation of each country.

However, since the 1990s a global trend began the use of Enterprise Resource Planning (ERP) systems. By the 2000s, large companies in Latin America increasingly relied on ERP's or other digital tools to support sales, accounting, and other business processes. The gap between the expanding digital processes in the private sector and the burden of costs associated with printing, managing, sending, correcting, canceling, storing, and organizing paper tax invoicing was widening.

Furthermore, governmental administrative capabilities were at full capacity, demanding manual verification of paper invoicing in audits (SAT, 2018).

Transactions of paper tax invoices generally required the taxpayer to issue an original, and two copies: one for the receiver and one for the accounting archive for audit purposes.

Modernization of the invoicing schemes was required in order for tax administrations to achieve the substantial tasks of increasing collections and reducing tax evasion, which generally occurred through the falsification of paper invoices.

In the early 2000s, diverse electronic invoicing schemes were designed by different countries in Latin America, all of them based on a clearance system (Sovos Basware, 2019). Clearance systems require the validation of an invoice before an issuer delivers the document to the receiver, and thus, real time data of commercial activities is traceable by the tax administration from the moment an electronic invoice is issued.

Pioneering countries like Chile, Mexico, and Brazil, leveraged the benefits of Public Key Infrastructure, PKI to develop their clearance systems. With PKI, digital certificates are issued to taxpayers, which they in turn use to digitally sign electronic invoices. This guarantees that the electronic invoices issued comply with the principles of authenticity, integrity, confidentiality and non-repudiation (Centro de Estudios de la Economía Digital, 2002).

The authentication element of the parties in PKI is based on digital certificates that are electronic files consisting of a “pair of keys” issued to the holder, which can be a natural or legal person:

- **Public key:** .cer file.
- **Private key:** .key file.

Beyond the technology required to issue, process, send, receive, and safeguard electronic invoices, tax administrations had to establish the regulatory framework to define the scope of the scheme to be adopted.

Countries like Mexico, Peru, Guatemala, and Colombia have conceived in their regulations the collaboration with the private sector, through regulated entities as third parties for the implementation, delivery, and support of taxpayers in the operations of electronic invoicing. These clearance models, where third parties are strictly regulated by tax administrations for validating and certifying invoices, are popularly known as network models, or collaborative, distributed models.

Generally, network models have opted for a broader number of documents beyond electronic invoices to be certified in real time. That is in part for the increased capacity reached in conjunction with third parties to reach taxpayers for service orientation and technical support.

Other countries like Brazil, Chile, Argentina, and Ecuador provide services of validation and certification directly to taxpayers or through the tax administration or related state agencies. These clearance models, where government itself is responsible for validating and certifying alone, are popularly known as centralized models.

In the beginning of the transition from paper invoicing to electronic invoicing, network models in Latin America authorized third parties, as an option for taxpayers that managed a similar process to the one executed by authorized printers, to: Require folio numbers from tax administrations to insert into digital documents that would be signed by the third party before being sent to the tax authorities. Third parties also managed monthly reports which included the management of cancelled transactions.

Centralized models planned for a much slower implementation of the electronic invoicing scheme, like in Chile, where during for more than 10 years adoption of electronic invoicing was an option even for large companies, and more than 14 years have elapsed since the first regulations were created for full adoption to take place. Other countries in centralized models have a reduced scope of digital tax documents to be certified. For example, establishing a limited obligation to issue electronic invoicing only to certain taxpayers, such as government suppliers and/or large companies, which set up hybrid environments where paper and electronic invoicing coexist. Another example of reduced scope of the scheme is lack of digital certification of documents such as business to consumer transactions or payroll salary payments.

In the early days of electronic invoicing, some of the network models and some of the centralized models in Latin America allowed for a delay in the delivery of the invoice to the tax administration of up to a month after the invoices were issued, generating risks of bad practices because transmission of data was not made in real time.

Notwithstanding the latter, the main schema of electronic invoicing was based on:

- **Extensible Markup Language (XML).** Universal and non-proprietary standard for the definition of data structure in the digital document of electronic invoice.
- **PKI based electronic signatures.** Guarantee authenticity, integrity, non-repudiation, and confidentiality of the information.

In order to enable real time delivery to the tax administration of every electronic invoice, ensuring secure availability of the scheme for any number of issuers and receivers, including the tax administrations, a key milestone was still to be incorporated: Collaboration with *trusted* third parties.

Figure 7.2-1 Latin America electronic invoicing overview



* These countries have legally regulated the participation of third parties of electronic invoicing for generating, pre-validating, transmitting, and safeguarding the document to the tax administration but have not yet regulated the full validation and certification of the documents directly through the network entities.

Source: AMEXIPAC

7.2.3. *Trusted third parties: PAC entities and their peers in Latin America*

By 2010, Mexico, one of the pioneering countries in Latin America to adopt electronic invoicing, defined an online invoicing scheme which further strengthened the controls for invoicing, securing availability for users on all ends (government and taxpayers), and capitalizing on governmental agency efficiency and low investments required.

Thus, Mexico's tax administration designed a regulatory framework that attained a major increase in the capacity to expand communication services for millions of users, and a network of support to advise taxpayers individually for the integration and continuity of operations in the scheme (SAT, 2018).

Authorized third parties evolved into the Authorized Certification Service Providers,⁶⁵ also known as, PAC entities.⁶⁶ The new entities are a trusted third party authorized by the tax administration. Specific functions of the PAC entities include the validation of an issuer's certificate of identity, as well as the digital document structure according to the defined standard. After confirming validations, a PAC entity signs and seals the invoice for immediate return to the issuer and the tax administration simultaneously.

In order to obtain authorization qualifying organizations must first prove an exhaustive technical audit, to proof the operational and infrastructure security according to the service level agreement established by the tax administration.

Technical requirements include:

- Proof of functionality of the free application to generate electronic invoice.
- Evidence of controls applied to execute validation of XML according to the current standard.
- Controls for the management of digital certificates that would be trusted by the tax administration.
- Communication protocols for transmission of data to the tax administration.
- Remote tools for audit.
- Safeguard of archiving functionalities.

If the technical audit is approved, legal requirements must be fulfilled for the tax administration to grant authorization. Legal requirements include:

- Proof of tax compliance record.
- Proof of subscribed capital in the organization of at least \$500,000 USD.
- Confidentiality and privacy of data agreement.

Finally, if both technical and legal audits are approved, the tax administration grants the authorization giving 30 days for the new PAC entity to present a security of \$500,000 USD to the Federal Treasury.

The scheme of PAC entities was the network which allowed the introduction of the current version of electronic invoicing in Mexico, *Comprobante Fiscal Digital por Internet* (CFDI) (Online Digital Tax Receipt), which began gradually in 2011 and optional for some taxpayer sectors, and was fully consolidated in 2014, when the obligation to issue CFDI is required for all taxpayers as the only valid scheme for invoicing in the country.

Through the definition of a schema relying on the network of PAC entities as trusted third parties, Mexican authorities secured what has become a key value in the face of rapidly developing technologies: continuous availability.

Since multiple PAC entities are authorized, a broad range of private sector offers with diversified technical infrastructure are available. Due to the fact that each PAC entity is autonomous to allocate its own hardware security module (HSM) in premises or clouds that comply with regulations, a variety of locations and service providers further protects all users in the system from a downtime caused by a centralized scheme.

Cryptography and information security controls are standard for all trusted third parties. Organizational processes regarding human resources, business continuity plans and disaster recovery plans are also in force for every PAC entity authorized.

Taxpayers can select more than one option to issue their invoices. Thus, a broad range of private sector PAC entities, each supporting specialized verticals while complying with technical requirements, aid in fulfilling the requirements for operations that lead to an electronic invoice.

In Mexico, the incorporation of the network of PAC entities into the process of electronic invoices, simplified the adoption for large and medium sized companies that required tailor-made integrations to comply with the standard. Also, through the availability of free applications for issuing -required by the tax administration to all PAC entities-, micro and small companies had access to a broad spectrum of free services that ensured adoption for taxpayers in every tax regime.

Trusted third parties need to maintain compliance with all requirements on which basis their authorization was granted. They are continuously supervised and audited, both on premise and remotely. Also, PAC entities are subjected to fines if a service level agreement or regulation is not strictly observed, and revocation is possible if a serious breach of a regulation becomes apparent.

Today, Mexico is leading worldwide in a scheme of electronic invoicing, where all transactions, including business to business, business to consumer, business to government, payroll salary payments, imports and exports, merchandise shipping, credit notes, receipt of payments, and bank account statements are certified. All these transactions currently represent 577 million invoices

monthly that are validated, certified, and delivered in real time, which translates to the issuance of 230 invoices per second. There are more than 70 PAC entities in the network with the tax administration in Mexico, each specializing in specific market verticals.

The Mexican Tax Administration stated during the 48th CIAT General Assembly, at Rio de Janeiro, Brazil in 2014, “*The public-private collaboration for the implementation of the electronic invoice scheme, allows to ensure the compliance with new provisions, without altering their operations and allowing the exchange of information so that the standards are consistent with the expectations of the authority and the real operation of the taxpayer.*”

Other countries in Latin America such as Colombia, Peru, Guatemala, and Uruguay have envisioned third parties in their regulations.

The *Proveedor Tecnológico y Proveedor Autorizado* (Technology Provider and Authorized Provider) are the references for third party entities in Colombia. The Proveedores Tecnológicos are currently authorized to generate, pre-validate, and deliver invoices to the tax administration. Rules for authorization of *Proveedores Autorizados* that will certify electronic invoices together with the tax administration, as provisioned in article 616-4 of *Estatuto Tributario Nacional* (National Tax Statute) are still pending.

Guatemala through the *Acuerdo de Directorio Número SAT-13-2018* (Board Agreement Number SAT-13-2018) has begun the authorization of *Certificadores de Documentos Tributarios Electrónicos* (Electronic Tax Document Certifiers), and is moving forward with a full network clearance system.

Uruguay has conceived *Proveedores Habilitados* (Enabled Providers) (DGI, 2019) entity as an intermediary that allows interested issuers to simplify their incorporation to the electronic invoicing system. While *Proveedores Habilitados* do not certify directly the invoices, they have a series of characteristics that set the first steps for network clearance through third parties:

- Required to successfully approve tax administration tests for all types of electronic invoicing included in the scheme.
- Offer services for the electronic exchange of documents (sending and receiving).
 - ❑ Help desk.
 - ❑ Module that allows import and export of electronic invoices.
 - ❑ Secure mechanisms for the storage of fiscal data, tax receipts, and digital certificates.
 - ❑ Information security policy that includes security and confidentiality agreements.
 - ❑ Service level agreements that guarantee their minimum availability.

Bolivia published on November 2018, *Resolución Normativa de Directorio* (Board Resolution) N° 101800000026 R-0011, which regulates the certification of systems for the issuing and transmission

of tax documents to the tax administration. Although it is opening the path for network clearance, this model has yet to evolve into a permanent audit of a trusted third party not based on software certification but on authorized entities.

While regulations, operations and scope of services vary due to the powers granted by the respective authorities to the trusted third parties, the network clearance model is based on 3 principles:

- **Extensible Markup Language (XML).** Universal and non-proprietary standard for the definition of data structure in the digital document of electronic invoice.
- **PKI based electronic signatures.** Guarantee authenticity, integrity, non-repudiation, and confidentiality of the information.
- **Trusted Third Party Certification.** Network of authorized entities and tax administration are available to validate and certify electronic invoices.

The Digital Agenda for Latin America and the Caribbean (eLAC2020), presented during the Sixth Ministerial Conference on the Information Society of Latin America and the Caribbean in 2018, included the commitment to “Establish and promote standards of digital services that facilitate and streamline government services and promote multiple access channels, favoring a regional interoperable digital services environment through the development of infrastructure, platforms, architectures, standards and integrated systems.” (CEPAL, 2018)

PAC entities and their peers in Latin America constitute multiple access channels that favor interoperability in the communications between all users of electronic invoicing.

For its part, the Inter-American Development Bank (IADB), in conjunction with the Inter-American Center of Tax Administrations (CIAT), highlighted in its publication on Electronic Invoice in Latin America, that: “The solution implemented in Mexico, meanwhile, diminishes the necessary effort of the Tax Administration in relation to the reception and certification of documents and the PACs, by the model itself, can be backed by one of the others. In this sense, the volume of direct investments on the part of the administration is relatively minor, as well as the effort of the implementation of the model in the management of technical support and in the guarantee of high availability.” (Barreix & Zambrano, 2018, p.18).

7.2.4. *Issuing models in Latin America: Government and taxpayers' perspectives*

As illustrated before, there are three main models of issuing electronic invoice in Latin America:

- **Network clearance model.** Trusted third parties, PAC entities or their peers in Latin America are granted authorization by tax administrations to validate and certify electronic invoices, sending the documents to the issuer and the state and archiving according to regulations. Together, PAC entities and tax administrations also validate and certify electronic invoices in free applications with basic features.

- **Centralized clearance model.** Tax administrations validate and certify all electronic invoices directly and return the final document to the issuer.
- **Post audit model.** Tax regulations do not require the delivery of real time or near real time of the invoice. Electronic invoice is only validated by the issuer and the receiver but has to be archived to prove integrity in audit processes.

Tax education in Latin America is challenging for authorities throughout the region. With the participation of networks of regulated entities as trusted third parties, not only are communications distributed in multiple channels, but also, a fine structure of specialized resources is deployed to aid taxpayers in adopting regulations.

Other value-added services to the certification of electronic invoice, provided trusted third parties, PAC entities and their peers in Latin America are:

- Document generation.
- Mailbox for reception.
- Verification of electronic invoices received.
- Cancellation of electronic invoices in high volume.
- Extended safeguarding.

Integrations for e-commerce include:

- EDI solutions and applications.
- Systems integration between customers and providers.
- Purchase orders, reception notes, payment receipts.
- Integration by web services, SFTP, OFTP, AS/2, AS/4.
- Inventory control.
- Electronic catalogs of products and services.
- File format conversion.

Administrative systems:

- Implementation.
 - ❑ Legacy data migration.
 - ❑ Development and support to databases.

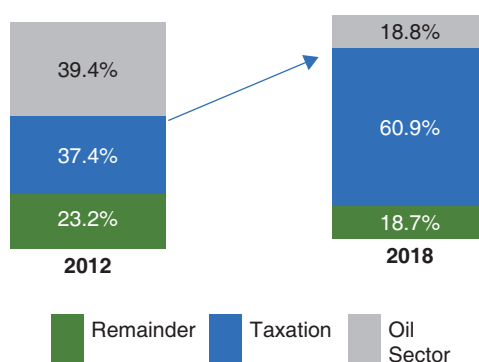
- Online security services:
 - ❑ SSL certificates.
 - ❑ Time stamping.
 - ❑ PKI infrastructures.
 - ❑ Data storage.
- IT services outsourcing:
 - ❑ Data center services.
 - ❑ Service desk, user support.
 - ❑ Data migration.
 - ❑ Development and support to databases.
- Mobile Applications and Web Portals:
 - ❑ Inter-platforms and devices.
 - ❑ Customers, providers, employees.
- Digital marketing:
 - ❑ Market research.
 - ❑ Press releases and newsletters.
- Payment and Financing:
 - ❑ Online payment methods.
 - ❑ Factoring, dynamic discounting.
- Other factors:
 - ❑ Paperless Office.
 - ❑ Software Design and Development.
 - ❑ Hardware Use Optimization.

In sum, the use of peripheral value-added services to the offer of digital tax services, complement the administrative and operational needs of taxpayers of all sectors and economic levels, capitalizing on the benefits of online taxation.

Regarding collection, in Mexico's case with a network clearance model of electronic invoicing, the Mexican economy grew 75% in the last two decades, while the collection of taxes increased 172%, more than double than the economic activity.

From 2012 to 2018, taxes have become the most important public revenue source in Mexico.

Figure 7.2-2 Mexico's Source of Public Income. 2012-2018



Source: SAT/SHCP

7.2.5. Network clearance of electronic invoicing: Beyond issuing

According to a study conducted by the Monterrey Technological Institute of Higher Education (ITESM by its Spanish abbreviation) on the impact of electronic invoicing on tax evasion (ITESM, 2016):

- The introduction of electronic invoice resulted in an increase in transactions involving VAT and in declared deduction amounts.
- Electronic invoice incorporation complicates tax evasion by generating real time transaction information, while increasing the probability of evader discovery through higher-quality audits that produce sufficient evidence in less time.

Electronic invoicing is a key tool for diagnosing and combatting tax evasion schemes, such as illicit outsourcing and simulated, or ghost, invoicing operations, throughout Latin America. Electronic invoicing makes parametric analysis and business intelligence possible so that the authorities can develop massive, specialized strategies for dealing with illegitimate tax receipt exchange networks.

Tax statements are based on real data rather than the sampling mechanisms of paper-based invoicing used in the past. Today tax administrations with mature electronic invoicing systems are able to analyze information from electronic invoices to identify costs and expenses, including payroll salary payments and compare them with company records to identify evasion schemes based on simulated operations.

Another benefit of electronic invoicing are digital audits available to tax administrations, reducing costly resources and time. Audits can now be carried out during the taxpayer cycle and are not limited to periodical or eventual exercises. Electronic audits evolve to become a permanent verification that enforce compliance.

For taxpayers in some electronic invoicing jurisdictions, pre-filled tax statements are now available. The latter shortens time businesses and natural persons have to assign to comply with tax obligations.

In some countries in the region additional reports regarding VAT have also been eliminated, since information is already in the tax administration thanks to electronic invoicing. Calculation of income tax can be anticipated based on previous periods data.

Some tax administrations have made mobile applications available for further simplification. All the above contribute to shorten the time to access return of taxes, if applicable.

Finally, electronic invoicing is opening the door for factoring and dynamic discounting. Invoices can become a key element for access to finance for micro, small, and medium sized companies that have long required working capital. Regulation is being promoted by the private sector to achieve adequate guarantees for all parties towards developing this goal.

H.C. Lee states that, *“For successful standardization, public and private participation is important. Private stakeholders such as e-invoice service providers and e-invoice users with their own legacy systems should be able to agree on common e-invoice standards in order to minimize their adjustment costs”* (Lee, 2016).

Harmonization of Latin America regarding electronic invoicing has the potential to increase commercial exchange and tax collaboration in the region.

Notes

54. Forming what some Asian literature qualify as “Fiscal Internet of Things”, although in the opinion of the author a truly Fiscal IoT should be more valuable to businesses than to a tax administration – which is not this case, since the communication capability serves only for tax control purposes.
55. In some cases, the equipment ceases to be usable if no transmission is successfully made in a reduced number of days, and its functions only resume after the completion of a successful transmission.
56. In this case, maturity has been understood as 100% of B2B operations supported in electronic invoice transmitted to the tax administration.
57. Except for Italy, and it is believed this country will soon be imitated by a number of other countries which struggle with expressive figures on VAT breach and businesses informality.
58. Article 218 - For the purposes of this Directive, Member States shall accept documents or messages on paper or in electronic form as invoices if they meet the conditions laid down in this Chapter (Directive 2010/45/EU of the European Parliament and of the Council of 13 July 2010, amending Directive 2006/112/EC on the common system of value added tax as regards the rules on invoicing procurement, underlined by the author).
59. Takes into account only transport services invoices and goods invoices, because services invoices, including communication services, and energy bills are not part of that system.
60. Source of information: CIAT e-Invoice Network of Tax Administration Professionals, consolidated by the author.
61. Some countries adopt both: validation must occur before the operation when the buyer is also a VAT taxpayer (because in this case the tax registered in the invoice will reduce the total VAT owed by the buyer), or can occur

- after the operation, when the operation is for final consumption (it is assumed that, in this case, the tax administration has the invoices regarding the retail operations acquisitions, since those acquisitions are B2B operations, transmitted to the tax administration before the occurrence of the commercial transaction).
62. Juridical concepts extracted from (Carnelutti, 1950) and (Chiovenda, 1998). These concepts from penal law and civil law studies, originally stated for Italy in the middle of the 20th century, are nowadays broadly accepted in most countries of the world.
 63. CIAT e-Invoice Network of Tax Administration Professionals, consolidated by the author.
 64. Secretaría de Hacienda y Crédito Público, SHCP.
 65. PSECFDI, as per the acronym in Spanish according to regulation in force in 2010. The name of the entity changed in 2014 into PCCFDI, Proveedor de Certificación de Comprobantes Digitales por Internet, which remains until today.
 66. PAC stands for Proveedor Autorizado de Certificación, its description of popular acronym in Spanish.

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8. MERGING CUSTOMS AND TAX ADMINISTRATIONS: A REFLECTION ON ICT SYSTEMS GOVERNANCE - THE PORTUGAL EXPERIENCE

8.1. Introduction

The purpose of this article is to take a retrospective view and reflect upon the impacts and consequences of the merger of the Tax and Customs Administrations in Portugal, which occurred back in 2012.

Although the article starts with a general contextual background, which aims to allow the reader to understand the initial motivations and objectives of this merger, its focus will be the analysis of the impact of the merger at the level of the governance of information technology (IT) systems. As the chapter will make clear, although there is a broad set of consequences that transverse the whole organization, the synergies that result from such a merger at the level of IT systems governance can be, provided the adequate strategy is put in place, particularly significant.

The chapter adopts the following structure: first, it presents a very brief historical background and context to the merger. Then, it analyses the merger from the perspective of the integrated governance of IT systems, assessing its main characteristics and strengths, and presenting some recent practical examples where the integrated governance of the IT architecture allowed for significant efficiencies and optimization of resources. Building on the accumulated experience of the last years, the chapter concludes with a set of recommendations and practical guidance.

8.2. Historical background and context

The merger of the Portuguese Taxation and Customs Administrations occurred back on the 1st of January of 2012. A particularity of this merger was that it involved merging not only the Taxation Administration (*Direcção-Geral dos Impostos – DGCI by its Portuguese acronym*) and the Customs Administration (*Direcção-Geral das Alfândegas e dos Impostos Especiais sobre o Consumo – DGAIEC by its Portuguese acronym*), but also the Information Technologies Administration (*Direcção-Geral de Informática e Apoio aos Serviços Tributários e Aduaneiros – DGITA by its Portuguese acronym*), which until then had worked as a stand-alone General-Directorate, providing IT services to both

the Taxation and the Customs Administrations. The entity that resulted from this three-party merger, so-called “*Autoridade Tributária e Aduaneira (AT by its Portuguese acronym)*” is today’s Portuguese Tax and Customs Authority.

This merger was part of a broader political strategy of optimization of the Portuguese Public Administration, with the stated objective of increasing its efficiency, rationalizing the use of public resources, and reducing public expenditure. At the time, rationalizing the governance structure of Public Administration, eliminating potential redundancies and promoting better use of its human resources was perceived as crucial to modernize the State and reduce its operating costs.

The new organic structure of AT was approved by Decree-Law 118/2011, which re-defined, in a broader and more coherent way, the mission and objectives of this new administration, with the purpose of ensuring a higher degree of coordination on the implementation of fiscal policies and more efficient allocation and use of existing human resources. It is worth noting that, from its inception, there was a profound concern with preserving the specialized competences, and certain of the cultural identity traits, that existed in the centennial organizations that were the object of this merger.

At the budgetary level, the creation of AT was meant to reduce costs through a streamlining of its central governance structure, the rationalization of the structure of the regional and local services, and the promotion of an investment step up in its IT infrastructure, adapting the organization to the new relationship paradigm between administrations, taxpayers and economic agents.

8.3. The merger from the perspective of ICT systems governance

While the merger process certainly resulted in an enormous challenge to the organization, it opened up the doors to a significant set of opportunities, which have gradually been explored since then.

The strategic alignment that led the merger process allowed for the creation of a unified vision, shared among AT’s organic units. This, in turn, has permitted AT, in the course of time, to obtain an added value from this process and to gradually establish a transformation roadmap that has allowed the organization to be seen as a reference and an engine of digital transformation within the Portuguese public administration.

Today, when facing its challenges, AT follows a strategy of permanent innovation, looking to each challenge as a step towards the path of digital transformation. This positioning is the result of a strategic option, which lies to a great extent on the pillars that were laid with the merger process.

Indeed, when viewed from the perspective of IT systems, the merger process has allowed for the consolidation of the global architecture of IT systems and for the establishment of a Reference Architecture that aims to address the challenges that current times pose to the administration of taxation and customs.

The convergence of IT systems allowed for very significant technological synergies to arise, allowing for the definition of this Reference Architecture, laid upon principles of technological consolidation and maximization of financial investments.

The existence of an IT architecture that transverses all areas of AT is an enormous asset of the organization, since it is the root for its capacity to answer efficiently to the challenges that it embraces.

The management of skills, when looked at from the perspective of the technological infrastructure that supports the development and exploration of IT systems, won new flexibility and scalability, which would not have been possible if the management of the different business areas was considered independently. That is, without the possibility to benefit in a shared and transversal way from the installed capacity.

Also, at the level of the management, operation and exploration of IT systems, the consolidation of technologies allowed for the optimization of processes, as well as for the concentration of the technical knowledge of our people. This, in turn, has been proving crucial to aim for a high level of performance.

Further, the adoption of processes and methodologies, at the level of portfolio and project management, that are common to the whole organization, has been contributing to the optimization of the capacity for planning and execution of the organization. Remarkably, it has also significantly contributed to the fostering of a unified organizational culture.

The integration of several IT systems, as well as the construction of an architecture of services of interoperability, has allowed for the construction of an IT ecosystem, which is able to centralize the processes of AT, as well as of other entities of the Portuguese public administration.

Fundamentally, the merger process has allowed for the enrichment of available information and of its respective analysis, adding different perspectives to the existing data. The data and the information that the organization is now able to obtain are one of its core assets, after its people. Overall, this was one of the assets that mostly benefitted from the merger, in that the analytical capacity of the organization, in a transversal perspective, was strongly reinforced.

The reinforced capacity that resulted from the amplification of the data that is subject to analysis, has allowed for the addition of new perspectives to the interpretation of such data. This, in turn, has allowed AT to raise the value that it obtains from this important asset. Be it at the customs level, be it at the tax level, the integrated vision of the information that is associated with taxpayers and economic operators, has allowed for higher efficiency of the organization, contributing to a more accurate 360° view of the reality of those that we serve.

In particular, information and its diverse complementary perspectives, has served to increase the quality of the services that we render; the mechanisms of assessment and control of risk; and the

audit process, in a holistic perspective of the relationship between taxpayers, economic operators and their tax and customs administration.

Naturally, the management of such an important asset as data, has required from AT a constant attention to the reinforcement of its data processing, treatment and analytical capacity. Further, it required the incorporation of demanding mechanisms of data governance, capable of transforming the enlarged universe of data available in the organization into useful information.

The path followed until now in this journey of organizational transformation has profited from the available technological opportunities and from the exploration of information, in order to develop services to citizens and to companies based on the principle of simplification of processes and obligations.

Looking to the recent past, the projects that stand as milestones in this long road of digital transformation are those that have consistently followed a cycle of data collection in a first phase; treatment and analysis in a second; and, lastly, that resulted in simplification or elimination of certain tax and customs obligations, for citizens and businesses.

All in all, this virtuous cycle of organizational transformation that started with the merger process, has allowed the organization to seriously profit from the integration and interoperability of the IT systems that support its different areas.

Some recent practical examples may be illustrative of how the integrated governance of the IT architecture has allowed for significant efficiencies and optimization of resources.

For instance, recently, in the context of the *Simplex* Program,⁶⁷ AT implemented two ambitious projects, that demanded a transversal involvement of Customs and Taxation IT systems and technical experts. The integrated governance structure of the organization was key to the successful and timely implementation of both projects.

The first project aimed at allowing for the payment of import VAT directly on the VAT tax return. Indeed, until the recent past, whenever goods were imported from outside the European Union to Portugal, VAT needed to be paid immediately at the Portuguese Customs at the moment of the importation. A temporary deferment of such payment could be allowed if an adequate financial guarantee was provided. This naturally penalized the cash-flow of companies, which needed to pay VAT upfront, and was also detrimental to the competitiveness of Portuguese ports. In order to counteract these negative effects, an IT structure was developed that connected traditional customs IT systems with the VAT tax return, allowing, through an interface that connected both systems, for import VAT to be showed directly on the VAT return, and to be treated as any other payable VAT. The interface also allowed the taxpayer to see, directly on the VAT tax return, all the information collected at the customs level regarding such imports (ex., port of entry, time of assessment, etc.). The measure counted with a massive adherence of taxpayers, which now do not need to pay their VAT immediately at the moment of importation, and is currently up and running.

Another project that tested the integrated governance of the organization, was the implementation of the Simplex project “E-Taxfree Portugal”. Very broadly, this new system dematerialized the refund of VAT to foreign tourists that are visiting Portugal from outside the European Union, whenever they do purchases in Portugal above a certain defined threshold. This new dematerialized system allows for a much more refined control of the entire VAT refund process, since all transactions are communicated in real-time to the servers of AT in order to be validated. Furthermore, and crucially, it allowed for a very substantial improvement of the experience of tourists visiting Portugal, in that, instead of queuing for a long time at the airport to have their VAT refunds validated by the customs administration, they may now do it themselves in electronic Kiosks which are now available in all Portuguese airports. The implementation of this project, which demanded a very close interaction of customs and taxation experts and IT systems, was extremely facilitated by the integrated governance structure that AT now possesses.

Lastly, AT is now facing a substantial IT challenge, just like all its European counterparts, to implement the new VAT rules for taxing e-commerce. This challenge is especially acute in areas that intersect customs and taxation, such as the removal of the VAT exemption on imports of small consignments from non-EU countries. Very broadly, small consignments imported into the EU that are worth less than €22 are currently exempt from VAT. This will change starting on the 1st of January of 2021. In order to allow for a smooth transition to this new legal framework, trustworthy sellers from outside the EU will be able to register in a VAT One Stop Shop to deal with their VAT-related compliance where they make sales of goods of a value of not more than €150. The implementation of this new IT structure is demanding a very close interaction between AT’s tax and customs experts; and, is benefiting enormously from an integrated governance of its IT systems for a more efficient decision-making on the design of the best available solutions.

All in all, in these three recent examples, we were able to witness the strong added value of an integrated governance structure of Customs and Taxation and their respective IT systems. These examples come naturally on top of the immense benefits that we obtain on a daily basis from this integrated governance structure in areas such as the assessment and control of risk, or the audit process, as described above.

8.4. Conclusions and recommendations

Reflecting upon the merger process from the lenses of the governance of IT Systems, we have identified the following critical elements for success:

- The creation of an Architecture of Reference of IT Systems, capable of consolidating the different needs of the organization; of minimizing the dispersion of installed technology; and, of allowing for an efficient management of the technological and human resources that support the IT Systems, is essential to maximize the opportunities associated with a merger process;

- The promotion of the convergence of the diverse array of existing technological solutions that support the organization within the Architecture of Reference, is a task that requires the firm commitment of the top management of the organization;
- Stabilize the Architecture of Reference of the organization, in order to allow for a strategic management of skills, capable of providing an adequate answer to the challenges that the organization faces;
- Ensure the alignment between the strategic needs of the organization and the evolution of its IT Systems. In this regard, it is essential that the decision processes are always articulated among the different areas of the organization;
- Ensure the integration and interoperability between the different technological solutions of the organization, so as to promote a true transversal operational character of its IT Systems;
- Make the most of the transversal sharing of information, maximizing the value of data to the organization;
- Define processes and methodologies that are common to the whole organization, as an essential step towards the transversal adoption of best practices.

Notes

67. Very broadly, a program launched by the Portuguese Government, which aims at administrative and legislative simplification, with the ultimate purpose of facilitating the relationship of citizens and business with the public administration, and of contributing to the increase of the internal efficiency of public services.

9. IMPACTS OF INFORMATION AND COMMUNICATION TECHNOLOGIES ON THE STRATEGIES OF THE TAX ADMINISTRATIONS –THE PERUVIAN EXPERIENCE

This section shall describe the process whereby senior management of tax administrations formulates and develops the organizational strategy. It provides a description of the notions contained in the strategy, the contextual information that drives it, the actions instructed, and the tools proposed in consideration of Information and Communication Technologies (ICTs) in its various aspects.

Notwithstanding, it shall not prescribe a methodology for the formulation of an institutional strategic plan rather focus on how such an exercise may be improved by including consideration of ICTs, especially if these apply directly to the strategic actions proposed to meet the goals of the tax administration.

To this end, the progress made by the Peruvian tax authority, the National Superintendence of Customs and Tax Administration (SUNAT, as per the Spanish acronym), in its role as the tax administrator, is used as a benchmark.⁶⁸

9.1. Formulating the strategy

Strategic planning aims at ensuring that the tax administration meets the goals assigned to it, which in most cases relate to efficient collections as stated in the tax burden⁶⁹ established by ministries of economy or finance to fund public spending.

In formulating the strategy either directly or with the support of a strategic planning committee, the tax authority's senior management should carefully analyze the following main aspects:⁷⁰

- **The reality in which it operates**, ranging from an acknowledgment of the features of the government structure, the population it serves, the public and private institutions that may be related to its work, to the potential, restrictions and risks posed by the stakeholders that interact with the tax administration.
- **The desired future**. On the basis of the legal remit of the revenue agency, its own goals and expectations as well as those of its higher bodies or other bodies entrusted with defining the country's management guidelines⁷¹ should be set forth in such a way as to converge in a

single mission and vision that respond to the opportunities and threats posed by the environment. To ensure compliance with said future, plans should be coordinated with related agencies and an efficient assessment should be made of the progress and fulfillment of the goals relative to the plans.

Undeniably, the changing dynamics of ICTs and their pervasiveness even in the simplest everyday things mean that ICTs are now present in every economic and social activity, thus changing our way of producing, selling, working and communicating irreversibly. For this reason, they have evolved from being used by a minority or elite to being embraced by massive audiences, transforming many of our old paradigms in the process.⁷²

This reality affects not only the lives of citizens but also public institutions, especially those responsible for managing taxes, since ICTs can produce and manage data in a fast and massive manner. These data can subsequently be transformed into information, one of the main assets used by tax agencies in building their revenue systems. Suffice it to mention the multiple data that can be obtained immediately from electronic payment vouchers, such as quantities, type and amounts of purchases and sales, the processing of which may be used to derive both corporate and individual behavioral patterns, such as regular purchases versus infrequent ones, for a given type of business or consumer.

Furthermore, ICTs allow us to expand our scope in terms of communications, since it is possible to contact citizens most efficiently and even personally, both for purposes of providing them with information and receiving their feedback with a view to improving the revenue service.

Considering both the above-mentioned review of the reality surrounding the tax administration and its desired future should be part of the strategy formulation, a comprehensive in-depth assessment of the development of ICTs both in their current status and into the future must be made, for it might lead to significant changes in: (i) the action path chosen to reach the goals set; (ii) the way and rate at which the priorities defined may be served; and (iii) the establishment of a more or less demanding vision based on the availability of technologies and their trends.

9.2. The Peruvian Strategy

As part of Peru's government policies,⁷³ the strategic variable related to the role of the tax administration is effective tax collection, i.e. the government's overall revenue capacity from the actual collection of taxes, contributions and rates measured as the ratio between the government's overall tax revenues and the GDP (tax burden), whose targets are set in the Multi-annual Macroeconomic Frameworks⁷⁴ and their updated projection reports.

On this basis, for the 2018 – 2022 period,⁷⁵ SUNAT has determined five strategic institutional goals, three of which are directly linked to tax management, namely:

- **Improving tax compliance.** The intent is to make significant progress in taxpayer compliance by designing the necessary mechanisms and strategies.

In line with the global trend and for purposes of achieving the significant improvement expected, SUNAT has identified greater use of ICTs as a determining factor leading to more effective and efficient management of tax risks⁷⁶ in pursuit of a transformation of taxpayer behavior towards timely voluntary compliance, detecting inconsistencies, errors or omissions of mandates or behaviors, even before the tax obligation arises.

This is only possible by implementing strategic actions aimed at collecting, treating and distributing the necessary information supplemented by new ways of communicating with taxpayers based on agile processes with a view to improving the effectiveness of the tax administration's guidance, as well as all of its induction, deterrent and assessment efforts.

This spirit has prompted strategic institutional actions: (i) massive use of electronic proofs of payment; (ii) balance checking through a "Single Account";⁷⁷ and (iii) improvement of control capabilities focused on implementing risk management.

- **Reducing the cost of tax compliance** to avoid incurring and transferring unnecessary costs to taxpayers by the administration's commitment to process simplification, enhancement and automation, including by providing taxpayers with tools and products based on information held by the tax administration to help them be more efficient and competitive in their respective businesses.

Given the fact that we live in a changing era, not only in the sphere of technology but also in terms of citizens' habits, the tax administration has become especially concerned with seeking cost reductions in tax compliance and the implementation of new automated, simplified services that do not require the physical presence of citizens at service offices. To that end, it has focused on leveraging the use of massification and network evolution, as well as the proliferation of terminals and services.

The above is enabled by the fact that Peru has a national government guideline seeking to familiarize citizens with the use of ICTs, where government agencies must progressively ensure, if applicable, the deployment and provision of digital taxpayer services.⁷⁸

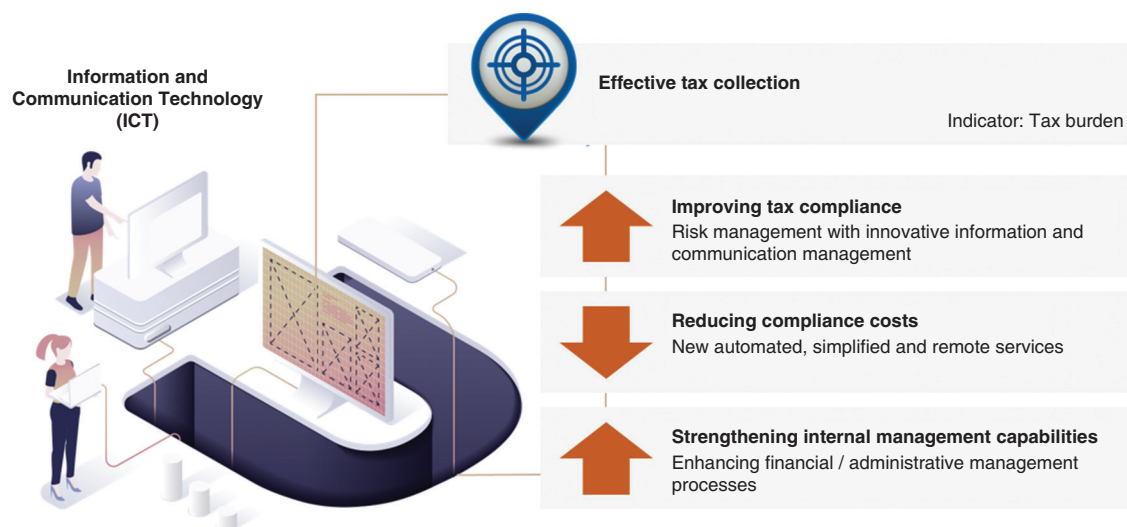
This has been the framework for the consideration of strategic institutional actions, including: (i) facilitation of voluntary compliance with tax duties by a comprehensive improvement underpinned by simple, virtual, automated and integrated processes, and (ii) the modernization of SUNAT services through the massive use of remote services.

- **Strengthening internal management capacity** to lead the organization towards enhanced financial and administrative management processes and improved productivity with the purpose of ensuring efficient use of the funds allocated to that end.

To achieve this strategic goal, SUNAT is undergoing an in-depth modernization process, which has resulted in accelerated changes in the key factors of the organization, ranging from the procurement and use of new technologies, which increased the rate of contracting, to the reprofiling of human resources arising from emerging needs for different types of knowledge, skills and attitudes, and the requirement of implementing new forms of internal communications that convey the strategic message effectively.

This requirement led to strategic actions in the organization, including: (i) improved internal efficiency; (ii) managing the training of internal users; and (iii) managing ethical strengthening and fighting corruption.

Figure 9.2-1 Strategy of the Peruvian Tax Administration



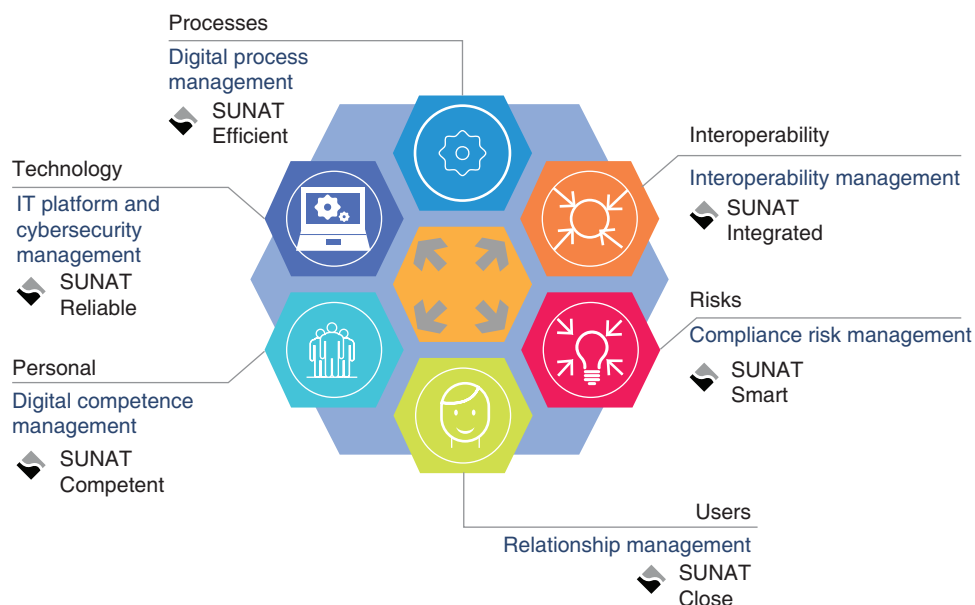
Source: Prepared by the author

9.3. Development of the strategy

The strategy set by the Peruvian tax authority can be summarized as reaching the annually determined tax burden by seeking to shift taxpayers' behavior towards timely and voluntary compliance, which requires the implementation of tax compliance risk management, efficient information use and innovative taxpayer relations. The latter should distinguish various taxpayer attitudes to determine risk profiles and prioritize facilitation for taxpayers willing to comply vis-a-vis those who choose not to comply. To this end, adequate internal management capacity should be ensured to enable the timely implementation of all necessary changes.

As discussed, one horizontal lever of the strategy is the use of ICTs through the opportunities awarded primarily by information management and the innovation of processes and taxpayer services as well as the tax administration's internal business. In this regard, it is necessary to develop the organizational structure of every one of the areas where such technology will be deployed so that progressive and planned implementation raises their effectiveness, for technology should not be viewed as a mere tool used for solving operational issues but for defining strategic actions.

Six areas were identified as part of the planning process for the use of ICTs: (i) digital process management; (ii) interoperability management; (iii) compliance risk management; (iv) relationship management; (v) digital competence management; and (vi) IT platform and cybersecurity management.

Figure 9.3-1 Action fronts of SUNAT's digital transformation plan

Source: Superintendencia Nacional de Aduanas y de Administración Tributaria (SUNAT) Perú

Digital Process Management

- It implies restructuring processes with a focus on technology to make them flexible to the efficiency improvements brought about by the updating of tools and technology platforms.
- The slow flow of information in analog processes creates weaknesses such as coordination bottlenecks between the various tax administration units, restrictions to the rate of changes needed, inadequate standardization of proceedings and limited evaluation leading to inefficient outcomes. For this reason, digitization efforts should begin at the processes related to taxpayer identification, as well as those referring to debit and credit controls, for these are the most impactful. Moreover, they should be leveraged by centralization, which will lead to improved efficiency.
- Migrating from physical to digital documents, not only in terms of their issuance but also their notification, is another key element in the search for process enhancement through the use of ICTs, which makes their implementation and later massification the basis for digital process management.
- Along these lines, the Peruvian Tax Administration has prioritized the digitization of the following processes, among others:
- Simplification of the Single Taxpayer Registry (RUC, as per the acronym in Spanish),⁷⁹ beginning by implementing a “digital identity”, which implies accepting as valid for tax purposes the use of the national identity document number granted by the Peruvian government to citizens born in Peru and nationals from other countries who request Peruvian nationality. This will eliminate the current need for a different type of identification under the RUC, with

the resulting administrative simplification and opening up to the implementation of technology innovations such as biometrics or blockchain to facilitate proceedings even further while providing for adequate security.

As part of this initiative, the Peruvian Tax Administration signed an agreement last July with the agency responsible for the National Registry of Identification and Civil Status (RENIEC, as per the acronym in Spanish)⁸⁰ to facilitate access for Peruvian citizens to digital tax and customs services by the massification of digital identities through biometric queries, using both fingerprint and facial recognition. This has been the first step towards gradually eliminating the need for approaching SUNAT's taxpayer service offices physically and enabling access to services from any location over the Internet instead. By the second semester of 2020, the initiative will be expanded to include identification of potential taxpayers by relating the persons' identity to tax records.

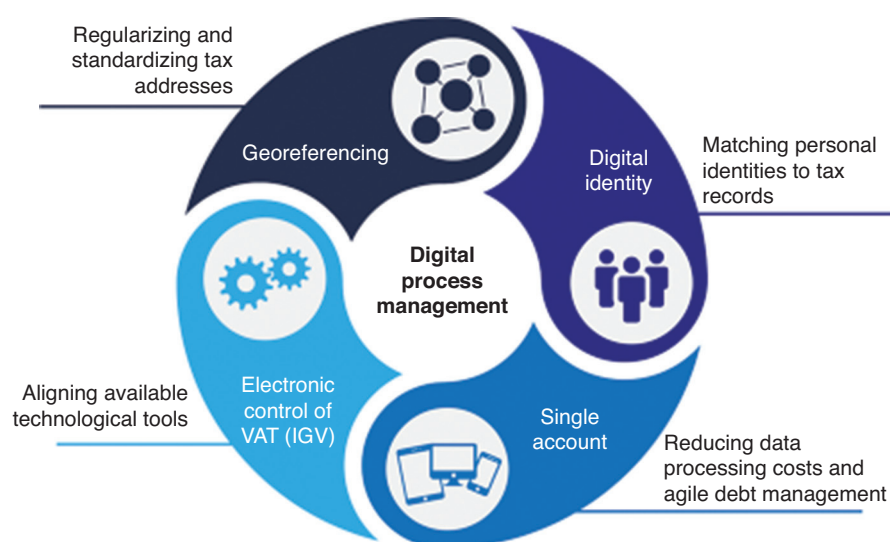
- Another feature that has been prioritized is the georeferencing of tax addresses⁸¹ and ancillary establishments, which is underway thanks to modern technology such as that using geographical indicators found on the Internet with the purpose of regularizing the names of railways or geographical areas. Upon detection, the system matches these to the names recorded in the databases, thus minimizing the errors in the recording or entry of information and increasing connectivity with taxpayers.
- Control and management of taxpayers' debits and credits by means of the initiative called "Single Account", which may be supported from cloud-based services enabling cost reductions in data processing and faster process management, with the subsequent enhancement in tax debt recovery and timeliness, especially if related to the preparation of the proposed tax return that will be provided to taxpayers generically.
- In parallel, there are initiatives underway for organized electronic verification of the Overall Sales Tax (IGV, as per the acronym in Spanish),⁸² by aligning a set of technical tools available in the tax administration to issue notices to taxpayers, define compliance indicators and variables, decide on a means to communicate information to taxpayers massively and the possibility of correcting omissions online, thus expanding significantly the tax administration's coverage capacity relative to non-compliance.

Said initiatives can be broken down into four control phases: (i) at the Single Taxpayer Registry by implementing risk profiling at the time of registering with the aim of detecting corporations without substance and by guaranteed connectivity with taxpayers by email and mobile telephony to improve the tax administration's persuasive capacity for compliance with tax obligations; (ii) at the issuance or reception of payment proofs by sending text message alerts when invoices were received for expenses or costs that Artificial Intelligence systems deem unusual for the type of business that made the purchases, and restricted authorization for printing payment proofs when tax obligations are outstanding, such as at submission of IGV returns; (iii) at the declaration and payment of the IGV by checking for inconsistencies between the information from electronic purchase and sale records⁸³ and electronic payment proofs reported by the taxpayer, their customers and providers; and (iv) at the audit of IGV assessments by the use of partial electronic auditing, enabling massive control through fully

electronic interaction between the tax administration and the audited taxpayer with no need for physical presence at offices or establishments.

- In addition to the progress made in controlling IGV electronically, other initiatives are being developed in connection with the restricted issuance of electronic payment proofs when the sole purpose is granting a tax credit to a buyer or user who has neither purchased goods nor received a service, prompted by the corporations' declaration of (inexistent) transactions. Implementing a centralized virtual control window through which the taxpayer interacts in real-time with the tax administration relative to any outstanding tax debt the latter has detected which needs correction; and the preparation of the electronic auditing file, making it fully virtual from the notice of requirement and initial submission letter to the issuance of closure documents of the audit procedure.
- Documenting transactions by the massive use of electronic proofs of payment with expected completion by 2021. The use of electronic documents awards the possibility of tracking transactions and makes it more feasible for the collection agency to obtain contextual data relative to taxable events, thus enabling more efficient management.
- Finally, although not a process per se, the massive use of digital documents, mainly those relative to collections prepared by the tax administration, is a cross-cutting need for all processes earmarked for digitization. For that reason, a plan has been established for the last phase. This initiative will provide further security to taxpayers, since digital signatures will be certified, there will be cost and time savings in the notification phase and thus in recovering the tax debt. In addition, there will be a mechanism to reduce the environmental impact by the almost complete elimination of paper.

Figure 9.3-2 Digital Process Management



Source: Prepared by the author

Interoperability Management

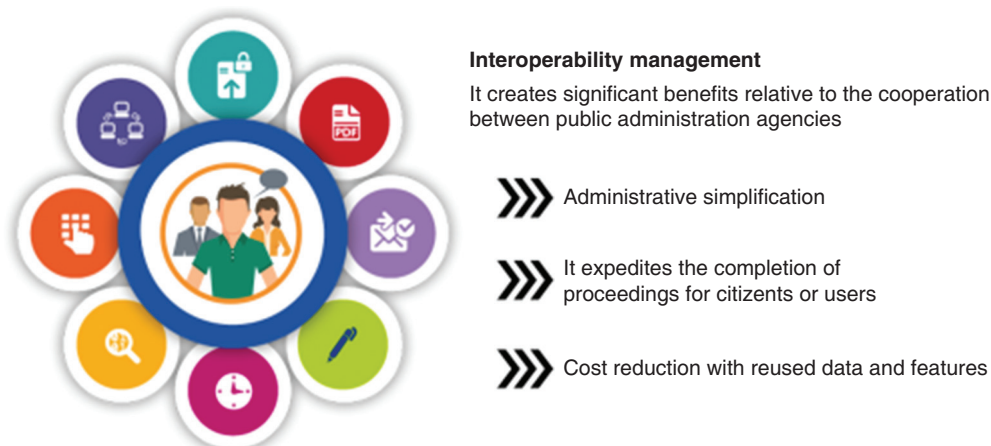
As mentioned above, the use of information, not only that derived from tax administration data but also from other public and private entities provided they are related to taxable individuals or economic activities is relevant in meeting the strategic goals.

It is worth stressing that interoperability brings about significant benefits to the State as a result of the cooperation among different public administration agencies regardless of their degree of technological development. These include administrative simplification, the streamlining of the institutions' business processes, expediting the completion of required formalities for taxpayers or users, and cost reductions achieved from the reuse of data and features.

In view of the above, building ICT-based systems and processes that enable the exchange information and knowledge among the various agencies will result in increased efficiency in controlling tax obligations as well as in reducing compliance costs. This is explained by the fact that in the former, the use of massive information matching may be leveraged to detect inconsistencies in tax returns, while in the latter, it can lead to simplified administrative proceedings resulting from a reduction of requirements and, consequently, a shorter assessment term from shared information with other bodies.

On that premise, SUNAT has undertaken the updating of its information platforms to implement public services online by electronic means and electronic data exchange among government agencies through the technological means available, having first signed institutional cooperation agreements containing information exchange clauses, as with RENIEC, in addition to the one signed with the National Superintendence of Public Risks (SUNARP, as per the acronym in Spanish),⁸⁴ given that they have a significant impact on the institutional objectives.

The interoperability with SUNARP enables detection of corporations that fail to register in either registry (tax and property) or to update their status of activity, or lack thereof. As a way of controlling tax obligations, the RUC registration requirements can be simplified for legal entities, for the information of their incorporation is received directly by the tax administration through the Digital Intermediation System⁸⁵ and their registration as taxpayers is provided to the notary public's offices⁸⁶ with no need to physically approach SUNAT, thus reducing compliance costs while improving the taxpayer service rendered.

Figure 9.3-3 Interoperability Management

Source: Prepared by the author

Compliance Risk Management

Although efforts are made to recognize, quantify and rate tax non-compliance, in addition to determining taxpayer profiles to enable differential treatment based on their respective inclination to meet tax obligations, whose results should be measured, it is clear that this is only feasible through appropriate management of the large volumes of information from the document digitization process, interoperability and exchange of national and international information with institutions that manage relevant information for purposes of controlling tax obligations, which must be supported with improved analytics.

The above-mentioned data management and analytical capabilities, which would very likely involve Big Data tools, should be used in: (i) formulating data modeling of the main taxes, in response to the most frequent questions posed by tax auditors or in connection with the consistency of information available at an early stage relative to potential omissions with a view to ascertaining the reliability of such information for use in the subsequent risk management phases; and (ii) building a profiling and selection system that provides for standardized and secure decision-making when prioritizing risks.

To this end, the Peruvian Tax Administration has already built analytical data models for IGV and Individual Income Tax and is in the process of developing the same in connection with Corporate Income Tax. It has recently implemented an integrated taxpayer selection system as part of the already developed analytical models and it is in the process of completing the implementation of a unified matrix of risk variables and indicators on all taxpayers. A risk profiling system will be run on it to enable the allocation of a quantitative rating of taxpayers to trigger differential treatment regarding all administrative procedures fulfilled by taxpayers⁸⁷ aimed at encouraging voluntary tax compliance.

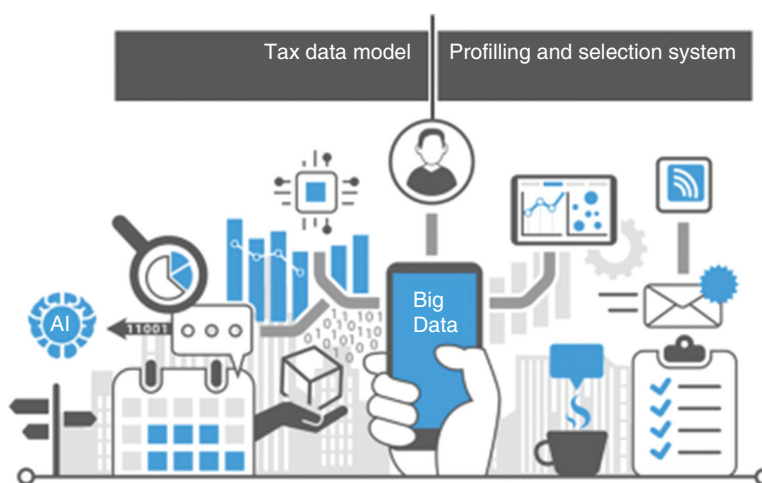
Taxpayer histories may even be used by other public and private institutions as a differentiating factor to trigger greater benefits to taxpayers who show favorable behavior. This is the case with the Third-party Tax Report implemented by SUNAT, which can be issued by taxpayers to the

banking institution with which they interact⁸⁸ as a way of expediting their background assessment and obtaining differential financing rates based on their compliance history, thus creating positive repercussions from being a responsible taxpayer.

There is another area of use of ICTs in connection with risk management, namely data science. SUNAT has tapped this capability through a specialized team of professionals with backgrounds in different areas of expertise such as statisticians, mathematicians and engineers who have the mission of developing algorithms capable of detecting evasion,⁸⁹ as well as formulating risk profiles that include identifying deviations from typical behavior, thus allowing the tax business experts to focus on bridging the voluntary tax compliance gaps with a greater impact on collections.

Data science products developed at the Peruvian Tax Administration include (i) detection of non-deductible expenses presumed personal expenses unrelated to the business. These are detected by machine learning models and text-mining by matching the description of goods and services on electronic payment vouchers to the taxpayer's recurrent economic activity, flagging those that do not match their regular purchases to trigger text messages to the buyer for their verification; and (ii) detection of taxpayers dealing in e-commerce who omit to register in the RUC or fail to submit tax returns or pay IGV by web-scraping and text-mining techniques, which enable the structuring of information contained in websites that facilitate online transactions with the purpose of matching them with the information on SUNAT's databases for subsequent communication of such omissions to the providers requiring their regularization.

Figure 9.3-4 Compliance Risk Management



Source: Prepared by the author

Relationship Management

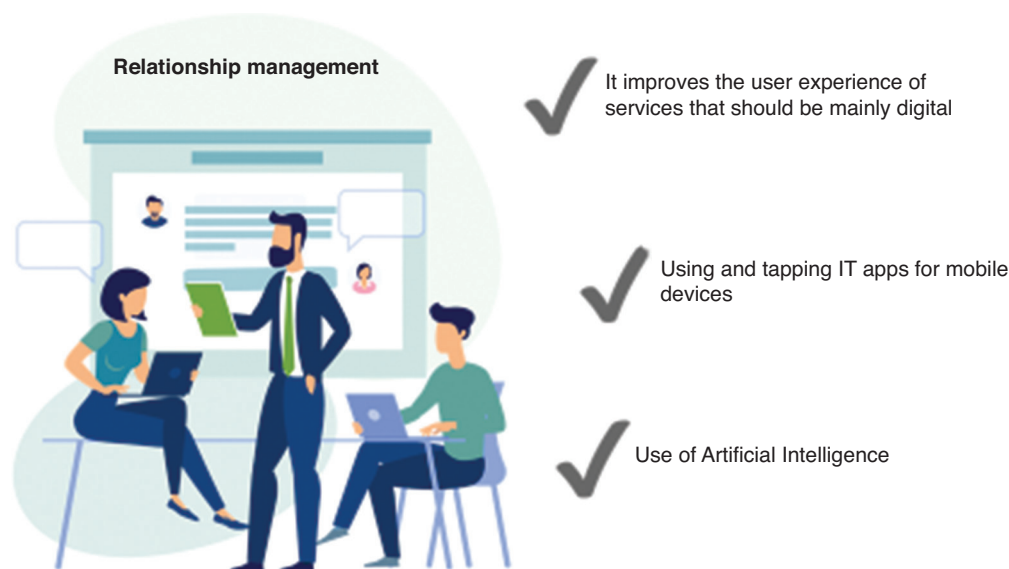
Adopting ICTs for process and risk management is extremely relevant for it increases the likelihood of an improved outcome. However, in the absence of well-managed communications between the tax administration and taxpayers, it could be useless, given that collection efficiency is largely dependent on the taxpayers' response relative to the direct or indirect actions of the body of the collection.

Such relationship should be based on:

- Improving the user experience with services that should be largely digitized, seeking to create new tax administration products that meet user needs and expectations. Conditions should be created to ensure their active engagement in the design and usage of these products.
- Using and tapping IT applications for mobile devices, thus leveraging their powerful connectivity with users, unlike service at the collection agency's offices or premises which are based on desktop terminals.
- Using Artificial Intelligence so that the management of interactions leads us to provide proactive services that anticipate user needs even in a preventive fashion in cases of tax non-compliance.

All three aspects described in the previous paragraph are being developed by the Peruvian Tax Administration, with the following use cases: (i) the new institutional web portal has built in not only taxpayer segments but also public and private agencies as users of the platform; (ii) migrating to services such as the filing of tax returns, information queries and, in the future, the issuance of electronic payment proofs to the institutional mobile application, which will enable better taxpayer connectivity with SUNAT and vice versa; (iii) pilot tests on the use of the chat box called "Sofia"⁹⁰ to service the claimed rebates from individuals' income and from the fourth category of self-employed workers,⁹¹ where it has shown great potential; and (iv) providing assistance and guidance through virtual online chat on platforms such as Facebook, and short video clips on a YouTube channel using a tax administration communicator who empathizes with taxpayers through a simple message with audio visual support.

Figure 9.3-5 Relationship Management



Source: Prepared by the author

Digital Competence Management

Using ICTs and leveraging their benefits requires a transformation of the organizational culture and the establishment of new models that guide actions, while keeping the focus on the institutional goal of achieving efficient revenue collection.

Management and employees are sometimes the root cause of delays in ICT adoption processes. Lack of knowledge, fear of not being able to adjust to the new technologies or the threat of certain jobs disappearing are a few of the obstacles institutions encounter. Thus, to minimize such resistance it is imperative for people to understand the benefits ushered in by the new technological tools. To that end, the following actions should be carried out:

- Allocating process management responsibilities to managers who are ICT savvy.
- Establishing training and awareness programs on eGovernment.
- Introducing a new recruitment policy that secures profiles that are technologically aware to the extent that their functions will be demanding of said skills,⁹²
- Transforming the way in which the institution interacts with its employees, adopting technology as the driver of a new digital culture.

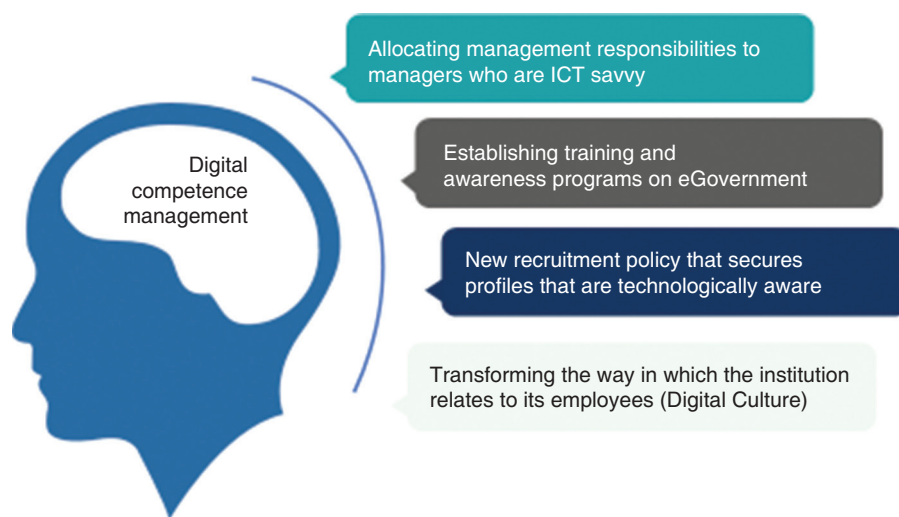
Regarding the points made above, the Peruvian Tax Administration has entrusted processes in the area of guidance, revenues and tax collection to professionals who are vastly experienced in ICTs, which has boosted their implementation in a compelling fashion.

Furthermore, SUNAT has streamlined considerably its relationship with employees by processing most of their labor requests such as proofs of employment, salary receipts, etc. by automated remote means. Moreover, the areas of workplace climate and wellbeing interact with employees both personally and over virtual corporate chat and video apps.

On the other hand, competitions for promotions or senior leadership positions as well as new hires are partly virtual. In the latest competition to retain interns, the procedure was fully virtual, having replaced the personal interview by a recording made and sent by the applicant according to the time limit set by SUNAT where applicants shared their main achievements and the reasons for their interest in training at SUNAT.

Although these examples are not part of the strategy, the fact that they engage employees directly contributes to their growing awareness about the importance and advantages of adopting ICTs in the day-to-day work of the institution, thus promoting a digital culture in the organization.

Finally, the agency is in the process of building a curriculum that includes developing specific digital competencies. It is also working on a plan to widespread the need and advisability of using ICTs in the pursuit of institutional goals.

Figure 9.3-6 Digital Competence Management

Source: Prepared by the author

IT platform and cybersecurity management

Although ICTs offer a great opportunity for agencies to enhance their results, the initial phases of implementation require that systems are stabilized and an architectural transformation is undertaken, while in later phases it calls for greater flexibility and an accurate interpretation of the trends to ensure timely implementations to leverage the benefits of technology.

Given that information security affects the security of individuals' digital capital, which is in turn the tax administrations' most valuable asset, a plan should be developed to face the complex challenges of cybersecurity consistently, effectively and in a way that can be monitored. To this end, educational solutions should be applied to their universe of employees, while legal solutions should be sought with a view to determining liabilities for failing to adhere to protocols, and techniques with regard to the implementation of necessary technical firewalls based on a vulnerability assessment.

The Peruvian revenue agency is the process of stabilizing its most impactful legacy systems so that it can later undertake their evolution by using new IT platforms focused on implementing the Application Protocol Interface (API) to offer new taxpayer services and the use of cloud digital services to replace the current on premise solutions resulting from their assessed benefits, which include processing performance and availability.

Cybersecurity has been tackled mostly by developing an information governance model that implies the definition of information governance roles, information security management, data quality management, governance of the decentralized systems that require standardization, and building data models for analytics. This set of activities will enable greater traceability of the data, which represent an asset for the organization as per the highest international standards.

Figure 9.3-7 ICT platform and cybersecurity management

Source: Prepared by the author

9.4. Final remarks and challenges from ICT adoption in implementing strategic actions

As already indicated, SUNAT's strategy can be summarized in achieving the revenues or tax burden set by pursuing a change in taxpayer behavior towards timely voluntary compliance with their tax obligations, while adequately managing the risk of non-compliance and streamlining processes so that taxpayers can be brought to comply timely and voluntarily, as wished for by every tax administration.

Along these lines, as we have described in the various examples in this section, the actions determined to meet the strategic goals rely on the use of ICTs as a cross-cutting factor. Leveraging ICTs to improve taxpayer behavior implies tapping their potential to process and obtain information massively, know taxpayers better, i.e. by having a more accurate profile. It further means leading control, auditing and collection actions more appropriately, in addition to adopting facilitation and even competitiveness measures, while changing processes to substantially improve them and interact with taxpayers in a timelier, closer and personalized manner.

SUNAT is undergoing a digital transformation process aimed at leveraging all the advantages provided by ICTs and becoming a modern, simple and fair agency. The journey has not been without challenges.

Undertaking a digital transformation process and including ICTs as part of the institution's daily work requires the implementation of policies that promote innovation, with room for the staff to take the time to think out of the box and work differently. Such policies should create a virtuous circle where everyone wants to continue innovating through the discussion of ideas, project evaluation and the implementation of actual programs, while leveraging ICTs in meeting the institutional goals. Allowing for this space and time implies that part of the daily work will be "lost". Therefore, it is necessary for Senior Management to be fully committed to this goal and demand the enforcement of said policies. Fail this, there will be neither space nor time.

This process further requires that staffs work outside their comfort zone, which raises varying degrees of resistance. Fear of the new almost invariably leads to initial rejection. As a result, using ICTs to quickly communicate the advantages that can be derived from their implementation becomes an essential tool. It is a lesson learned along the way.

On the other hand, there is the additional challenge of matching the development of strategic actions with the country's degree of connectivity. It should be noted that there are still some geographies with low or null connectivity. It is important to identify those areas, where traditional services should be maintained, while permanently following up on the evolution of the connectivity status and coordinating an improvement with the competent authorities given that, as already discussed, the digital transformation of services results in considerable savings to the cost of proceedings which should be affordable to all citizens.

In parallel to building a digital culture among the organization's staff, the tax administration should communicate and showcase the advantages in the way of time savings, simplification, accuracy and cost reduction that can be derived from adopting ICTs in tax processes. The professional officials involved in the digitized processes should be engaged, since they will have an impact on the development of the services they had been offering, as is the case with accounting practitioners.

Finally, we are aware of the various challenges faced by our tax administration on this path. However, as discussed, the benefits from the adoption of ICTs in implementing the strategy with a view to improving the work of the tax administration as well as tax compliance by taxpayers outnumber the challenges.

Notes

68. It should be noted through Supreme Decree 061-2002-PCM, SUNAT became responsible for the National Superintendence of Customs. Thus, in addition to its role as tax administrator, SUNAT is further charged with the functions, powers and duties of the country's customs authority. Through Legislative Decrees 1103 and 1126, the agency became responsible for the registry and oversight of the chemicals that might be derived from illegal mining and illicit drug trafficking, effective since 2012 and 2013, respectively.
69. The country's tax revenue-gross domestic product (GDP) ratio.
70. Model suggested in the Guideline for Institutional Planning of the National Center of Strategic Planning of Peru (CEPLAN).
71. For example, in Peru, the National Covenant is a forum that designs and approves government policy guidelines based on dialogue and consensus between the three levels of government and the political and social institutions in Peru.
72. Amazon, Airbnb, Expedia, Meetic, Uber, Netflix, Twitter and Facebook, among others, have dramatically changed the way in which we buy products and services, relate and communicate.
73. Stated in the 2017-2021 Multi-annual Strategic Plan of the Economic and Financial sector.
74. Documents containing official multi-annual macroeconomic projections adopted in sessions of the Council of Ministers.

75. By the 2018-2022 Institutional Strategic Plan adopted by Superintendence Resolution 189-2017/SUNAT, the scope of which was expanded by Superintendence Resolution 072-2019/SUNAT.
76. Stated in the different forms of non-compliance, ranging from the failure to register in the taxpayer registry to the omission of income or the claim of undue refunds by planned mechanisms.
77. System aimed at controlling and managing taxpayer debits and credits on a modern platform, thus replacing legacy systems that the Tax Administration has kept for almost twenty years.
78. According to Chapter III “Digital Service Provision” in the eGovernment Law adopted by Legislative Decree 1412.
79. Single taxpayer identification system (individuals, legal entities or any other form of incorporation) where they record their identification data.
80. Technical body in charge of identifying Peruvian citizens. It issues national identity documents, records life facts such as births, marriages, deaths, divorces and other events that shift the civil status of individuals.
81. Location set by the tax debtor for all taxation purposes within the national territory, which must be reported to the Tax Administration. As digital addresses become more prevalent, said location will become less relevant for purposes of tax notifications.
82. Tax levied on all the phases of the production and distribution chain aimed at end consumers. Usually charged on the purchase price of goods purchased (VAT).
83. Where the corporation records sales and purchases of goods and services made in the course of business. The duty to keep said books will be phased out as electronic payment proofs become massive.
84. Body charged with issuing internal and administrative policies for public registries, as well as planning, organizing, leading, regulating and coordinating the publication and recording of acts and contracts in Public Registries, including those of legal entities and real estate property.
85. Service platform enabling the registry entry from the electronic submission of digitally signed documents by the notary public.
86. Civil servant with studies in law whose involvement confers public status to private documents and authorizes them for such an end by their signature.
87. If there is no previous non-compliance, the procedural requirements will be relieved and the response times for taxpayer service will be shortened. Such procedures include registration, issuance of payment proofs, access to installments, and others. Conversely, for taxpayers with a negative tax compliance history, controls will be performed prior to servicing their proceedings aimed at promoting voluntary compliance with tax obligations.
88. Security features have been embedded, such as limited access time and access by QR coding in consideration of the confidential nature of the information transmitted, which includes declared income.
89. For purposes of tapping the large volume of information available currently, techniques such as text mining, data mining, machine learning, score CatBoost and natural language processing have been used.
90. Automated Information Guidance and Facilitation System.
91. Relative to personal income from a profession, art, science or practice whose revenue is obtained under no labor contract.
92. They may range from the level of users, to implementers, to analysts of large volumes of data, which might require previous professional experience, not necessarily on tax-related matters.

10. ENABLING DIGITAL TECHNOLOGIES AND SERVICES

Some digital technologies and services should be considered as part of the ecosystem wherein a Tax Information System (TIS) will be developed. The previous consideration of these technologies and services will facilitate the development of a TIS. This does not mean that they cannot be implemented in an operating TIS, but in this case the level of difficulty could be greater.

We have selected three of these qualifying technologies and services for a TIS: security of the information, documents and process management.

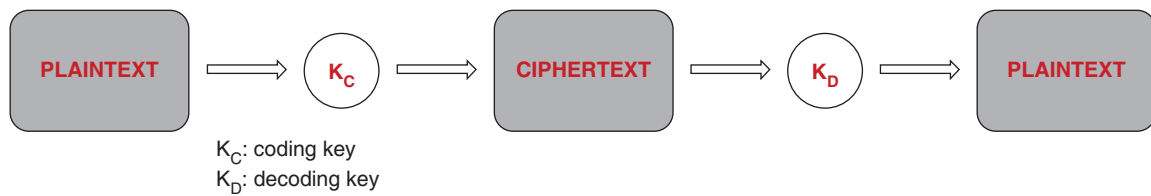
10.1. Security of the information

Concealing the information so that it may not be seen or understood by unauthorized persons is one of the fundamental aspects of the security of information. The word “cryptography” is based on the Greek term *kryptós*, which means hidden or concealed. The representation of contents by means of codes that may conceal the original contents is called cryptography.

This concealment technique, which has been used for thousands of years, was initially employed in military messages to hide the contents in case of interceptions or information leaks. That time, they used conversion tables that were previously known by the sender and addressee, through the application of a symmetrical coded method, since the key used for coding the contents and the key used for decoding are the same or are closely interrelated.

Many years later, in the era of the Information Society and the use of computers, beginning with a seminal article by Whitfield Diffie and Martin Hellman, another cryptography method was developed, namely: the asymmetrical cryptography. In this method, the coding and decoding keys are quite different and the knowledge of one does not facilitate obtaining the other. Following the previously mentioned article, there was a great contribution by Ralph Merkle. There is also evidence that the government of the United Kingdom had developed the concept prior to the publication of the article, but for security reasons, it decided not to publish the results.

In general terms, the coding and decoding processes use the steps shown in the diagram of [Figure 10.1-1](#).

Figure 10.1-1 Coding and decoding process

Source: Prepared by the author

The plaintext, in its original form, is transformed into ciphertext through the application of a particular cryptographic method and the use of the coding key (CK). The ciphertext, when managed through the cryptographic method corresponding to the one used for coding and the decoding key (DK), is again presented as plaintext.

Through the process shown in [Figure 10.1-1](#), the ciphertext may be hidden under coding protection. In this way, the contents may be stored or transmitted with greater certainty over the risk of being known. The plaintext may be text, number, audio, image, etc. The ciphertext may be printed, recorded in a storage device, transmitted, etc.

10.1.1. Symmetrical coding

In symmetrical coding, the keys CK and DK are directly related, although they may differ among themselves. For example, if the plaintext is treated as a number, the ciphertext may be achieved by applying the 137 power. On having access to the corresponding ciphertext, the plaintext is obtained by extracting the 137 root. There are two special difficulties inherent in the symmetrical coding: (1) safe distribution and storage of keys; and, (2) violation of the security of keys through exhaustive computer-based techniques.

10.1.2. Asymmetrical coding

The CK and DK keys used in asymmetrical coding are not immediately interrelated; that is, knowledge of one key does not result in knowledge of the other key. This allows the CK key to be known and disseminated, while the DK is kept secret (private), for which reason the asymmetrical coding is frequently known as Public Key Coding.

To codify contents which only X may decipher, simply use the corresponding method and the X public key. To decode the coded contents, X applies the corresponding method and its private key. With this process, only X may decode the contents that has been coded with its public key. In a similar manner, when X codes the contents with its private key, the ciphertext may be decoded with the X public key.

Therefore, the asymmetrical cryptography does not show the difficulties existing in the symmetrical cryptography, in relation to the distribution of the keys and security violation through the knowledge of one of the keys or through exhaustive calculation.

There is a large amount of published material, especially on the RSA (Rivest-Shamir-Adleman) method, based on the factoring of large prime numbers.

The asymmetrical coding or public key coding has additional benefits. In the previously described situation, when X codes the contents with its private key and decoding can only be done with the X public key, the authenticity of the contents is ensured, since only X knows its private key and only X can produce the coding of the contents.

At this stage, it is important to understand that the same technique, cryptography, is used for two different purposes: concealing the contents and identification of those involved. Hereinafter, in this text, attention will be given to the use of asymmetrical cryptography for identification and related issues.

In July 1993, The New Yorker review published Peter Steiner's cartoon (*Figure 10.1-2*), which has been quoted in numberless articles on the Internet. In front of a personal computer one dog tells the other that "on the Internet, nobody knows you're a dog". Although it was not the cartoonist's intention, the drawing is a milestone of the Information Society.

Figure 10.1-2 Cartoon on the identity in Internet

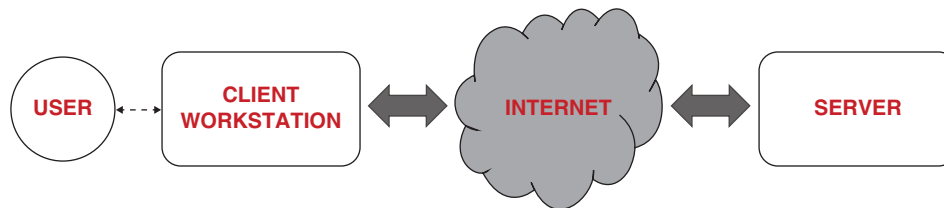


Source: On the Internet, nobody knows you're a dog. From "The New Yorker Collection," by P. Steiner, 1993.

Retrieved January 27, 2020, from <https://archives.newyorker.com/newyorker/1993-07-05/flipbook>. Copyright 1993 by The New Yorker.

Figure 10.1-3 presents a very simplified scheme of the digital world, which renders possible the scenario shown in the cartoon in Figure 10.1-2. Through the use of the basic functionality of the network, the server and the customer may assume any identity. The following approach mainly uses problems associated with the Client-Server integration. This approach is only used for convenience's sake, since everything can be expanded to include also the Server-Server integrations.

Figure 10.1-3 Client / Server Interaction



Source: Prepared by the author

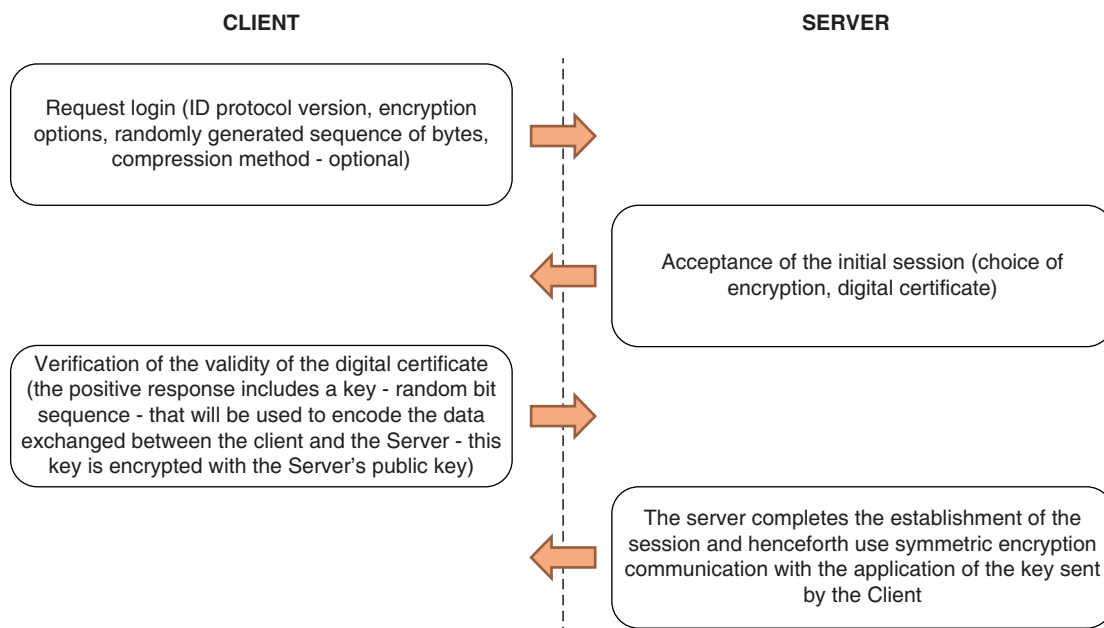
The solution used to solve the problem was based on the Secure Sockets Layer (SSL) protocol. Later on, the protocol of the transportation layer security (TLS) was developed with more powerful characteristics than SSL and in some versions, with the possibility of interacting with this protocol. The SSL protocol is still used and will be used as reference in this text. The SSL and TLS protocols are standardized through the Request for Comments (RFC) of the Internet Engineering Task Force (IETF).

10.1.3. Digital identity certificates

The initial basic assumption is that the server has a DIGITAL IDENTITY CERTIFICATE. This certificate, standardized through the X.509 standard of the ITU (International Telecommunications Unit), includes data that identify the holder and is generally signed by a CERTIFYING AUTHORITY (CA). In general, this CA is a recognized third party and is based on the trust of the participants in the interaction. The CA is part of a system known as Public Key Infrastructure (PKI), and it is acceptable to understand that they are the same.

It may occur that a given network element uses a digital certificate signed by its own PKI (“self-signed”), as will be shown further on.

The Digital Certificate has several fields, with data that identify the owner of the certificate, its public key of asymmetrical coding, the date of issuance, the date of expiration, the identification and the digital signature of the CA. Assuming in this initial approach that the server has a digital certificate and that the working station uses a browser without digital certification, a safe connection is established between the workstation and the server, based on the SSL protocol, according to the diagram in Figure 10.1-4.

Figure 10.1-4 SSL based interaction

Source: Prepared by the author

The dialogue between Client and Server is only indicative of the sequence of messages that are exchanged. If the Server requires that the Client also have a digital certificate, this step of the operation will be included in the negotiations of the session's establishment.

The beginning of the dialogue shown in [Figure 10.1-4](#), uses asymmetrical coding (public key). Once the session has been established, the client-server communication will use symmetrical coding.

In the situation that has been described, where only the Server has a digital certificate, the Client's station will indicate the use of the "HTTPS" protocol at the end of the negotiations of the session, with the corresponding indicators that appear in the browser's screen.

In addition to the server identification (specific case of the situation shown in [Figure 10.1-4](#)), the described scheme also allows for coding the data transmitted. There are additional benefits, such as the previously mentioned compression possibility, as well as the use of mechanisms for verifying the integrity of the messages.

When verifying the validity of the Server's digital certificate, the browser uses its list of recognized Certification Authorities (CA). If a CA does not appear in the list, the browser shows a "violation of security incident" and affords the user the possibility of downloading the CA's digital certificate and including it in the list.

The asymmetrical coding may also be used for validating and non-repudiation interactions. The functionality hereby afforded is known as "digital signature."

The essence of the mechanism is the coding of the contents with the private key, which can be decoded with the corresponding public key. Since the private key is only known by its owner, the authenticity is guaranteed. On extending this type of request to a situation wherein two owners exchange contents among themselves, non-repudiation is possible: the sending party cannot deny that it sent it, while the receiving party cannot deny that it received it.

10.1.4. *Secure client/server interaction without the use of digital identity certificates*

Security in the client-server interactions may be increased through the use of other functions, with or without coding. The most common is the identification in two steps: the user identifies himself in the system and provides his password; the user then receives a code (“token”) through another channel (more commonly an “SMS” message by telephone), which must be informed to the server within a specific time frame.

Another characteristic, with the possibility of using coding, is to send a “2D bar code” image to the user’s workstation. By means of a previously authorized telephone and an application, the user “reads” the image and obtains a code which must be informed to the system (in order to authorize access or confirm the execution of an operation). These are only two examples that circumstantially use another communication channel to increase security.

10.1.5. *Implementation of digital identity certificates*

There are several types of digital certificates, according to the domains covered (3 types) and the required level of validation (3 types).

The user (individual or corporation) may also have a Digital Certificate in the Client’s station, linked to a Certification Authority. Likewise, in the Server to Server communication, all may use the Digital Certificate.

There are many organizations that provide digital certificates delivery services, including at the international level. These organizations constitute a “trust chain” that facilitates the validation of certificates. The implementation and operation of a certification authority is complex and very demanding. The CA’s private key is used to generate digital certificates signed by the CA itself. It is vital to maintain the security of this private key (or original key). If the original key is infringed, the entire security fails, which renders vulnerable the digital certificates issued by said CA.

The implementation and operation of a Certification Authority (or PKI) requires highly qualified staff, sophisticated physical facilities, well-defined and implemented processes, specialized hardware and high-level management. In addition, a complex software infrastructure is required for generating, cancelling and managing the certificates.

Currently there are many solutions based on open source software for implementing a PKI (EJBCA, Dogtag, OpenCA, Boulder, etc.). Without evaluating the reasons (national sovereignty, supplier’s

independence, etc.), an organization may implement its own PKI and sign its original certificate (private key). There might be some difficulty with the generalized recognition of the digital certificates issued, but nothing that cannot be solved by bringing the certificates which may be of interest to the organization from the client's stations. At the government level, Romania implemented its own certifying authority, based on open source software, in order to provide digital certificates so that the citizens could access electronic government services (Vatra, 2011).

Finally, there are questions regarding the use of “blockchain” technology for implementing a PKI. Blockchain is an instrument for verifying and managing records of safe transactions, while PKI has to do with the identification of the participants and shares the authentication needs. PKI and blockchain may exist and cooperate among themselves. Coding is the technique that renders both viable. However, one must consider that given the serious risks posed by a failure of the CA and the complexity of implementing and operating a CA, the blockchain technology has been evaluated to be used as AC infrastructure (Yakubov, 2018).

10.1.6. *Organization and implementation of information security in a tax administration*

Information security should be a permanent concern in the public sector, especially in the tax administrations, which in addition, take care of sensitive information, subject to tax secrecy. A survey undertaken among public officials in the United Kingdom regarding concerns with information security (Bunker, 2013) disclosed that the main concern of 62% of those surveyed was the accidental loss of data; in the case of data leak, 31% was concerned with damages to the institution's reputation; financial consequences, 20%; policy or compliance issues, 18%.

Bruce Schneier, a well-known expert in digital security wrote that, contrary to what he had declared and reaffirmed in his first work, cryptography is not “the” response to security challenges, a “magic powder” that would solve all the security challenges. Even with all the intelligence and sophistication of the cryptographic instruments, they find themselves in a complex environment of persons and computers that may fail and act differently from what is expected (Schneier, 2000).

This message is indispensable to understand that the wealth of techniques and benefits provided by coding does not exhaust issues dealing with security.

Security is a transversal process for the organizations. Although it is true that its base is ever more technological and sophisticated, it is no less true that only through the definition of clear policies, consistent practices, effective procedures and everyone's active participation may one guarantee and effectively and completely manage aspects dealing with information security. It is a matter of establishing a comprehensive and effective **information security system**.⁹³

The ISO/IEC Standards of the 27000 series, especially 27001 and 27002, organize the actions aimed at the establishment of an information security system. The adoption of these standards as guide of the information security actions facilitates planning, coherence and integrity of the plans.

The standard in practice

One way of transforming the standard into practical actions is through the establishment of an **Information Security Program (ISP)**, which initially consists of projects to which different priorities must be assigned according to the institutional context. These projects, once concluded, would cover the institutional information security needs. The information security approach through the optics of a coherent ISP additionally allows for observing the weak aspects, even in a tax administration that considers satisfactory its isolated initiatives.

A list of ISP-associated projects, aligned with the aforementioned ISO standards is proposed below.

I. Information security policy

The Information Security Policy defines the set of rules, methods and procedures used for maintaining information security, which should be defined in a document whose contents should be known by all the information users.

This project covers the preparation and approval of the document that includes the strategic guidelines regarding the safe use and management of the information that belongs or is under the custody of the tax administration.

The main objectives are:

- Coordination of roles and responsibilities of information security.
- Guarantee alignment with the legal and regulatory requisites, including privacy and civil freedom related to information security.
- Governance of the information security system.

II. Information security management model

The preparation and approval of a management model that renders possible the identification of requisites and the implementation of actions that represent the cycle of information security management strategies, affording institutional sustainability to the process. It establishes the entities involved and their responsibilities.

The documents that are part of the regulatory framework for information security management are divided into 3 categories: (1) Policy (Strategic level) – defines the high-level rules that represent the basic principles which the tax administration has decided to incorporate to its information security management, according to the strategic vision of its high-level managers. Policies serve as basis for creating standards and procedures; (2) Standards (tactical level) – specify the tactic plan, the technological options and the controls that should be implemented for achieving the scenario proposed in the policy; (3) Procedures (Operational level) – provide the instruments for what is written in the standards and policies, allowing their direct application to the activities of the tax administration.

III. Information security standards and best practices

Preparation of regulatory documents with rules for the users, at the tactical level, regarding the use and safe treatment of institutional information, as well as the appropriate use of the computer resources available. As a complement, security standards can also be accompanied by some recommendations of best practices regarding the use of computerized facilities.

In general, the priority rules are:

- Rule regarding the management of passwords and other identification means;
- Rule on access to the network;
- Rule on electronic mail;
- Rule regarding access to the tax administration's computerized systems;
- Rule regarding shared files;
- Rule on data security;
- Rule on protection technologies.

IV. Physical security of the data center

Identification of vulnerabilities in the physical environment of all the data centers under custody of the tax administration and recommendation of security controls for minimizing the risks found. These recommendations would be implemented by means of a specific project.

V. Information security dissemination campaign

Determination of specific campaigns for creating awareness among the staff working with the tax administration (employees, contractors, assistants, etc.) and external users of the computerized tax systems regarding the importance of the institutional information security. The internal campaign will include dissemination of the ISP, rules and best practices;

VI. Methodology for managing information security risks

Definition of an institutional risk management technology for identifying and managing information security risks to which the organization is liable. The corporate risk analysis perspective will be focused on the following aspects:

- Risk evaluation.
- Identification and documentation of the vulnerabilities of organizational assets.
- Identification and documentation of internal and external threats.
- Identification of the entrepreneurial impact and the probability that it may occur.

- Determination of risks through threats, vulnerabilities, probabilities and impact.
- Determination of the response to the risk according to its priority.
- Risk evaluation strategy.
- Support the definition of risk tolerance.

VII. Training in information security management

Training of security professionals for acting or assisting in information security management. The first phase of this project could be the internal training of the employees of the tax administration's information technology area on basic concepts and information security management.

In a second phase, for those who will devote themselves to information security in the tax administration, it is recommended that they take advanced courses in information security such as: *COBIT 5 for Information Security – Professional*; *COBIT 5 for Risk Professional*; *CISSP – Information Security Officer*; *CRISC – Professional Risk Manager*; *Certified Ethical Hacker – Computer Security Manager*.

VIII. Classification of the information

Establish criteria, rules and procedures for the correct classification of information, by determining the adequate management of the information throughout its life cycle (development, use, storage, transportation and elimination).

IX. Assets management

Inventory of all the devices and physical systems existing in the tax administration and classification of the physical and reasonable resources, according to their criticality and value for the business.

X. Continuity management

Determination of the structure, roles and responsibilities and management methodology for the continuity of the business. It describes the development of a continuity plan for each critical service, in order to prepare the institutional structures for responding to the following criteria:

Responding to anomalies

- Response plan
 - Monitor the implementation of the response plan.
- Communication
 - Ensure the information flow during the execution of the plan.

Develop an event report.

Coordinate the information exchange of the response plan.

➤ Analysis

Investigate notifications.

Impact - analyze the impact of the incident.

Classify the incidents according to the response plan.

➤ Mitigation

Establish parameters.

Risk mitigation.

Risk transfer.

Acceptance of risk.

➤ Improvements

Propose improvements to the response plan as necessary.

Recover from anomalies.

➤ Recovery plan

Monitor the implementation of the recovery plan.

➤ Improvements

Update the recovery strategy.

➤ Communication

Guarantee the flow of communication regarding the recovery status.

XI. Digital certification

Use of Digital Identity Certificates within the scope of the applications of the tax administration and its users. According to the current status of the tax administration information systems, the use of digital certification is essential for identifying the parties, improving control and increasing the services offered, at the level of client/server interactions as well as the exchange of digitally signed documents.

It is necessary to decide between the alternatives:

➤ Use of local market digital certificates, if there is a PKI.

➤ Use of international market digital certificates (promote the installation in the country of certifying companies or their representatives).

- Create its own digital certifier, in order to issue Digital Identity Certificates, of scope limited to the institution business and stakeholders.

The Chapter “Invoices and Electronic Documents” includes notes and describes alternatives for the creation and/or use of Digital Identity Certificates, which may be used for the digital signature of invoices and other electronic tax documents, as well as to ensure the interactions of the taxpayers with the tax administration.

XII. Threats control

Security solution focused on the network to monitor, prevent attacks and implement rules of access to all of the tax administration’s environment, by complying with the criteria described hereunder:

- Events and anomalies
 - Attacks (analyze attacks).
 - Determine the impact of the detected events.
 - Measure the sensitivity to incidents.
- Continuous security monitoring
 - Participate in the network monitoring.
 - Participate in the physical environment monitoring.
 - Participate in the user activities monitoring.
- Detection process
 - Determine the detection parameters.
 - Improve the monitoring process.

XIII. Access control

- Access control
 - Determine the rules of institutional identity and credentials.
 - Determine the rules for physical access to the protected files.
 - Determine the rules of remote access.
 - Determine the reasonable rules of access (based on privileges and separation of tasks).

Implementation

In order to plan an ISP, it may be advisable to count on the support of specialized external consultancy.

Surely a tax administration already has implemented several isolated actions for the security of its information, such as a firewall, some access controls and/or rules regarding the use of its own devices in the institutional network (known as *BYOD - Bring Your Own Device*). An ISP must consider these initiatives, including them within the Program so that they may be integrated with the others and probably improved.

Information security has its cost and the projects to be developed must determine budgets to be evaluated by top level management. Theoretically, the information security policies involve the determination of the technologies (hardware, software and its parameters), which shall constitute the context of institutional information security. But actually, there is feedback between policy and technology: some given security policy may be technically impossible or too costly to be fully implemented. On the other hand, a new technology may render feasible the introduction of new policies. The dialogue between policy and technology improves the information security system.

The Chapter “*System Architecture and ICT Infrastructure Alternatives*” deals with the insertion of information security in the technological architectures proposed for a tax administration.

There are examples of general and specific business security policies that may be used as guide. These policies have different levels of specificity (high level, specific areas, general recommendations, etc.), to be selected as guideline for the institutional needs. Some examples are mentioned in the bibliography of this chapter.

10.1.7. Security within the information systems and applications

On the one hand, the tax administration's information systems deal with the processes and data that afford the necessary resources required by the country. On the other hand, most countries have rules provided by their laws, which guarantee the taxpayers' tax secrecy. Because of the critical nature of their mission, the security management of tax information systems, requires the implementation of appropriate mechanisms to safeguard the integrity and accuracy of the information, as well as safeguard and protect the taxpayers' private data.

Different levels and security mechanisms must be available. These mechanisms will allow, where appropriate, the implementation of security policies determined by the organization, which have already been discussed in the previous sections.

Role-based security

Within the tax administration, users interact with information systems based on a specific set of roles. The security, access verifications and permissions are based on the individual's function at

the time of interaction. An individual can hold different positions during his career, move from one department to another, achieve managerial functions, apply for vacation, replace a colleague or go on leave to study. The permissions given will vary accordingly. The system must provide a way to link users to the roles, for specific time periods. At any particular time, a user will have the sum of all the permissions dealing with all the roles that have been assigned to him and which are active at that moment.

Security levels

There are at least three different levels of security worth implementing by the tax administrations. At least the first two should be implemented by all tax administrations.

➤ Functional level

This kind of permission grants access to functional parts of a system. For instance, the taxpayer maintenance, current account view, parameterization of a system. A system must verify, at the very entry point, whether the user has the appropriate permission to use said facility.

This information is commonly used to structure dynamic menus to be presented to users, based on their permissions.

When a centralized approach is used, this type of permission might also be used to allow access to full applications or facilities. For instance, access to a mobile app for querying files or access to a business intelligence facility.

➤ Object level

These are permissions to access objects. As an example, consider an auditor who audits taxpayers. He may have permissions at the function level to view a taxpayer's tax returns and current account. However, it might not be convenient to let that auditor access all of the taxpayers' information. Thus, specific permissions may be established so that an auditor may only access the tax returns and current accounts of the taxpayers he is auditing or has audited in the previous couple of years. It would be forbidden to try to inquire about the current account of taxpayers with whom he is not involved.

In a centralized and business-wide security approach, this type of permission could be used in any function, applications or channel that would provide access to those objects.

Business rules associated with the roles will determine which roles will be given permissions at the object level.

The set of permissions could be dynamically managed. For instance, a supervisor or the head of a division could grant access for an auditor to inquire about the current account of taxpayers that interact with a taxpayer that he is currently auditing.

➤ Field level

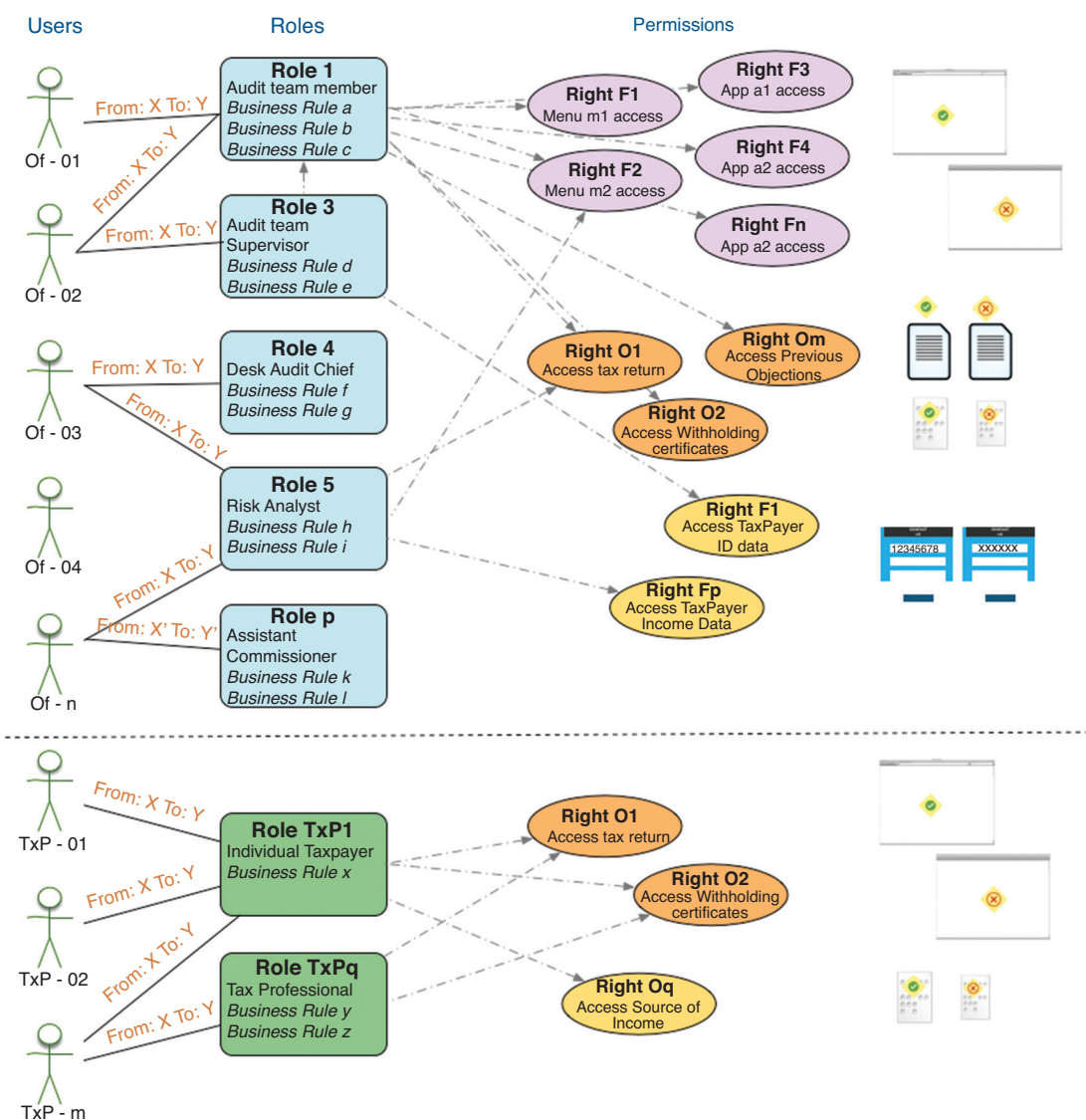
These permissions are not necessarily found in all tax administrations but are eventually becoming more important. They are established to grant access to specific fields of an object.

For instance, an officer responsible for verifying compliance with the filing of returns may have access to a tax return and verify that it has been filed on time and see what fields were filled by the taxpayer but might not see the actual values.

On the other hand, a risk assessment analyst may have access to the data of millions of tax returns but might not have access to the fields that could identify a taxpayer such as the TIN, name, phones or addresses.

The figure below illustrates these concepts, where individuals that need to have access to a system, are assigned specific roles for periods of time. These roles, via well-defined business rules, will grant access to system functions, menus and applications; to some objects like certain files or tax returns; or even to some fields within those objects.

Figure 10.1-5 An illustration of the security framework within an information system



Source: Prepared by the author

A good practice when dealing with companies, partnerships and others is to grant access to individuals that represent or can act on behalf of those taxpayers instead of providing direct access to the company. The individuals that act for those companies might have specific roles or permissions. For instance, one person might have access for payroll related matters while a different person might deal with Corporate Income Tax. When accessing the system, those persons need to indicate whether they are operating on their behalf or as a representative of a different taxpayer.

One relevant aspect of security implementation in relation with taxpayers is the authentication mechanisms. Tax administrations need to analyze and implement appropriate authentication methods that would avoid inappropriate access to accounts without adding significant burden to taxpayers.

Tax administrations may offer different means of authentication available for all taxpayers but might require that some taxpayers use only the most secure. For instance, small taxpayers, self-employed and employees with a single source of revenue might use the basic user ID–password method with some additional second factor data sent by e-mail, SMS or authenticator application for all accesses, or at least when accessing the system from new devices or IP addresses.

Large taxpayers might use a different type of second factor authentication with some kind of biometrics-based authentication, digital certificates supported by a PKI or multi-party authorization.

10.1.8. *Logs and audit trails*

The information systems that support the functions of the tax administration must keep logs of updates, insertions and deletions of every single record. The logs must include all relevant information regarding the transaction, such as user identification; the roles that were active for that user; the program, application, screen or page from where the transaction was executed; the IP address and other relevant information to locate the physical or logical equipment used including MAC address, mobile identification number, or other serial numbers; timestamp where the transaction was started and the previous values that were altered or deleted. In addition, logs of queries with no updates must also be kept.

The **Self-Assessment Guide for the Tax Administrations** recommends that logs and audit trails be used not only to identify those responsible for inappropriate actions after an irregular operation or data breach is discovered (CIAT, 2007). These records should be proactively used to monitor the behavior of officials within the tax administration. “A system should be established for sanctioning the undue use of computerized resources in general and inappropriate access to sensitive or critical information” (Sacristan, 2019).

Special attention should be paid to replicated data resulting from ETL⁹⁴ processes that prepare transactional data to be used in a different environment for analytical purposes, typically using some kind of business intelligence tools, where access controls and monitoring and usage of these

data might be less strict than with the original data. Ideally, the security policies defined should also be applied to replicated data.

10.2. Documents management

The documents management systems are tools designed to create, store and manage electronic documents, thereby allowing for reducing or completely eliminating the use of paper. Originally conceived in the late 80s as systems for managing physical documents, they rapidly evolved to work with digitalized documents and subsequently with electronic documents in structured and non-structured formats.

Currently, they may be found as independent systems or components of conceptually larger packages and platforms, such as entrepreneurial contents management systems (CMS/ECM), contents service platforms (CSP) or business processes management suites (BPMS).

10.2.1. Functionalities of a documents management system

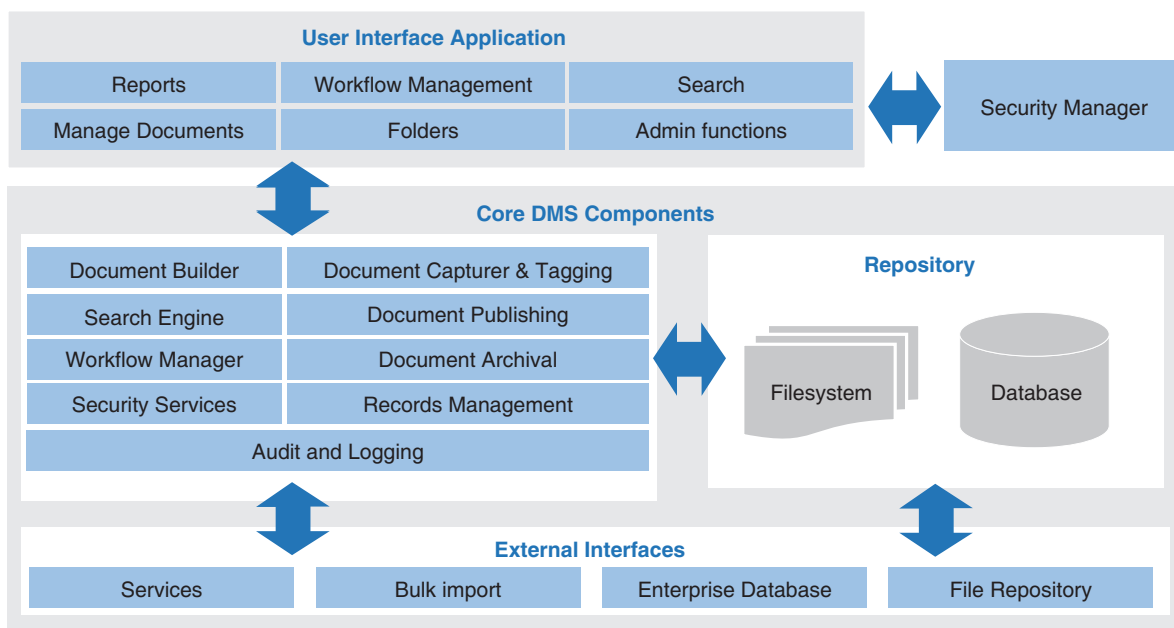
The essence of a documents management system is to set up and administer a centralized virtual repository for all documents generated and used in the organization's business processes. These may be physical documents digitalized by means of scanners, electronic documents created in automatically generated user interfaces, documents prepared in commercial office tools, and even documents automatically generated by other systems (Shivakumar, 2016).

The architecture of a documents management system (*see Figure 10.2-1*), allows for offering great value functions for setting up a tax management system, among which some of the most important are:

- Design forms and templates for documents that specify their structure and metadata, as well as the presentation forms, validation rules and status diagram.
- Create, edit and eliminate documents based on the forms and templates determined, by applying the corresponding validation rules to each operation and keeping control of their versions and status.
- Digitalize physical documents and process them through optical character recognition (OCR) techniques and optical mark recognition (OMR), for their subsequent inclusion in the repository.
- Incorporate documents digitalized within and outside of the tool in the centralized repository and attribute the metadata to them.
- Undertake searches of structured and non-structured documents within the repository, through the application of various indexation techniques to their metadata and their contents.

- Control access to the documents in the repository according to rules defined in the tool itself or through integration with external security components.
- Allow the collaborative creation and editing of documents, as well as determine and execute simple workflows for their review and approval.
- Implement the digital signature and verify the authenticity of the documents that are part of the repository.
- Maintain and manage versions of documents when they are being prepared.
- Allow the management of documents being edited and those concluded. The latter may be secured in terms of integrity and not admit modifications.
- Allow for adding information attached to finished documents by means of notes and highlighting or pointing out parts of the document for their subsequent reference.
- Determine document withholding strategies, administration of storage means and copies of total or partial support from the repository.
- Become part of legacy systems, business process management suites (BPMS) and data mining and business intelligence (BI) tools, using such standard protocols as HTTP, SOAP, REST or components of enterprise applications integration (EAI).

Figure 10.2-1 Reference architecture of a documents management system



Source: From "Enterprise Content and Search Management for Building Digital Platforms," by S.K. Shivakumar, 2016, November 30. Copyright 2016 by John Wiley and Sons Ltd.

10.2.2. *Benefits for the tax administration*

The main benefits offered the tax administration by a documents management system are:

- **Better inputs for integral risk management** as a result of the establishment of an electronic and centralized repository of all the documents that support and record the administration's performance, as well as centralized mechanisms for the application of rules in the various stages of their development process.
- **Greater transparency** as a result of the capacity for accessing or providing access at any time, to the contents, as well as to the historical records for modifying documents related to its business processes, thereby facilitating the examination of its performance.
- **Greater efficiency and savings** as a result of the elimination of the need to print, distribute and physically store documents.
- **Greater security of information** generated by the capacity to monitor and control access, copy and distribute documents, as well as take advantage of the assurance of authenticity and identity provided by the use of the digital signature.

10.2.3. *Main implementation risks and keys to mitigate them*

Experiences with the implementation and subsequent use of the documents management system in Latin American tax administrations such as Brazil, Guatemala, Dominican Republic and Panama allow for considering the following associated risks:

- Lack of alignment between the acquisition and implementation of the tool and other related information technology projects, thereby incurring in conflicts or duplication of costs and efforts.
- Underestimate the nonfunctional requisites of the tool (storage capacity, availability, bandwidth, capacity and performance in transmitting data to and from the repository, among others) and their evolution through time.
- Difficulties or deficiencies in the integration with legacy systems and other components of the tax management system which compromise the principles of atomicity, consistency, isolation and durability of the information (ACID).
- Deficiencies in determining document retention strategies, that is, the rules that determine the amount of time they should be kept in the repository and the response time criteria according to which they may accessed through time. They thus render difficult an adequate administration of the storage means and the search mechanisms which, given the accelerated increase in the amounts of information significantly affect the system's performance.

- Deficiencies in the integration of security and access control policies which affect the users' satisfaction and the efficiency of the processes.

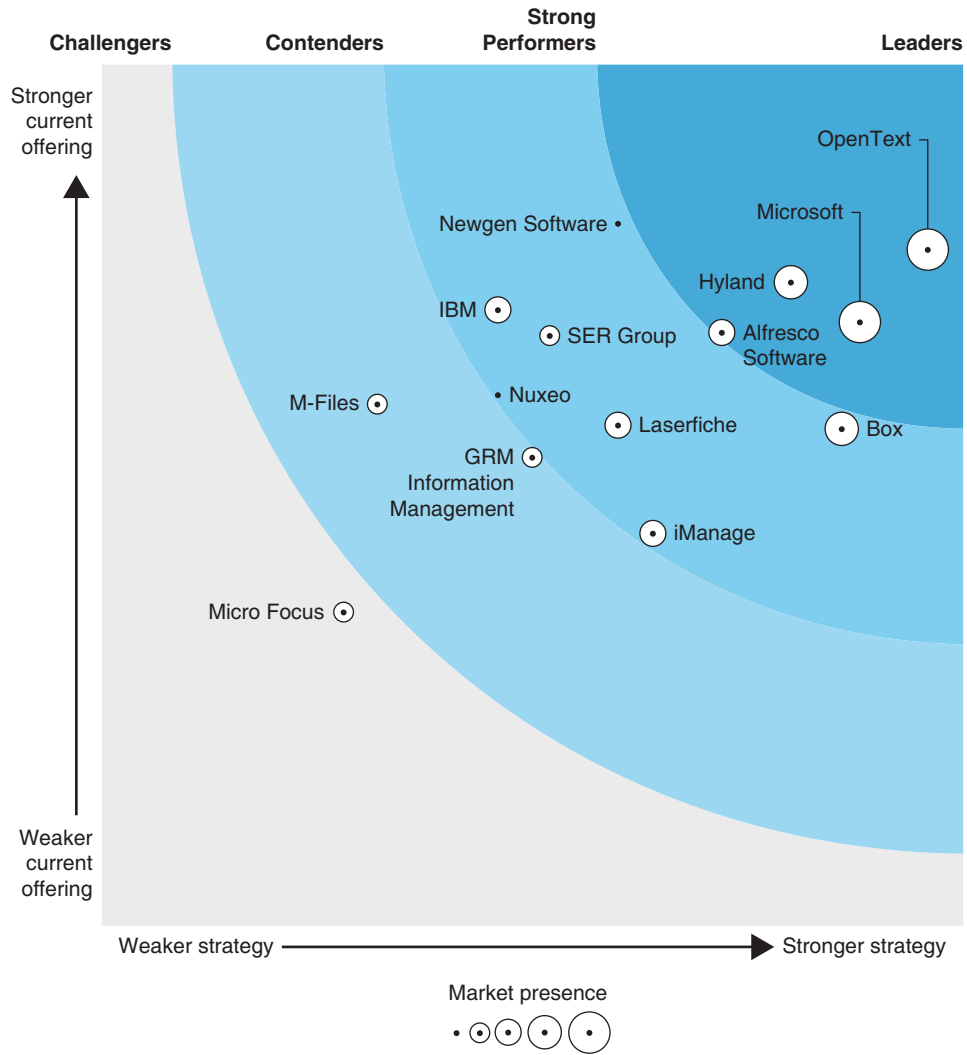
To mitigate these risks, the administration must:

- **Incorporate the documents management system to the information technologies strategic plan.** This will allow for establishing the guidelines for its adoption within the tax administration's technological platform (Cotton & Dark, 2017a), in a distinct manner with other similar tools such as process management systems (BPMS) or contents management systems (CMS/ECM) and thus, reduce costs and facilitate its integration.
- **Carefully determine the nonfunctional requisites of the tool.** By means of estimates of the amounts of information it must manage and the service quality levels it should offer the users, as well as other components of the tax management system.
- **Determine a documents retention strategy.** Based on regulatory frameworks wherein the oldest and/or less accessed documents occupy less costly storage areas.
- **Establish a basic infrastructure for the integration of systems.** With transversal mechanisms for communication and invocation, dissemination of events, authentication, authorization and coordination of distributed transactions.
- **Anticipate the classification and definition of forms, rules and metadata.** This information will be extremely useful for determining the universe of information to be administered by the documents management system and will facilitate the estimation of the functional and nonfunctional requisites of the system prior to its acquisition.

The selection of the business model that may be best adapted to the needs and reality of the tax administration is a fundamental aspect for the mitigation of future risks. The *in-house* or customized development, used by the majority of the Latin American institutions that implemented the documents management system in the last two decades, demands greater development and evolution effort, thus resulting in a significant number of the cases, in an advanced obsolescence of the tool (Cotton & Dark, 2017b).

It is advisable that, for general purpose systems such as the documents management systems, one opt for the acquisition of commercial packages or open source solutions, together with installation services, training of users, technological transfer and corrective and evolutionary support. Some main suppliers of contents service platforms and entrepreneurial contents management systems, which offer documents management system components, identify themselves in commercial comparative frameworks such as Forrester and Gartner, whose summary is shown hereafter:

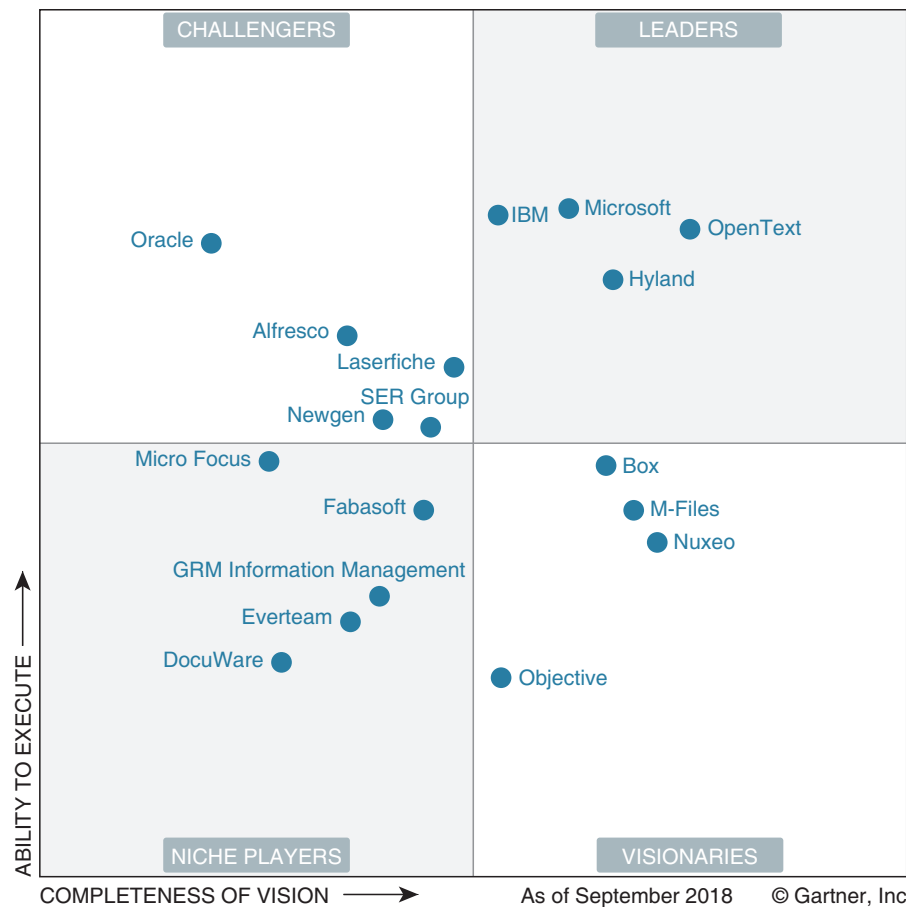
Figure 10.2-2 Referential commercial comparative frameworks for documents management system (ECM/CSP) in 2019



Source: From "The Forrester Wave™: ECM Content Platforms, Q3 2019" by C. McKinnon, D. Hong, and C. Ewald, 2019, July 24, *Forrester*. Copyright 2019 by Forrester, Inc

(continued)

Figure 10.2-2 Referential commercial comparative frameworks for documents management system (ECM/CSP) in 2019 (*continued*)



Source: From "Magic Quadrant for Content Services Platforms" by M. Basso, K. Hobert, and M. Woodbridge, 2018, October 25, Gartner. Copyright 2018 by Gartner Inc.

10.2.4. Documents display

An especially valuable function of the documents management systems for the tax administration is the capacity for presenting a specific document in various forms, according to the environment or the desired purpose, without involving the alteration of its data.

This mechanism allows, for example, a field auditor to prepare, revise and sign a non-compliance report in an application for mobile devices. He then prints a summarized version thereof in a thermal printer in order to notify the taxpayer, who immediately signs it. This printout has an electronic address which the taxpayer uses to visualize the entire writ in the web, including its complete legal agreement and subsequently prints or downloads the PDF digitally signed by the auditor if he so wishes. All the operations were carried out on the same document whose data were established and signed just once by the auditor when he prepared it. The difference in each case was the way in which the data were presented.

Examples such as the foregoing, are already routine in several Latin American administrations. In addition to the uses mentioned, personalized modes of presentation are used for publishing documents in the official gazette, notifying via certified mail, making presentations on large screens and even, allowing them to be read by persons with special needs, by using Text-To-Speech or Braille readers.

10.3. Management of business processes

The business process management (BPM) because of its contributions to increased productivity, quality and transparency of public and private organizations at the world level, has been consolidated as a fundamental element of the modern management models. Business process management promotes continuous improvement and the intensive use of management support technologies, a fundamental mechanism for generating value and the minimization of harmful effects of the functional silos in the organizations (Benedict et al., 2013).

BPM's pertinence in the current highly competitive context allows for expecting that its associated technological market may achieve a compound annual growth rate of 13.25% in the coming years, moving from 6.06 billion dollars in 2016, to an estimated 23.04 billion dollars by 2024 (Orbis, 2019).

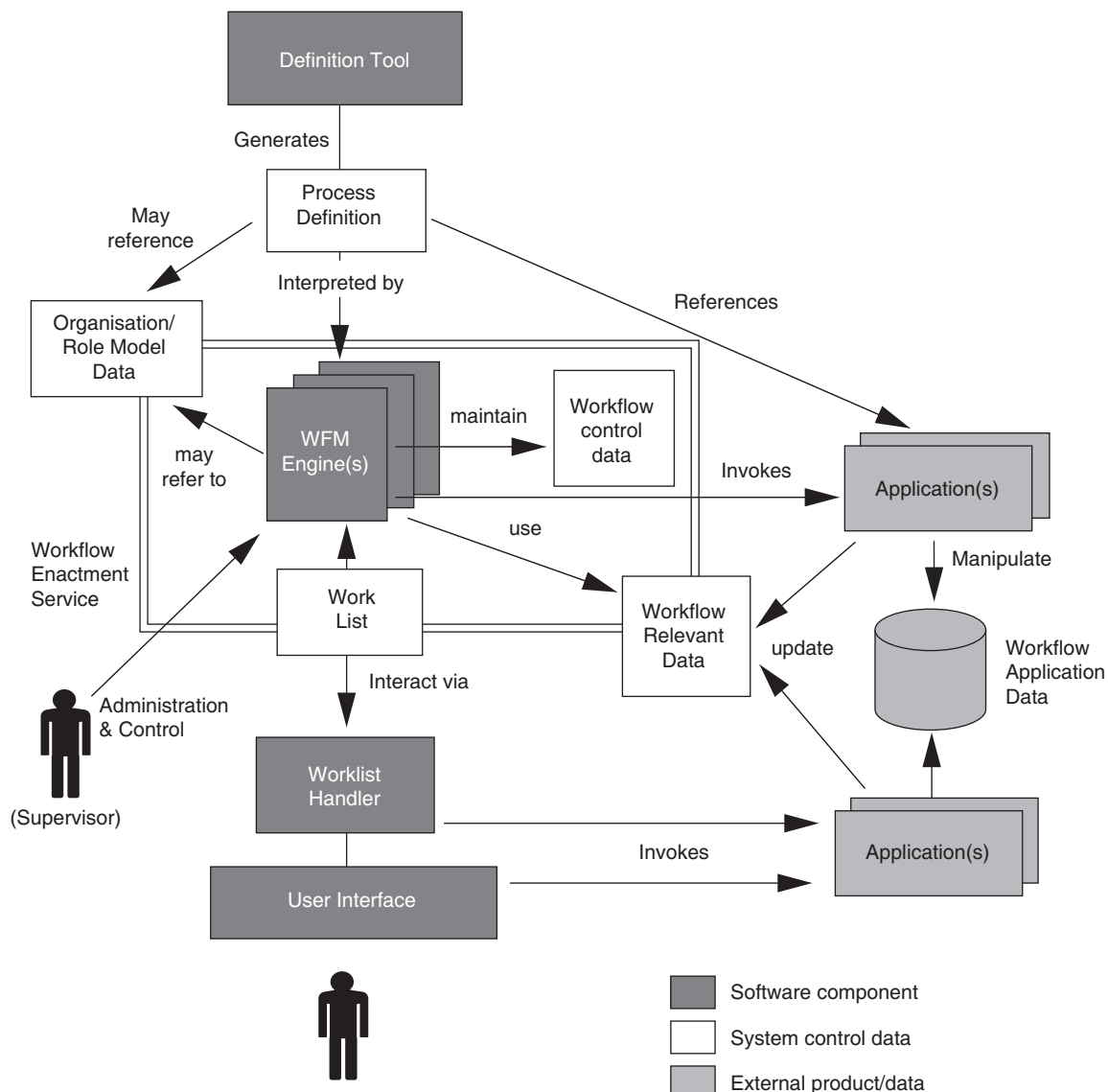
10.3.1. Types of process management systems and their characteristics

The essence of a process management system is to allow the definition and execution of sequences of activities whereby the individuals and/or machines contribute to generate an expected value. For this purpose, in the “design time”, the process administrators upload in the system abstract representations of said sequences and the rules for their execution. Each of these representations is commonly called “process definition” or “process model” (Dumas, La Rosa, Mendling & Reijers, 2013).

The execution of a process, known as “process instance”, is arranged according to the model loaded in the system in the “execution time.” When a specific activity must be carried out by an official, the system places it in its “activities tray.” Upon entering in the activity, the official uses all the necessary information and tools for doing his work. On concluding, he indicates to the system that he has finished and upon validating the results through previously configured rules, the system sends it to the next operator. If a machine or other system must intervene, the system calls upon it at the appropriate time.

This concept, focused on the definition and execution of processes, determined the reference model for the first process management systems: the workflow management systems (WMS). These were developed in the 90s, in response to the technological difficulties found for implementing, in acceptable terms, the changes proposed by the countless process reengineering projects (BPR) at that time. (Dumas et al., 2013)

Figure 10.3-1 Reference model for the workflow management systems



Source: Generic Workflow Product Structure. From "Workflow Management Coalition: The workflow Reference Model," by D. Hollingsworth, 1995, January 19, *The Workflow Management Coalition*, p. 13. Copyright 1995 by The Workflow Management Coalition

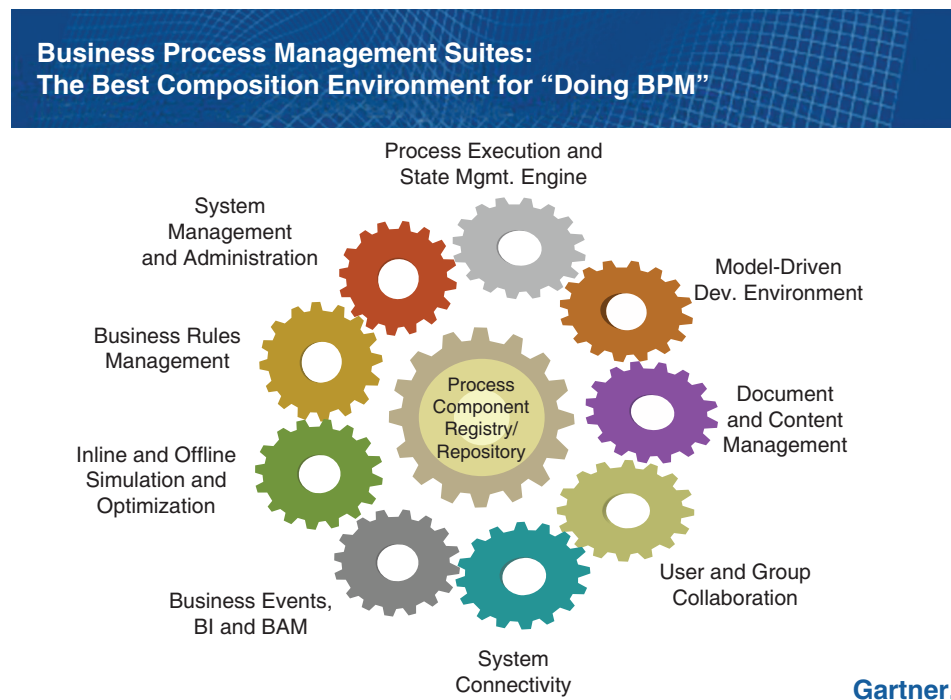
In early 2000, the BPR radical redesign approach began to weaken and gave way to a phenomenon known as "the third wave of thought by processes", whose main element is the promotion of a new managerial discipline called "business process management (BPM)."

BPM not only endeavors to define and execute the processes, but also to monitor and improve them gradually, in line with the organization's strategy. To this end, a continuous process improvement cycle is executed, based on key performance indicators known as "BPM life cycle." According to Dumas et al. (2013) this new approach originated a new generation of systems: the business process management suites (BPMS).

As is mentioned by Marroquín (2015) the main difference between WMS and BPMS lies in the scope and sophistication of the support they provide to the BPM life cycle. The BPMS, as successors of the WMS, are designed to provide support in the stages of identification and definition of the cycle, which originally were not covered by the WMS, in addition to providing more and better tools for the design and monitoring stages.

The BPMS are also designed to be distributed in uncoupled components, allow the simulation of hypothetical scenarios with variations in structure, demand and resources, facilitate the prompt development of applications, use the latest standards and protocols in the market, connect themselves more easily to other systems and to be executed in more modern and scalable infrastructures than their predecessors.

Figure 10.3-2 Main components of a BPMS



Source: The full functionality found in a good BPMS. From “Do You Understand the Difference Between Workflow and BPM?,” by J. Hill, 2010, *Gartner Blog Network*. Retrieved January 27, 2020, from <https://blogs.gartner.com/janelle-hill/2010/04/22/do-you-understand-the-difference-between-workflow-and-bpm/>. Copyright 2010 by Gartner Inc.

In 2012, the denomination “intelligent business process management suites (iBPMS)” was promoted for the subset of BPMS tools which incorporate new technologies and work approaches. They are aimed at the reduction or elimination of coding tasks, collaborative work, real time business activities monitoring (BAM), process mining, business intelligence (BI), dynamic case management (DCM), support to unstructured processes (ad-hoc) and predictive analysis upon demand.

Much in the same way as the great majority of WMS evolved to become BPMS, a significant part of the traditional BPMS have evolved toward the concept of iBPMS. Hereinafter the term BPMS

shall be used to refer in a generic manner to business process management systems, by referring to characteristics or technologies of specific interest to the tax administration whenever necessary.

10.3.2. *Benefits for the tax administration*

The characteristics of a modern BPMS make it the ideal platform for the prompt automation of the business processes of a tax administration, serving as basis for the development of all the other modules of the tax management system. Based in the ideas from Benedict (2013) and Dumas (2013), some of the main benefits which such a tool offers the administration are:

- **Better inputs for integral risk management:** The administration will have detailed information and performance indicators for all and each of the cases managed through the tool and will be able to use them not only to identify and manage risks, but in addition will be able to do so as part of the continuous process improvement cycle.
- **Discretion reduction:** The administration will count on a powerful tool for incorporating automatic validation rules that may ensure that its officials' actions are carried out according to the established procedures and assigned in an impersonal manner.
- **Improvement of the quality of service:** The characteristics of this type of tools allow the administration to offer digital services to the taxpayers and other entities, through the use of various channels and with significantly less effort than would be required if done in the traditional manner. In addition, it will be allowed to count on performance indicators to more easily monitor and improve its services.
- **Greater transparency and traceability:** The detailed information on the processing of each case will allow the administration to offer a transparent service, whereby its actions may be duly audited by the pertinent entities and supervised by society. In addition, together with such elements as the tax current account and a documents management system, the tool will afford the administration integral traceability regarding the evolution of the tax credit.
- **Efficient reduction and distribution of workloads:** Automation and/or the elimination of tasks, have the potential for reducing the workload of the officials, much in the same way as the graphic development of applications has the potential for reducing the numerous computerized requirements, thereby releasing development resources for more demanding technical tasks.
- **Greater flexibility and speediness in the implementation of changes:** On counting on a tool whereby they determine the rules and behavior of the system, as well as to test and simulate the effects of changes in the operation, the business experts may anticipate bottlenecks, work overloads and potential risks, thereby additionally reducing their dependence on the computerized areas for implementing regulatory changes.
- **Permanent monitoring of performance goals and support in decision-making:** The composition and monitoring of performance indicators, process mining and other related functions will allow the administration to evaluate the effectiveness of its strategic planning, keep

its operation aligned with the objectives, prioritize resources and make strategic decisions based on metrics and definitely move toward a working culture based on data analysis and management by results.

10.3.3. *Main implementation risks and keys for mitigating them*

Based in the ideas from Benedict (2013) and Dumas (2013), the main risks faced by a tax administration for successfully moving forward in the implementation of a business process management system, as well as effectively taking advantage of its potential benefits are:

- Not counting on a clear and agreed vision of the processes that are to be implemented in the system, thereby placing at risk the definition of the scope of the project.
- Delays in the progress of the project due to conflicts with respect to such basic concepts as: process, activity, task, procedure, etc.
- Delays and repetition due to difficulties in determining the role of each of the areas in the management of the processes and various stages of the project.
- Lack of performance indicators that may contribute to prioritize the redesign, align the processes to the strategy and evaluate the impact of changes to the processes.
- Facing resistance from the officials on understanding the project as the adoption of a technological tool and not as a new way of working.
- Select a business model or a tool not aligned with the reality and needs of the administration.
- Not having a clear idea of what the product may and should offer the administration within short, medium and long term.
- Opt for an implementation strategy that may exceed the organization's abilities for adequately managing the change.
- Delays or reconsiderations of times and costs of the project, once begun, due to uncertainties related to the basic technological infrastructure and/or integrations with the legacy systems.
- Counting on an inadequate scheme for the support, user assistance and evolution of the system, thereby compromising its appropriate functioning and useful life.

Shown below is a series of key actions for mitigating these risks, which have been recommended by specialists (Benedict, 2013) and corroborated with experiences from various BPMS implementation projects in Latin American tax administrations.

Preparation of the organization

Developing an institutional vision by processes is a determining factor in the successful implementation of the system. To this end, it is advisable that the administration:

- **Allocate and train a team in charge of leading the management and continuous improvement of the processes:** in charge of identifying, defining, modeling, implementing and leading the continuous improvement of the processes in the BPMS. The team should have technical knowledge of the business, of methodologies for improving the processes as well as information technology.
- **Define governance scheme and a methodology for the management of the business processes:** that may involve the sponsorship and follow-up of the top-level management, as well as the necessary documents for the continuous improvement of the processes and their implementation in the system.
- **Define its process map:** general view of which are the transversal processes of the administration, how they are related, and the value expected to be added by each of them to the taxpayer and the treasury. This map will be the starting point for the application of BPM techniques and practices that will lead to taking full advantage of the system's potential.
- **Define a strategy and a general implementation chronogram:** See section Definition of the implementation strategy below.
- **Implementation of a change management plan:** to disseminate the process map and BPM concepts and prepare the definition and modeling of the current situation ("AS IS") and the desired situation ("TO BE") of the processes.

Selection of the business model and technological tool

To build, maintain and make evolve a process management system that may provide adequate support to the BPM's life cycle, using an *in-house* or custom-made model is a task that exceeds the development resources available in the great majority of Latin American tax administrations. The most advisable option in this case is to acquire a commercial package or adopt an open source solution, by hiring specialized training and support to soften the learning curve of technicians and users.

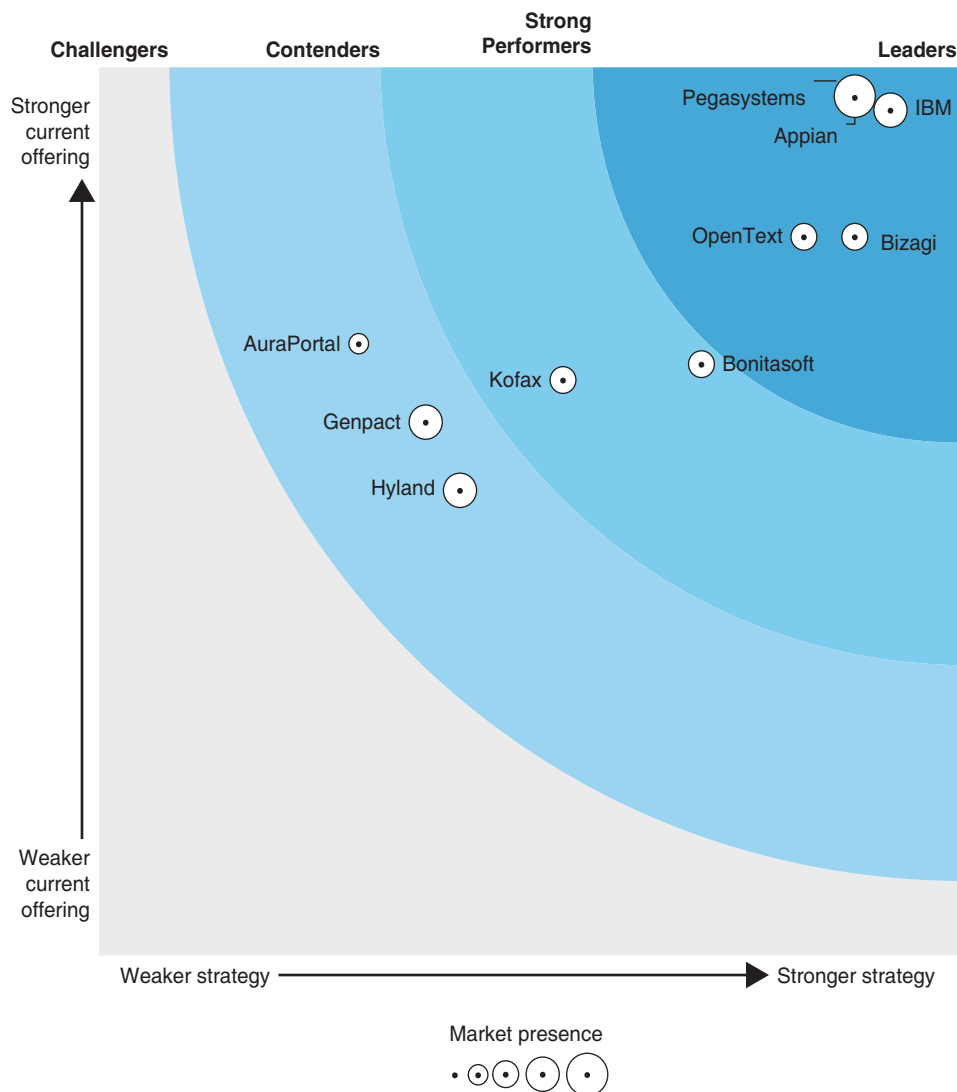
When selecting a tool, in addition to considering the budgetary factor, it is essential to ensure that it be adapted to the functional and technical criteria determined by the administration. To that end, it is advisable that prior to determining the terms of reference for the acquisition process, the team responsible for the continuous improvement of the processes:

- **Define a framework for evaluating the tools:** The Gartner and Forrester comparative frameworks (see *Figure 10.3-3*) are very frequently used to compare commercial tools. However, they might not include some open source tools or may be inadequate to support a formal acquisition process. Such works as "*Un método de evaluación de Sistemas de Gestión de Procesos de Negocio*" (see bibliography) may be a good starting point to establish a formal evaluation method.
- **Analyze adjoining cases in the public and private sectors:** Because of the nature of their activity, the ministries of planning and foreign trade, central banks, financial entities and

businesses in the logistic sector, are regular customers of BPMS tools and may provide the administration data regarding their implementation experiences and the behavior of local suppliers, thereby contributing to mitigate potential risks.

- **Request demonstrations and evaluate well-known tools:** Practically all BPMS suppliers offer free demonstrations and/or open use versions to facilitate the evaluation of their products. Experience shows that if a tool lacks a good pre-sale commercial representation, there are little probabilities that the post-sale support may be the ideal one.

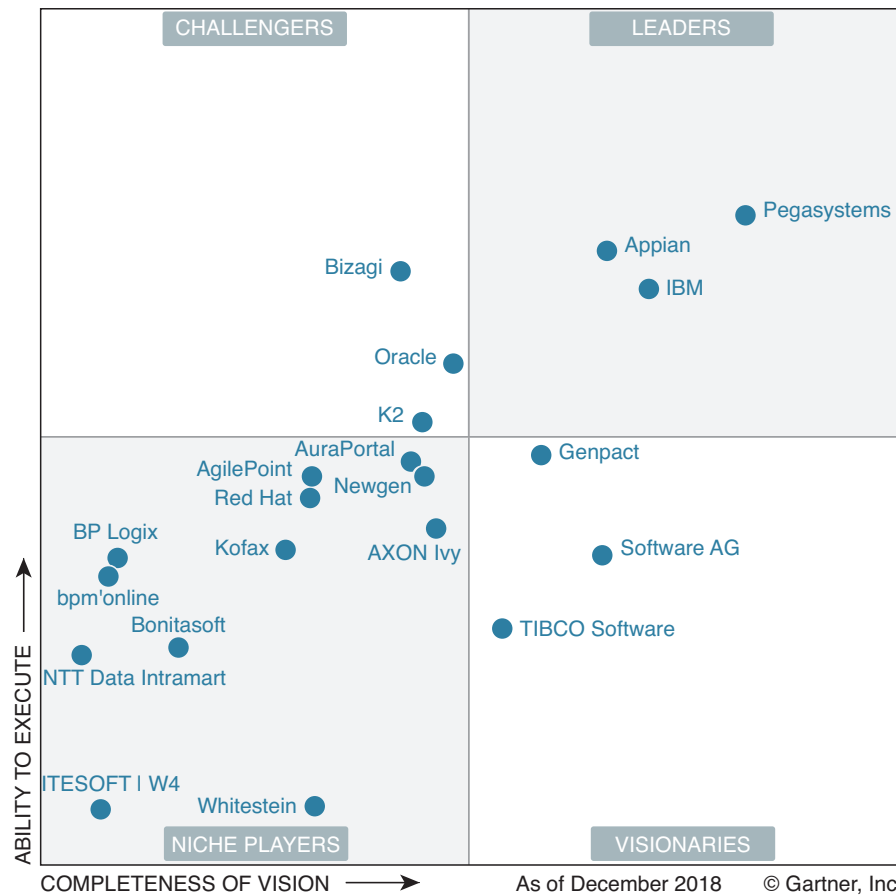
Figure 10.3-3 Examples of commercial comparative frameworks for BPMS in 2019



Source: From "The Forrester Wave™: Software For Digital Process Automation For Deep Deployments, Q2 2019," by R. Koplowitz, C. Mines, A. Reese, & S. Sjoblom, 2019, June 19, *Forrester*. Copyright 2019 by Forrester, Inc.

(continued)

Figure 10.3-3 Examples of commercial comparative frameworks for BPMS in 2019. (*continued*)



Source: From "Magic Quadrant for Intelligent Business Process Management Suites" by M. Kerremans, R. Dunie, K. Iijima, D. Miers, P. Vincent, & J. Wong, 2019, January 30, *Gartner*. Copyright 2019 by Gartner Inc.

It is essential to understand that when acquiring a BPMS an investment is being made in a tool not only for end users to carry out processes, but which will also be used by business experts and computer technicians to develop new applications, expand the computerized coverage to the organization's processes and carry out future changes. Therefore, the tool should not be selected by barely considering the current technological scenario, but also its medium- and long-term perspective. According to Cotton & Dark (2012) it is advisable that such perspective be traced in the administration's Strategic Information and Communication Technologies Plan.

From the broad spectrum of possible evaluation and functionalities criteria offered by the BPMS tools available in the market (Marroquín, 2015), it is advisable to consider the following as a desirable minimum set for a tax administration:

Table 10.3-1 Desirable functionalities and characteristics for the BPMS of a tax administration

Category	Functionalities / Characteristics
Identification of processes	<p>Capture of strategic objectives</p> <p>Modelling of process map and high-level diagrams (e.g. Value-added chain diagram)</p>
Definition of processes	<p>BPMN Support 2.0 (modeling, import and export)</p> <p>CMMN Support (modeling of dynamic case management)</p> <p>Extended documentation of models (descriptions of activities, activities procedures, links to external guides and manuals)</p> <p>Definition of process and business performance indicators (KPI)</p> <p>Integration with organization model, external users and roles (RDBMS and LDAP)</p> <p>Graphic modeling of business rules and integration with external business rules management systems</p> <p>Validation and simulation of processes based on data sources</p>
Design of processes	<p>Automatic transformation between modeling language and execution language</p> <p>Synchronization between executable process model and business process model</p> <p>Creation of service level agreements</p> <p>Links between performance indicators (KPI) and service levels</p> <p>Support to errors, exceptions, compensations and process transactions</p> <p>Access connectors to internal data sources (JDBC, ODBC, OLE-DB, etc.)</p> <p>Connectors to external service sources (SOAP, REST, RPC, etc.) and access to external web sites</p> <p>Support for federal authentication and authorization and PKI (SSO, LDAP, SAML, etc.)</p> <p>Support to integration with ECM/DMS, EAI middleware and distributed transactions</p> <p>Support for the development of personalized connectors</p> <p>Support for automatic generation of user interfaces and personalization of generic interfaces</p> <p>Support for prompt development of user WYSIWYG user interfaces</p> <p>Support to high level programming languages and scripting (Java, C#, JavaScript, etc.)</p> <p>Responsive user interface with latest generation Web standards and frameworks (CSS3, HTML5, JavaScript, AngularJS, Bootstrap, etc.).</p> <p>Support for the creation and execution of test cases, functional, nonfunctional and regression tests</p> <p>Generic assignment strategies and support for the creation of strategies based on rules</p>
Execution of processes	<p>Support for simultaneous execution of several versions of the same process</p> <p>Support for integration with corporate portals and interaction from mobile devices</p> <p>Programmatic API</p> <p>Support for cluster/cloud execution</p>
Administration	<p>Administration of technical aspects: configuration of connectivity to databases and repositories, errors management, support and security copies</p> <p>Administration of cases in execution time (begin, pause, cancel, reassign, etc.)</p>
Monitoring	<p>Reports and generation of alerts due to system and connectivity errors, active connections, response times, etc.</p> <p>Support to active monitoring of activities (BAM), process mining, OLAP and BI techniques</p> <p>Scoreboards by process, business area and general</p>
Product	<p>Guarantee of support with levels of service and training of technical team and users that will manage the processes</p> <p>Legal responsibility and indemnity</p> <p>Updates, patches and alignment with the product's route sheet</p>

Source: Prepared by the author

Definition of the implementation strategy

The availability of BPMN modelers, process simulators and even complete free use BPMS suites, benefit the definition of an implementation strategy, wherein the identification and modeling of processes begins in parallel with the selection and acquisition of a BPMS tool for use in production.

Large tool suppliers boast of offering implementations of processes in production in terms between 3 and 6 months as of the purchase of the product. However, experience shows that this term depends to a great extent on the organization's clarity regarding its processes, its capacity for simplifying and optimizing them, the architecture and capacity for adaptation of the legacy systems and the definition of a strategy that may allow it to devote key human and technological resources to the implementation project.

A gradual approach for implementing and starting the automated processes, with respect to the process map as well as its regional coverage, is essential for adequately managing the change. It is advisable that the complexity of the first processes implemented range from low to average, with sufficient visibility for generating political support to the project and the institution, but that they be little demanding in terms of number of executions per time unit.

The general trend is to begin implementation through the Tax File Management processes. However, it is necessary to segment the taxpayer universe to avoid the great potential negative impact generated by possible implementation problems. Such processes as the granting and review of tax benefits, or the authorization for the development of tax receipts issuing systems, may be more attractive options to initially get going.

Recent implementation experiences of commercial BPMS in Latin American tax administrations, as is the case of Panama and Guatemala, support the idea that a term between 9 and 12 months as of the date of acquisition of the software, is adequate to begin production of the first processes. The implementation of all assigned processes may take between 2 and 3 years. Shown below is an approximation of the temporary disposal of the working lines that must be considered in the strategy:

Figure 10.3-4 Example of temporary disposal of working lines for the implementation of a BPMS

Working line	Year 1				Year 2				Year 3				Year 4		
	T1	T2	T3	T4	T1	T2	T3	T4	T1	T2	T3	T4	T1	T2	T3
Transversal working lines															
Composition and training of team															
Evaluation and selection of tools															
Identification and definition of processes															

(continued)

Figure 10.3-4 Example of temporary disposal of working lines for the implementation of a BPMS (*continued*)

Working line	Year 1				Year 2				Year 3				Year 4		
	T1	T2	T3	T4	T1	T2	T3	T4	T1	T2	T3	T4	T1	T2	T3
Adaptation of basic infra. (physical and logic)															
Adaptations of legacy systems															
Acquisition process															
Training and technological transfer															
Implementation of the tool															
Stabilization and adjustments to the tool															
Implementation of automated processes/continuous improvement															
Group 1: Phase 1 (Pilot)															
Group 1: Phase 2 (Total)															
Group 2: Phase 1 (Pilot)															
Group 2: Phase 2 (Total)															
Group 3: Phase 1 (Pilot)															
Group 3: Phase 2 (Total)															
Other processes (not assigned)															

Source: Prepared by the author

In the same way the duration of the purchase processes may significantly affect the initial stages of the project, the high-level management commitment and the institutional capacity for undertaking regulatory changes that may allow it to abandon obsolete practices are key factors for the success of the project. It is advisable that the continuous improvement team may be free to propose and implement regulatory changes during the redesign of the processes, with the support and co-participation of the juridical area.

Integration with pre-existing systems

The adequate integration of the process management system with the administration's legacy systems is another of the fundamental factors for the success or failure of its implementation. In Latin America, there is a generalized trend of the computerized areas of the tax administrations to overestimate the complexity of these integrations, while the business areas tend to underestimate them, especially when considering the terms of reference of the acquisition processes.

In both cases, this phenomenon may be attributed to the uncertainty regarding the details of the activities that must be carried out, lack of knowledge of the true internal complexity or obsolescence of the legacy systems and even, to deficient technological transfers and flight of information technology human capital.

The solution that is commonly proposed for solving this problem is to abandon and fully substitute the legacy systems. Although this might seem the only sensible option, this strategy places great

pressure on the BPMS implementation project, thereby increasing its size and term of execution, and discarding one of the main pillars of its design: the facilitation of interoperability and interconnectivity.

To adopt a strategy that may allow for implementing the tool and obtaining significant results for the administration within an acceptable term, it is fundamental to count on the active participation of the computer technology area in the process management and continuous improvement team as of the time of its composition and training. Likewise, the adoption of an implementation strategy spread out at intervals is determinant in carrying out the gradual integrations with legacy systems, as every process is being implemented.

The preparation of the basic, physical and logic infrastructure for the implementation of the BPMS, is an activity that must begin during the analysis phase of probable tools, prior to proposing the acquisition process. It includes, among others, the following activities:

- **Unification of the organizational model:** departments, officials, users, roles and national and international catalogues useful to the business covering countries, currencies, rates of interest, etc.
- **Establishment of a centralized security layer:** for authentication and authorization (preferably with capacity for accepting dynamic authorizations based on tickets).
- **Arrangement and documentation of integration mechanisms:** Including access to data sources and document management or entrepreneurial contents systems (CMS/ECM), with support for distributed transactions, as well as middleware of entrepreneurial applications integration (EAI).

Integrations with legacy systems will benefit from the basic infrastructure as they are being approached, with the precise and necessary measures for the processes as they are being identified and determined. In general, the preparation of legacy systems seeks to transform them in series of reusable services, which implies:

- **Identifying the points of integration:** Components, services, pages, screens, tables, database objects, lines, etc.
- **Designing the integration strategy for each case:** The objective is to allow access to the function or information using standard protocols supported by the great majority of market tools (e.g. JDBC, ODBC, SOAP, REST, HTTP, EAI/ESB, etc.). New technologies for the simulation of user actions by means of such software as screen scraping and Robotic Process Automation (RPA) very valuable options at this stage.
- **Executing the designed changes:** If necessary, some components must be totally or partially reconstructed, to which end it will be necessary to adopt a specific strategy for the migration of the information and management of change for the users.

Support and evolution

The automation approach with little or no codification of the modern BPMS, allows the administration to adopt a mixed support and evolution scheme, which divides its workload between business experts and computer technicians. This characteristic makes the BPMS ideal for many tax administrations that are currently suffering with saturated computer technology teams and long lines of requirements that can hardly be taken care of.

To take the best possible advantage of this characteristic, it is advisable that the administration:

- **Define a user (internal and external) assistance and support model:** Aligned with the governance scheme for the management and continuous improvement of the processes, based on assistance spread out at intervals and supported by an institutional knowledge base.
- **Empower the business experts:** Ensuring that owners, administrators and process analysts be the ones to carry out the parametrization and creation of applications tasks with the WYSIWYG tools of the BPMS, thereby reducing bottlenecks during the development.
- Restrict interaction of the computer technicians with the user: using them as last resort in terms of support.

As for the relationship between the administration and the tool supplier, it is essential that in addition to the initial training, the technological transfer and support to the system during production, a contractual support commitment be established according to levels of service (associated with the supplier's response time), at least for one year as of the beginning of production of the system. It is also advisable to consider in the contract, the distribution and installation of updates, patches and new functions for a term of 3 to 5 years.

10.3.4. *Integration of the BPMS and DMS in a tax administration*

In the tax administration, taxpayer communications, administrative acts and even regulatory provisions are physical or electronic documents that must be prepared, signed and/or referenced throughout the business processes. In this context, the integration between the document management system and the process management system constitutes a fundamental part of any management digitalization and automation strategy to be adopted in this type of organizations.

This integration should facilitate, not only the registration of a document in the DMS to represent each of the interactions between the administration and the taxpayer, but also, the creation or modification of any document representing an event that may set off, automatically and given the necessary conditions, actions such as:

- **The execution of a new business process.** As in the case of the presentation of an administrative appeal that disputes a notice of reassessment, thereby initiating an administrative litigation.

- **The continuation of one or more processes being executed.** As in the case of a certificate presenting additional information wherein the taxpayer responds to a request previously made by an auditor, to give continuity to an examination process, or an act of the session of an administrative court wherein the decisions on various administrative appeals are recorded, giving continuity to the judged processes.
- **The conclusion of one or more processes being executed.** As in the case of a payment or payment agreement which cancels the collection processes corresponding to the debits included in the agreement, or actually paid by the taxpayer.

In the foregoing examples, as well as in other similar situations, the documents that cause the aforementioned actions may be generated independently or as part of a business process executed in the BPMS, manually or automatically, according to the level of automation of the process that generates it. This latter case is, for example, that of the payment agreement that cancels the collection processes, probably generated as the result of a process for responding to payment agreement requests.

As documents and processes are managed in an integrated manner in the DMS and BPMS, a network of digital records is set up, which provides detailed traceability of the entire evolution of the tax credit, as of the origin of the obligation up to its eventual extinction, allowing for accessing and auditing the acts carried out with the speediness, security and transparency expected from a modern tax administration.

Notes

93. Orderly series of standards and procedures that regulate the operation of a group or collectivity.
94. Short for extract, transform and load.

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11. ROADMAP TO MODERNIZE A TAX INFORMATION SYSTEM

An efficient Tax Information System (TIS) is essential for tax management. Currently, tax administrations depend on their tax information systems to carry out the functions determined by law. On the other hand, total or partial malfunctioning of the system puts at risk collection and the control of taxes and, accordingly, the financing of public policies. The chapter entitled: “*A Tax Administration Framework*” describes these functions.

The dynamic nature of the tax policies and regulations requires a flexible computerized system, which may timely accept these changes, without putting at risk the normal execution of its components, while maintaining the expected performance. To these challenges one must add the adjustment of functional weaknesses, expand institutional coverage, improve the capacities for exchanging data with other institutions, handle the problems of the computerized platform, and facilitate the provision of more and better services to the taxpayers.

In addition, the technological panorama has changed in the past decades, by providing new architectural alternatives, methodologies, services and technologies that may be used for facing these challenges.

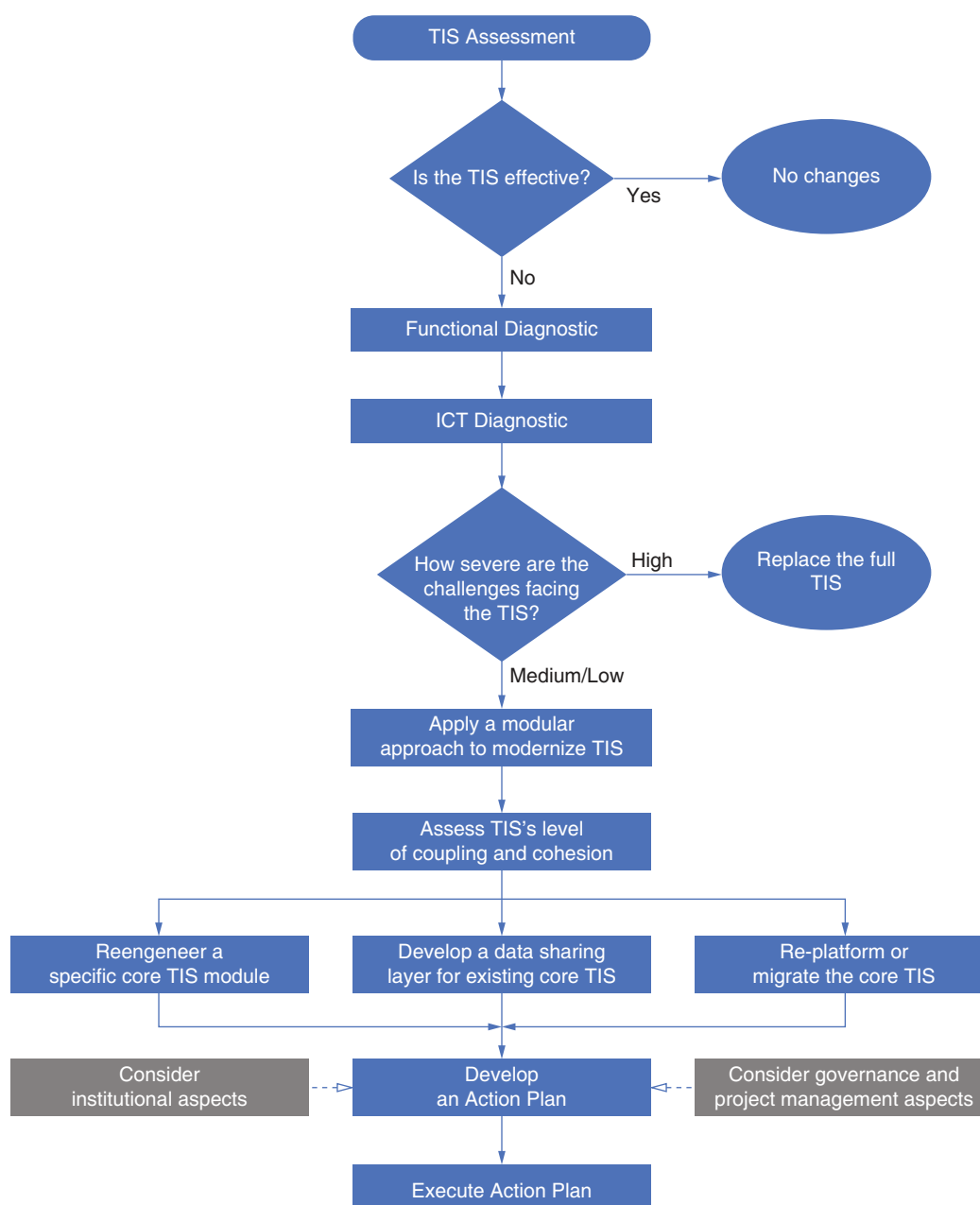
Decision-making in relation to modernizing and improving the effectiveness and efficiency of the Tax Information System covers a series of considerations to be taken into account in a complex organizational and technological environment, where costs and implementation times play an important role. Some of the main questions which administrators ask themselves with respect to this type of initiatives are:

- Is the institutional coverage sufficient?
- Are its components individually effective with respect to the functional coverage of the activities that are carried out in the tax management processes?
- Are its components individually effective in technological terms?
- Are the costs and difficulties for the maintenance/updating of the Tax Information System acceptable?
- Does the current architecture of the system allow for the evolution in terms of information exchange, provision of digital services to the taxpayers, and Big Data analysis?

- Is the software's computerized platform updated, with acceptable license costs and sufficient technical support from the suppliers?
- Is the computerized platform of the hardware flexible for including the increasing amounts of data, and maintaining performance?

Figure 11-1 shown below summarizes the activities carried out to decide on the need to modernize a Tax Information System, either through its replacement or improvement of the modules/components.

Figure 11-1 Steps to modernize a Tax Information System



Source: Modernization of an FMIS: Key Steps and Decision Points. Adapted by the author from "How to Design a Financial Management Information System: A Modular Approach," by R. Allen, N. Botton, and G. Uña, 2019, p. 18. Copyright 2019 by International Monetary Fund.

The subsequent sections of this chapter propose a series of basic evaluations and orientations in relation to the process proposed in *Figure 11-1*. To this end, verification lists, maturity model and questionnaires intended to establish the current situation of the Tax Information System are proposed. In each specific questionnaire, one may attribute to each line or factor an evaluation based on points or grades of veracity or operational values for the factor. Further details are found in the description of the questionnaires.

From the analysis of the results generated through the use of the proposed tools one may obtain, indirectly, an idea of the effectiveness of each functional component, so that the tax administration may determine a modernization plan for its Tax Information System or its total replacement, if necessary.

It is important to highlight that the factors shown in each chart are a reference framework for which each tax administration must validate, and thereafter, add, change or eliminate factors to better characterize its context.

11.1. Sources of information for the proposed evaluation methods

The information required by the evaluation methods identified in this chapter may be obtained internally, through self-assessment and based on data provided by management tools used by the tax administration. For the self-assessment, it is more effective to use groups with participants from multiple areas of the tax administration and, if possible, taxpayer representatives for the evaluation of services.⁹⁵

In addition, there are two tools for providing data to fill out and improve the questionnaires. These are the International Survey on Revenue Administration⁹⁶ (ISORA) and the Tax Administration Diagnostic Assessment Tool⁹⁷ (TADAT). These instruments, which have been developed for the general evaluation of the tax administrations, work on several dimensions, which may be considered in the proposed evaluation.

It is worth noting that the participation of the countries in the ISORA and TADAT programs is voluntary.

11.2. Maturity of the tax information system

The evaluation of the maturity of the Tax Information System is based on the verification of the functional and service coverage, in addition to the level of automation, according to a series of key characteristics. *Table 11.2-1* identifies a series of functions or services and their respective levels of automation, organized by types of taxes. Other taxes, functions and services may be increased to better represent a specific tax administration. It is worth highlighting that this division only evaluates the level of automation of the functions available for each tax and not the tax administration's organizational model.

It endeavors to characterize four levels of automation:

- **Level 1:** There is no automation (1 point).
- **Level 2:** There is a preliminary automation level, with the main focus on digitalizing the data after completing the transaction. The general objective is to create an electronic data base to generate useful management reports (2 points).
- **Level 3:** This level is mainly focused on automating the transactions internally, with or without minimum interface with the taxpayers. Only the tax agency staff has access to the system (3 points).
- **Level 4:** An advanced automation level where the services and functions related to the tax administration are automated with the taxpayers' interaction. There are also provisions for the exchange of data with other external interested parties such as banks (4 points).

Table 11.2-1 List of automated functions/services (illustrative)

Key Issues	Level of Automation		
	Income Tax (Number between 1 to 4)	Corporate Tax (Number between 1 to 4)	Value Added Tax (Number between 1 to 4)
Information services such as processes, tax calendar, application forms, acts, and tax exemption limits			
Online application for TIN registration			
Electronic fiscal domicile (<i>e-TaxDomicile</i>)			
Processing of registration application with online verification with original data sources and third parties and issuance of certificates			
Self-assessment of tax liability by taxpayers and generation of returns (all methods)			
Electronic filing of returns			
Pre-filing of tax returns			
Payment of taxes at banks and others financial institutions			
Electronic payment of taxes			
Integrated taxpayer current account (all taxes)			
Auto-generation of reminders and assessment notices for nonpayment and erroneous payment			
Preparation and issuance of assessment notices to defaulters			
Electronic submission of appeals, including tracking and processing			
Electronic management of arrears collection processes such as issuing alerts and notices for seizure			
Online submission of refund request			
Processing of refund request with electronic transfer of funds			
Online submission of application for tax clearance certificates			
Processing of tax clearance certificate request			

(continued)

Table 11.2-1 List of automated functions/services (illustrative) (*continued*)

Key Issues	Level of Automation		
	Income Tax (Number between 1 to 4)	Corporate Tax (Number between 1 to 4)	Value Added Tax (Number between 1 to 4)
Processing of taxpayer registration cancellation			
Automated generation of accounting and MIS reports			
Allocation, tracking, and preparation of response to audit queries			
Online request to authorize invoices and other fiscal documents			
Availability of web services or API to accept electronic invoices, electronic withholdings certificates and other fiscal documents			
Availability of functionalities for small and mid-size taxpayers to generate invoices, withholding certificates, fiscal account bookkeeping and other records directly on the tax administration system			
Web services to query compliance status of taxpayers by authorized parties (like government agencies in procurement processes)			
Facilities to a taxpayer query information provided to the tax administration by third parties			
Facility to a taxpayer to verify that an audit process has been initiated and the authorized auditor			
Anonymous services to file complaints and leads about fraud and irregularities of a taxpayers			
Total score (sum of each column)			
Overall TIS Maturity Level (*)			

Source: List of Automated Functions and Services. Adapted from “Tool Kit for Tax Administration Management Information System,” by Asian Development Bank, 2014, p. 32. Copyright 2014 by Asian Development Bank (ADB)

(*) The total maximum score per tax is 116.

The categorization of the general maturity of the Tax Information System, by tax, is based on the following scale: **Low: 0 - 37; Average: 38 - 75; High: >75**

For an in-depth institutional coverage, one may consider the number and types of transactions available for each functional area of the tax administrations, which may also be a complementary coverage indicator of the Tax Information System. It may also serve as reference for expanding the transactions available in a system. The annex in section 11.8.1 below provides a table indicating for each functional area, an illustrative vision of the transactions or services that may be implemented by a Tax Information System.

11.3. Enabling factors

This evaluation is focused on verifying the level of preparation of the tax administration for effectively implementing a modern Tax Information System. These factors are subdivided into two groups: aspects of a legal nature; and, aspects related to the exchange of information with other institutions.

The existence of enabling factors of a legal nature in the context of the tax administration's action allows the implementation of a Tax Information System that may make better use of the existing digital technology. Many services to be automated depend on the existence of legal support to the digital means for their total or partial implementation. On the other hand, the exchange of data by the tax administration with other entities, although not completely automated, indicates a positive potential of institutional maturity that will facilitate automation and expansion actions.

The enabling factors in the current scenario are evaluated by placing an "X" in the appropriate column. Column 1 indicates a totally negative scenario with respect to the ideal scenario, while column 4 indicates a totally positive scenario. Columns 2 and 3, respectively, indicate an intermediate-negative and intermediate positive situation, with respect to the ideal scenario

It is important that negative enabling factors be examined, and actions be taken for approaching the ideal scenario, under the risk of loss of efficiency, even in spite of investments in information systems.

Table 11.3-1 Evaluation of enabling factors

Diagnostic Questionnaire	Ideal Scenario	Current Status		
		1	2	3
Enabling legal environment				
Does the current legislative framework provide legal validity for electronic commerce, electronic filing, and electronic data storage through an Electronic Transaction Act or e-Commerce Act?	4			
Does the legal framework provide for the sharing of information between different agencies involved in tax administration such as banks and stock exchanges?	4			
Do policies exist for defining the data architecture, application architecture, and data exchange standards for the ICT system?	4			
Information exchange between Agencies				
Is information exchanged between the finance ministry and tax authorities?	4			
Is information exchanged between banks and tax authorities?	4			
Is information exchanged with the ICT systems of other entities such as banks via an integrated financial management system (IFMIS)?	4			
Institutional maturity				
Does the institution have project management capacity?	4			
Does the institution have the capacity to make procurements?	4			
Does the institution have organizational change management capacity?	4			
Does the institution have processes and quality management capacity?	4			

Source: Assessment of Other Enabling Factors. Adapted by the author from "Tool Kit for Tax Administration Management Information System," by Asian Development Bank, 2014, p. 36. Copyright 2014 by Asian Development Bank (ADB)

It is important to have a clear vision of the qualifying factors prior to formalizing a Tax Information System modernization project. Some measures may be adopted after determining the qualifying factors that are in a negative situation.

In the legal context, legal experts must participate for determining if specific limitations may be replaced with regulatory changes (which are usually easier to obtain) or if there is a need for changes in laws (which usually take more time and effort). With this definition, the project actions are clearer with respect to risks and possible mitigations or alternatives.

Information exchanges with other institutions indicate the existence of the legal framework and experience in the negotiation of this type of exchange, which involve aspects of tax secrecy, security of the information in an external environment, risks and others. A positive situation will strengthen an orientation toward the technological improvement of the process, a negative situation will require the previous formulation of exchange of information models with the support of legal experts.

The evaluation of the institutional maturity is critical for the success of Tax Information Systems modernization projects. There should be an acceptable level of the management skills mentioned for the execution of these projects, in accordance with the previous evaluation of the project preparation team. If it does not exist, its qualification should be carried out, even during the project.

11.4. Level of service of the tax information system

The evaluation of the level of Service not only verifies the current performance, but also establishes indicators for future verifications. The Level of Service is verified according to two dimensions: performance levels and attributes of the selected services.

The **first dimension** deals with the service levels and key performance indicators (KPI). The international *reference points* values are proposed in reference to (ADB, 2014, p. 33) and may be revised for the specific objectives of a tax administration. One may select as *reference point* a tax administration that is comparable in taxes and its practices and which has available the necessary data.

Table 11.4-1 Benchmarking of the levels of service and KPI

Services or functions	Service Level or KPI			
	International Benchmark	Income Tax	Corporate Tax	Value Added Tax
What is the average time required to register taxpayers and issue tax identification number	7 days			
What is the average time required to prepare tax return and pay taxes?	10 days (for major taxes only)			
What is the average number of days required to process tax return and identify invalid, erroneous, and underpaid returns?	15 days			

(continued)

Table 11.4-1 Benchmarking of the levels of service and KPI (*continued*)

Services or functions	Service Level or KPI			
	International Benchmark	Income Tax	Corporate Tax	Value Added Tax
What is the average number of days required to identify, assess, and issue notices to defaulters?	15 days			
What is the average duration required to resolve an appeal?	30 days			
What is the average number of days required to process refunds?	25 days			
What is the average time required to issue VAT registration certificates for importers and exporters	2 days			
How many agencies or offices are involved in the issuance of tax clearance certificates?	1			

Source: Benchmarking of Service Levels and KPIs. Adapted by the author from “Tool Kit for Tax Administration Management Information System,” by Asian Development Bank, 2014, p. 33. Copyright 2014 by Asian Development Bank (ADB)

If there are levels of services that are much deviated in relation to the international reference points selected, this means that there are opportunities for the reengineering of business processes to improve the levels of services, possibly with the support of more adequate technologies.⁹⁸ The deviations may also result from inadequate computerized implementations.

The **second dimension** deals with the attributes of selected services, in terms of the extent of their use by the taxpayers. With respect to the attributes considered in this dimension, the values of the international *reference points* appear in (ADB, 2014, p. 35) and may be revised for the specific objectives of a tax administration.

The utilization attributes in the current scenario are evaluated by indicating the current percentage value of the attribute being considered.

Table 11.4-2 Analysis of the utilization attributes of some services

Diagnostic questionnaire	Ideal scenario (international benchmarking)	Current status
Total number of registration applications received online (% of total registered taxpayers)	100%	
Number of filings made or presented online (% of total transactions)	>90%	
Number of tax payments made at banks (% of total transactions)	30%	
Number of tax payments made online (% of total transactions)	60%	
Total number of appeals submitted online (% of total appeals)	50%	

Source: Statistical Analysis of Transaction Data. Adapted by the author from “Tool Kit for Tax Administration Management Information System,” by Asian Development Bank, 2014, p. 35. Copyright 2014 by Asian Development Bank (ADB)

A percentage of utilization below the value of the international reference point established may indicate:

- Lack of adequate dissemination of the service.
- Difficult to use interface.
- Deficient computerized implementation.
- Bothersome process for providing the service.

All these possibilities may be combined and must be evaluated and corrected, if necessary.

11.5. Information and Communication Technology (ICT) diagnosis

The evaluation of the ICT dimension is essential for determining the effectiveness of a Tax Information System and indicating aspects requiring improvement. The proposed model covers three components, gathered in the same table/questionnaire: i) infrastructure; ii) processes; and, iii) ICT human resources.

The current status is evaluated with an “X” in the appropriate column: column 1 indicates a totally negative scenario in relation to the ideal scenario, column 4 indicates a totally positive scenario. Columns 2 and 3 indicate, respectively, an intermediate-negative and intermediate-positive situation, in relation to the ideal scenario.

Table 11.5-1 Evaluation of the infrastructure, processes and ICT human resources (indicators)

Diagnostic Questionnaire Infrastructure H&S, Processes and ICT Human Resources	Ideal Scenario	Current Status			
		1	2	3	4
Hardware and Software Infrastructure					
Do the software packages used in the TIS correspond with the system’s continuous modernization needs?	4				
Does the infrastructure support technologies for the provision of service to the taxpayers via Internet?	4				
Is the TIS platform based on the Web?	4				
Does the TIS computerized platform allow for the timely evolutionary maintenance of the system?	4				
Is the computerized platform stable?	4				
Does the platform allow the online and flexible Exchange of information between institutions?	4				
Are the maintenance and updating costs of the computerized platform acceptable?	4				
Is the system’s documentation adequate and sufficient to guarantee its maintenance?	4				
Is there a world class Data Center (e.g., TIER 3) or similar service in the cloud?	4				

(continued)

Table 11.5-1 Evaluation of the infrastructure, processes and ICT human resources (indicators) (*continued*)

Diagnostic Questionnaire Infrastructure H&S, Processes and ICT Human Resources	Ideal Scenario	Current Status			
		1	2	3	4
Are all the regional offices and central office interconnected with online access to the TIS?	4				
Do servers and storage equipment respond to the needs of the tax administration within short- and medium-term?	4				
Are the software licenses used in the TIS sufficient and legalized?	4				
Processes					
Are there processes implemented for the management of the TIS life cycle?	4				
Is there an adaptable methodology implemented for the development of the system or commercial system management methodology (COTS)?	4				
Are there data management processes?	4				
Is there a process for the preparation, approval and follow-up of the Information and Communication Technologies Guiding Plan (ICTGP)?	4				
Is there a strategy for service outsourcing?	4				
Human Resources					
Are ICT human resources sufficient?	4				
Are there training and updating programs for ICT human resources?	4				
Are there strategies for attracting, maintaining and evaluating ICT human resources?	4				

Source: Prepared by the author

The proposed topics are indicative and may be changed to better reflect the actual context of a tax administration. The answers to the questionnaire provide an integrated macro vision of the scenario of infrastructures, processes and human resources currently available in the ICT area (“as-is”) and may justify the development of a project for specific improvements. In the case of modernization of the Tax Information System, these improvements may be considered as part of the modernization project, since continuing with the status quo represents risks to the successful achievement of the project and its operational continuity.

11.6. Replacement of components or of the entire system?

The diagnostic modalities previously presented serve to identify problems and call the attention regarding the modernization needs of a Tax Information System. However, the actual implementation of the modernization calls for an in-depth diagnosis of the functional and technological challenges to be solved. The two main alternatives available are: **replace the unsatisfactory components** or **replace the entire Tax Information System**.

The decision to replace a complete Tax Information System is radical, costly, complex and requires the participation of all decision-making levels within and outside the tax administration. However, at times, substitution is essential for an adequate evolution of the services provided to the tax

administration in the medium- or long-term. Because of its strong organizational impact, the decision must always be made by a high-level group consisting of interested parties, such as the general directorate and the directors of the business areas.

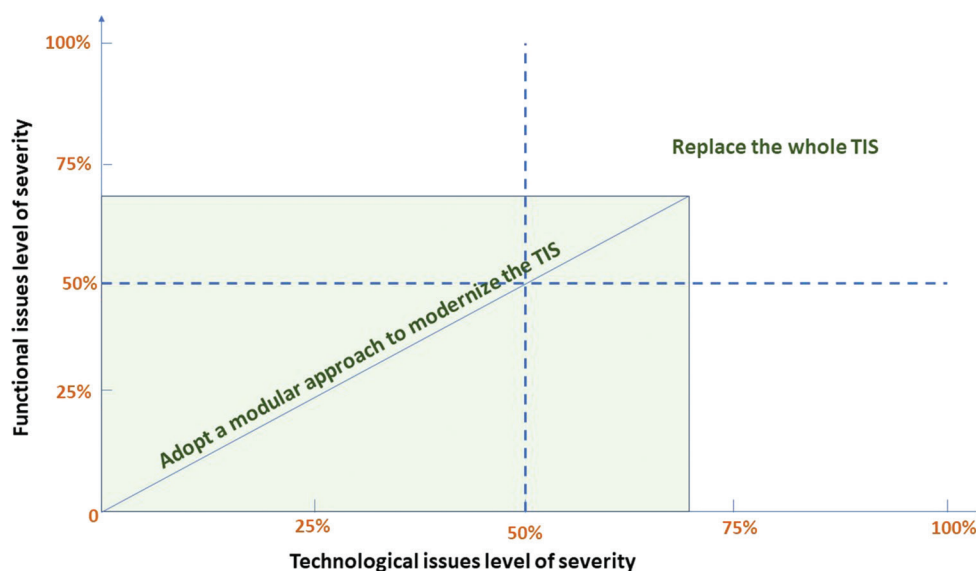
On the other hand, the replacement of individual components of the Tax Information System is a less traumatic alternative, although at times it may be less feasible, mainly because of the construction characteristics of the original system.

Although the strategy to be adopted strongly depends on the internal contexts of each tax administration, and thus it can hardly be standardized, some systematic processes or methods may help the decision-making team. Two of these methods are shown below.

Severity limits

An empirical method was proposed by (Allen, Botton, & Uña, 2019, p. 14) for a Financial Management Information System (FMIS). We adapted this method for a TIS, as outlined in [Chart 11.6-1](#).

Chart 11.6-1 Modernization options of a Tax Information System



Source: Modernization of an FMIS: Key Steps and Decision Points. Adapted from “How to Design a Financial Management Information System: A Modular Approach,” by R. Allen, N. Botton, and G. Uña, 2019, p. 14. Copyright 2019 by International Monetary Fund.

The decision will be based on the level of severity of the technological and functional problems diagnosed. According to the study, it has been established that with a rating of over 80% in terms of functional and technical problems (part of the upper right quadrant of [Figure 11.6-1](#)), the replacement of the Tax Information System (TIS) can be planned in its whole. For all other situations, it is probably a better alternative to replace the individual components.

In the other situations, the replacement of components would probably be the best alternative.

The measurement of the level of severity of the technological and functional problems is not a mathematical procedure and depends on the context of each institution. Nevertheless, some indications may be proposed:

- For the technological axis, consider in particular that items 1 through 8 of *Table 11.5-1* are critical and determinant in assessing the level of severity. The lower levels (“1” or “2”) given to some of these items must be evaluated in detail. A level of severity must be established for each one. It must then be added to obtain the total level of severity of all the technological issues. Different weights may be established for each issue, according to the importance for the tax administration.

Herein one must separate the intrinsic deficiency of a specific technological item, from the organization’s deficiency in using it, for which there may be other causes;

- For the functional axis, the level of maturity of the system provided by the evaluation in *Table 11.2-1* is an important grader. A level of maturity graded as “low” is an important negative factor worth considering. The service levels measured in *Table 11.4-1* (“Service Levels”) and the attributes of use of the services measured in *Table 11.4-2* (“Attributes of Services”) should also be considered. That is, the severity of sensitive deviations caused by process or computerized implementation deficiencies must also be evaluated and added up to obtain the grade of total functional severity.

It is important to consider complexity when carrying out a reasonable and impartial measurement of these factors, which should be evaluated with the support of external experts.

Detailed analysis applied to the Tax Information System and the institution

In this method, the various diagnoses made are submitted to a technical/functional team established for such purpose. There should preferably be external specialized consultancy. The activities of this working team, if necessary, could be paid by multilateral financing entities.

The team will consider the diagnoses in greater depth and evaluate the severity of each problem of the current Tax Information System, while at the same time proposing to the institution’s top management the most adequate alternative.

Sometimes one may decide to completely substitute a Tax Information System, in anticipation of one or two extremely severe potential problems. For example, the anticipated obsolescence of the ICT platform, which serves as basis of the Tax Information System that would result in serious medium- and long-term problems regarding the evolution, sustainability and maintenance of its operation. In such a case, this is also a most appropriate method for allowing the discussions to be carried out by a team that will endorse the authenticity of the premise(s).

11.6.1. Considerations on the total substitution of a Tax Information System

The critical issues to be considered with respect to the total substitution of a Tax Information System are construction alternatives, qualifying technologies and priority of the development of the business components.

Construction alternatives

After deciding the complete substitution of a Tax Information System, there are three main alternatives for its construction:

- Commercial software package (COTS⁹⁹ for its English acronym);
- Development by a supplier¹⁰⁰ (LDSW for its English acronym) and;
- Internal development.¹⁰¹

Table 11.6-1 summarizes the advantages and disadvantages of each alternative.

Table 11.6-1 Advantages and Disadvantages of ICT solutions

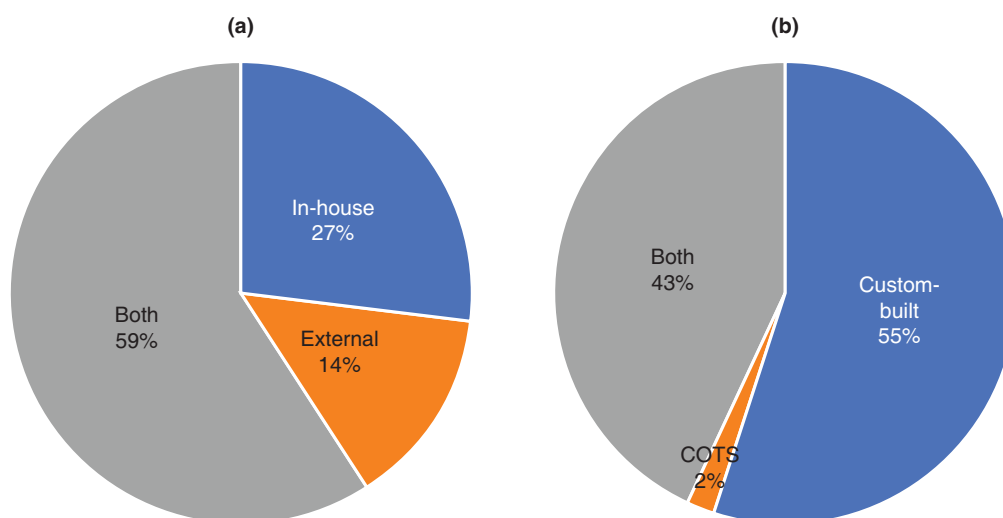
IT Solution	Main advantages	Main disadvantages
In-house IT solutions	<ul style="list-style-type: none"> ➤ Government retains ownership of the software source code ➤ Possibility of introducing changes to the system quickly ➤ Reduced maintenance cost in the short term ➤ Development is under government's full control and responsibility 	<ul style="list-style-type: none"> ➤ Usually involves hiring new staff and the creation of large ICT units to develop and maintain the system ➤ The government assumes all the costs and risks of the project
Locally developed software solutions	<ul style="list-style-type: none"> ➤ The government retains ownership of the software source code ➤ Risks and costs are shared between the government and the vendor ➤ There is less of a need to increase the staff or create large ICT units 	<ul style="list-style-type: none"> ➤ Often requires the contracting of maintenance services ➤ Tends to create dependency on the vendor
Commercial-off-the-shelf solutions	<ul style="list-style-type: none"> ➤ Facilitates the implementation of good practice business processes ➤ Risks and costs are shared between the government and the supplier ➤ Implementation times could be shorter 	<ul style="list-style-type: none"> ➤ Government does not own the software source code ➤ Requires a greater willingness of the government to adapt business processes to the IT solutions ➤ Costs related to licenses, support, and maintenance fall on the government

Source: Prepared by the author based in information from Integrated Financial Management Information Systems in Latin America: Strategic aspects and challenges (Uña & Pimenta, 2015)

A comparative study carried out by the Organization for Economic Cooperation and Development (OECD, 2019, p. 119) with tax administrations from 55 member countries and others from

advanced and emerging economy shows that most of the tax administrations still opt for development according to IT solutions, although more of them are adopting developments shared with external suppliers (LDSW) – *Chart 11.6-2 a*. The number of administrations that exclusively opt for commercial solutions (COTS) for their Tax Information System is less common, but combined COTS/custom-built solutions are already significant – *Chart 11.6-2 b*.

Chart 11.6-2 (a) Development of primary ICT solutions (2015), (b) ICT from internal X both (2017)



Source: From "Tax Administration 2019: Comparative Information on OECD and other Advanced and Emerging Economies," by OECD, 2019, p. 119. Copyright 2019 by OECD

In terms of coverage of the information system for the execution of the processes, the more the frequently required functionalities are available in the commercial software package, the easier the implementation. It is estimated that an eligible COTS must handle over 70% of the business rules and requirements of the tax administration (ITC KfW, 2015, p. 92).

A COTS solution represents a strategic relation with the supplier, which should last for several years. It involves the change of directors and rulers and should respond more to a spirit of alliance than to a strictly contractual relation. It has been observed in developing countries that many problems with the use of COTS are due to radical changes in processes. They have not been considered when acquiring the product and often they need to be implemented in a non-parameterized manner (inclusion of business rules in the programming code). In addition, the cost of licenses, maintenance and support which, in general, which are paid annually, may generate conflicts from the updating of prices and increase in costs due to extensions not previously considered.

The total cost of ownership (TCO) of an information system, considering a specific time period, is an important factor to be evaluated for making the decision regarding a commercial software package, whether it should be developed by a supplier or developed internally.

Usually, the total cost is divided into three groups:¹⁰² implementation costs (software acquisition and implementation costs); operational costs (costs incurred while the software is in operation); and, removal costs (costs of preservation of modules or data while a new system is changed and rendered operational). The reference (ITC KfW, 2015, p. 93) summarizes the main factors to be considered in determining the software model for a Tax Information System.

In relation to these issues, the chapter titled: “*System Architecture and ICT Infrastructure Alternatives*” proposes additional approaches in the perspective of the general architecture of the tax information systems.

Enabling technologies

Three main technologies support all the business components of a Tax Information System:

- Security (cryptography, digital identity, firewalls, user access profile, among others).
- Workflow management.
- Documents management.

It is important that these technologies be considered in the project and installed as support to the business components of a new Tax Information System. It is more complex (although not impossible) to introduce an enabling technology in an already existing system. In this document, the enabling technologies are considered in greater detail in the Chapter: “*Enabling Digital Technologies and Services*”.

What is the priority of the modules to be implemented in a new Tax Information System?

After deciding the replacement of a Tax Information System, two main strategies must be determined: the priority for developing each component and the simultaneous subsistence of the new components with the former system until its total replacement.

Priority for developing the business components

The priority for structuring the modules of a Tax Information System depends on the tax administration’s analysis of the deficiencies of the former system. However, the usual order, based on a scenario without distinct deficiencies may be:

- 1) Taxpayer’s Registry.
- 2) Tax Returns.
- 3) Tax collection and payments.

One must consider that not only the systems are replaced, but also the associated data must be migrated to the new platform. This situation also represents an opportunity for verifying the quality of these data.

Shown below, as example, are the stages of substitution of components adopted in an African country, according to (ITC KfW, 2015, p. 182), which prioritizes the VAT related components:

Stage 1: Taxpayer registration and identification number.

Stage 2: Processing of VAT services (returns, accounting, reimbursements).

Stage 3: General revenue payments, taxpayer accounts, revenue accounting, tax compliance activities.

Stage 4: Inquiries for the taxpayers, auditing tools - VAT investigation, VAT electronic services, location of documents.

Stage 5: Income tax, refunds, income tax electronic services.

Stage 6: Electronic payments (general), objections and appeals, advanced auditing tools.

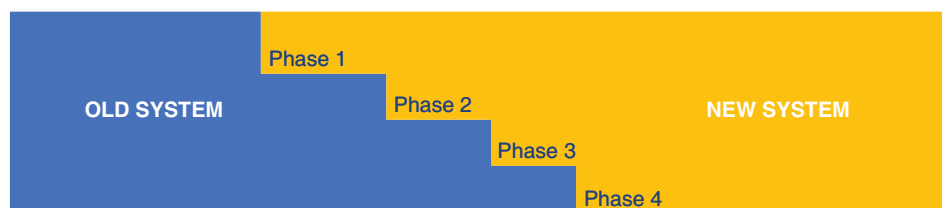
In this case, it is explained that execution of the five stages of the project takes no less than three years. In many Tax Information System modernization projects, time restrictions are very important, especially because of issues involving financing requirements and/or risks associated with organizational changes. What is being sought, besides time, is an adequate prioritization, avoiding reliance on other aspects and promoting consistency and integration.

Coexistence between systems

The total replacement of an existing Tax Information System with a new one must follow a strategy, usually chosen from among three alternatives:

- **Bigbang implementation strategy.**¹⁰³ It involves high risk; it is rapidly displayed and has a low implementation cost. The cost of going back to the previous system, if necessary, is high.
- **Implementation by phases strategy.**¹⁰⁴ It involves average risk; its display is repetitive and incremental and has an average cost.
- **Parallel implementation strategy.**¹⁰⁵ Involves low risk; its implementation is lingering and has a high cost.

Tax Information Systems are usually implemented by phases, as shown in [Figure 11.6-1](#).

Figure 11.6-1 New TIS phased implementation

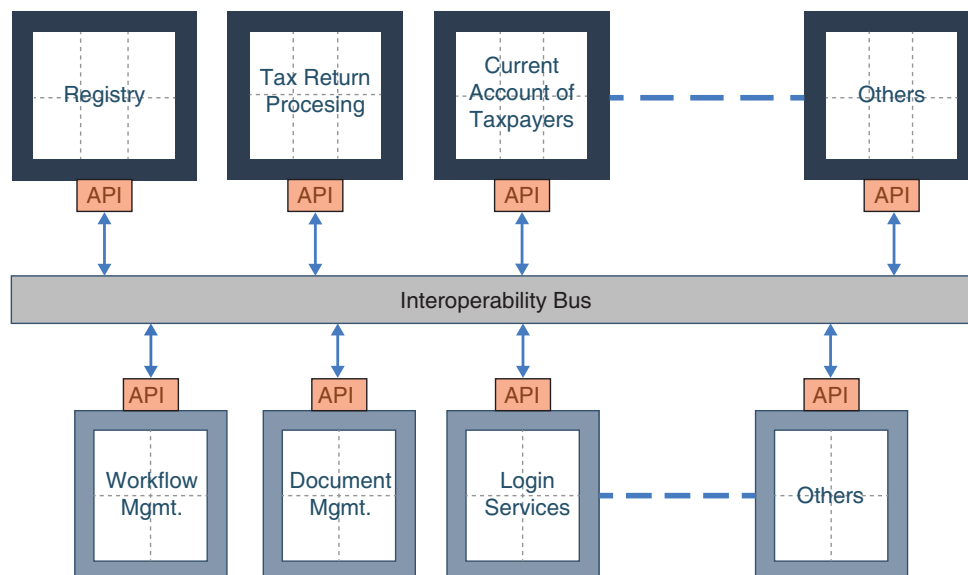
Source: Prepared by the author

One of the main characteristics of the implementation by phases is the need for temporary interfaces between the new system and the remaining parts of the former system. These interfaces may be complex and have no long-term value, since they are abandoned as soon as the new system is completed.

Replacement of a Tax Information System components - Modular Approach

The convenience of replacing components of a Tax Information System will depend on additional considerations regarding the structure used to develop it, as well as the cost/benefit analysis.

Figure 11.6-2 shows an alternative modular approach for the system.

Figure 11.6-2 Representation of a modular approach

Source: Prepared by the author

Common languages, such as PL/SQL, support the traditional modular development, although there are new architectures that propose a modular development with greater granularity. Standing out, among them, is the **microservice** architecture. This technique is a variant of the service-oriented architecture (SOA) which structures an application as a collection of articulated services in a flexible manner. The benefit of breaking down an application into different smaller services is that it improves modularity. This makes the application easier to understand, develop, test and more resistant to the architecture's erosion (Chen, 2018). It also facilitates parallelism in development, by allowing small autonomous teams to develop and implement their respective services independently. Several programming languages or *frameworks* may be used for the development of microservices, such as Java, C++, C#, C, Python, and Ruby.

Some of the important factors for determining the characteristics of the modular approach to be adopted are:

Coupling: in software engineering, coupling is the measure of the level of interdependence between modules. A good software has a low coupling level. There are several coupling models, however; data coupling, when the dependence between modules is only based on data exchange, it is considered the most effective one.

Cohesion: in software engineering, cohesion is the measure of the level of functional relationship between the elements of a module. That is, the level whereby all the elements of a component are directed towards a single task. A good software has a high cohesion level.

The optimum case of application of the modular approach is when there is low coupling and high cohesion of the Tax Information System.

In general, the maintenance of systems with high coupling and low cohesion are very complex and lead to high risks for the institution. They are difficult and costly to change, improve, expand and test, because each case demands a detailed analysis of all the components of the system and/or the database structures. Such complexity also implies an expanded risk of interruptions in the operation, as well as the involuntary introduction of errors, which many times will be perceived some hours or days later.

In this case, it is worthwhile to timely evaluate the substitution of the Tax Information System with a more modern version.

According to [Figure 11-1](#), the following technical alternatives may be used in keeping with the characteristics of the original Tax Information System (adapted from Uña, Allen, & Botton, 2019, p. 16):

➤ **Reengineering of a specific module of the Tax Information System**

It is recommended when there is a low level of coupling in the software, as well as low or medium functional problems.

It is matter of replacing a specific module, with a software that may solve the problems detected and improve performance. The supplier of the new component does not necessarily have to be the same vendor as the one of the original software.

➤ Develop a layer of shared data for the system

Recommended for internally developed software when there is a medium coupling level; and, low or medium functional problems and there are no severe technological problems.

It involves the creation of a series or group for transactional data exchange. This approach maintains the existing applications and uses APIs based on ESB.¹⁰⁶

➤ Change the platform or migrate to the cloud

Recommended when there are functional problems of lower importance and medium or high technological challenges, mainly dealing with software licenses, database or hardware weaknesses and connectivity.

Although migrating the Tax Information System to the cloud may sound attractive for simplifying the ICT environment, reducing the institutional responsibility for managing the environment, reducing capital expenditures (CAPEX) and rendering flexible the use of reliable hardware and software platforms, it is not yet accepted by most of the tax administrations. This is mainly due to doubts regarding the security of the information and national legal aspects. As an alternative, the tax administration must invest in the modernization of its ICT equipment and Data Center.

11.6.2. Modernization and quality of data

The process of modernization of a Tax Information System is an opportunity to evaluate and improve the quality of the data available. All system modernization programs, in particular those involving the complete substitution thereof, must include a project for migrating data from the previous to the new system. It is not a trivial project, inasmuch as it may include the restructuring of the entire database, with data reformatting, inclusion or exclusion of data. This may result, for example, in eliminating and/or moving to other types of storage, tax debts that have been pending for many years and of low value, that have expired and/or are uncollectible.

The huge amount of internal and external data managed by a tax administration, used in transactional processes and data analysis, requires the development, if there is none, of a data governance policy. Data governance is the specification of the rights to make decisions and a responsibility framework to guarantee adequate behavior in the assessment, creation, use and control of data and analysis.¹⁰⁷ Because of its importance, the data governance issue is dealt with in greater detail in the chapter: “*System Architecture and ICT Infrastructure Alternatives*” of this publication.

11.7. Outsourcing ICT in tax administrations

According to (ISO37500, 2014), outsourcing is a business model which involves the delivery of a product or service to a customer by a supplier, as an alternative to the provision of those products or services internally by the customer them self, where:

- The outsourcing process is based on a business decision (to do or purchase);
- Resources may be transferred to the supplier;
- The supplier is responsible for delivering the services contracted for an agreed period of time;
- The services may be transferred from one existing supplier to another;
- The customer is accountable for the services contracted and the supplier is accountable for providing them.

The main motivation for outsourcing is the reduction of costs, although for the tax administrations and public sector in general it may also be aimed at the reduction of staff positions.¹⁰⁸

There are other important motivations for adopting the outsourcing of ICT (information and communications technology) services, although there are also risks as shown below:

Table 11.7-1 Outsourcing: advantages and risks

Advantages	Risks
Lower costs (due to scale economy)	Slow turnaround time
Increased efficiency	Lack of business knowledge
Variable capacity	Language and cultural barriers
Increased focus on core competencies	Lack of control
Access to skills or resources	
Increased flexibility	
Lower ongoing investment in internal infrastructure	
Access to innovation	

Source: Prepared by the author based on information Overby (2017)

For a tax administration, hiring a professional generally involves a slow and bureaucratic process. It implies, in addition to the legal labor commitments with respect to salaries, vacations and social security contributions, authorized staff quotas, labor stability, commitment to keep them technologically updated so that they may satisfactorily perform their activities.

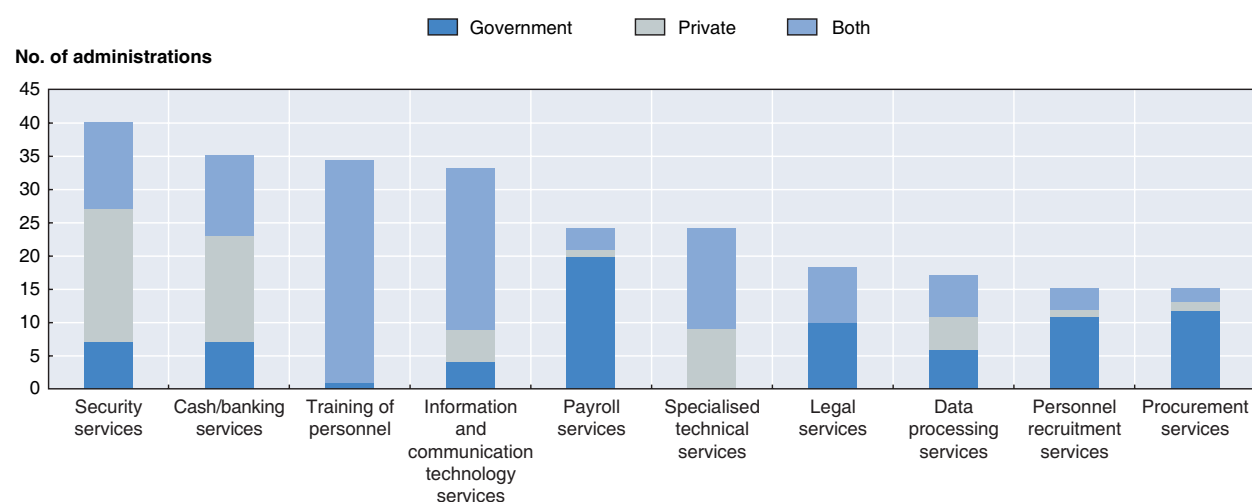
On the other hand, the investment in equipment and software, considering the total cost of ownership (TCO), may represent a challenge for some tax administrations. In a context of changing technologies, they are permanent and costly commitments. In this context which requires flexibility, efficiency and continuous access to innovation, the outsourcing of specific areas may be an interesting alternative.

It should be taken into account that the outsourcing of ICT services is not a panacea, but rather should be considered as a strategy for achieving specific objectives. It involves decisions, methods and management, as will be discussed in this section.

It should be noted that the outsourcing of services is nothing new in the tax administrations. One may mention the outsourcing of the tax collection operations for the financial entities as a framework for improving the efficiency/effectiveness of the tax administrations.

The OECD published statistical data regarding the outsourcing of the services/activities of the tax administrations of the member countries, as shown in [Chart 11.7-1](#).

Chart 11.7-1 Most common administrative functions/operations that are predominantly outsourced (2017)



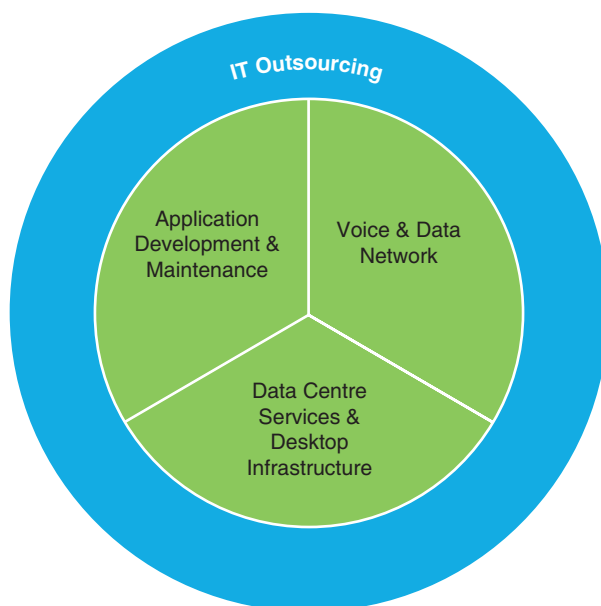
Source: From "Tax Administration 2019: Comparative Information on OECD and other Advanced and Emerging Economies," by OECD, 2019, p. 119. Copyright 2019 by OECD

One observes the importance of the areas related to the ICTs in the outsourced services by the tax administrations. In addition, private initiative, other government entities or both are considered as potential suppliers of outsourced services.

Considering the international context, the expansion of the availability of services in the cloud brought about new outsourcing opportunities, although there may be restrictions regarding the territoriality of data storage. In previous paragraphs of this chapter and in Chapter 12 (*System architecture and ICT infrastructure alternatives*) in this book deal with the services in the cloud and the technical and legal contexts for their use by the tax administrations.

11.7.1. What can be outsourced?

There may be outsourcing in practically all the ICT areas of the tax administrations, as shown in [Figure 11.7-1](#).

Figure 11.7-1 Potential ICT areas for outsourcing

Source: IT Outsourcing. From "The Outsourcing Handbook," by Deloitte, 2013, Version 2.0, p. 4. Copyright 2013 by Deloitte

Some examples:

The operation of data centers and networks, in general, may be outsourced, because they are activities weakly connected to the business and, in general, because there are specialized private businesses available in the market. In addition, the KPIs (*key performance indicators*) to be managed are known and mature, which situation facilitates the preparation and management of service contracts. The operational systems and other basic software may be parameterized by third parties, under the supervision of the contracting party. In this case, the tax administration must have human resources to manage contracts and guarantee the confidentiality of the data.

The installation and operation of security monitoring is a complex and costly area, with tools that are always being updated. There are companies in the market that provide these services, which could diminish the number of staff members of a tax administration, with similar or superior quality. It would be the responsibility of the contracting party to supervise the operation and jointly decide the actions to be undertaken when detecting attacks or fraud attempts outside the determined profiles. Most of the tools required are provided by the contracted party, which generally carries out similar tasks for other institutions (economy of scale).

The development of application systems is an area which many tax administrations prefer to have under direct control, because of its proximity with the business. In this area, the activities involving the architecture of the applications and the data, and the specification and homologation of information systems are considered strategic. So, for these strategic areas, the tax administrations should have qualified technicians to implement them, although **with eventual** external support. The programming of the systems may be carried out internally by their own technicians or technicians

hired from third parties, or as an external service. Even though COTS (*Commercial-off-the-shelf*) systems or cloud services in the SaaS modality, it is required that the parameterization of the system be performed by technicians of the administration, although with the supplier's support. In this chapter there has been previous discussion regarding the advantages and disadvantages of the different forms of development and maintenance of the tax information systems – self-development, self-development with the support of third parties and COTS.

The database management may also be outsourced, although it is many times considered strategic and therefore the tax administration internally assumes its management and operation, in the logical as well as physical design. Likewise, it should count on specialized staff in order to carry out this task. In COTS and SaaS systems, the data bank design is the responsibility of the supplier, while the technicians of the tax administration must follow up and report anomalies.

New technological areas, such as data analytics and artificial intelligence, which have an enormous potential for supporting the *core* activities of the tax administrations, are being subjected to different approaches. Several are seeking external support by means of agreements with universities and/or contracting specialized consultancy, in order to support internal groups in pilot projects and create a critical mass for future developments. In addition, these new technologies are quickly renewed and there is need to count on updated techniques and algorithms. Likewise, for the successful implementation they require multifunctional groups who are familiar with the taxation business, statisticians and ICT professionals specialized in computerized tools. It is recommendable to set up small groups with these skills for the purpose to test specific projects, exchange knowledge and create internal experts in order to move forward. The management of these groups should be centralized, in order to allow for evaluations and knowledge management.

Table 11.7-2 shows outsourcing possibilities for several activities carried out by the ICT area. The propositions shown in the table consider usual contexts in the public sector, but the definition of “strategic area” whose outsourcing would not be recommendable, is inherent in the specific context of each tax administration.

Table 11.7-2 Outsourcing possibilities for some ICT functions in tax administrations

ICT function	Recommended not to outsource ¹⁰⁹	Can be outsourced
Information systems architecture	Yes	-
Application systems requirements specifications	Yes	-
Application systems approval	Yes	-
Programming	-	Yes
Database design	Yes	-
Database operations and management	-	Yes
Data management	Yes	-
Data analytics and Artificial Intelligence	Yes	-
Data center operation and management	-	Yes

(continued)

Table 11.7-2 Outsourcing possibilities for some ICT functions in tax administrations (*continued*)

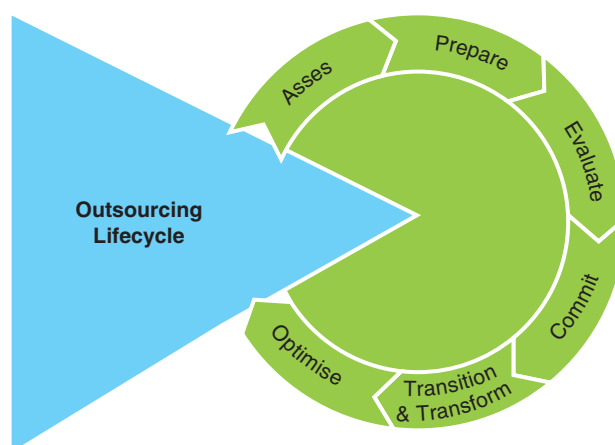
ICT function	Recommended not to outsource ¹⁰⁹	Can be outsourced
Data back-up ¹¹⁰	Yes	Yes
Network operation, support and management	-	Yes
Security management	-	Yes
Security architecture	Yes	-
Service desk	-	Yes
Support of office equipment and applications	-	Yes

Source: Prepared by the author

11.7.2. How to outsource

The process for undertaking the outsourcing of an ICT area requires discipline and method. There is a real possibility of failure which must be minimized.

Shown below is an outsourcing life cycle proposal, consisting of six phases, as presented in (Deloitte, 2013):

Figure 11.7-2 Outsourcing lifecycle

Source: OAS method. From "The Outsourcing Handbook," by Deloitte, 2013, Version 2.0, p. 6. Copyright 2013 by Deloitte

➤ Phase 1: Assess

The purpose of this phase is to evaluate whether outsourcing is an alternative for the activity under consideration and, if so, the form and preliminary value of the agreement to be sought. Herein, one seeks to determine a strategy for important issues, such as the outsourcing scope. In addition, an identification is made of the internal stakeholders in the outsourcing objectives and which will have some type of contact with the company to be contracted.

➤ Phase 2: Prepare

The first interactions with the suppliers, through the RFIs (*Request for Information*¹¹¹) take place here. The RFP (*Request for Proposal*¹¹²) is prepared and the potential suppliers are selected. The process of creation of the RFP allows for precisely determining the required scope, with the formal participation of the internal stakeholders and combined with the appropriate documentation for the acquisition process, to be distributed to the selected suppliers. The determination of sound requisites is the key for reducing risks in the execution of the contract.

➤ Phase 3: Evaluate

The evaluation phase covers the process of questions and answers exchanged with the suppliers, which takes place while they are preparing their proposals. The purpose of this phase is to identify and select the suppliers that offer the best cost for the outsourced services. The evaluation stage is concluded with the *due diligence*¹¹³ process and contractual negotiation with the selected suppliers.

The process to be followed in the identification and selection depends on the laws and regulations in force with respect to public contracts adopted by the tax administration. The project management team must monitor the progress and update evaluations and scores, which should reflect the most current situation.

➤ Phase 4: Commit

The actions previously initiated are concluded in this phase and the outsourcing contract is signed. Additional efforts are required to seek consensus of the stakeholders (regarding the terms of the contract) and prepare the documents to be signed. There should be a contract follow-up plan describing how the necessary correction actions shall be carried out. It is important to seek not the lower price, but rather an agreement that may imply optimizing the long-term benefits for both parties. Probably some of the security and control aspects of the activities to be outsourced may be checked with the supplier and the rules must be clearly stipulated in the contract.

➤ Phase 5: Transition and Transformation

The purpose of this phase is the transition of the work and resources to the selected supplier. The emphasis will be on the implementation of the process, management of the project and transfer of knowledge. Problems will appear and there should be scaling mechanisms for their prompt solution. At the end of the phase, the established services/activities should have been transferred to the third party and the management mechanisms that were determined should have been implemented.

➤ Phase 6: Optimize

The focus of this phase is on the activities that guarantee that the outsourcing agreements will be fulfilled and continuously improved, including security and risk aspects. This phase includes the preparation for an eventual renewal or cancellation of the contract. The preparation for

renegotiation includes: relationship aspects (quality of delivery – perception and reality, strengths and weaknesses of the supplier); financial review (review of business cases, price *benchmarking*); verification of the contract (rights and contractual obligations and support information, comparisons with similar contracts in the market, agreement of the level of service used); risk assessment (aim to continue with the supplier, feasibility of changing the supplier, transition risks).

Disputes must be promptly solved, avoiding the deterioration of the relationship.

It is important to continue focusing on innovation, by promoting activities to encourage, capture and review the innovative ideas, facilitating joint roundtables where new ideas may be presented and discussed. Contract management is a discipline that requires practice and most certainly the contract management team will achieve maturity, through time, for more complex negotiations.

This life cycle may be adapted to the characteristics of each tax administration.

11.7.3. Contracting and price setting models

According to Overby (2017), the following contracting and price setting models are the most widely used in the outsourcing of ICT services:

- Time and materials: the customer pay the supplier for the time and materials (including human resources) used for completing the service. In general, it is used in long-term contracts for the systems development and maintenance. It is recommendable when the scope and specifications are difficult to estimate or change rapidly.
- Unit prices / upon demand: the supplier establishes a specific rate for a particular level of service, and the customer pays according to their use of said service. For example, if they are subcontracting the maintenance of microcomputers, the customer may pay a fixed amount for the number of microcomputers supported.
- Fixed price: the price of the contract is determined at the beginning. This model may work well when there are established and clear requisites, objectives and scope. The payment of a fixed price for subcontracted services may be attractive, inasmuch as it makes the costs predictable. It may work well, but when the market price goes down through time (as it usually happens), a fixed price is not changed. The fixed price is also difficult for the supplier, who must comply with the service levels at a determined price, regardless of the amount of resources those services may end up requiring.
- Variable price: the customer pays a fixed price on the lower extreme of the service rendered by a supplier; however, this method allows a certain variation in price, based on the provision of higher service levels.
- Cost plus margin: the contract is drafted in such a way that the customer pays the supplier its real costs, plus a predetermined profit percentage. Said price plan does not allow flexibility as

the commercial objectives or technologies change and provides few incentives for a supplier to function effectively.

- Prices based on performance: the customer offers financial incentives that encourage the supplier to have an optimum performance. This type of price plan requires that suppliers pay a fine for unsatisfactory levels of service. Setting prices on the basis of performance is frequently used with a traditional price setting method, involving time and materials or fixed price. This approach may be beneficial when the customers may identify specific investments which the supplier could make in order to offer a greater level of performance. However, the key is to guarantee that the result may generate an increased commercial value for the customer. Otherwise, they may end up compensating the suppliers for the work which they should anyway be providing.
- Sharing profits: prices are based on the value delivered by the supplier beyond his usual responsibilities, although derived from his experience and contribution. With this type of agreement, both the customer and supplier have responsibilities in the activity. Each one has money at risk, and each one may obtain a profit percentage if the supplier's performance is optimal and complies with the customer's objectives.
- Risk / shared reward: the supplier and the customer jointly finance the development of new products, solutions and services with the supplier sharing rewards for a specific period of time. This model encourages the supplier to propose ideas for improving the business and diffuses the financial risk between both parties. It also mitigates some risks by sharing them with the supplier. However, it requires a higher level of governance to do it right. It may be applied to concept tests.

Some of these models are difficult to use in the public sector, although they may generate new ideas or adaptations to the tax administrations managers.

11.7.4. *Special institutional agreements: outsourcing for the public sector*

The outsourcing of ICTs in the tax administrations has required some differentiated institutional agreements, wherein outsourcing takes place within the public sector itself. The cases of Brazil and Italy provide two examples.

Brazil:

SERPRO¹¹⁴ (Federal Data Processing Service) is a public company belonging to the Ministry of Economy. It was created in 1964 to provide all ICT services to the entities related to said Ministry, including the tax administration. The main motivation was to provide flexibility in the use of the digital technologies, with speedier and specialized structures within the same public sector, enabling greater synergy, also protecting the security and tax secrecy of the information. Currently, SERPRO has available world class data centers and a voice and data network within national reach, in addition to information systems development units. All the large information systems of the tax administration are developed and operated by SERPRO. The federal tax administration (*Receita*

Federal do Brasil) has an ICT management structure called COTEC or Technology Coordination, which determines policies, systems and all the relationship with SERPRO. Through time, SERPRO positioned itself as a promoter of structuring systems of national scope, based on the treatment of large volumes of data.

The relationship between the tax administration and its main provider of ICT services is not exempt from problems and continues to be improved since the establishment of the company.

At other levels of the Brazilian federation, some states and municipalities repeated this institutional arrangement, by creating public enterprises to respond to their needs in the ICT area. Through time, some of these specialized public enterprises did not achieve the expected objective and were eliminated. Others were successful and continue to provide services, such as, for example, PRODESP (which is linked to the State of São Paulo government) and PROCERGS (linked to the State of Rio Grande do Sul government).

Italy:

The Italian tax administration adopted a matrix model, wherein several entities in charge of different activities cooperated for achieving common objectives (Finance Department of the Ministry of Economy; the Revenue Agency; the Customs Agency; the Guardia di Finanza; Equitalia Spa (enforced collection of debits); the Social Security Institute and SOGEI Spa.¹¹⁵

SOGEI Spa (*Società Generale d'Informatica*) is an ICT company belonging to the Ministry of Economy, initially created to manage the national tax information system. Currently SOGEI guarantees ICT services to all the institutions involved with tax management. For example, SOGEI created and operates the “*Anagrafe Tributaria*” system, which includes all relevant data and information for managing the tax systems. According to OECD (2017) in a manner similar to that of its analogous entity in Brazil, SOGEI also provides ICT services to other government institutions such as the Ministry of the Interior and the Ministry of Health.

The two examples presented were implemented in specific periods and contexts and the accumulated know-how currently serves the entire government. However, these models, in a current vision, may have inserted therein negative aspects related to the government's efficiency and policies that need to be evaluated. For example, the exclusiveness of the service may result in very expensive prices, to be paid by the tax administration. Also, there are resource transfers within the government, when one could be encouraging the private initiative with a better cost-benefit relationship.

11.7.5. Remarks

The outsourcing of activities requires that the tax administration incorporate and/or prepare technicians with ICT management abilities, with skills for preparing and managing service and consultancy contracts. In order to carry out these activities, these professionals may count on the support of the administration's own technical staff, from the institutional contracting area (which

has general legal and market knowledge) and many times of specific consultancies (in general, used in tax administrations beginning to implement the ICT service outsourcing strategies). Chapter 16 (*Human resources and ICT*) deals with the impacts of outsourcing in relation to the competencies required by ICT technicians in the tax administrations.

The ISO (International Organization for Standardization) published an outsourcing guide – standard ISO37500 of 2014 (ISO37500, 2014), which proposes a four-phase life cycle for outsourcing, with the associated practices and processes. It is an important reference to be used by those interested in this issue.

11.8. Final comments

The current Tax Information Systems are firmly based on the digital exchange of information with the taxpayers and society in general. Therefore, the full digital inclusion of society is required as an external factor for its success. In this case, the impact on collection would also be positive. A simulated analysis presented in (IMF, 2018, p. 49) indicates that reducing the distance to the of digitalization frontier by 50 percent could increase the average VAT revenues by 1.7 percent of the GDP in the low-income developing countries; 1.0 percent of GDP in emerging market economies and advanced economies and 0.5 percent in the EU.

Another important aspect is that a Tax Information System is a sort of repository of knowledge of the tax administration. When it is transformed into computerized programs, the knowledge becomes active and obliges officials and taxpayers to use it. It is different from manuals and books which are also repositories of knowledge, although passive ones. Therefore, regardless of the use of personalized solutions by the Tax Information System (whether developed with its own staff and/or hired resources) or COTS, or whether it operates the system with its own staff or third party services, it is essential for the tax administration that, at a minimum, the knowledge regarding the solution's architecture and data management be kept by its own staff.

The solution proposals or alternatives for modernizing the Tax Information System should be complemented with the analysis of capabilities and impact on the organization. Consideration should also be given to the necessary resources and respective financing sources, estimations of term for its implementation, skills for the management of the project in such areas as risk analysis, scope management, human resources management and acquisition strategies. These topics are considered in Chapter 10: *“Implementing ICT Tax Projects in Tax Administrations”*.

This chapter provides a general overview for identifying and implementing modernization alternatives for a Tax Information System. However, to carry out a complete modernization project, it is necessary to consider in depth the issues discussed herein. Some of the publications referred to above and devoted to this purpose, may be consulted to guide this process: (ADB, 2014); (ITC KfW, 2015); (USAID, 2013); (Cotton & Dark, 2017a); (Cotton & Dark, 2017b); (Uña, Allen, & Botton, 2019).

11.8.1. ANNEX I. List of Proposed Transactions According to Functional Area

(Illustrative)

Functional Area	Service or transaction
Registration of taxpayers	<ul style="list-style-type: none"> ➤ Registering taxpayers under each tax category and issuing registration certificates ➤ Manage the Fiscal Electronic Domicile (e-TaxDomicile) ➤ Issuing registration confirmation letters for registration under applicable taxes ➤ Issuing copies of registration number certificates ➤ Issuing temporary registration certificates ➤ Issuing copies of tax registration certificates ➤ Issuing registration forms to nonregistered taxpayers (nonvoluntary) ➤ Issuing penalty notices for taxpayers (nonvoluntary) not responding to registration forms issued by the tax unit ➤ Online facility for citizens to report unregistered taxpayers ➤ Online facility for incorporating changes to taxpayer details (e.g., change in address, change in name of business) ➤ Nomination of authorized tax consultant by the taxpayer ➤ Nomination of statutory auditor by the taxpayer
Self-assessment of tax	Online tools for self-assessment of tax by taxpayers based on existing information (e.g., category of taxpayer, type of business, tax credits, tax exemptions).
Electronic filing of returns	<ul style="list-style-type: none"> ➤ Online facility for printing pay slips ➤ Electronic payment of taxes through internet payments and bank transfers ➤ Electronic payment of penalties for delays in filing of returns and payment of taxes ➤ Online submission of tax receipt data to the tax agency ➤ Data extraction from bank-related ICT systems ➤ Auto-update of taxpayer records with tax receipts and dishonored cheques from bank ➤ Auto-generation of reminder and default notices for nonpayment of taxes and other notifications to taxpayers ➤ Auto-computation of penalties for delays in payment of taxes, and generation and issuance of penalty notices ➤ Auto-generation of notice to taxpayers on dishonored cheques ➤ Tracking of payments by taxpayers in case of dishonored cheques
Assessment of tax liabilities	<ul style="list-style-type: none"> ➤ Auto-generation of assessment notices for discrepancies in tax returns and payments data ➤ Auto-generation of assessment notices for nonpayment of taxes ➤ Preparation of estimated assessment notice for defaulted taxpayers ➤ Issuing assessment notices to taxpayers (through intimations and e-mails) ➤ E-mail and mobile alerts to taxpayers on assessment notices ➤ Online facility for preparation ➤ Taxpayer current account

(continued)

(continued)

Functional Area	Service or transaction
Collections management	<ul style="list-style-type: none"> ➤ Generation of notice of default to taxpayers who have not responded to the assessment notices ➤ Alerts (mobile and e-mail) to taxpayers on the notice of default raised by the tax agency ➤ Online submission of objection letters along with a facility to record the manual objections received by the tax agency ➤ Issuing acknowledgement letter for the objections received by the tax agency ➤ Issuing rejection notices for rejected objections ➤ Amendment of assessments based on validation and processing of objections ➤ Issuing amended assessment notices ➤ Intimations and alerts to the collection's unit for recovery of taxes ➤ Generation of discharge notices if assessed tax is cancelled or reduced ➤ Issuing discharge notice to taxpayer and collections unit ➤ Recording the details of tax amounts recovered by the collections unit and updating taxpayer records ➤ Issuing notice of recovery of tax out of debts ➤ Issuing notice for seizure of property ➤ Recording and tracking court cases related to tax recovery
Processing refunds	<ul style="list-style-type: none"> ➤ Online submission of refund request by the taxpayer (or facility) to record manual refund applications submitted to the tax agency ➤ Issuing acknowledgement for a refund request ➤ Intimation to taxpayer for any supporting documents needed for processing a refund ➤ Generation of refund assessment notices for excess tax payments made by taxpayers ➤ Processing of refund requests ➤ Issuing rejection notices for rejected refund requests with reasons for rejection ➤ Preparation of refund assessment notices by the assessors ➤ Electronic fund transfer for approved refund requests ➤ Update of taxpayer records with refunded tax details
Issuing clearance Certificates	<ul style="list-style-type: none"> ➤ Generation of statement of taxes paid by taxpayers ➤ Submission of application for tax clearance certificate ➤ Validation of tax liabilities and generation of tax clearance certificates ➤ Issuing tax clearance certificates to taxpayers ➤ Information to taxpayers of rejected applications for clearance certificates
Cancellation of taxpayer registration	<ul style="list-style-type: none"> ➤ Submission of request for cancellation of tax account ➤ Activation and deactivation of tax file ➤ Cancellation of taxpayer registration ➤ Issuing taxpayer registration confirmation letter
Accounting and Reporting	MIS reporting for various tax (and other supporting) units within and outside the tax agency, including both standard report formats used by the tax agency and a dynamic reporting tool to facilitate the generation of customized reports based on their day-to-day reporting needs.
Auditing	<ul style="list-style-type: none"> ➤ Preparation of audit queries on the tax files and associated records ➤ Allocation of audit queries to tax unit, assessors, and tax officers ➤ Tracking the responses of tax units for audit queries ➤ Preparation of responses to audit queries by the tax units

Source: List of Transactions Services for Tax MIS. Adapted by the author from "Tool Kit for Tax Administration Management Information System," by Asian Development Bank, 2014, p. 23-26. Copyright 2014 by Asian Development Bank (ADB)

Notes

95. Some tax administrations create groups of voluntary taxpayers for the previous evaluation of their digital services.
96. Supported by CIAT, IMF, IOTA, OECD
97. Supported by IMF, World Bank, European Commission and others.
98. However, an inadequate legal or regulatory framework may also limit improvements in the processes.
99. *Commercial-Off-The-Shelf* – commercial software package intended for a business area, theoretically adaptable to the needs of a purchaser.
100. Local development – system developed by the supplier hired by the government, with local representation. Generally, the same supplier is hired to provide maintenance to the system. Sometimes the hired supplier performs part of the work in software factories located abroad.
101. Internal development – system developed and maintained by internal government teams.
102. For more information, see: <https://www.cio.com/article/3005705/calculating-the-total-cost-of-ownership-for-enterprise-software.html>
103. Big Bang is a method for the migration of hardware or software which involves the deactivation of the existing system and simultaneously transferring all the users to the new system.
104. Components of the former system are progressively substituted, until the new system is completed.
105. The two systems (old and new) are maintained simultaneously operational, until reaching a point of trust wherein the old system is deactivated.
106. Enterprise Service Bus (ESB) software that implements the communication between modules of a system.
107. For more information, see: <https://www.gartner.com/it-glossary/data-governance>
108. In many countries, the number of staff positions assigned to an institution is legally limited and/or preferentially aimed at the activities that are the purpose thereof.
109. Activities preferably carried out by the tax administration's own technical staff, even with external support.
110. May be outsourced to a cloud service, saving investment in storage.
111. RFI is a standard business process whose purpose is to collect written information about the capabilities of various suppliers. Normally it follows a format that can be used for comparative purposes. (Cobalt)
112. The RFP informs vendors of customer needs and expectations. In turn, vendor proposals should respond specifically to the requirements outlined in the RFP. (Technopedia)
113. Due diligence is a comprehensive appraisal of a business undertaken by a prospective buyer, especially to establish its assets and liabilities and evaluate its commercial potential. (Oxford)
114. For more information, see: <http://www.serpro.gov.br>
115. For more information, see: <http://www.sogei.it>

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12.

SYSTEM ARCHITECTURE AND ICT INFRASTRUCTURE ALTERNATIVES

The architecture of a Tax Information System (TIS) is a reference framework and set of principles, guidelines, and rules that define the overall design of the system and the logical and physical interrelationships between its components. In this chapter, architectures for information systems, hardware and software infrastructure, and information will be discussed. The objective is to introduce the main characteristics of each of them, applicable to the design of a TIS, and, to mention implementation cases with the necessary adaptations to the requirements of the institution

12.1. System architecture

12.1.1. *Technological architecture models*

N-Tier or Multitier

It is the most traditional architecture among client-server computer systems, widely disseminated in web platform solutions. This architecture divides the operation of the system into groups of components or layers, depending on the characteristics and objectives of their operations.

- **Presentation layer.** Includes the components that manage user interaction. In a web system, for example, we have the components that produce the HTML code and the JavaScript content that the browser presents and interacts with users.
- **Business logic layer.** Corresponds to procedures and tasks that follow business-level rules and **establish** system capabilities.
- **Persistence layer.** Responsible for communicating with the data storage components generated as a result of transactions made in the system. It is typically implemented by a database.

Layers define an order in their communication protocol, where a top layer (presentation) requests services to an immediate below layer (business logic or persistence). A lower layer never requests services from a top layer. Each layer has a specific responsibility. Layers can be logical or physical divisions of the infrastructure and can be on the same machine or on different machines.

Queues Based Flow

This architecture is intended for scenarios where intensive information and extensive operations processing are required, in terms of response times for the user. This separates request attention into a set of presentation layer (web) services, which serve user requests, and a set of business logic layer services, which handle complex and high-end processing operations.

Figure 12.1-1 Queues Based Flow



Source: Prepared by the author based on Microsoft (2017)

When the web layer sends the request (command) to the service layer, it is recorded as a message in an **attention queue** and the control returns to the presentation layer, so that it continues its interaction with the user. The attention queue will then be handled according to the available backend resources, which will take its next allocations for execution.

In this model, the presentation layer can also represent other request attention technologies, such as an API (set of protocols that are used for software development and integration) in a mobile application requesting operations.

Among the advantages of this model, we find:

- Simple and easy-to-understand architecture.
- Easy to publish to its servers and manage.
- Both the frontend and the backend can be scaled out horizontally.

Microservices

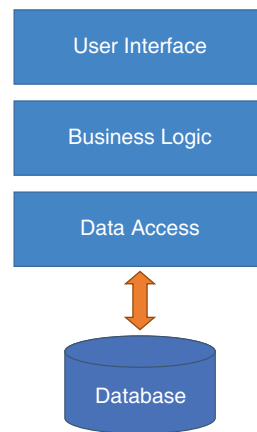
The microservices architecture consists of several small, independent services. Each service is highly specialized and implements only one business feature.

Some features of microservices are:

- Services are small, independent and weakly coupled.
- Each service has its separate source code and is unique.
- They can be deployed in a production environment independently and continuously, without altering the operation of the system.
- Services are responsible for persisting their own data and encapsulate their own storage, unlike the traditional structure where a data layer has that responsibility for the entire system.

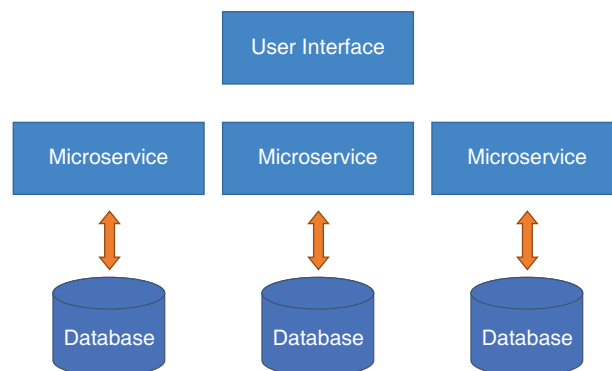
- Services communicate with each other using a well-defined API.
- Services do not have to use the same technology, programming language, or components.

Figure 12.1-2 Monolithic Architecture



Source: Prepared by the author

Figure 12.1-3 Microservices Architecture

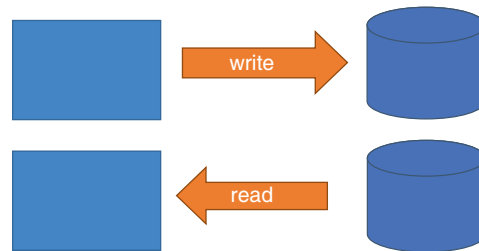


Source: Prepared by the author

A clear benefit for this type of architecture is the delivery of software running interactively and incrementally, reducing deployment time.

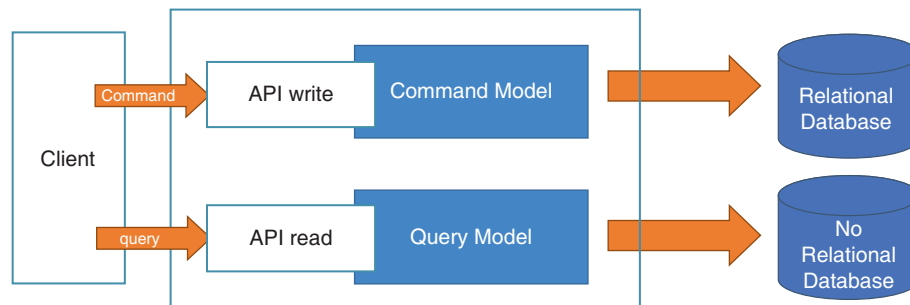
Commands and Queries

The principle behind this architecture is to separate data models for write and read operations to optimize their performance. This architecture often applies to portions of the system and not to its entirety, as it would make its implementation very complex.

Figure 12.1-4 Commands and Consultations

Source: Prepared by the author based on Microsoft (2017)

In addition to creating separate models for one operation or another, separate databases or data repositories can be created, with highly optimized structures for each operation. The read database is synchronized with respect to the transactional database, so that any changes made by commands are displayed in queries.

Figure 12.1-5 Examples of Commands and Consultations

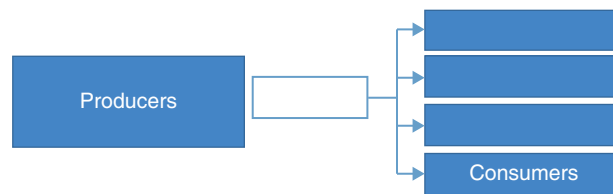
Source: Prepared by the author based on Microsoft (2017)

Among the advantages of this model, we find:

- **Differentiated escalation for specific operations.** System operations are often different according to their volume. There is generally a higher volume of queries than writing for a tax information system.
- Allows working on data structures and indexes separately and design them in a way that gives the highest performance for each type of operation.
- **Simpler queries.** It avoids creating complex unions and cross-referencing between tables for the creation of queries.

Event Driven

Refers to an event publication and subscription model, where components called producers publish events and consumers subscribe to receive them, creating decoupled relationships between components. Producers are consumer-independent and independent of each other.

Figure 12.1-6 Event Guided

Source: Prepared by the author based on Microsoft (2017)

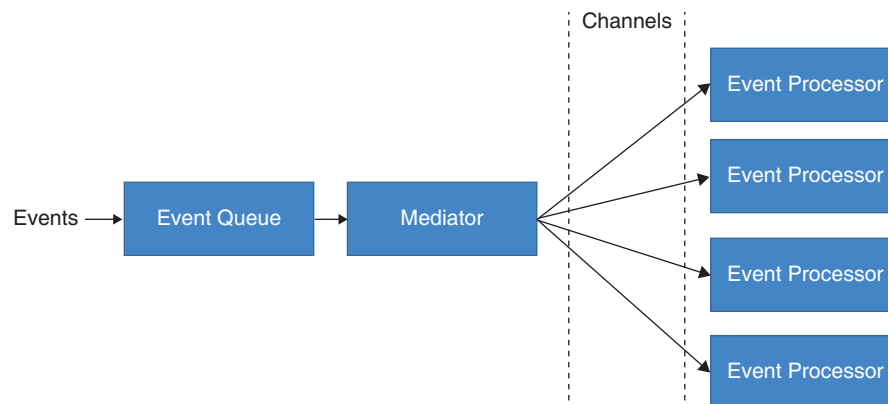
Some features of this model are:

- Producers and consumers of the event are decoupled.
- It's easy to add new consumers to the system.
- Can scale easily.

There are two main topologies when implementing this architecture:

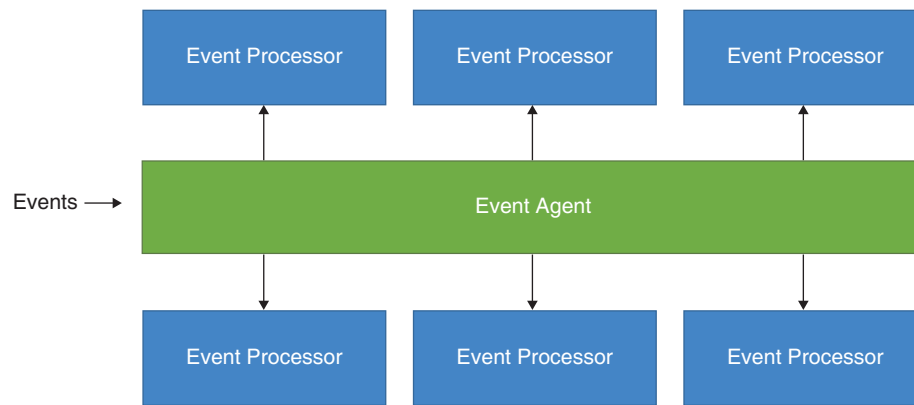
- Mediator.
- Agent.

In the mediator topology, there is an event queue and a mediator that directs events to its consumers.

Figure 12.1-7 Mediator Topology

Source: Prepared by the author

In the agent topology, no event queue is used. Each event consumer is responsible for getting their event and processing it.

Figure 12.1-8 Agent Topology

Source: Prepared by the author

Note that there are no atomic¹¹⁶ transactions in a business process in this architecture. This is due to the high decoupling feature between components.

12.1.2. Scalability

Introduction

Current Tax Information Systems must support access by individual and institutional officials, taxpayers and other citizens while presenting an acceptable performance. On the other hand, the expansion of the services provided online to users, the new methods of access to these services, especially mobile devices, in addition to the growing amount of information received and reviewed, continuously pressure the available information and communication technology (ICT) resources.

Thus, ICT managers are charged to be prepared for the continued growth of ICT resource needs, in order to meet the organization's expectations and demands. What is enough for today surely will not be for the next year's demand, and the situation will be worse in three or four years, so technological services must be prepared for steady growth and adapt quickly to demand.

As a result of the above, the concepts of scalability are of vital importance for any initiative to implement or improve tax systems. Below is an introduction to scalable architecture models for information systems.

Definition

Scalability is the ability of the IT system to change its size or configuration to suit dynamic circumstances. In other words, a system is scalable to the extent that the system can serve an increasing number of users successfully and at the same time. The point where the application can no longer serve new user requests is the limit of its scalability (Wilder, 2012).

These limits are often reached when there are not enough hardware resources for system execution. Key examples of these resources are processor, memory, network bandwidth, and storage capacity.

We can consider running a system, such as multi-node work, which have associated hardware resources. These nodes can be running, data storage, and more. It is possible to improve our system by adding hardware resources and can be done vertically or horizontally.

- To scale up vertically system capacity, we add new resources to existing nodes.
- To scale out horizontally, new nodes are added to the system.

Both forms are not exclusive. It can improve a system in both directions, partially or completely.

Vertical Scalability

Node capacity is increased by increasing their hardware characteristics. It can be increasing its memory, processor cores, larger or faster storage, among others.

Among its main advantages we find:

- Hardware component costs are lower and lower, so it often represents a convenient option economically.
- It is easy to implement, does not require modifications to the system software.
- It is relatively independent of the architecture of the software to be run; most systems are favored by better hardware performance.

One important thing to consider with this scaling method is that it has a limit, for example, when you can no longer increase individual components without incurring large investments and service interruptions, as surely these changes always disconnect the system node, to apply the changes to it (recently mitigated with the use of virtual equipment). Vertical scalability also requires planning and coordination, as hardware intervention means the unavailability of services.

Finally, a system with vertical scaling is sized from its peak demand, so its resources could be wasted during periods of low activity.

Horizontal Scalability

In this mode, new nodes are added to the system. This modality is usually more complex in its engineering, with respect to vertical scalability, and requires that the system architecture is designed to take advantage of additional nodes.

This node growth can occur for a particular group, such as increasing web server nodes, business logic nodes, or those serving web services. The node group that has the same configuration is called homogeneous nodes. This makes it easier to plan your growth and work distribution, as we can expect equal yields for each of them.

The greatest benefit of node growth in the system is when the system execution on each node is independent. That is, they don't have to know the status of the other nodes. This makes it easier to add or remove nodes without affecting their job synchronization.

An additional advantage of scaling horizontally is that system service time is typically not affected, because adding nodes can be done transparently, without affecting the work of the other nodes.

Easy Scalability

The proliferation of virtual machine tools and automatic computer configuration tools support the boom in the use of the horizontally scale-out model.

Infrastructure management can configure model machines for each of the node groups that make up its architecture and then replicate them when that group grows.

Cloud platforms are designed to provide such services. Node expansion can be done through its management consoles, entering the number of nodes we want to add, and in a short time scale platform technology. For more details on cloud platforms, see the specific section within this chapter.

Automatic Scaling

It should be noted that, just as scale-out horizontally has been presented for the growth of system resources, the same structure also supports decreased resource usage.

This means that, according to automatic or manual rules, we can determine if fewer nodes can meet user needs. The remaining nodes can be assigned to other systems or deactivated.

This capacity is in line with the reality of the administrations, in which the use of the services varies according to the month of the year, and within each month, according to dates of expiration of the taxpayer's obligations.

This means that we can decrease the use of nodes at times of least use. Their application depends on each institution, but may serve to lower the cost of services, in case the contracts are linked to the number of active nodes, or to free up resources on servers, which can then be allocated to other areas or systems. In addition, it is a typical feature of cloud services.

12.2. Purchase or Custom Development

IT architecture decisions for a Tax Information System become a reality in its implementation. For this, a strategic decision to make is to choose between custom development mode, using internal resources or contracts with software development companies, or the parameterization of a commercial software package (Commercial Off-the-Shelf or COTS for short). This topic is discussed in depth in the chapter "Roadmap to modernize a Tax Information System."

12.3. Information Architecture

The information architecture is about the classification, applications, and governance of data that a tax administration has. As important as obtaining and storing information is defining the actions that the tax administration will execute from it. Data and information must be used in an agile and efficient way, to transform it into a main tool in decision-making and the definition of action policies for the institution.

The information handled by tax administrations can be grouped into the following main groups:

Master Data. Master data is critical business data and is usually of 4 types: people, things, places, and concepts. The master information describes the business objects on which the transactions are performed and the dimensions on which the analyses are performed.

Transactional Data. It is data managed by computer applications. In a tax administration we find, for example, tax returns, resolutions, payments, invoices, and other types of interaction with the institution.

Analytical Data. They are used to support and back the business decisions of the tax administration. Taxpayer behaviors can be analyzed for long periods of time to identify patterns of misconduct or identify improvements to implement. The information is stored in datastores, as well as in small datasets in table structures that support aggregation, online queries, and data mining.

As the data is used, the information about its origin or the changes that have occurred represent a fourth group of information, called metadata, and an additional fifth group that is the unstructured data.

Metadata. The information is then moved and manipulated, the description of where it came from, or the changes that happened, represents a fourth type of information that is called Metadata (data about the data). They can reside in a formal repository or in other different forms such as XML documents, report definitions, descriptions of columns in a database, log files, connections, and configuration files.

Unstructured. These are data found in emails, PDF documents, magazine articles, corporate intranet portals, product specifications, marketing information, or other of similar characteristics.

12.3.1. Data management

The process of data administration involves the acquisition, validation, storage, and processing of the information that is relevant to the institution. The information can be used for basic functions, such as the identification of taxpayers and their activities, but it can be very useful once it

is combined with analysis techniques and technologies to discover conducts and patterns in their behavior.

In order to identify the tools and technologies that the institution requires, we must first know the goal and reach of every one of them, as is described here:

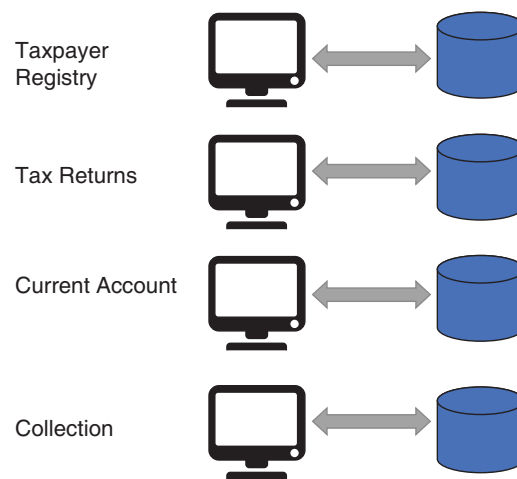
- **Data mining.** It isolates specific information from large volumes of information and transforms them into usable metrics.
- **Extraction, transformation, and loading.** A process of this kind automatizes the processes of extraction, transformation, and loading, in a way that the information will be available for users and is more consistent.
- **Data warehouse.** A centralized data storage space gathers all the information from the institution and other sources. It is an indispensable part of the data administration plan since it keeps information accessible and links different types of data from taxpayers in order to have the whole picture.
- **Monitoring.** These are tools that provide security and safeguard the quality of the information, by monitoring critical environments, diagnosing problems as soon as they appear, and quickly notifying the team of analysts.
- **Business intelligence and reports.** They transform processed information into detailed information for each role of the user who receives it. The data must be presented in a particular way, according to the use that will be given to it.
- **Analysis.** They combine specific measures with an intuitive interface for the user. They are usually integrated into non-analytical tools to provide a better user experience.

It is important to stop thinking about prior technologies as isolated entities, but to think about their joint work as an organized unit. An example of the application of an architecture that allows the operations mentioned before is through the analysis of the most common realities that present themselves in the different tax administrations.

In general, every tax administration has a set of heterogeneous applications, where parts of the total information that the institution has access to are captured. These technologies are frequently uneven, since systems inherited from prior technologies coexist, as well as the application of specific products in different areas of specialization.

Applications for everyday operations

Normally, there are sets of applications that carry out specific functions and store transactional data as a result. The structure of the information and its storage are designed exclusively to fulfill the functionalities and transaction levels required by the application. Each one of them functions correctly but an integration strategy must be defined, from the moment the need to have these applications share information arises.

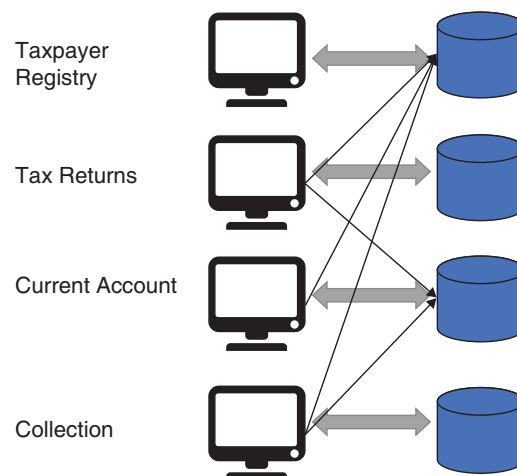
Figure 12.3-1 Everyday operation applications

Source: Prepared by the author

The problem of integration

The integration of these systems represents a problem of exponential growth as the number of applications grows, which could elevate costs and the complexity of the systems until they become very difficult to maintain.

This type of scenario is what has promoted the creation of Enterprise Applications Integration technology.

Figure 12.3-2 Integration among applications

Source: Prepared by the author

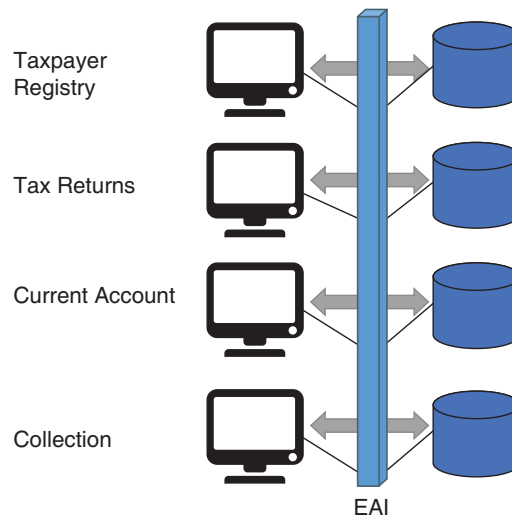
Integration of business applications

All of the metadata information is used to synchronize information between the different applications. All of the information regarding which data must be moved, when to do it, which transformation to execute as they are moved, which process to recover mistakes to use, is stored in the repository of metadata of the Enterprise Application Integration (EAI) tool.

This information, along with connections to applications, are used for the synchronization.

According to the topology, these configurations are sometimes called Enterprise Service Bus (ESB) or Hub Integration.

Figure 12.3-3 Enterprise Application Integration (EAI)

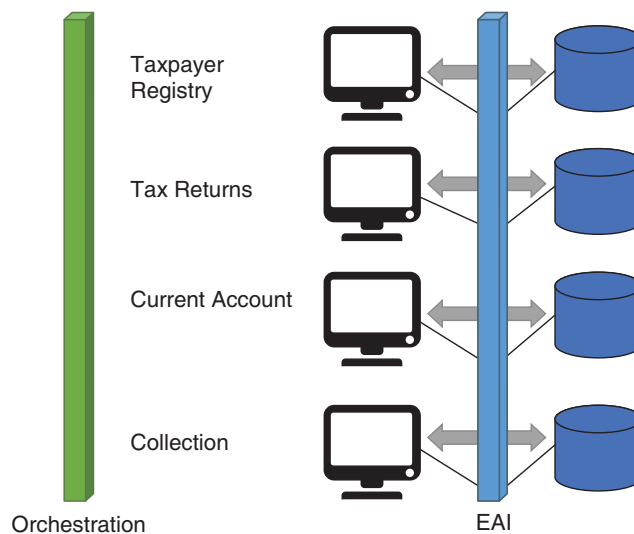


Source: Prepared by the author based on Oracle (2011)

Service-Oriented Architecture

In Service-Oriented Architecture (SOA), the services and functions of applications are exposed as shared services using standard interfaces. These are then combined in businesses processes between applications, through a technique that receives the name of Business Process Orchestration.

The orchestration layer represents the tools used to design and publish the business processes between the applications.

Figure 12.3-4 Service-Oriented Architecture (SOA)

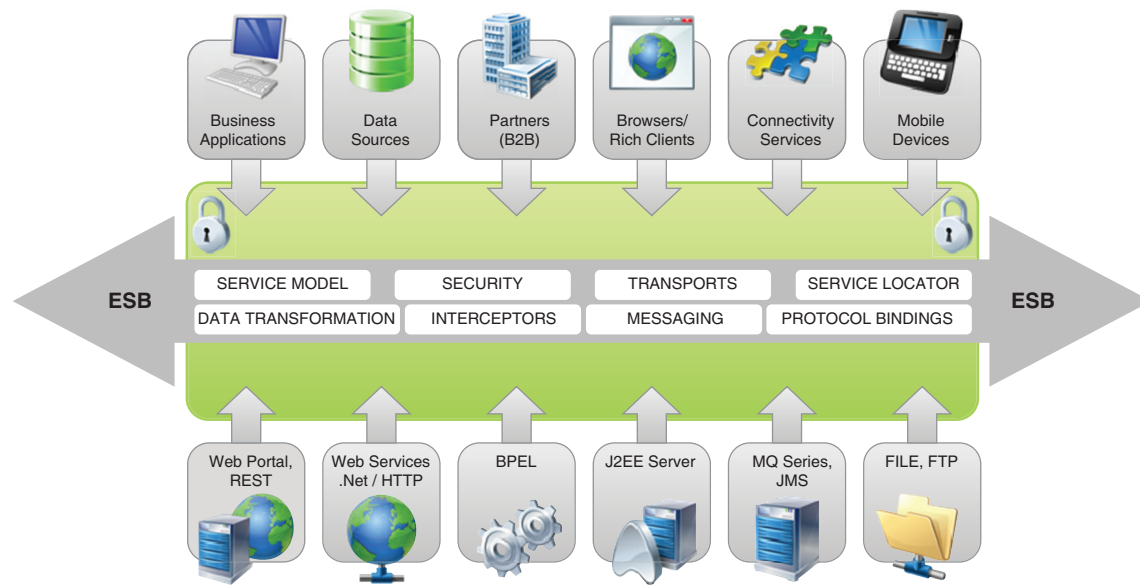
Source: Prepared by the author based on Oracle (2011)

Integration through Enterprise Service Bus

The Enterprise Service Bus (ESB) is born as an improvement on the Enterprise Application Integration (EAI) process. The characteristic that existed before ESB was that applications had to be highly linked to others in their communication. They had to know how to communicate with, the methods to use, and the protocols that are required for its communication. The problem lies in the fact that data processes and transformations are implemented within the application.

The ESB proposes a Service-Oriented Architecture (SOA) for the progressive integration of all kinds of systems in a decentralized structure that is called Service Bus. Its progressive character means it is not an all-or-nothing option, but instead can be implemented in a gradual way, incorporating more and more services to its structure.

The main novelty of the ESB regarding other solutions is that it replaces all communications between systems with virtual communication channels; thanks to this the systems interact in a much more coupled way and tools for the administration of said communications are provided.

Figure 12.3-5 ESB Architecture

Source: The ESB Architecture. From "Everything you need to know about Enterprise Service Bus (ESB)," by S. Agrawal, 2016. Retrieved January 27, 2020, from <https://www.hcltech.com/blogs/everything-you-need-know-about-enterprise-service-bus-esb>. Copyright 2016 by HCL Technologies Limited

Breest & Schulte (2006) mentions the three main components of ESB architecture are:

- **An asynchronous messaging system.** It allows for the communication between different systems through virtual channels. As a result, all of the point-to-point, synchronous, and highly coupled communications are replaced by indirect, asynchronous, weakly coupled communications. The MOM is responsible for maintaining the message queues and distribute them to the different systems through service containers.
- **Service Container.** It has the mission of enabling services from and to all of the systems of the institution. It connects to messages and queues of the MOM and is capable of transforming these messages into service invocations. It can encapsulate any kind of operation, for example, sending and receiving mail, invocations of EJB methods, invocations of Web SOAP / REST services, etc. Its basic use is reading messages of the MOM in services, but can contain as much functionality as wished, such as including audit registries, control accesses, system alerts, etc.
- **Administration tool.** Due to its decentralized and complex message, route, and service structure, administration tools are provided for the management of these service points, of the rules that determine the behavior of messages, and in general, of all the execution flow of the services that are offered. Using these tools, two or more services can be combined to work in a coordinated manner and provide new functionalities to third parties. Furthermore, they facilitate the continuous monitoring of the execution of the service bus, as well as the management of alerts and errors, allowing, for example, to consult the state of each service and download or upload services as needed.

Some of the most popular implementations are:

- Jboss ESB (<http://www.jboss.org/jbossesb>).
- Apache Servicemix (<http://servicemix.apache.org>).
- Open ESB (<http://www.open-esb.net>).
- Mule ESB (<http://www.mulesource.org>).
- JBoss Fuse (<http://www.jboss.org/products/fuse>).

Integration example

A successful example of data integration for public administration, in general, is the case of the **X-Road** service in Estonia (Seco & Munoz, 2018, p. 115). X-Road is an interoperability product. It allows for the exchange of data between organizations. Technically, it is a Data Exchange Layer. Besides the technological component (software and hardware), there are management rules for the adhesion of an entity; standards for the connection, formatting, and identification of data; and processes to be followed. There is an X-Road management center that defines policies and processes, adds new entities that will participate, monitors all exchanges, applies security policies, evaluates transaction logs, and maintains a helpdesk to support participating entities. X-Road makes the databases and registries of the Estonian Government available to most people.

Nearly 900 organizations use X-Road every day and almost 500 million queries are executed every year. The X-Road was exported to Finland and integrated to the equivalent system in Estonia, as part of a cooperation effort between the tax authorities of both countries, for the management of foreign trade at the border.

12.3.2. Analytical Systems

Since the decade of the 1980s, many organizations focused on using data warehousing tools in order to have a global vision of reality. Data models are published in relational databases with functionalities of business intelligence and the possibility to store large quantities of historic information, in structures designed for the execution of complex consultations and multiple table combination.

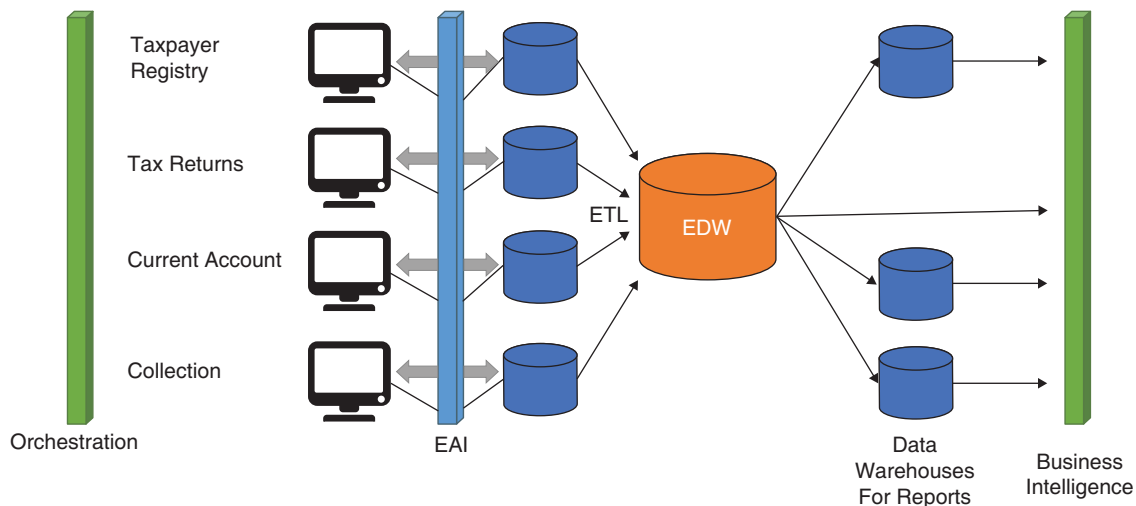
This analytic structure has three main components:

1. Data storage.
2. Tools for extracting data from transactional systems, transform them into a data storage structure, and finally upload it (ETL).
3. Business Intelligence (BI) tools, for analyzing information that reside in the data warehouse.

Enterprise data warehouse and data warehouse

The Enterprise Data Warehouse (EDW) contains the historic information of transactions of the transactional systems, including key dimensions, such as Taxpayer, Taxes, Deadlines, among others. The data warehouses can be independent from the EDW or connected and sharing common data definitions.

Figure 12.3-6 Data Warehousing



Source: Prepared by the author based on Oracle (2011)

Extraction, Transformation, and Loading (ETL)

It is a process that is based on metadata that extracts the data from the source systems and subsequently loads them into the data warehouse. As part of this process, it executes transformations with the goal of improving the quality of information and its presentation as a report. These metadata maintain a history of applied transformations.

Business Intelligence

The use of the data loaded into the data warehouse is carried out through business intelligence tools. Usually, the information is accessed in the form of reports. In more sophisticated cases, consultation construction tools or reports from the end user are used.

The Online Analytical Processing (OLAP) tools allow for the manipulation of information that contains large quantities of searches in tables or dimensions and are of great help in trend and forecast analysis. Furthermore, all of these tools provide results that can be consulted from portals or work panels.

Many business intelligence tools provide options to conform information cubes or multidimensional databases, which employ a data structure that is pre-processed and optimized for its analysis, instead of a relational data source.

12.3.3. *Ideal information architecture*

The Business Application Integration and the Service-Oriented Architecture reduce the cost of integration but leave every data node without modifications. They have not been designed to identify which data must be contained in the different systems that are connected but instead to treat fragmentation (not eliminate it), so all pre-existing data quality problems will remain.

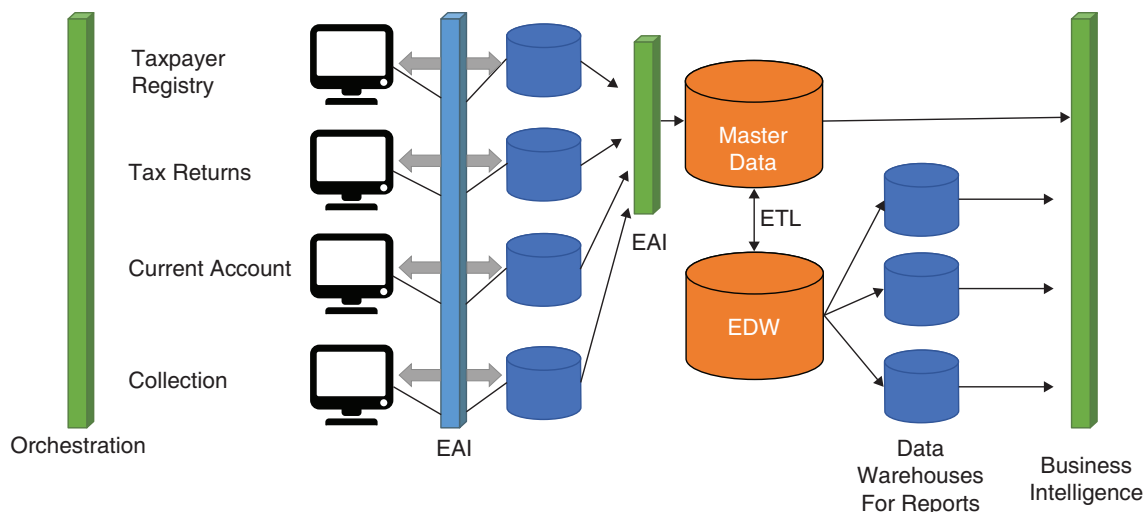
For example, the taxpayer registry module and the one for the reception of electronic invoices can have their own legal representatives' registry. Each one has the correct information for its end but may not be enough to provide a global vision at the level of administration for the taxpayer, nor have the necessary mechanisms to keep information consistent.

The advancements that led to the creation of analytical tools have been very important for the development of different areas of tax administration; however, they all present a problem from their conception (i.e., the quality of data in transactional systems).

Although the ETL stage allows for cleanliness of information and unification of criteria, many times these corrections have a limit, due to errors in the original information. Additionally, these results can only be observable in the analysis presentations and will never reach day-to-day tools, such as operating systems.

In order to improve the available architecture, the concept of Master Data Management (MDM) is introduced, a component that links the operational and analytical aspects of the tax administration.

Figure 12.3-7 Master Data



Source: Prepared by the author based on Oracle (2011)

The master data are connected to all of the transactional systems through the Enterprise Application Integration technology. This ensures that all master data are synchronized with all the applications.

Any business object is available to the orchestrator, to ensure that the right data are used in the business processes between applications.

ETL is used to connect the master data with the data warehouse. ETL is also used to complete the attribute data derived from the analytical process. This information remains available automatically for the connected applications and their business processes. This architecture allows us to unify operational and analytical processes, achieving a unique vision for the tax administration.

Table 12.3-1 Comparison between data warehousing and master data administration

Data warehousing	Master data management
Information is historical	Information is current
Contains transactional data, as well as master data	Contains only master data
Contains only necessary data for the analysis requirements	Contains complete information about all of the entities used in the Administration
Usually consumes data	Consumers and providers of data, usually with bidirectional relations
Its goal is to analyze historic data	Its goal is to safeguard correct, updated data
Its focus is aggregation and reports	It is focused on entities
Its dimensions are not used by other applications	Its entities are used by other applications, including data warehouses

Source: Data Warehouse vs Master Data Management. Adapted from "James Serra's Blog," by J. Serra, 2013. Retrieved January 27, 2020, from <https://www.jamesserra.com/archive/2013/09/data-warehouse-vs-master-data-managment/>. Copyright 2013 by James Serra's Blog

12.3.4. Analysis of large volumes of structured and non-structured data

During the last 15 years, every tax administration has improved its digitalization of information. Through the improvement of services to the taxpayers, a large volume of information (structured or non-structured) and data from third parties (banks, social networks, credit cards, among others) has been captured. Recent developments, such as the electronic invoice, contribute to this large combination of data that is stored in every institution, plus international agreements that incorporate data from abroad.

The large volumes of information, the variety of the sources they come from, added to the speed with which they have to be managed, motivated the creation of the Big Data concept:

- **Volume.** The size of the data is very big and multiplies with each passing year.
- **Speed.** The high speed with which data is received.
- **Variety.** The information arrives in different formats and structures. From perfectly structured databases to text files or multimedia files with no defined structure.

Use of Data Lakes

The three abovementioned characteristics -- volume, speed, and variety -- present a technical challenge when it is time to design how and where the information, which has to be read to be analyzed, will be stored. As a response to said challenge, a concept called Data Lakes has been introduced. A Data Lake is a repository in which all of the data of the company are stored. Whether they are structured or not, these data are included in raw form, without any organization, to be subsequently analyzed. Some characteristics of Data Lakes:

- Absolutely all data are stored. Information is not discarded as they do not require a fixed structure to store the data.
- Any kind of data can be stored. Sources of information can be varied, such as social networks, multimedia files, security device information, among others.
- They adapt to changes easily, thanks to their flexible structure.

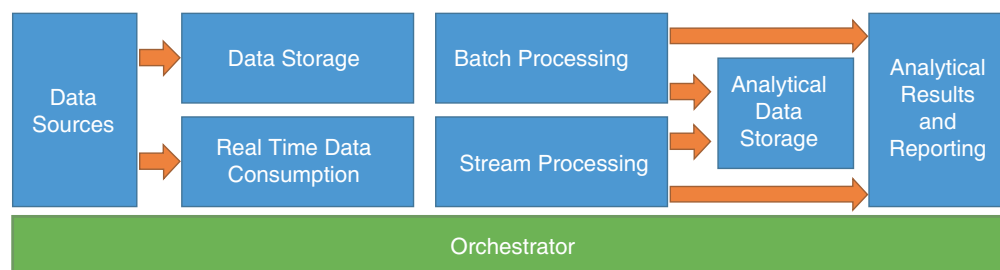
These characteristics mark the differences with the traditional concept of data warehousing, where information has a defined structure that has to be modeled and created before information can begin to be uploaded. That process usually implies data cleansing routines during which information is discarded.

Information is processed at the moment it is received in the data warehouses, while it will only be processed in the Data Lakes at the moment someone wants to use it.

Big Data Architecture

A commonly used structure to treat Big Data is the following one:

Figure 12.3-8 Big Data Architecture



Source: Prepared by the author based on Big Data Architecture Style (Microsoft)

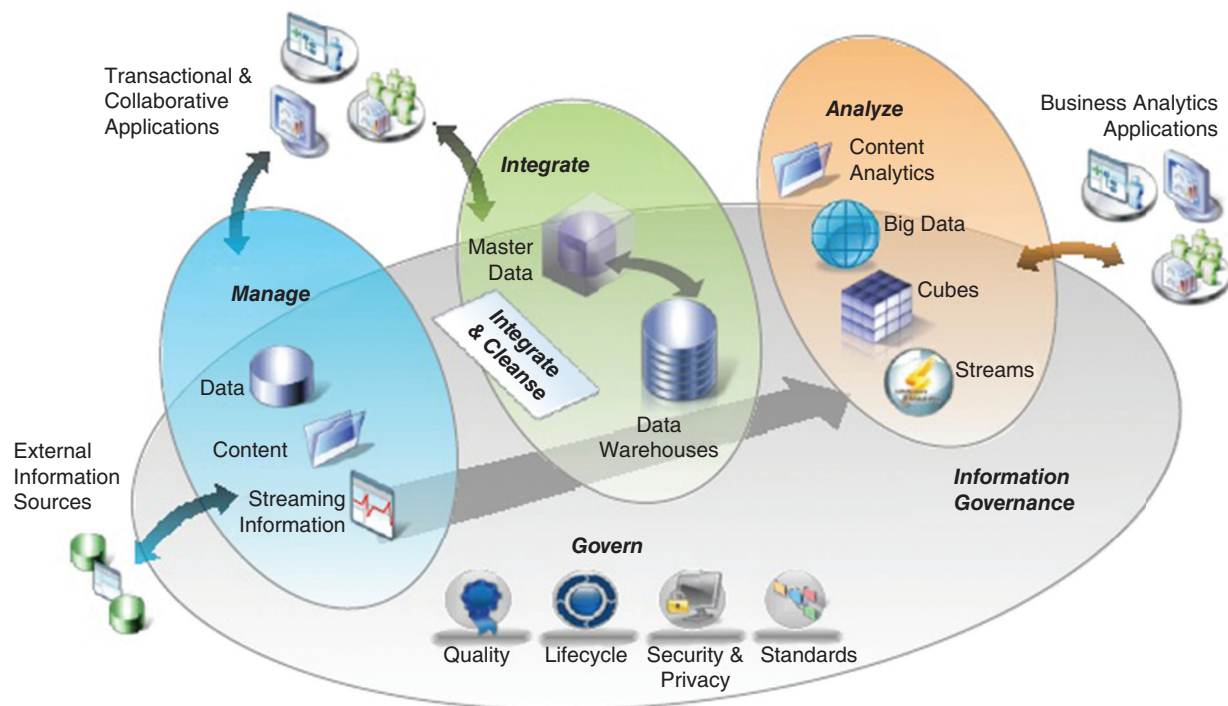
Most Big Data solutions include some of the following components:

- **Data sources.** They can come in several forms and origins, for example: databases, multimedia files, text files, among others.
- **Data warehousing.** The information processed in lots is stored in file systems, which can contain high volumes of information in different formats.
- **Lot processing.** The received data must be processed and stored again in files with a known format that makes it easy to read them later.
- **Data consumption in real time.** When the source of information is captured in real time and in continuous form, this information must be stored in particular sites; however, it is common for the data to be processed at the same time it is received. Some information solutions to this are available, for example, Azure Event Hubs, Azure IoT Hubs, and Kafka.
- **Stream processing.** Data that has been captured in real time have to be processed in a swift, reliable manner.
- **Analytical data warehousing.** Databases with specific formats for their analytical processing. These formats make it easier to read the data.
- **Reports.** The results of the prior information processing must be presented to the user in a way that facilitates its analysis, reading, and manipulation. This is achieved through the use of report and analysis tools.
- **Orchestrator.** The reading and processing of the received data is generally a series of steps repeated in time, with a defined workflow and in which several different technologies and players participate. This management of information can be carried out using orchestration technologies.

The use of Data Lakes is recommended as a way to have access to all of the original information and to speed up the process to receive it.

12.3.5. Administration structure

The Information Architecture mentioned in the [Figure 12.3-9](#) reflects the interaction of the present technologies and entities, which adjust to the reality of most tax administrations.

Figure 12.3-9 Administration Structure

Source: Information Supply Chain. From "Information Governance and Data Quality," by S. Mino, 2012, IBM, p. 7.
Copyright 2012 by IBM Corporation.

12.3.6. Information security

Most of the success of a tax administration depends on the quantity and quality of the information that it has on its taxpayers, the operations they carry out, and the economic environment of the associated financial market. This is the reason a larger, more detailed volume of data is being increasingly accumulated.

This strategic advantage for the operation of the institution brings with it a great responsibility. Data must be stored and managed carefully to avoid unauthorized access to it, or its unlawful use by the public officials themselves. Mistakes in the custody of said information imply risks for the institution, which can be classified as:

- **Reputation.** A negative opinion of citizens and taxpayers, as well as a loss of trust.
- **Compliance.** In some countries, there are rules and regulations to protect the information of their citizens. Information leaks may present breaches of these rules.
- **Operations.** Failures in the internal processes or even the external ones, such as attacks or frauds, may compromise the everyday operations of the institution and its systems.

- **Information that is managed or used by third parties.** Signing contracts for system development or data warehousing in remote servers or the cloud increases the risk of information loss or leaks.
- **Strategic.** Erroneous or inexact information, due to fraudulent alterations, can lead the institution to implement the wrong measures.

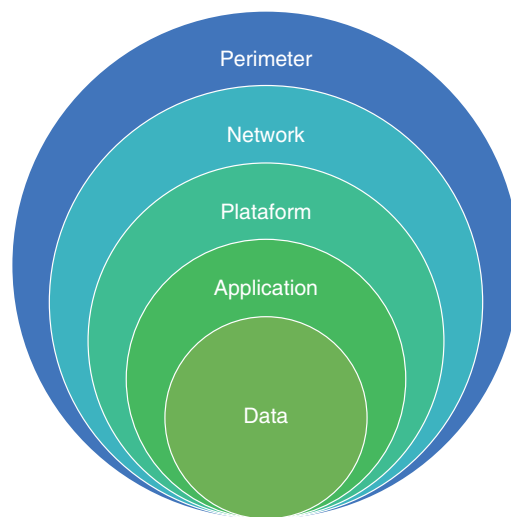
Information security “refers to the protection of data from unauthorized access, use, change, disclosure and destruction and includes network security, physical security, and file security” (Carnegie Mellon University Libraries, 2020).

The practice of safeguarding information is the main occupation of information security and it involves the following:

- **Privacy of information and confidentiality.** Information has to be accessed only by those who have a right to do so.
- **Data integrity.** Information must only be modified by those who have been authorized to do so.
- **Data availability.** It must be available to those who require the information, whenever they require it.

Measures to be taken to protect information must represent an effort of the whole tax administration, in both technical and management aspects. A format that is generally used to protect data is the layer protection model (Berson & Larry, 2010).

- **Perimeter.** Threats that come from outside the institution. They are normally implemented through firewalls that protect the DMZ.¹¹⁷
- **Network.** Protects the information that flows on the network. It usually uses technologies such as Transportation Layer Security¹¹⁸ (TLS/SSL or IPSEC), Public Key Infrastructure¹¹⁹ (PKI), and virtual networks¹²⁰ (VPN).
- **Platform.** Threats against the devices that store the information. For example, database servers, application servers, authentication servers, etc.

Figure 12.3-10 Layer protection

Source: Prepared by the author

- **Application.** One of the most complex forms of protection is the code of the applications that access the information. It must be analyzed for possible security errors or bad programming that could allow its users to vulnerate security controls.
- **Data.** It refers to the methods to protect the content of transactions, historic information that the institution acquires, stores, and manipulates. This not only includes their databases but any other method to store or transport information that it uses.

The security of these aspects must be treated in a comprehensive way and maintaining a balance regarding the resources employed at every level. This annotation comes from the observation of the very common practice of investing in security hardware but, on the other hand, to neglect the quality of applications, maintaining high-risk vulnerabilities. Data security is also addressed in the chapter named “Enabling Digital Technologies and Services.”

12.3.7. Data governance

Data governance is an organization’s ability to manage the knowledge it has about its own information so that it can respond to questions such as: What do we know about our information? Where does that data come from? Are these data aligned with our institutional policy?

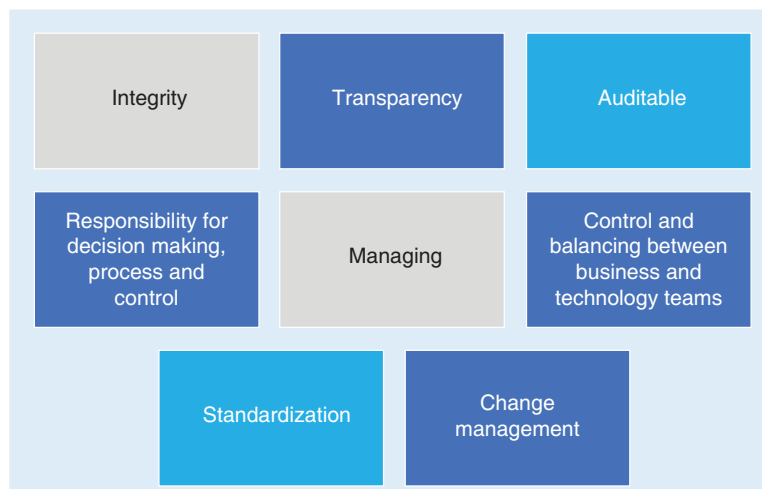
According to the Data Governance Institute, data governance is defined as the specification of a framework of responsibility to encourage appropriate behavior in the valuation, creation, storage, use and disposal of information. This includes the processes, roles, standards and metrics that ensure the effective and efficient use of information so as to enable an organization to achieve its goals.

Its main objectives are:

- Allow for better decision making.
- Reduce the operating load.
- Protect each of the needs of the different areas interested in the data.
- Train staff and management to adopt common approaches with regard to the problems presented by the data.
- Develop standard and repeatable processes.
- Reduce costs and increase efficiency by coordinating efforts.
- Ensure transparency of processes. (Soaring Eagle Consulting, 2019)

Its fundamental principles regarding the data to be managed are the following:

Figure 12.3-11 Fundamental Principles of Data Governance



Source: Prepared by the author

The Data Management Program

Data management is a general term that describes the processes used to plan, specify, enable, create, acquire, maintain, use, archive, retrieve, control and purge data. These processes overlap and interact within each knowledge area of data management.¹²¹

In a practical approach, IBM¹²² mentions the following steps as fundamental for Data Governance:

1. Set goals

The goals must be specific, measurable and attached to the success of the business or to the processes and initiatives that lead to that same success. Organizations must establish two types of goals: situational and sustainable.

Situational goals: these are specific policy goals based on a measurable deficiency and reported as a key performance indicator (KPI): Achieve 90% of the quality of taxpayer data regarding their addresses.

Sustainable goals: these are the goals that the program hopes to achieve. These goals are directly related to the business: cost reduction of 10%, increase sales by 25%, are just a few examples.

2. Define metrics

Without careful metrics, it is very difficult to know if the program is achieving its goals. A metric must be real and objectively measurable.

3. Make decisions

Every decision is a policy. To determine why a policy is working or not, metrics are required about the decision process itself, which can be analyzed to plan the next move. Some decisions require speed and authority. In those cases, you can choose an escalation route. This means a hierarchical type model, in which decisions are sent to the head or a consultation with other groups, is required.

4. Communicate policies

Regardless of the model to be used to define the policies, they must be communicated effectively to achieve the desired results. Verbal announcements, emails and written documents are examples of policy communication.

5. Measure Results

It is necessary to measure how well the policies achieve the program's sustainable and situational goals. An approach to the fulfillment of the incremental goals is sought; it bases its performance and adjustment on an iterative process of policy creation and implementation.

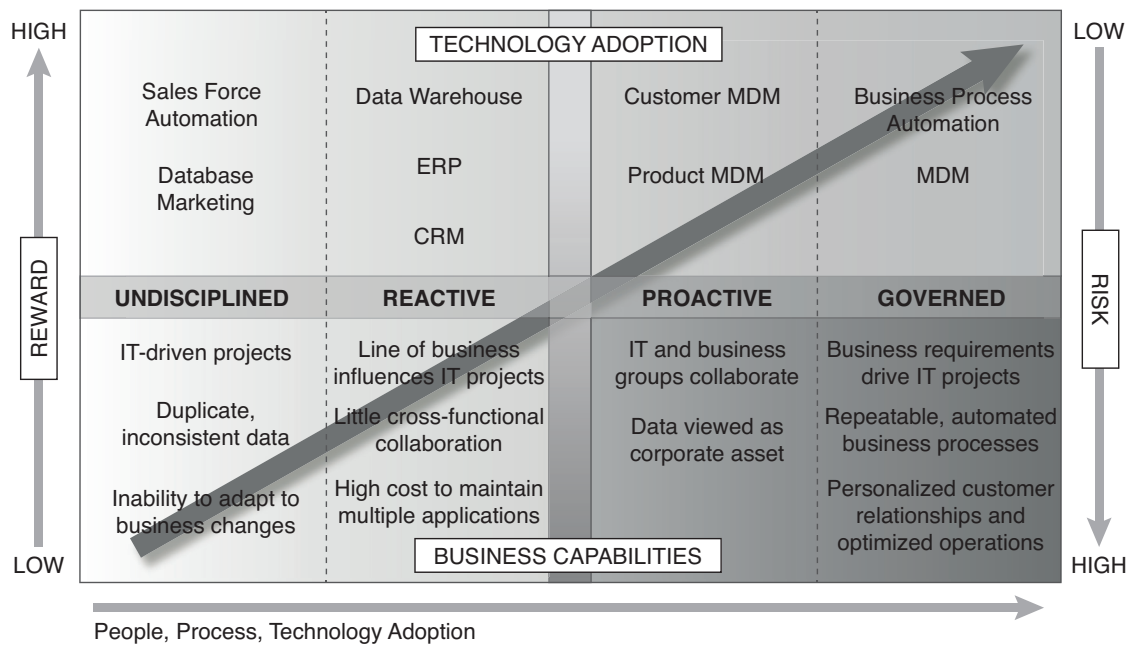
6. Audit

The Audit process is the heart of every aspect of the Data Governance program. Auditing is the key process and technique that underlines many of the previous measurable steps. But periodically auditing is not enough; it is also important to conduct an investigation and define why things happened and make a record of those reasons. Over time, there will be an accurate registry of errors and omissions, which will help to avoid past mistakes and make better governance decisions in the future.

Maturity Model

According to the statement presented by DataFlux CEO Tony Fisher in his book “Data Asset: How Smart Companies Govern Their Data for Business Success”, a model to measure the maturity of data governance in our tax administration is as follows:

Figure 12.3-12 Maturity Model for Data Governance



Source: The data governance maturity model. From “The Data Asset: How Smart Companies Govern Their Data for Business Success,” by T. Fisher, 2009. Copyright 2009 by DataFlux Corporation, LLC.

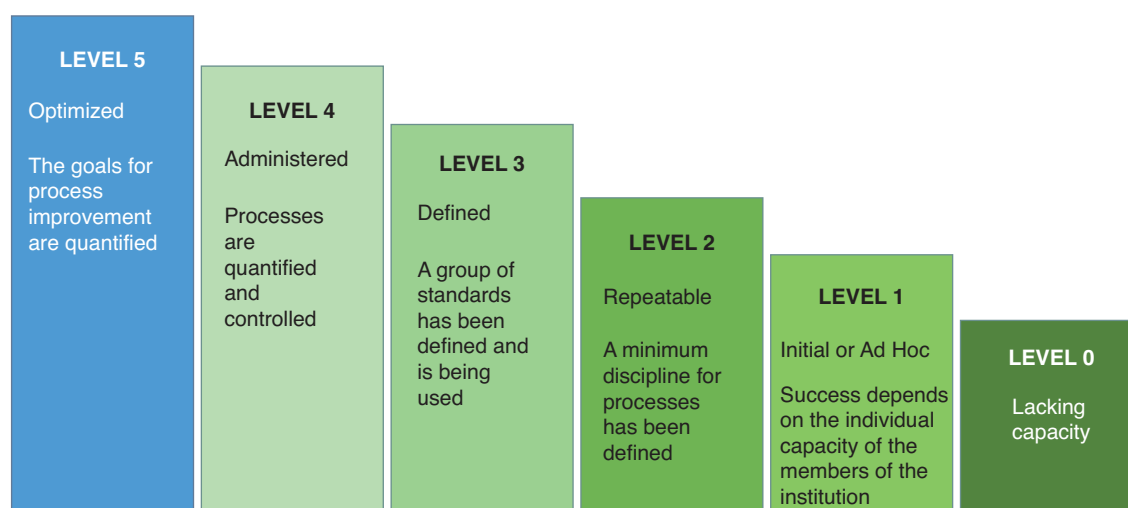
The model shows that institutions normally move from one category to another as they increase their information management capacity. Another observation is that normally an institution doesn't fit entirely in one category but rather the different departments within the institution match different categories.

Evaluation of Data Management Maturity

DAMA International proposes in its publication “DAMA-DMBOK: Data Management Body of Knowledge: 2nd Edition” a methodology to assess the maturity of an institution regarding its data management (DAMA, 2017). Maturity models are defined according to progression through levels that describe the characteristics of the process. The progression of an administration happens in the order of levels defined; levels cannot be skipped.

Normally, levels include:

Figure 12.3-13 Maturity Levels



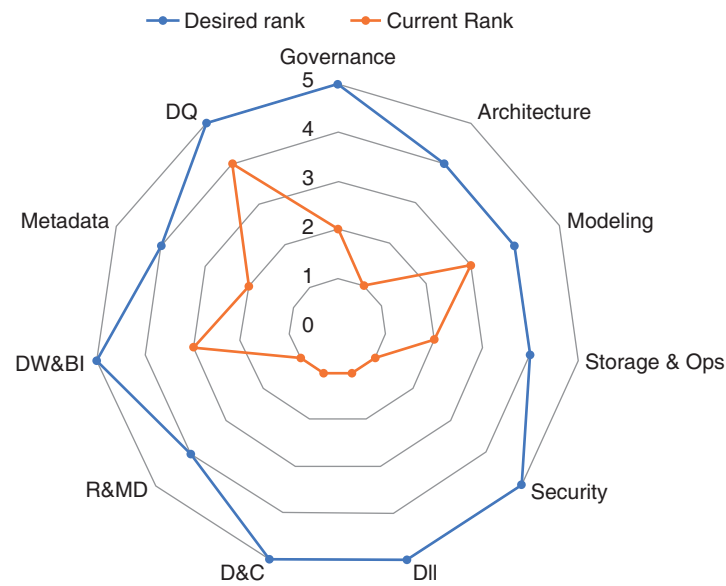
Source: Prepared by the author

A maturity counseling process (DMMA) can be used to assess the maturity of the institution and the steps to improve its level. Before beginning an advisory process for data maturity, the institution must establish as its baseline its current capabilities, objectives and priorities. Equally important is the commitment to respond to the results of the maturity measurement, defining objectives, a road map and monitoring said process to effectively achieve results.

The evaluation of the level of the tax administration and its position in the maturity scale provides information on its strengths and weaknesses. It also allows identifying, prioritizing and implementing improvement opportunities. Each maturity level is associated with a set of criteria by which compliance with the objectives of that level is measured. At all levels, these criteria will be rated within a scale of 1 to 4, which shows the level reached in the path towards the next level of maturity.

- 1 - Not started.
- 2 - In process.
- 3 - Functional.
- 4 - Effective.

The results of the maturity evaluation can be presented in a graphic format, in order to visualize the state of the administration in the area evaluated, and its relationship with the state that is being sought.

Figure 12.3-14 Visualization Evaluation Criteria

Source: Example of a Data Management Maturity Assessment Visualization. From "DAMA-DMBOK 2nd Edition," by DAMA International, 2017, DAMA International, p. 537. Copyright 2017 by DAMA International

Some of the work environments defined to assess the maturity of data management are:

- CMMI Data Management Maturity Model (DMM). Developed by the CMMI (Capability Maturity Model Institute).¹²³
- Enterprise Data Management Council has developed the DCAM (Data Management Capability Assessment Model).¹²⁴
- IBM Data Governance Council Maturity Model.
- Gartner's Enterprise Information Management Maturity Model.¹²⁵
- Gartner's Enterprise Information Management Maturity Model.

12.4. Cloud computing¹²⁶

Cloud computing is a transversal technology that impacts public administration in general. It refers to the shared use of storage, computational capacity and, optionally, application software, provided externally and interconnected by Internet. The management of the entire environment, including data security and the local environment, is the responsibility of the cloud provider. Thus, the institution ceases to operate under a capital expenditure model (CAPEX) and moves to an operating expenditure model (OPEX).¹²⁷

The concept is attractive, since assembling, maintaining and operating a quality ICT infrastructure for the exclusive use of an institution is very costly and requires highly specialized personnel to maintain it. Thus, a company that provides cloud services can invest in the construction of highly insured and redundant, world-class computing infrastructure (the cloud) and sell “quotas” of its use to other institutions, guaranteeing and taking responsibility for all operational aspects and of security. For example, Microsoft has a global cloud service, called Azure.¹²⁸ The data centers of this cloud are scattered throughout all regions of the world, as shown in the image below.

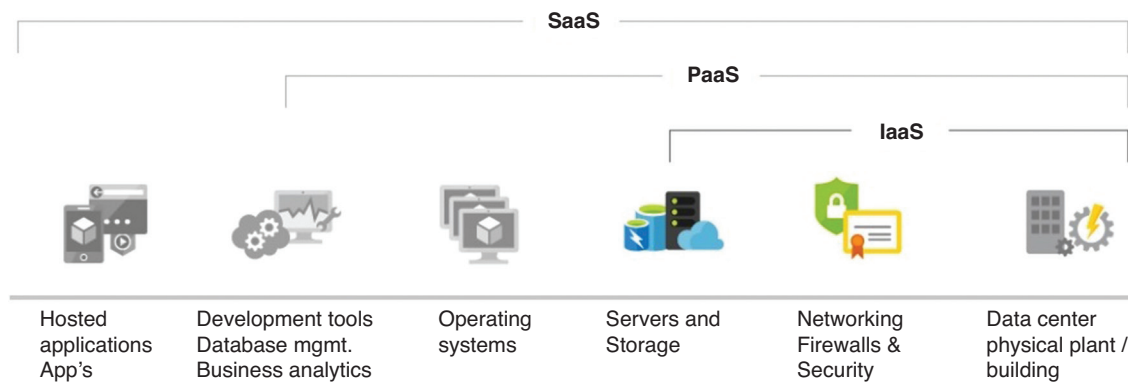
Figure 12.4-1 Location of Azure cloud infrastructure centers



Source: Azure regions. Adapted from “Azure global infrastructure,” 2020. Copyright 2020 by Microsoft Azure.

In the image, the blue dots indicate the effective presence of data centers, while the dotted circles indicate future expansions. In the United States of America, Azure has several data centers dedicated to governments (central, in the states and Department of Defense).

Cloud computing has three basic models of service provision: IaaS - infrastructure as a service (IaaS), PaaS and *software* as a service (SaaS) - as indicated in the following figure.

Figure 12.4-2 Cloud service provision models

Source: Microsoft

Cloud solutions are sophisticated and currently, in addition to raw processing and storage, commercial products are offered for multiple business needs (SaaS). At Amazon, another leading provider of cloud computing services, there is a range of data analytics, artificial intelligence, email, contact center, etc. In Amazon's government cloud registered users include the Department of Agriculture and the Food and Drug Administration of the US Government, among others.

12.4.1. Cloud computing in public administration ¹²⁹

For public administration, an emerging issue is the geographical¹³⁰ location of the server and cloud storage equipment: concepts such as "sovereignty," local laws and the rules that will be applied in the case of divergences (especially related to access to judicial information), in addition to issues of possible weakness for fiscal stealth. The classification of the data under government management, identifying which information has sensitivity concerning national security or sovereignty, would free up the others for transfer to the cloud (Zaballos & Rodriguez, 2017, p. 32).

In some countries, cloud service providers offer structures appropriate to the specific needs of governments (Amazon and Microsoft created some of these clouds in the United States of America). There are cases in which state companies implement clouds for the public sector, as in Brazil.¹³¹

Due to their strategic importance and volumes of data and processing, most national tax administrations can justify one or more exclusive data centers, which operate or are in the process of adapting to high-level international standards (i.e., TIER). There are also conditions for the adoption of cloud services for certain data intensive subsystems, such as electronic invoices and *Big Data / Data Analytics*. Mexico's Tax Administration Service (SAT) already operates some of its services in the cloud, such as in Microsoft's Azure. Additionally, in December 2017, it awarded a large contract to migrate all its operations to the cloud.

It will be a hybrid cloud called Managed Hybrid Cloud Services (SENHA), that is, a private cloud (formed by the three existing data centers of the SAT) and a public cloud (using commercial cloud services). The virtualization of data in the SAT headquarters is also part of this contract.¹³²

The Guatemalan Tax Administration (Superintendencia de Administración Tributaria - SAT) is initiating a modernization program whose strategy is to enable an infrastructure and platform for information systems that can use cloud services, whose availability and security strengthen the operation of the institution, at the same time that it allows to make payment in accordance with the services provided, reducing the total cost of ownership (TCO). Preliminary evaluations indicate a reduction of 1/3 for the TCO, with “Online Electronic Invoice” being the first system to be implemented under this concept.

The tax administrations of the United States of America (IRS) and the United Kingdom (HMRC) are making progress in the use of cloud computing, following the government policies of the respective countries based on *cloud first*.¹³³ Similar policies are still not perceived in LAC.

The lack of reliable suppliers with sufficient capacity to meet the operational requirements of large public institutions could be mentioned among the factors that prevent the public sector of many countries in the region from adopting cloud computing more broadly. In certain cases, the prices charged by the suppliers discourage the use of these services. At the same time, it has been observed that regarding the cloud services market, it is basically the global giants that can meet the great needs of availability, security and elasticity in the requirements demanded by large institutions, such as national tax administrations. The good news is that these suppliers are establishing themselves in several countries, often associating with local companies (Seco, 2018a).

Similarly, the biggest beneficiaries of cloud computing may be subnational tax administrations, as we will see later.

12.4.2. SaaS as an opportunity

In order to present the services they must deliver to internal users and taxpayers, tax administrations require an infrastructure of technological services that can nowadays be located at some point on a line that has at its ends all of its resources in the premises all the way to the total use of services provided by third parties. Occasionally, these decisions may respond to election criteria. For example, a tax administration can use email services under the SaaS mode and keep all its systems related to its mission operating completely under its control and in its own facilities. Some other times these decisions may be influenced by legal, contractual, budgetary or resource availability criteria or by the organization's own size. It is possible, for example, that an administration may have difficulties in introducing long-term service contracts, or that it will be easier to obtain funds for investment in purchases of equipment, but not to pay for services that will become routine, for example, with funds specific for investments or through development bank funds. Sometimes, on the other hand, particularly for smaller administrations, cloud services can be very attractive in terms of costs or human resources necessary for the operation of all services.

The use of the SaaS¹³⁴ model enhances cloud computing, further reducing the need for large capital-intensive investments. *Blockchain* system architectures, with distributed data, can potentially be users of cloud services.

The IoT and *Big Data* are technologies that generate and process huge amounts of data. The use of storage and cloud services appears to be an effective alternative, as proposed by (Google, 2017, p. 10). One of the reasons is the unpredictability of the amount of storage and processing required. In the cloud, these needs are quickly met by the provider without the need for acquisition processes, permits, installation, physical space, training, etc. There are even clouds that provide storage differentiated by latency time, with cheaper prices for longer periods of time.

This mode can be used to acquire “raw” data in real time, which would be addressed for storage with larger latency times (lower cost). After being treated (cleaning, transformation, etc.), the data would be moved to a lower latency storage for use by the data analytics mechanisms. Thus, the institution can still choose two models to process its data stored in the cloud: using its own data analytics tools or using the tools offered as SaaS in the cloud.

12.4.3. Opportunity for subnational tax administrations

For many municipalities and provinces/states, it is almost impossible, in terms of cost and human resources, to assemble data centers with adequate physical facilities and management processes. In general, they use “server rooms,” limited by operational and security problems of restricted scope. Cloud service alternatives (IaaS, PaaS and / or SaaS) can be a solution to reduce investment costs, improve operability and obtain better services for tax management and taxpayers. Cloud service providers, such as Azure (Microsoft) and AWS (Amazon), offer configurable alternatives to meet the needs of small and medium-sized institutions.

In addition, tax administrations of countries with few ICT human resources or without investment capacity in quality computing centers should evaluate the feasibility of using cloud services.

12.5. Hardware and communications architecture

Most organizations, in the beginning, have structured their Data Processing Center based on an infrastructure already there, starting with the network infrastructure, the servers in the computer layer, storage resources and systems.¹³⁵ This configuration generally leads to encountering technological events that create risks such as:

- High dependence on hardware and software from specific vendors;
- The renewal of critical equipment is subject to the evolution imposed by the solution providers, impacting the speed of innovation of the equipment and the data center;
- The manual configuration of equipment and services, resulting in a high dependence on technical human resources and impacting the configuration and deployment cycles.

The enormous evolution of the Internet and communications services, combined with the immediate need to access data by internal and external users, has led to a revolution in the field of data center architecture; everything points to an important evolution taking place that impacts the way

in which the services are delivered. Cappuccio (2018) points out that by 2025 there is a possibility that 80% of companies will be closing their traditional data centers.

12.5.1. Cloud computing in a hardware and communications architecture

Cloud computing is a transversal technology that brings opportunities for corporate technology services with the possibility of drastically changing aspects that were traditionally supported with in-house infrastructure within corporate facilities. This technology has the potential to impact public administration in general.

Through this technology, storage, computational capacity and, as an option, software – externally provided and interconnected via the Internet – are shared. The management of the entire environment, including data security and the local framework, is the responsibility of the cloud provider. There are currently at least four cloud computing models: 1) Private cloud, with the infrastructure provided for use by a single organization; 2) Public cloud, with the infrastructure available for general use; 3) Community cloud, with the infrastructure provided for the exclusive use of a certain group of associated institutions; 4) Hybrid cloud, with the infrastructure made up by several types of cloud (public, private or community), linked by an in-house or proprietary technology.

These concepts are widely explained in the “Cloud computing” section of this chapter and it is recommended that it be considered when designing strategies related to the architecture of a data center.

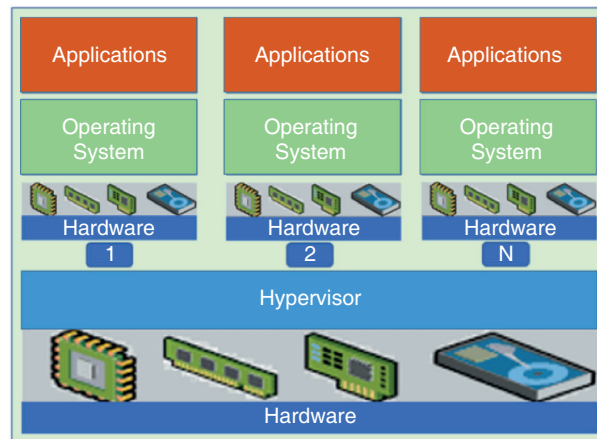
12.5.2. Virtualization

Virtualization allows you to create a virtual copy of a computing environment or a physical machine or device; it constitutes the central axis of the operation of the Cloud.

Through virtualization, the abstraction of physical resources such as hardware, software, memory or network components is achieved. The goal is to make these resources available on a virtual level to distribute them among the different clients in a flexible way, according to the needs of each one. This ensures the best use of ICT resources. (1&1 IONOS,2019a)

Virtualization with hypervisor

It is a virtualization method on the same system for several virtual machines. To implement it, the hypervisor (or virtual machine monitor) is used, which provides the intermediate layer or software environments that are identical to those of the original machine; it has full control over the resources available to the system.

Figure 12.5-1 Hypervisor based virtualization

Source: Prepared by the author based on functional images of the Web

Virtualization with container

Virtualization of the operating system is an alternative to hardware virtualization; whereby diverse server applications are implemented in isolated virtual environments (called containers) that work with the same operating system.

In contrast to conventional virtualization based on the so-called hypervisor (or virtual machine monitor), which distributes the system's hosting hardware proportionally among guest operating systems, virtualization with containers does not start any additional operating system. Instead, the shared operating system creates isolated models of itself, or virtual containers that create a full-time environment for the applications.

A software container, in its most basic conception, can be considered a server application. To install an application, the container is loaded onto the computer in a portable format or "image" that includes all of the data needed for its operation and one begins in a virtual environment in the computer.

Practically all operating systems support the installation of application containers. In Windows the software Virtuozzo is used; FreeBSD has the Jails virtualization environment and Linux supports virtualization containers in the OpenVZ and Linux LXC (Linux Containers) format. For the vast majority of users, the virtualization of operating systems begins to be feasible through platforms like Docker or rkt, as they add certain functions to this technology that facilitate the use of these containers.(1&1 IONOS,2019b)

According to 1&1 IONOS (2017) the most important platforms and best-known third-party projects that are developing open source tools for Docker include, among others, Docker Engine, Docker Hub, Docker Machine, Docker Swarm, Docker Compose, Docker Cloud, Kubernetes, etc.

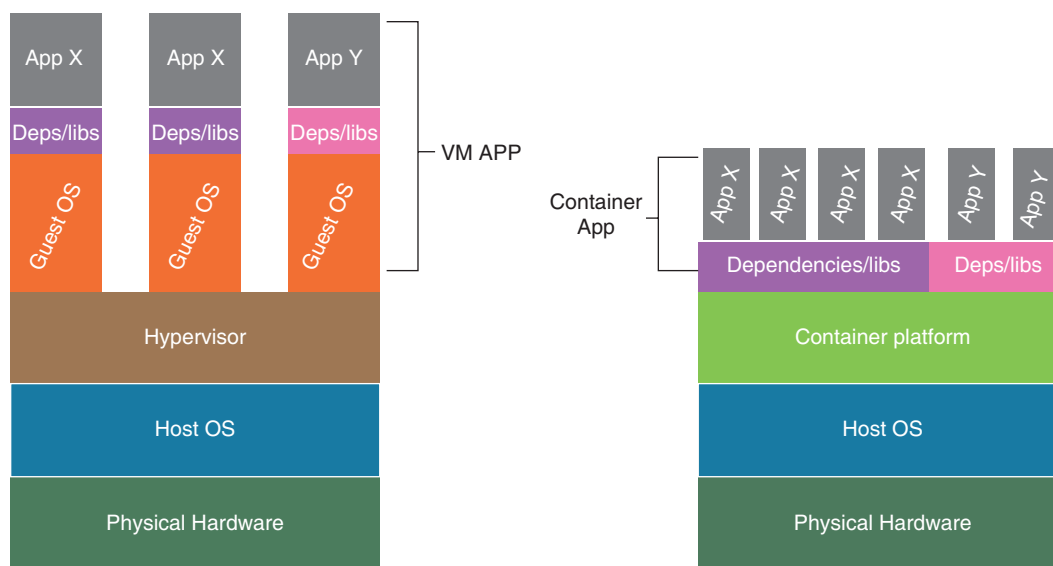
Containers versus virtualization: what is the difference?

Briefly put, in a container the main axis is the running of a single application. The more functions that are added to a container, the more convenient the use of a virtual machine becomes.

These technologies have their advantages and disadvantages, though both have the same objective, which is to isolate an application from other processes and applications in the host system, which have very different approaches.

- **Virtual machines.** As its name suggests, this approach is much more involved in the scope. It is based on a hypervisor (for example, KVM or XEN) that emulates a complete physical machine, assigns a desired amount of system memory or processor cores and other resources like disc storage, networks, PCI add-ons, among others. (Lanner, 2017)
- **Containers.** Containers essentially isolate an application from the host using different techniques, but they use the same core of host systems, with processes (for example, network stacks) to execute the applications or virtual network functions (VNFs).¹³⁶ The technologies have existed for a long time, though with different names, such as cages or sandboxes, for example. The technology has matured enough and has been introduced to production environments.

Figure 12.5-2 Comparison of a container architecture with that of a virtual machine running applications X and Y



Source: Contenedores y máquinas virtuales: ¿cuál es la diferencia. From "Contenedores vs virtualización: ¿cuál es superior?," by Lanner, 2017. Copyright 2017 by Lanner

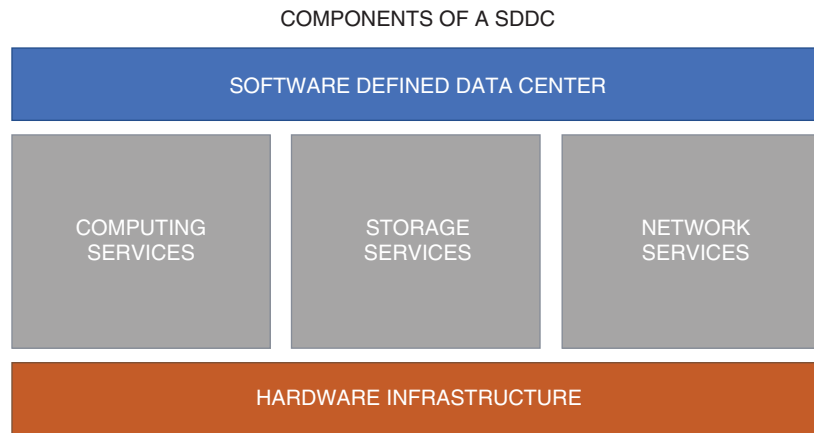
Software-defined Data Center

A software-defined Data Center is a space in which all infrastructure is fully virtualized and can be administered with software. This includes calculations, the network, storage and memory. The

so-called “virtual data center” is defined by software and is structured independently of the hardware. Infrastructure is presented as a service.

This software has all of the necessary requirements to provide comprehensive management of a data center, with all of its services based on automation and minimal manual intervention. The main features of a Software-defined Data Center are standardization, uniformity, adaptation, automation, and resistance.

Figure 12.5-3 Structure of a mode Software-defined Data Center and its components



Source: Software-defined Data Center Components. Adapted from “Software defined datacenter: uma proposta de entrega ágil para os serviços de negócio,” by L. da Silveira Webster, 2017.

Challenges and evolution of software-defined data centers

Software-defined Data Centers (SDDC) have had a major impact on the evolution of their components, both in terms of power and new functionalities, but their integration among each other or with applications that give life to the tax systems has not evolved at the same pace.

The rise of cloud-based services and technological capacities that make infrastructure as a service (IaaS) possible offers a great chance to offer new resources quickly. For example, pushing a button to access a new server or even elastically, using microservices in containers that can access resources dynamically to attend to external or internal requests as needed.

While the providers of cloud-based services and new technologies can offer that level of agility, a limiting factor for tax administrations is often of the regulatory type, preventing or hindering the use of public clouds, including in hybrid cloud frameworks, making it necessary to foresee paradigm shifts in ICT management.

In terms of administration, one of the big challenges is to break the silo mentality, which often has an impact on the lack of agility and the mistakes that can be made when working with incomplete or outdated information. In systems, this is often translated into projects with solutions that overlap or are not properly integrated with each other, different administrative domains, challenges integrating different technologies and long production times due to complex configurations.¹³⁷

In addition, the silo logic can have a major impact on both operating expenses (OPEX) as well as capital expenditures (CAPEX), related to the challenges of making investments that often do not properly communicate with each other. Needless to say, this can also have an impact on the total cost of ownership.¹³⁸

One methodological perspective is to adopt methodologies and tools in the DevOps world, as well as in NetOps 2.0, DevSecOps. One way to expedite the adoption of these two methodologies is to move toward technologies that are aligned with these strategies. Some options to consider are:

- **Software-defined Networking (SDN) Technologies.** One example is Cisco Application Centric Infrastructure (ACI), which combines the underlay and overlay design through specialized switches to operate under the orchestration and automation of the solution's APIC Cluster. In that way integrating with the physical and virtual infrastructure with the purpose of simplifying the network's operation and administration while providing application-focused network services; also, offering a holistic approach to the agile deployment of new applications, unifying the policies governing communications by applications or microservices in a data center into a single management tool (APIC Cluster), or even integrating with public clouds to extend local policies to cloud-based services. Another option for Software-defined Networking (SDN), though with a different approach from Cisco's, is the VMware NSX option, which depends on an existing underlay (that is, there must be an existing networking infrastructure) on which to fully virtualize the network's overlay functions in the hypervisors. There are two different versions of NSX, NSX-V and NSX-T, where version -V is oriented toward the vSphere hypervisor and version -T toward other hypervisors like SXi, KVM, bare-metal servers, Kubernetes, OpenShift, AWS, Azure and also vSphere. The difference is that NSX-V is currently more advanced in terms of functionalities than NSX-T is.
- **Hyperconverged technologies.** Hyperconverged infrastructure (HCI) is software-defined infrastructure that virtualizes all elements of conventional "hardware-defined" systems. At a minimum, HCI includes virtualization (a hypervisor), a virtualized storage area network (SAN, software-defined storage) and virtualized networks (software-defined networking). One of the advantages of hyperconverged technology is that it simplifies things considerably and acts to reduce the silos where there are different devices in different "silos" and thus achieve the same functionality as hyperconverged architecture. There are several hyperconvergence solutions available on the market, among which is one of the precursors of Nutanix,¹³⁹ which is a software-based solution that can run on proprietary hardware or third-party solutions that use the Nutanix technology. Another option is vSAN by VMware.¹⁴⁰

Container platform

From the container perspective, downloading images from Docker Hub and running them on a host operating system, for example, could be considered relatively trivial. However, when hundreds or thousands of applications need to be run and each of them orchestrated so that, when loading in a given moment, more instances are created to support incoming requests with a reasonable

response time for the user, then one must begin to consider tools that automate several of the processes required for all of this to take place naturally and transparently for users.

If one adds to the above the need for log centralization, integration and ongoing deployment of applications, monitoring of applications and the operations cluster, then we are talking about the essential features that any PaaS (Platform as a Service) should have.

According to the organization Chakray (2019), the advantages of using microservices as a fundamental part of the systems architecture include gaining the following properties:

- Minimum equipment required for each microservice.
- Scalability: just the component that requires it is easily replicable to bear the load.
- Modular functionality; independent modules, separation of interests.
- Use of containers, allowing quick deployment and development of the application.

The Paraguayan Tax Administration has adopted the Red Hat OpenShift Container Platform as a platform-as-a-service solution in an electronic invoicing project to achieve the rapid deployment of applications in containers and to engage in quick software product testing.

This project by the National Integrated Electronic Invoicing System has adopted agile practices and methodologies for software development, DevOps, and also an architecture based on microservices, where the resulting artifacts are deployed in the OpenShift Container Platform. Each of the approximately 12 current modules have its own independent life cycle.

Following software development best practice, each module has its own Git-based open source version control repository. One of the features of Git, aside from controlling the code version, is the possibility of separating the code into several “branches”. This functionality allows separating the unstable code from the stable code, productivity tests and specific hotfix functionalities. In short, to arbitrarily create a source code version governance policy.

While the functionality allows developing arbitrary governance policies, in recent years a policy published by Driessen (2010), called Gitflow, has become quite popular. It basically defines two main branches: develop and master, in addition to secondary ancillary branches: features branches, release branches and hotfix branches. It then defines a series of rules to determine when the code must belong to each branch. The main rules are that after testing, the semi-stable code should go to the “develop” branch and the productive stable code should go to the “master” branch.

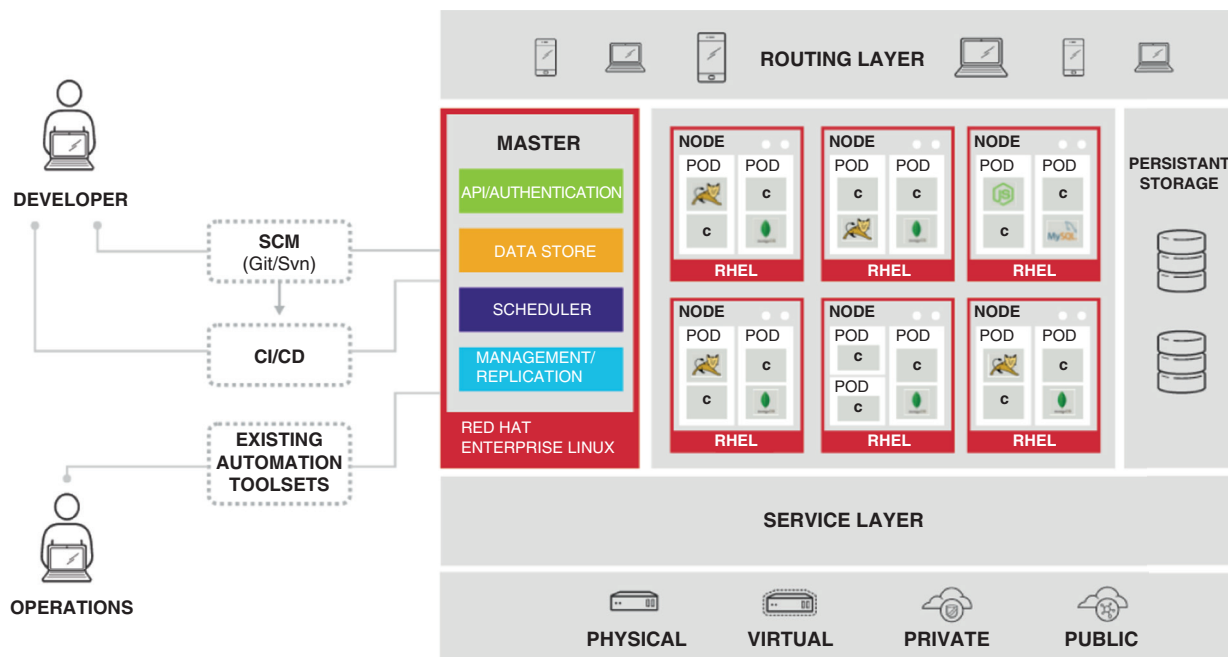
This policy has been implemented in Paraguay’s National Integrated Electronic Invoicing System (SIFEN) along with triggers that run compilation, packaging and deployment tasks when new code is loaded into the main “develop” and “master” branches. The triggers were configured in Red Hat OpenShift Container Platform for automatic deployment in the corresponding environments. This

allows source code development, testing, and final move to production phase to be sped up, resulting in a more stable, secure and reliable code.

In addition to the triggers, initially automatic scaling policies were configured and deployed on the cloud using equipment with the Nutanix hyperconverged architecture referred to above, defining a minimum of three instances per module at a given moment, for example, if the instance load surpasses an average of over 80% of the central processing unit assigned to each instance, automatically creating a new instance that is a replica of the previous ones based on the same application container image. In contrast, if the load falls to less than 80%, once again as an average of all instances, then automatically as many instances as necessary are eliminated until the load is balanced again. The maximum number of possible instances created is 10 and each instance is assigned one core from the central processing unit, thus resulting in a maximum of 10 cores used.

In this type of deployment, it is vital to have tools with support and technical experience with certified supplier technicians.

Figure 12.5-4 PaaS with OpenShift in private infrastructure



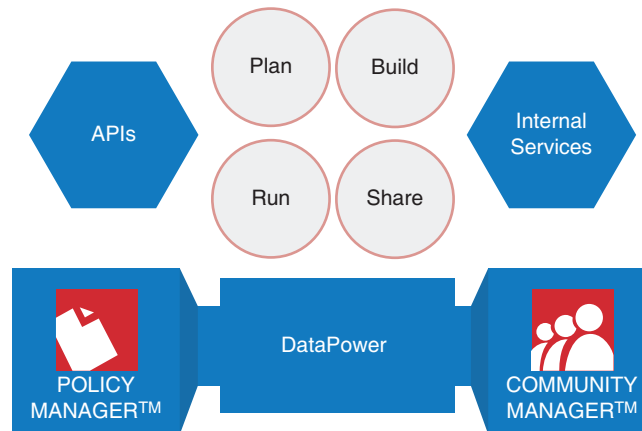
Source: OpenShift Enterprise 3. From "OpenShift Enterprise 3: la estrella de los PaaS (1/2)," by A. Rodríguez, 2016, February 22. www.paradigmadigital.com/

Access to applications and services

As an alternative, IBM Datapower¹⁴¹ is a tool that several tax administrations have adopted (Mexico, for example) as part of their critical infrastructure and main support for processes related to electronic invoicing.¹⁴²

It consists in a single multichannel gateway platform that protects, integrates, controls and optimizes the distribution of workloads in multiple channels, including: mobile, API (Application Programming Interface), web, SOA, B2B and cloud. It allows one to have a single point of entry to protect and use consistent security policies in business channels, cutting operating costs and improving security while helping to reduce product launch times, improve productivity, scale experience and to cut total cost of ownership.

Figure 12.5-5 An integration model for API with Datapower



Source: IBM DataPower. From "Solutions for api integration: Your seamless API integration platform," by Akana, 2020. Copyright 2020 by Perforce Software, Inc.

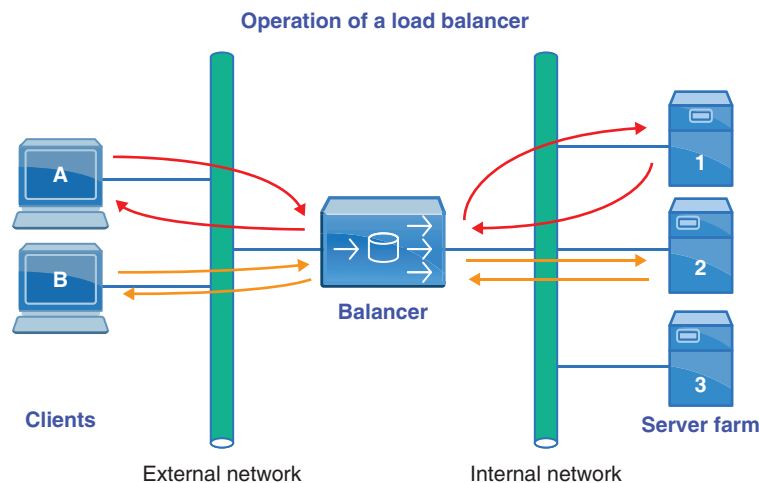
Network administration

Tax administrations propose applications that demand high levels of availability and security. When administering web applications for public use, they are exposed to a significant number of cybersecurity threats. These threats may consist in attacks to steal information from the platform or to render it unavailable, which can have a significant impact on a country's economy.

It is indispensable to have equipment with modular and high-performance features that allow scalable growth over time, providing a series of services, consolidating devices and saving on the management, energy, space and air conditioning required for the data center.

BIG-IP hardware and VIPRION chassis are technologies that improve performance and scalability through the downloading of tasks in intensive processor use, such as SSL processing¹⁴³ and DDoS mitigation.¹⁴⁴ These chassis have high-performance modular blades that can be added or removed without interrupting applications or users' work.

The BIG-IP platform is an intelligent evolution of application delivery controller (ADC) technology. The solutions built on this platform are load balancers. They are also complete proxies that provide visibility to all traffic through their network, as well as the capacity to control it (through inspection and encryption or decryption). (Grupo Radical, 2019)

Figure 12.5-6 F5 traffic load balancer

Source: Operation of a load balancer. Adapted from "Balanceador de Tráfico F5. Principio de la Granja," by Netquarks Webmaster, 2019, February 27. Copyright 2019 by Netquarks Technologies.

12.5.3. The constant challenge of growth in storage capacities

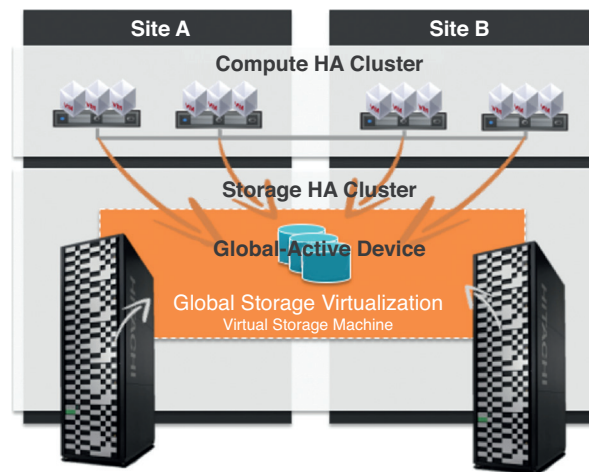
The constant and sustained growth of digital capacities is always a major challenge. The digitalization of products and processes helps eliminate paper-based processes and improves taxpayers' access to services.

There is a need to change the approach to storage as a way to support digitization needs and to obtain more value from the data. Enterprise block storage (EBS) remains an aspect to be considered: it has scalability capacities and availability to add value to data. Taxpayers must be able to access online documents and applications to comply with the policy of never eliminating critical data, which means that the capacity requirements are constantly increasing.

Availability is another key consideration, as digital services depend on real-time access to data. The technology areas of tax administrations have the permanent need to replicate data between two sites; the growing volume of data and the distance between data centers adds significant complexity to the process.

The ICT managers of tax administrations need to eliminate the risk of any downtime of critical applications, not just due to unexpected interruptions, but also with planned system maintenance. Implementing a solution with active-active controllers and replication significantly improves data protection and recovery capacities.

When it comes to considering implementation of data storage, it is indispensable to consider high-end types of storage and the broad range of products of this type offered by storage providers, such as Fujitsu, Hitachi, IBM, HP, DELL, Netapp and Pure Storage, among others.

Figure 12.5-7 Hitachi Global Active Device replication technology

©Hitachi Data Systems Corporation 2015. All rights reserved.

Source: What is a Global Active Device. From "GAD for dummies," by Ncora, 2018, January 11.
Copyright 2015 by Hitachi Data Systems Corporation.

12.5.4. A tax administration's experience

As can be seen in the development of this chapter, capacity, flexibility, and cost optimization are the keys to a modern and efficient tax administration hardware and software architecture. The following is an example of hardware and software architecture following these principles in a tax administration of an upper-middle-income country,¹⁴⁵ Paraguay.

In 2018 the Paraguayan Tax Administration implemented the technological upgrade of its Tax Management System, called Marangatu 2.0, accompanying the project of a new version of its Management System, undertaking the project of the National Integrated Electronic Invoicing System (SIFEN) and subsequently renaming it e-kuatia, with the first electronic invoices issued in the context of a pilot plan in November 2018.

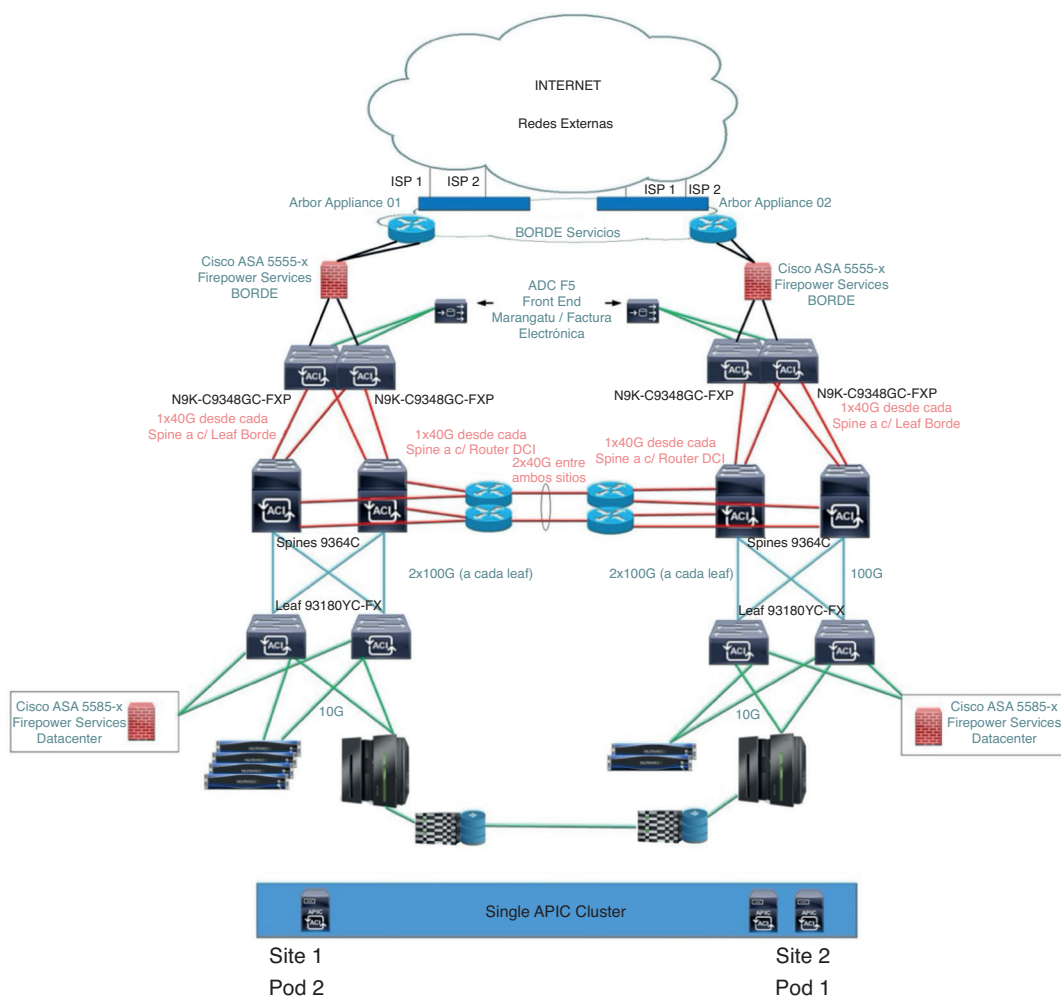
To accompany these two major challenges in the area of software, there was a need to undertake a series of infrastructure restructuring measures and readjustment of the hardware, where the following stands out:

- Reengineering of its critical data network, incorporating Cisco Application Centric Infrastructure (ACI) as the communications solution for its main and secondary data centers.
- Incorporation of hyperconverged technology (Nutanix) for critical services infrastructure.
- Incursion into new technologies based on the Red Hat Openshift Container Platform (OCP), incorporating this new paradigm into the electronic invoicing project.
- Incorporation of IBM Datapower, reinforcing security in XML messaging-based services, thanks to the structural validation capacities in compliance with the standards of the World Wide Web Consortium (W3C). In addition, with the support of firewall and administrative

capacities on the services level that this device provides, security and resource control policies were defined to guarantee the stability and resilience of services and exposed to third parties.

- Incorporation of F5 networks, applying them in two dimensions: web applications firewall and load balancer. The load balancing module¹⁴⁶ has replaced the Apache server's infrastructure,¹⁴⁷ allowing applications to be delivered in a reliable, secure and optimized way, simplifying and automating things in a more agile and predictable way. The web applications filter module¹⁴⁸ allows one to secure the applications delivered from attacks on the application layer level, such as SQL injection and XSS (cross site scripting) attacks, among others.
- Servers from the high-end IBM line, in this case Power 8, were implemented for the Database infrastructure. The high-end Hitachi line has been implemented for storage.

Figure 12.5-8 General architecture of the network and critical equipment of the Paraguayan Tax Administration



Source: Prepared by the author

Notes

116. A transaction represents an atomic unit of work. All modifications are made within a transaction, or none of the changes are made.
117. For more information, see: [https://en.wikipedia.org/wiki/DMZ_\(computing\)](https://en.wikipedia.org/wiki/DMZ_(computing))
118. For more information, see: https://en.wikipedia.org/wiki/Transport_Layer_Security
119. For more information, see: https://en.wikipedia.org/wiki/Public_key_infrastructure
120. For more information, see: https://en.wikipedia.org/wiki/Virtual_private_network
121. For information on the framework proposed by the Data Management Association (DAMA) for best practices in data management see: <https://dama.org/sites/default/files/download/DAMA-DMBOK2-Framework-V2-20140317-FINAL.pdf>
122. For more information, see: <https://www.ibm.com/developerworks/ssa/data/library/techarticle/gobierno-datos/>
123. For more information, see: <https://www.cmmi.institute.com/data-management-maturity>
124. For more information, see: <https://edmcouncil.org/page/AboutDCAM-3?&hhsearchterms=%22data+and+management+and+capability+and+assessment+and+model%22>
125. For more information, see: <https://www.gartner.com/en/documents/3236418/gartner-s-enterprise-information-management-maturity-model>
126. This text uses information contained in (Seco & Muñoz, 2018, p. 65-69)
127. The tax administrations of CIAT member countries devote a percentage of current expenses of 6.35% to ICTs and capital expenditures reach 70%. In high-income countries, ICTs cover 10% and 73%, respectively (ISORA, 2017).
128. For more information, see: <https://azure.microsoft.com/en-us/>
129. A broader analysis of the use of cloud computing in the fiscal area can be found in (Seco, 2018b).
130. In theory, it is unknown where the equipment that implements a cloud is located.
131. For more information, see: <http://www.serpro.gov.br/menu/nosso-portfolio/por-linha-de-negocio-1/servicos-em-nuvem>
132. A note on this topic can be read in the Reform Newspaper of January 2, 2018, available at: <https://tinyurl.com/ybxx9nby>
133. The first cloud policy in the United States and the United Kingdom dictates that government institutions must first consider the use of cloud ICT services.
134. SaaS is the supply of applications over the Internet in subscription format, unlike the software that is paid for and must be downloaded. SaaS applications run on the remote servers of the provider. That is why SaaS is also known as “web-based software” or “software on demand.”
135. For more information, see: <http://www.dii.uchile.cl/ris/articulos/Vol16/03.pdf>
136. Virtual network functions (VNF) are virtualized tasks previously carried out with exclusive and dedicated hardware. VNFs move tasks from dedicated hardware devices (*appliances*) to software that runs on basic hardware. These tasks include firewalls, the domain name system (DNS), cache storage or network address translation (NAT) and can be run as virtual machines (VM).
137. For more information, see: https://devops.com/devops-the-ultimate-way-to-break-down-silos/#disqus_thread
138. For more information, see: <https://gblogs.cisco.com/ca/2018/09/10/capex-vs-opex-whats-the-difference/>
139. For more information, see: <https://www.nutanix.com/hyperconverged-infrastructure>
140. For more information, see: <https://www.vmware.com/content/dam/digitalmarketing/vmware/en/pdf/products/vsan/vmware-vsan-datasheet.pdf>

141. For more information, see: <https://www.ibm.com/co-es/products/datapower-gateway>
142. For more information, see: <http://www.ibm.com/developerworks/ssa/websphere/factura-electronica/>
143. SSL (Secure Sockets Layer) is the standard security technology for establishing an encrypted link between a web server and a web browser.
144. Distributed Denial of Service - a common type of attack against networked computers.
145. Work Bank classification
146. For more information, see: <https://www.f5.com/pdf/products/big-ip-local-traffic-manager-ds.pdf>
147. For more information, see: <https://www.f5.com/content/dam/f5/corp/global/pdf/deployment-guides/apache-dg.pdf>
148. For more information, see: <https://www.f5.com/pdf/products/big-ip-application-security-manager-overview.pdf>

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13.

MANAGING ICT SOLUTIONS AND INFRASTRUCTURE

13.1. Introduction

Information and communication technology (ICT) is one of the pillars that support the activities of tax administrations. Regardless of internal (in-house) or external (contracted) operations, ICT needs to be managed. Currently, the efficiency of tax administrations is strongly associated with the adequate use of ICT and the quality of ICT services. It is not possible to get total efficiency and effectiveness of the tax administration without ICT management.

The objective of this chapter is to provide staff responsible for the management of tax administration units (and ICT managers) with information in order to implement systematized ICT management using Information Technology Service Management (ITSM). The intention is to: encourage the deployment of ICT management that are best practices and in use in thousands of organizations; have been effectively tested; and, can be deployed according to the size and maturity of the organization. In addition, it is valuable that management enable more productive dialogue between the organization and the ICT unit or, where appropriate, with external providers.

In this chapter, the chosen approach for ICT management is the use of the ITIL (Information Technology Infrastructure Library) framework. It is among the most used framework in the world (Axelos, 2020). There are, however, several other equally well-structured and widely used frameworks – COBIT (Control Objectives for Information and related Technologies), ISO 20000, MOF (Microsoft Operations Framework), eTOM (Enhanced Telecom Operations Map), ITUP (IBM® Tivoli® Unified Process), FitSM, DevOps, SIAM, VeriSM etc. All are of proven quality and have similarities and differences.

The use of a real framework - ITIL - facilitates exposure on ICT management models. In an organization, selecting a framework depends on evaluating many variables. The choice to use ITIL as a reference is only circumstantial and a way of avoiding a theoretical approach. Implementing the framework is much more complex than selecting the model or supporting tools.

Secondly, the chapter could be motivational for ICT professionals who are - or will be - involved in the deployment of ICT management. However, the text does not claim to teach details about management frameworks. Technical material about ITIL, for example, is very broad. There is extensive material for professional certifications and implementation guidance on many websites.

ICT is managed in some way because such a complex activity cannot stand without coordination, control and financial management. However, if ICT uses a custom management solution, it is impossible to achieve some benefits such as: comparing with similar organizations, using ready-made support tools, and hiring trained and certified personnel in the custom solution. A widely used ICT management solution, such as ITIL, offers these benefits and can be customized and implemented to meet the needs of the organization.

Given the high importance of ICT for tax administrations, covering effectiveness, efficiency and security, it is recommended that ICT be managed according to an internationally recognized framework. Especially in the field of knowledge compartmentalization, classification and structuring, which lead to more easily recognizable patterns and guide human behavior.

On the other hand, rationality is not always the most powerful engine in the conduct of human actions. Often short-term sensations, over-optimism, exaggerated fears, biases of cognition, among other factors, lead to the intense use of intuition in the decision-making process.

The two characteristics - the structuring of knowledge and intuitive decisions - are inevitably present in ICT management. In addition, the ability to plan, adapt, collaborate and share narratives (even if they are fictional) characterize humanity. All these capabilities make the difference between humans and other living beings.

This outline is a very simplified model of the overall human life scenario, which, despite simplification, can help the understanding of ICT management. ICT management does not have to be intuitive. There are experiences developed over the years of application - with good practices, systematization of knowledge, processes and support tools - that make it possible, at very low costs, to achieve positive results.

Regardless of the degree of maturity of an organization, it is always advantageous to employ widely used standards. Deployment can be gradual and whatever is most appropriate for the organization. [Table 13.1-1](#) shows 15 questions that may be useful for analyzing an organization's ICT management context, challenges and needs.

Table 13.1-1 Questions about ICT systems management

Question	Yes	No
Is ICT aligned with the organization's strategic guidelines?		
Has ICT supported the organization in achieving the goals?		
Has ICT been essential to the organization's success?		
Has ICT been prepared for the organization's future needs?		
Has ICT responded satisfactorily to the changing needs of the organization and within appropriate time frames?		
Are ICT procedures clear and interactions with the organization work well?		
Are roles and responsibilities well defined?		

(continued)

Table 13.1-1 Questions about ICT systems management (*continued*)

Question	Yes	No
Has the good performance achieved by ICT been sustained?		
Has ICT learned from the mistakes it has made and has it taken steps to avoid a repetition of mistakes?		
Are ICT costs compatible with the reality of the organization?		
Have ICT investments delivered the expected return?		
Has ICT been effectively and productively managed?		
Do ICT and the organization “speak” the same language?		
Does ICT management require that the entire organization be involved in purely technical (ICT) issues and should be addressed by specialists?		
Is ICT dependency and the risks to the organization under control?		

Source: Prepared by the author

In organizations that do not yet use ICT management systematically, the questions can help in deciding the need and convenience of deployment. If 8 or more questions evidence a need of improvement, then it is very important to deploy a systematic ICT management. In organizations that already use ICT management systematically, questions can assist in evaluating deployment results.

The widely used ICT management frameworks mentioned previously, such as ITIL, are very well structured and independent of the managed technologies. Thousands of implementations enhanced those frameworks. In addition, they have commercial and open-source software support, the ability to count on specialized and certified professionals, easy comparisons with other organizations, and access to a large number of technical texts and training material.

For example, ITIL and COBIT are positioned among the best known and most used ITSM. ITIL and COBIT, like other frameworks, are not mutually exclusive. ITIL is recommended to focus on managing basic technical infrastructure and services, while COBIT is recommended structured to address focus on governance of information use (Scott, 2017). The difference is in focus. Both systems cover most elements of ICT process management (Andenmatten, 2019).

It is very important not to overlook the fundamentals of ICT service delivery: AVAILABILITY (percentage of time in which ICT services are ready to use) and UTILITY (benefits of using ICT to achieve an organization’s results). ICT management frameworks sometimes disturb the fundamentals and deployment becomes the challenge to be met.

ITIL is well built. Its components are harmonically integrated. Still, each one of them also offers flexibility to meet the specific needs of an organization, especially for gradual deployment. It is possible to tailor the modules and adjust the speed of deployment to the needs and conveniences of each organization.

Depending on the capabilities that differentiate humanity, a good management framework is also a form of narrative. A complete narrative has no gaps, its parts complement each other, and events

flow harmoniously. It has a structure that makes sense to people. A good management framework also helps collaboration between all those involved.

The tax activities depend on the treatment of information (collection, processing of tax returns, audit, inspection, etc.). It is not just about hiring the best resources and services on the market. It is, in fact, to seek the appropriate solutions, to implement them and to manage the operation – ICT included – in order to obtain the best results.

13.2. Management of information technology services

All types of services - including ICT services - can be operated, evaluated and managed according to two factors.

The first factor is AVAILABILITY, the amount of time a service is ready to be used. This factor covers the resources required for the provision of that service (such as equipment, software, environmental facilities, technical infrastructure, etc.).

The second factor is UTILITY, which is related to the ease of use and the results that the service provides. In general, UTILITY is associated with adding value to today's digital organizations.

AVAILABILITY is an objective measure that can be accurately defined and based on automated measurements. UTILITY counts on subjective characteristics, especially as the benchmark to be applied in evaluations can be adapted to specific contexts and goals.

Without claiming to be complete and accurate about the concepts, it seems reasonable to accept that in ICT management, AVAILABILITY is treated within the scope of technical infrastructure and operations, while UTILITY is directly related to information systems. The proposed separation is not indisputable, because there are many situations in which the classification would not be appropriate.

13.3. Availability

What is the percentage of time the service should be available to be used? ICT resources can suffer from “system failures, natural disasters or malicious attacks” (Gartner, 2019). These occurrences can produce downtime in services provided to customers.

Answering the above question, the usual goal is 100%. A service must be available for as long as it is intended to be used. It is not enough to have that will or good intention. To reach a value closer to that, it is necessary to use fault-tolerant solutions, high performance features, sophisticated monitoring systems, effective operational procedures, etc., and high-quality management.

There is, on the other hand, the consideration for costs. The increase in the percentage of availability of a service requires a corresponding increase in costs. As the availability target approaches

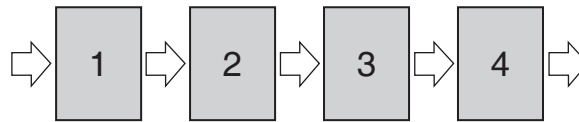
100%, cost growth becomes much more pronounced, and each step of gain in availability can imply many steps to increase costs.

No matter how much the costs increase, the goal of 100% availability is unattainable. This limitation is a real-life imposition. Initially availability is a measure of the likelihood that a service will be in a position to use. If service provision is based on a set of four serially interconnected components (*Figure 13.3-1*), the service will only be available for use when all components are functioning correctly at the same time.

At the component level, it is typical to call RELIABILITY the percentage of time in which the component is expected to function correctly. RELIABILITY is the probability that the component works correctly. The service will only be in good condition when all - and each - components are functioning properly. If at least one component is not working properly, the service is unavailable.

Thus, there is a case of composite probability, that is, the probability of the service being in a condition of use (service availability expectancy) is directly dependent on the probability that each of the components simultaneously works correctly.

Figure 13.3-1 Simple arrangement of 4 components



Source: Prepared by the author

According to the probability theory, the probability of the service being available is given by the product of the probabilities of each component functioning correctly (intersection of events). It is a case of independent events, when the occurrence of one of them does not interfere in the occurrence of any other.

Considering a service that works according to the model of *Figure 13.3-1*, if the components have the expectations of availability (or reliability) given below:

$$P_1 = 0.992 \text{ (99.2\%)}$$

$$P_2 = 0.989 \text{ (98.9\%)}$$

$$P_3 = 0.975 \text{ (97.5\%)}$$

$$P_4 = 0.995 \text{ (99.5\%)}$$

The expected availability of the service (AV_{serv}) will be given by the product of the reliability (or availability) of the components that make up the arrangement:

$$AV_{serv} = P_1 \times P_2 \times P_3 \times P_4$$

$$AV_{serv} = 0.992 \times 0.989 \times 0.975 \times 0.995$$

$$AV_{serv} = 0.952 \text{ (95.2\%)}$$

Using the above example as a reference, it is useful to make some comments:

1. The availability of the service will always be less than the lowest value of reliability of the components, as the result is product of values ranging from 0 to 1 - in the example the expectation of service availability is 95.2%, while the lowest component reliability is 97.5%;
2. Assuming the need for full-time operation (24 hours), if each component had reliability of 99.9% - which corresponds to the interruption of 44 minutes in a 30-day month - the expectation of service availability will be 99.6% (almost 3 hours of interruption per month);
3. Full-time operation (24 hours per day, 7 days per week) has been considered, but the reasoning can be applied to services that have other hours of operation.

For modeling a typical service, it is reasonable to consider the need to build arrangement with dozens of components. The product resulting from the multiplication between components reliabilities will be reduced as the number of components is increased.

In a service whose arrangement is made up of 20 components and if each component has 99.99% reliability (that is, it expects to interrupt 4.3 minutes in a 30-day month), the expectation of service availability will be 99.8% (corresponding to almost 2 hours per month).

There are two situations that may occur in the service or component life cycle. The first is the UPTIME (T_1), when the service or component is in correct use conditions. The second is the DOWNTIME (T_2), when the service or component is not in correct use conditions. It is ideal that the time T_2 equals 0 or a value close to 0.

The availability of a service or the reliability of a component is given by the relation:

$$AV = T_1 / (T_1 + T_2)$$

If T_2 tends to 0, availability will tend to 1 (or 100%).

In another approach, with a statistical nature, the mean value of times T_1 is called MTBF (Mean Time Between Failures) and the mean value of times T_2 is called Mean Time To Recovery (MTTR) for a service or to a component (equipment, communication circuit etc.).

There are many ways available to reduce the value of T_2 , almost always with increased costs. One of the goals of good management is to select the most efficient ways to help reduce the value of T_2 and

not to be costly. Failure time (T_2) consists essentially of three plots: (1) time to perceive the fault; (2) time to identify and locate the fault; and, (3) time to contour or to correct the fault.

There are general actions for the reduction of T_2 , such as the selection of equipment and services of high reliability and having a good performance history, use of redundant solutions (“fault tolerant solutions”), training of technical personnel etc.

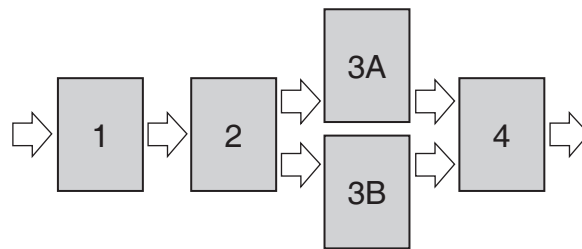
Specifically, applicable to item 1, above, for T_2 reduction, there are the monitoring capabilities. These features make it possible to perceive the occurrence of the failure before users have to make triggers and requests.

In conjunction with the monitoring capabilities, a reliable record of the assets and settings is indispensable for reducing the portion of the failure time presented in item 2. The adequate configuration management is very important and has been treated as a specialized area of management.

Finally, the reduction of the time described in item 3 can be made using alternative solutions (replacement equipment, for example), which can be triggered automatically or via specific action.

Figure 13.3-2 presents a simple model of arrangement for service delivery. The example considered that component 3 had a reliability of 97.5%, the lowest of the arrangement. If component 3, after technical analysis and cost evaluation, is replaced by a set of two components (3A and 3B), as shown in *Figure 13.3-2*, which functions in parallel and independent of each other.

Figure 13.3-2 Simple arrangement of 3 components plus 1 fault-tolerant



Source: Prepared by the author

In this form of operation, the reliability of “component 3” is given by the equation:

$$P_3 = P_{3A} + P_{3B} - (P_{3A} \times P_{3B})$$

According to the probability theory (union of events), if P_{3A} and P_{3B} have a value of 97.5%, the composition of set 3A and 3B in *Figure 13.3-2* would be given by:

$$P_3 = 0.975 + 0.975 - 0.975 \times 0.975$$

$$P_3 = 0.9999 \text{ (99.94\%)}$$

The reliability of the “3A + 3B” arrangement (*Figure 13.3-2*) becomes 99.94%, despite the reliability of each component (3A and 3B) being the same as that of component 3 used in the example associated with *Figure 13.3-1*. There is a gain in the availability of the service, which is now provided with the “1 + 2 + 3A + 4” arrangement and the “1 + 2 + 3B + 4” arrangement, plus gains in workload balance and performance of the service.

Usually, ICT services are used both inside the organization and offered directly to customers and partners of the organization. Any failure that causes disruption in the proper use of the services is detrimental to the organization. Damage ranges from loss of revenue to loss to reputation and image, besides the risk of other forms of penalties (fines, contract reductions, operational inefficiency etc.). It is not easy to calculate the losses produced by a failure, but certainly they are not negligible.

If a service is not useful to support the results and objectives of the organization, the service should not exist. If a service must exist, its UTILITY needs to be managed. If a service is useful to the organization, its AVAILABILITY must be managed. The service needs to be in correct use condition according to the behavior that was designed.

13.4. Utility

In an organization, ICT is useful when the organization knows the goals and results to achieve and knows the starting position it is in. The essence of the organization's strategy is an arrangement made up of: (a) the current situation; (b) the desired situation; and, (c) the path that can lead from the current situation to the desired situation.

If the organization does not have a clear direction and a clear strategy, any technology can be good or bad. Any technology, in this case, can be beneficial, harmless or harmful, but it always represents an additional cost. In the specific case of ICT, it can only provide the organization with the translation of the organization's processes into an information system.

If the organization has no well-defined strategy and well-defined processes, ICT will not be useful. An organization, however, is more than its strategy and its processes. Organizations are deeply dependent on the people and resources that support the operation.

If the organization has a well-defined strategy and well-defined processes, ICT can be useful, especially if ICT is well managed. In this case, there will be a greater probability of success, mitigation of risks and better expectation of sustainability of the good results that are achieved. Expenses - high with ICT - can produce valuable results for the organization. There will be a common language between organizational units, which will enable greater collaboration between people. Organizational processes can flow more efficiently.

A management framework, such as ITIL, includes mechanisms that also help organizations take care of strategy and processes. There are, of course, much stronger and more comprehensive approaches to strategy and process management. In ITIL, specifically, there is a strong dependence on the organization's strategy. There is no way to fully implement ITIL in an organization without

a strategy. It is even possible to initially implement some good ITIL practices while the strategy is formalized, but the absence of the strategy will impose an insurmountable constraint in the future.

The synthesis of these notes is simple: ICT can only be useful if the organization knows where it wants to go. ICT must collaborate to produce value-adding results.

Governance is mandatory for ICT, with elements to avoid repetition of errors, to sustain good results, to evolve continuously, to operate to be much more than a unit of costs.

13.5. Information Technology Infrastructure Library

Examined only from an ICT perspective, practices guide how to work and make it possible to avoid known bugs. ITIL incorporates the knowledge and experience derived from the use in thousands of organizations, on all continents, and its results can be measured. So, it is possible to build a sequence of continuous and gradual improvement, adequate to the need and the maturity of the organization, and to follow the implementation of the practices.

ITIL presents best practices applicable to any type of organization and any type of technology. The use of ITIL does not require any form of licensing or remuneration for use of the license. However, this may be required when the organization uses a commercial software that implements ITIL (there is, however, a wide range of open-source software) and external advisory services. ITIL is an effective resource to support organizational gains with ICT UTILITY and AVAILABILITY.

ISO (International Organization for Standardization) has a standard, called ISO 20000, which deals with the management of ICT services. This standard and ITIL have many similarities, but there are also differences. In terms of certification, ITIL only establishes the possibility of professional certification. The standard ISO 20000, as is usual in the standards of that institution, can be certified at the level of organizations.

ITIL professional certification facilitates the hiring of properly trained specialists whose knowledge has been evaluated according to different levels of expertise. Certification is currently available in approximately 150 countries. In the 1980s the UK government developed recommendations to guide organizations, government and the private sector in implementing ICT management. This was the origin of ITIL.

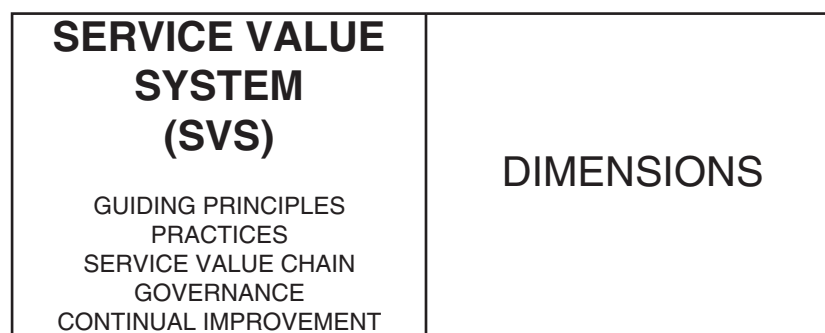
Initially, ITIL was a collection of books, in which each book presented specifically the management practice related to an ICT discipline. The recommendations gave rise to ITIL, which is currently in version 4, as the update published in February / 2019 (ITIL Foundation). Since 2013, ITIL is owned by AXELOS, a company that has the UK government as stakeholder. AXELOS takes care of the licensing of the use of ITIL intellectual rights (training, manuals, etc.), authorization of the institutions that take care of the professional certifications and update of the framework.

All the references cited in this chapter refer to ITIL Version 4 (or, henceforth, ITIL 4). References regarding previous versions are expressly stated.

In ITIL Version 1 the number of books reached a total of more than thirty volumes. In ITIL Version 2, the publications were reorganized and consolidated into nine sets, covering management, systems and services, with emphasis on the services segment. ITIL Version 3 was reorganized focusing on the ICT service life cycle concept, with a grouping of 26 processes and functions into 5 volumes. This is the most widely used version today and professional certifications have this version as the most updated.

ITIL 4 introduces some new concepts and refines well-established concepts. This latest version focuses on the digitization of services and the new forms of work of the so-called Fourth Industrial Revolution.

Figure 13.5-1 ITIL 4 diagram



Source: Prepared by the author based on ITIL® Foundation (ITIL 4 edition)

ITIL 4 has the structure shown in [Figure 13.5-1](#). ITIL 4 is formed by two fundamental components: (a) Service Value System - SVS; and, (b) Four Dimensions. This structuring is an indication of the importance given to the UTILITY of ICT services, or, in other words, to make clear that it is important to take care of the results that ICT participates. Instead of focusing on the life cycle of ICT services, ITIL 4 focuses on aggregating value to results delivered to external and internal customers.

13.6. Dimensions

The 4 dimensions were already present in version 3 of ITIL (rule of the 4P - people, products, partners and processes) and have been improved. These 4 dimensions are guiding forces for ITIL 4 deployment in an organization:

- Organization and people - The organization's objectives require the adequate capacity of the professionals and, overall, a culture that is able to support the achievement of the objectives. Each person should understand how his/her performance contributes to SVS.
- Information and technology - With the emphasis on the value of services, this dimension deals with information, knowledge and technological infrastructures required for ICT service management.

- Partners and suppliers - It deals with external agents who collaborate with the organization in the design, implementation, delivery, maintenance and continual improvement of services. The choice between using own capacity or contracting external providers is a complex decision (costs, scarcity of resources, expertise, demand patterns etc.) and must be done and managed very carefully.
- Flows and processes - Care for effective collaboration between the various parts of the organization, which must work in an integrated and coordinated way.

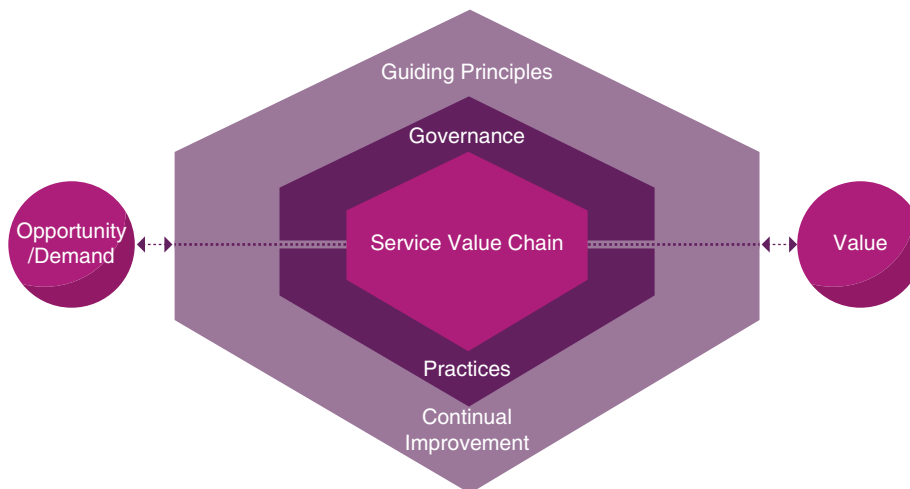
The performance in these 4 dimensions provides the possibility of seeking effectiveness and equilibrium in SVS. Dimensions can be seen as areas in which the organization acts to achieve capacity tuning and produce the best results. The 4 dimensions should be considered in each service operated by the ICT unit. Systematization facilitates the appropriate treatment of various external factors, such as economic, social, environmental, technological, political and legal aspects.

13.7. Service Value System

The changes applied in ITIL – going out focus on the service life cycle to focus on service utility - led to the structuring of a digital operating model. This model is flexible and adaptable to the needs, interests and capabilities of the organization. It also considers the growing importance of ICT in building the results produced by the organization.

The SVS, one of the pillars of ITIL 4, is composed of five parts, as shown in the diagram in [Figure 13.5-1](#). Everyone in the organization must work to generate more valuable results for customers. ITIL 4 specifically covers ICT in the context of an organization and in producing useful results for external and internal customers. It is important to understand how ICT is embedded in the organization and how ICT is involved in producing the organization's results.

Figure 13.7-1 Service Value System



Source: Service Value Chain & Continual Improvement. From "ITIL® Foundation, ITIL 4 edition," by Axelos, 2019, February 18, Axelos, p. 118. Copyright 2019 by AXELOS Limited

13.8. Guiding principles

The 7 guiding principles are present in all ITIL 4 components and should be used in guiding the deployment. [Table 13.8-1](#) shows the 7 guiding principles.

Table 13.8-1 Guiding Principles

Guiding principles	Observation
1. Focus on value	The organization should only work on activities that improve results that are delivered to external and internal customers.
2. Start where you are	The organization must maintain its good skills and perfect what it takes.
3. Progress iteratively with feedback	The organization must evolve in safe steps and measure evolution.
4. Collaborate and promote visibility	Teams must be clear about the importance of working together, attending to processes and practicing feedback.
5. Think and work holistically	The organization has to manage the full set of resources - people, processes, technologies - that participates in the composition of services delivered to customers.
6. Keep it simple and practical	The organization must calibrate the use and proportions in the processes, tools and resources to produce high quality and efficient results.
7. Optimize and automate	Human intervention should be used only when and where it is indispensable. In other cases, automated solutions should be used.

Source: Prepared by the author based on Axelos information

13.8.1. Practices

Previously, the ITIL action (management) units were called “processes”. In ITIL 4 the processes are called “practices”. In a very direct and brief way, a “practice” materializes what can be implemented. The implementation should be guided by the Dimensions, Guiding Principles and Service Value System.

Practices do not need to be deployed at the same time. The organization can consider its needs and capacities and plan the implementation of the practices according to the existing situation.

[Table 13.8-2](#) presents the 34 ITIL 4 Practices, divided into 3 groups.

Table 13.8-2 ITIL 4 Practices

General management practices
14 practices - can be used in all units of the organization
➤ Strategy management
➤ Portfolio management
➤ Architecture management
➤ Service financial management
➤ Workforce and talent management
➤ Continual improvement
➤ Measurement and reporting
➤ Risk management
➤ Information security management
➤ Knowledge management
➤ Organizational change management
➤ Project management
➤ Relationship management
➤ Supplier management
Service management practices
17 practices - are specific to ICT unit activities
➤ Business analysis
➤ Service catalogue management
➤ Service design
➤ Service level management
➤ Availability management
➤ Capacity and performance management
➤ Service continuity management
➤ Monitoring and event management
➤ Service desk
➤ Incident management
➤ Service request management
➤ Problem management
➤ Release management
➤ Change control
➤ Service validation and testing
➤ Service configuration management
➤ ICT asset management
Technology management practices
3 practices - are specialized for technical activities of the ICT unit
➤ Deployment management
➤ Infrastructure and platform management
➤ Software development and management

Source: Prepared by the author based on Axelos information

Just as an example, in incident management (Service Management Practices), a recorded occurrence always has a responsibility clear and precisely defined. It is also necessary to define maximum limits of time of action of each instance and the flow and communications within the organization. In this way each incident can be managed, a bypass can be applied (if necessary), and the solution can be reached.

Regarding the importance of systematic management, it is interesting to note that, in recent years, changes are very impacting agents in the interruption of services. The resources and equipment have become increasingly reliable, so the interruptions produced by changes become more significant. Change management is present in overall management practices and in all ICT service management practices. Rigor in dealing with change often leads one to say that “ITIL is too bureaucratic” or “ITIL promotes inefficiency and delays.” These judgments and assertions are undue, as impacts may directly affect the organization’s customers and produce significant losses (loss of revenue, increased expenses, damage to image and reputation, etc.).

13.8.2. Service value chain

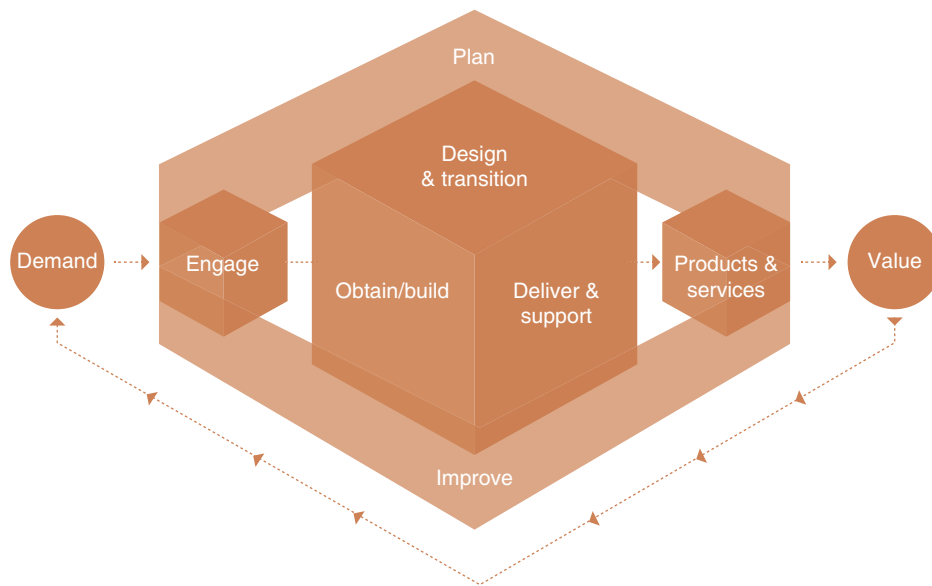
The chain of activities to add value to the services is the core of SVS. There are 6 activities that can be used in the composition of workflows, in any sequence, according to the stage of demands and responses. This freedom to use the activities to create, deliver and improve services is fundamental to the flexibility of the operation of ICT. Thus, the ICT unit can act efficiently and effectively when needed and changes in organizational demands are made.

Table 13.8-3 Actions of the Service Value Chain

Service value chain – Actions
Plan
Improve
Engage
Design and transition
Obtain/Build
Deliver and support

Source: Prepared by the author based on Axelos information

Thus, the actions in [Table 13.8-3](#) must be present in the flow between a demand for the ICT unit and the corresponding response.

Figure 13.8-1 Service Value Chain

Source: Service Value Chain (SVC). From "ITIL® Foundation, ITIL 4 edition," by Axelos, 2019, February 18, Axelos, p. 119.
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Figure 13.8-1 shows the diagram with the interconnection scheme of the Service Value Chain activities.

13.8.3. Governance

Governance is a widely used term and people generally do not care to use it accurately. In ITIL 4 Governance is the set of mechanisms that aim to ensure that ICT works in alignment with the strategic objectives of the organization. To seek alignment, ICT needs to use the right management and apply the resources correctly.

It is necessary to have a formal written organizational strategy that is shared with the entire organization. Only then can the ICT unit align its management strategy with the organization.

On the other hand, ICT needs to be agile in adapting to the new demands and directions that the organization will have. ICT must play a role to leverage the organization, not a burden that imposes inertial slowness.

In this sense, ICT must be also an enabler for the tax administration so that correct incorporation of new technologies could give a boost in terms of innovation for improved processes or completely new solutions without falling in the trap of being a perpetual researching lab of every new technology or buzzword.

Good ICT management practices, including ITIL 4, establish tools that provide attention to the readiness of responses. In the same way, ICT governance instruments are also established that aim to reduce the organization's risks.

Gartner, in its ICT Glossary, presents a wide view of ICT governance:

IT governance (ITG) is defined as processes that ensure the effective and efficient use of ICT in enabling an organization to achieve its goals. ICT demand governance (ITDG – what ICT should work on) is the process by which organizations ensure the effective evaluation, selection, prioritization, and funding of competing ICT investments; oversee their implementation; and extract (measurable) business benefits. ITDG is a business investment decision-making and oversight process, and it is a business management responsibility. ICT supply-side governance (ITSG – how ICT should do what it does) is concerned with ensuring that the ICT organization operates in an effective, efficient and compliant fashion, and it is primarily a CIO responsibility. (Gartner, 2019)

In a tax administration unit, ICT governance provides a useful roadmap for meeting the challenges of managers at all levels. ITIL, like other frameworks, includes this subject.

13.8.4. *Continual Improvement*

Finally, still within the scope of the Service Value System (SVS), actions are established that aim to incorporate the good practices in the set of ICT activities. The desired result is a form of continuous learning, fundamental for the incremental improvement and essential component of the valuation of the services delivered to external and internal costumers.

Continual improvement is compatible with quality management methodologies. This type of approach - compatibility with widely used methodologies - is typical of ITIL. Thus, if the organization already adopts one of those methodologies, it will not be difficult to adjust.

13.9. **Implementation of an ICT management framework in a tax administration**

Tax administration plays a fundamental role in the functioning of society. In the Information Age, all tax activities heavily employ ICT resources and services. Activities use large amounts of data and real-time interaction with taxpayers and partners. Increasingly tax administration services have been offered directly to taxpayers. ICT is not just a feature that improves operations and reduces tax administration costs.

Given this position of ICT, it is vital that the tax administration unit use best governance practices in that area. Thus, systematic ICT management is imperative to provide good services, achieve

positive results, and mitigate risk. Selecting a framework (or frameworks) is not very complex. The big challenge is making the implementation, which requires discipline and persistence.

Many organizations choose to continue working ICT intuitively and without method. The implementation of management is left to the future because of accommodation and the - incorrect - feeling that deploying a system consumes valuable resources, is just another “bureaucracy” and generates inefficiency.

There are external variables that contribute to the non-use of systematic management, because the quality of the services improves independently of the implementation of a systematic management. Some of these external factors are the growth of resource performance and reliability, the reduction of failures and price of fault-tolerant resources, and the concentration of offerings of solutions in a few suppliers. They also collaborate on the great dynamics in technologies and the “hope” that a “silver bullet” can be offered at any time. However, it is important to emphasize that the deployment of ICT management is undoubtedly useful for all organizations – tax administrations included.

In a post about choosing between COBIT and ITIL, Tamara Scott presented a very interesting consideration about the decision to deploy ITSM:¹⁴⁹

COBIT requires a top-down implementation that starts with stakeholders and defines business goals from their perspective. Implementation requires coordination between the stakeholders, C-level executives, and management staff to make sure available processes or products fit the needs of the stakeholders. ICT teams can implement ITIL within the department with little to no interference or communication from C-level executives or boards. Understanding ICT as a service-based department may require a change of attitude for those who aren't used to working for the good of the company/client/customer rather than the project itself. (Scott, 2017).

The recommendations given below may be more useful for organizations that do not yet use systematic ICT management. The general plan (*Table 13.9-1*) presents three initial activities (1, 2 and 3) and two activities (4 and 5) that must be repeated for each deployment cycle.

The choice of framework (or frameworks) can be made prior to the start of table activities or during initial activities. Selection is a challenge that must consider factors such as: organization's maturity, knowledge and experience of internal specialists, immediate challenges and shortcomings, medium term planning, use of internal ICT or external providers etc.

It would be nice to have a general guide for choosing the framework (or frameworks). However, the situation of each tax administration unit is unique. It seems almost impossible to make a general-purpose guide.

The use of external consulting services in the selection of frameworks (or frameworks) is recommended. External consultants must have advanced certifications - in more than one framework - and experience with ITSM implementation. They can offer an outside view and complement the insights of the internal experts. In any case, the responsibility for implementation will always rest with internal staff.

Table 13.9-1 Implementing ICT management – General Plan using ITIL

No.	Activity	Description
1	Mapping processes in use	Regardless of the maturity level, every organization performs repetitive tasks. The mapping of the current processes allows for a better understanding of how an organization works, to define more precisely the starting point and to take advantage of what is already in use. Seek to use consolidated practices and templates - like ITIL - instead of tailor-made solutions and to “reinvent the wheel.”
2	Assessing the needs (“Gap analysis”)	Identifying the differences between the intended situation and the current situation. It is advisable to consider only a few basic disciplines of systematic management, according to the most urgent needs and challenges of the organization.
3	Develop Roadmap	Select a subset of practices that address the organization’s most serious shortcomings and challenges regarding the resources that can be devoted to implementing ITIL.
4	Deploy, Share and Measure	As outlined below, the organization can count on a wide variety of ITIL deployment tools. It is recommended that the organization choose a tool and do the deployment based on the tool, seeking to take advantage of the good practices that are implemented, without prioritizing tailor-made adjustments that are expendable. In addition, ITIL practices can be used to implement ITIL. It is imperative to select indicators to systematically measure the evolution of ITIL deployment.
5	Continual improvement	This approach is inherent to ITIL, as presented in section 13.8.4

Source: Prepared by the author

Table 13.9-1 presents a general plan to implement ITSM. The activities may be performed by internal staff (preferably with professional certification) or by external consultants (with advanced professional certification and experience). It is advisable to use external consulting services in activities 1, 2 and 3.

It is advantageous for the organization to have internal professionals to carry out activities 4 and 5. These activities are long lasting. Preferably, internal professionals must have professional certification. Outside consulting in activities 4 and 5 can be used together, mainly to accelerate deployment, encourage the use of more challenging and productive practices, and avoid accommodations.

Usually, tax administration units with low maturity in ICT management have deficiencies in the following areas: (1) knowledge of assets, configuration and settings, not only to control, but mainly to reduce the duration of service failures and downtime; (2) monitoring the functioning of services (availability and performance), with the ability to anticipate the reaction of users; (3) recording and tracking of all incidents, from detection to conclusive solution; (4) use of a single channel of communication with users (point-of-contact); and, (5) make changes safely.

Therefore, using ITIL approach, the most general recommendation for ITSM implementation in a tax administration unit can be based on [Table 13.9-2](#). This Practices set is a recommendation and corresponds to activity 3 in [Table 13.9-1](#). An organization, especially with the support of external consultants, could establish other selections, with other priorities, without disrespecting the logical structure of the framework. Recommendations can be adjusted for other ITSM platforms.

Table 13.9-2 First Cycle Recommendation

ITIL Practice – First deployment cycle	Priority
General Management Practices	
➤ Workforce and talent management	2
➤ Architecture management	8
Service Management Practices	
• ICT asset management	1
• Service catalogue management	3
• Availability management	4
• Incident management	5
• Service desk	6
• Change control	7
Service management practices	
• Infrastructure and platform management	9

Source: Prepared by the author

The recommendation ([Table 13.9-2](#)) shows 9 Practices - of the 34 ITIL Practices - with implementation priority - First Deployment Cycle. Priorities 1 to 4 may be part of PHASE 1, with preparation of the basic registers and beginning of the training of ICT professionals. PHASE 2 can be performed with priorities 5 and 6, which marks the beginning of a new way of interacting with users. Finally, in a PHASE 3, implementations of priorities 7, 8 and 9 can be started.

It is important to highlight some points:

- Each of ITIL's Practices can be deployed in a gradual, harmonious and growing manner - it is not necessary to do at one time the complete implementation of a practice.
- The selection of ITIL practices and priorities ([Table 13.9-2](#)) should consider the current situation of the organization and the challenges to be faced.
- After this initial implementation ([Table 13.9-2](#)) it is reasonable to consider that the organization will have acquired experience and maturity to make the selection and prioritization to deploy other Practices.
- It is reasonable to consider that each of the phases (PHASE 1, PHASE 2, PHASE 3) will require 3 to 5 months to be executed.

The other ITIL Practices can be examined after the First Deployment Cycle. *Table 13.9-3* presents the list of 25 remaining Practices, if the 9 Practices (*Table 13.9-2*) have been selected and implemented before.

Table 13.9-3 Priority suggestion for the remaining Practices

ITIL Practice	Cycles
General management practices	
Strategy management	5
Portfolio management	5
Service financial management	2
Continual improvement	5
Measurement and reporting	5
Risk management	2
Information security management	2
Knowledge management	5
Organizational change management	2
Project management	3
Relationship management	3
Supplier management	3
Service management practices	
Business analysis	3
Service design	3
Service Level Management	2
Capacity and performance management	4
Service continuity management	2
Monitoring and event management	2
Service request management	3
Problem management	2
Release management	4
Service validation and testing	3
Service configuration management	4
Technology management practices	
Deployment management	4
Software development and management	3

Source: Prepared by the author

The tax administration unit does not need to implement all ITIL Practices. The selection must be made according to the needs, challenges and priorities of the organization. ITIL Practices can be deployed for internal ICT activities and for services provided by external vendors. In this case, the Practice is used in the context of the relationship with suppliers.

In *Table 13.9-3*, the CYCLES column shows only suggestions, with emphasis on security (Cycle 2), internal and external relationships (Cycle 3), configurations (Cycle 4), and strategy and governance (Cycle 5). It is imperative to select and use a good software solution to support the deployment of ITIL. There are dozens of solutions on offer. The choice of a solution depends on several factors:

- Commercial or open-source product
- Quantity of users
- Compatibility with the technology and standards used by the organization
- Availability of trained professionals
- Experience of other organizations
- Use of Cloud or On-Premise solution
- Among others.

Table 13.9-4 presents some tools that can support the implementation of ITIL, without any pretension of exhaustion or classification. It should be noted that the selection and installation of the ITIL support tool can be one of the contracted activities of external consultants.

Table 13.9-4 ITIL Tools

Solution	Website	Offer
BMC Helix ITSM	www.bmc.com	Commercial
CA Service Management	www.ca.com	Commercial
Cherwell Service Management	www.cherwell.com	Commercial
Combodo	www.combodo.com	Open Source
EasyVista Service Management	www.easyvista.com	Commercial
FreshService	www.freshservice.com	Commercial
GLPI	glpi-project.org	Open Source
IBM Control Desk	www.ibm.com	Commercial
Ivanti Service Management	www.ivanti.com	Commercial
MicroFocus Service M. Automation	www.microfocus.com	Commercial
Samanage SolarWinds	www.samanage.com	Commercial
ServiceNow ICT Service Management	www.servicenow.com	Commercial
TopDesk	www.topdesk.com	Commercial
ZenDesk	www.zendesk.com	Commercial

Source: Prepared by the author

Some tools do not offer all the functionality of ITIL. It is also important to consider the version of ITIL that the tool meets. Being very recent, ITIL Version 4 does not yet have a wide range of products, but, as usual, products should be gradually updated.

There are many open-source tools that partially address ITIL Practices (or ITIL Processes - version 3 designation). Searches for these products can be made on *sourceforge.net*. In the scope of commercial solutions, there are services offered in the cloud and in local premises of the customer (On Premise), with the possibility of the client to select one of the options. Although it is only a fact check, Pink Elephant's test of product compatibility with ITIL rules has been well accepted.

As written above, all recommendations presented may be adjusted for other frameworks. ITIL was used only to avoid a theoretical approach only.

13.10. Conclusion

ITSM is not simple. Independently of the management framework selected, ITSM requires persistence. The results of the early stages, even with flexibility, do not match the expenses. In the adoption of a new methodology, negative reactions are natural - "it is very bureaucratic", "we are wasting time with it". It is necessary to manage negative reactions. Deployment of the framework is a challenge, but the benefits are very important for the tax administration unit.

As the framework – or the frameworks – is implemented and disseminated, a common language for dialogue with ICT is gradually deployed. This is a plus for the tax administration unit, especially to stimulate collaboration.

If the organization uses other standardized methodologies (strategic management, governance, financial management, total quality, project management, risk management, etc.), integration with ITSM framework can be done. If ICT itself uses some specialized methodology (software development, security, project management, etc.) or has plans to incorporate advanced technologies (artificial intelligence, Internet of Things, etc.), in general ITSM's suitability is equally feasible.

ITSM is not only useful for deploying the single point of contact with ICT or ICT service desk. Good frameworks - and the support tools, public or commercial - is much more than that. ITSM can also be used to manage internal ICT (in-house) and in the relationship with external (contracted) ICT suppliers.

Considering the ICT's role for a tax administration unit, an ICT without systematized management is a great risk. Successes need to be incorporated into organizational practices; mistakes cannot be repeated. There are several ways to do systematized ICT management - ITIL is just one way. The organization does not need to "reinvent the wheel" and devise an ICT management methodology.

The ITSM framework can be adapted to the size of the tax administration unit. The methodology is not only applicable in large organizations, it can be adjusted and implemented gradually. Good results are visible before full deployment. It is important to be pragmatic and start with concrete challenges and a clear set of priorities, without overestimating the maturity of the organization. Very small tax administrations in terms of total number of officers might have a reduce number of ICT staff in-house and would depend a lot on external services to support all ICT services. In those

cases, the need for ICT governance, though adjusted in size, might be greater since it will certainly include the burden of managing and renewing contracts.

Note

149. This is not just about COBIT and ITIL, the commentary is valid for ITSM in general.

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14.

IMPLEMENTING INFORMATION AND COMMUNICATION TECHNOLOGY PROJECTS IN TAX ADMINISTRATIONS

14.1. Project Management

14.1.1. Introduction

Organizations seek to implement their strategy effectively and efficiently to gain a competitive advantage and the highest financial yield. Although there is neither competition nor profit-seeking in the sphere of tax administrations, the latter manage scarce resources under the constant scrutiny of citizens, who should receive results and perceive high quality from the public administration.

In its Pulse of the Profession® study “*Success in Disruptive Times*,” the Project Management Institute (PMI) identifies that organizations lose 9.9% of every dollar due to poor project management performance (PMI, 2018). The root causes identified by the study include: 1) failure to bridge the gap between the strategy designed and its implementation; and, 2) executives who **fail to recognize** that strategies are implemented through project execution.

The performance statistics quoted above coupled with its root causes is an invitation for tax administrators to strive to achieve the most efficient use of resources and ensure a set of skills that enable process transformations in the highly dynamic environment ushered in by the digital era.

Thus, in this section we shall explain both the process and the experiences and best practices in portfolio and project management that may support tax administrators in their constant search for efficient strategy implementation, regardless of whether it is part of a continuous improvement effort or the use of disruptive technologies.

14.1.2. Project portfolio management

The tax administration is an institution within a government system. Although it is true that the degree of decision-making autonomy and its hierarchy in the organization chart may vary, it will invariably be part of an overall country vision usually stated in a national development plan or a

government plan. Results-based management, one of the models used in governmental management, is based on five essential pillars (García & García, 2009), namely: 1) planning; 2) budgeting; 3) financial management; **4) program and project management;** and, 5) monitoring and assessment.

The first pillar in results-based management, planning, is undertaken both at the government level and by the tax administration. At the government level, macroeconomic goals are set that guide governmental institutions in developing a future vision of society. On the other hand, at the level of tax administrations, projects are established and aligned to said plan, in addition to tax administrations' development of their own mission, thus becoming a vital program to deliver on sectoral, regional and local policy.

The planning cycle of a tax administration usually starts by defining or reviewing the guiding principles such as the mission and vision. Next, objectives and strategies are defined. Finally, specific actions are planned that lead to their achievement. As depicted in *Figure 14.1-1*, project portfolio management is an integral part of organizational planning.

Figure 14.1-1 Relationship between planning and project management



Source: The organizational context of portfolio management. From "The Standard for Portfolio Management Fourth Edition," by Project Management Institute, 2017, p. 8. Copyright 2017 by Project Management Institute

To help understand the definition of portfolio and project management, we may point out that while the former refers to a series of programs, projects and activities, the latter is a temporary effort undertaken to create a specific product, service or outcome (see *Figure 14.1-2*). It should

be noted that although they are distinct management areas, they interact throughout the project life (pre-investment, investment and operational phases), and as such, they represent coordinated administrative processes.

Figure 14.1-2 Project portfolio components



Source: Prepared by the author

According to the fourth release of the standard published by the PMI, the life of a project portfolio can be divided into the following phases: i) initiation; ii) planning; iii) execution; and, iv) optimization. Each having the scope detailed below:

- **Initiation.** Selection and prioritization criteria are established in addition to formulating the projects.
- **Planning.** Projects are selected and prioritized from the project listing for subsequent resource allocation based on restrictions such as the execution timeline and risks.
- **Execution.** New programs and projects are authorized in the portfolio and their fulfillment is monitored.
- **Optimization.** Resource planning is adjusted to reflect new projects, and lessons learned throughout the process are compiled.

The project portfolio initiation phase is of utmost importance with a view to the tax administration's achievement of results in the implementation of their institutional strategy. This is mainly due to the fact that in this phase, work is done on the objective criteria to select the highest value initiatives according to current capacities and environmental conditions. This is also the time for project designing, which is mostly aimed at identifying the scope with greatest technical and economic feasibility to leverage opportunities or solve the problems targeted by the organization.

Project design is a critical success factor towards ensuring project implementation. Several tools have been created with the goal of improving this area. However, in the sphere of public management and multilateral financial institutions, the Logical Framework methodology is often used, which facilitates, among other aspects, project conceptualization and design (Ortegón, Pacheco & Prieto, 2015). This methodology is made up of various tools and techniques. However, the following activities can be pointed out as its best practices:

- Clearly identifying the problem or opportunity by a cause and effect analysis;
- Indicating specific, measurable, attainable, relevant and timely project objectives;
- Defining the alternatives that enable the creation of the desired future condition, which consists of proposing actions to address the root causes of the problem or leverage the opportunity;
- Establishing project scopes based on the selection of the best alternative to meet the objectives, which should also be feasible from the technical and economic perspectives; and,
- Identifying indicators to measure both the impact and progress of project execution.

The main value of the planning phase of the project portfolio is that it defines a combination of the “right” programs and projects within the portfolio, i.e., a selection of prioritized initiatives that lead to fulfilling the organizational strategy, while being technically feasible, posing an acceptable level of risk for implementation purposes and whose cost is justified relative to the benefits they may deliver for taxpayers and the government alike.

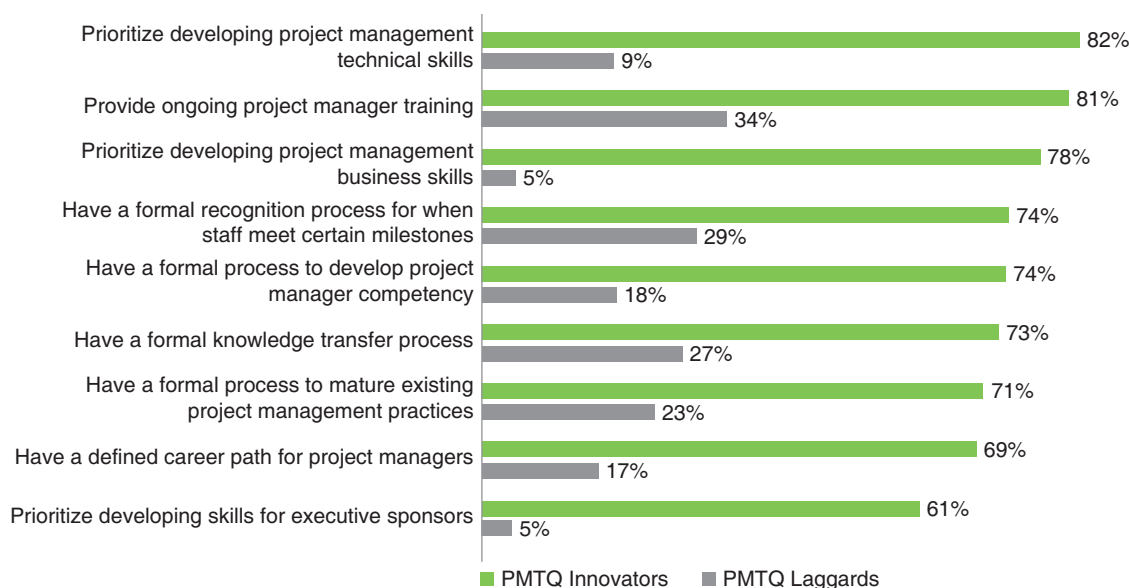
Cost-benefit analysis, one of the tools used in project selection, enables an assessment of the feasibility of the investment and cost comparisons across various alternatives. According to the study conducted by the Organization for Economic Cooperation and Development (OECD) called “*Government at a Glance: Latin America and the Caribbean 2017*,” the net present value (NPV) and the internal rate of return (IRR) are two pieces of data that help to assess investment alternatives in various Latin American countries and 85% of OECD member countries. As is mentioned in the study, the motivation for performing this type of analysis is that it provides elements to justify the selection and financing of given projects.

With the purpose of building a project portfolio, in addition to the above-mentioned financial indicators or cost-benefit analyses, the executing organization – in this case, the tax administration – should have adequate capacity and skills to undertake specific programs or projects. Summarizing, we may say that managing capacities and skills will enable a determination of the extent to which the organization may deliver on the portfolio based on the financial resources available and the potential of production factors, such as technical and behavioral competencies of civil servants. As a result, the use of resources will be maximized as risks are minimized.

14.1.3. Project management

Project management is regarded as one of the necessary disciplines for adoption or improvement when it comes to successfully implementing disruptive technologies (PMI, 2019). As shown in *Figure 14.1-3*, innovative organizations where technology development is highly prioritized, creating or strengthening technical competencies in project management among its staff is an extremely relevant effort.

Figure 14.1-3 Processes and capabilities: Project Management Technology Quotient



Source: Processes and Capabilities. From "Pulse of the Profession 2019," by Project Management Institute, 2019, March, p. 7.

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According to the latest data from the International Survey on Revenue Administration (ISORA, 2017) carried out in 2017, **78% of the tax administration respondents stated they either use innovative technologies or are planning to do so.** This means that for a significant share of respondents it is and will continue to be necessary to boost the adoption or improvement of project management processes that enable the rollout of new methods.

Projects are relevant for organizations with a view to ensuring the implementation of their strategy given that they are a bridge from planning to operations. They are drivers of change towards a future situation seeking to leverage the opportunities identified in the environment to reach higher efficiency and efficacy or solve operating problems.

In government institutions, project management is becoming increasingly standardized. It is measured and continuously improved with the primary goal of growing the return on investments. Thus, in 2016, for example, the President of the United States of America signed the so-called *Program Management Improvement Accountability Act* to boost the efforts of federal agencies to work

on adopting knowledge and experience from private sector enterprises in this field of government administration.

The Project Management Institute has issued several publications, noteworthy among which are the Project Management Maturity Model, the Portfolio Management Standard and the Guide to Project Management Essentials (*PMBOK® Guide*). These standards and methodologies have garnered private and public sector attention and become a guide to the implementation and improvement of administrative processes in this area.

By definition, a “project is a temporary endeavor undertaken to create a unique product, service or result.” (PMI, 2017, p. 4). This definition can be broken down as follows:

- **Temporary:** it has a clearly defined beginning and ending. Unlike processes, projects must end once their goals have (or have not) been achieved.
- **Unique product, service or result:** deliverables (either tangible or intangible) do not exist in nature. They are created once the project has been undertaken.

An essential principle in project management is understanding that this type of effort is undertaken within a broader environment (*Figure 14.1-4*) and that such environments should be taken into account in the decision-making process.

Figure 14.1-4 Project environment



Source: Prepared by the author

The planning, organization, management and control of a project should recognize the environment where they take place with a view to applying the knowledge, experience and most appropriate tools to ensure that goals are met. These are a few elements that may help understand the importance of the environment:

- **Sector it is in.** Tax administrations belong to the public sector and thus face public sector challenges. For example, the procurement of goods and services require the use of procedures that enable the fulfillment of the principles of transparency and competition, which implies that more time should be devoted to procurement activities. In addition, the staff should be familiar with the hierarchies among laws and international treaties, legal frameworks or specific methodologies.
- **Society and culture.** Projects interact within a group of persons with various beliefs, values, languages and customs. This indicates that some tools may or may not be used as a result of the reality where both the members of the team and the beneficiaries operate. For example, in some regions or countries, results orientation is of greater importance than human relationships while in others, aspects such as beliefs may prevail over results and, therefore, relationships are prioritized.

In connection with the above-mentioned aspects, it should be understood that projects undergo a series of life cycle phases (i.e., “The series of phases that a project passes through from its start to its completion.” (PMI, 2017, p. 19)). There are two types of life cycles: predictive and adaptive. These determine the overall working framework for project management. The development life cycles (not necessarily related to software) are one or more phases in the creation of a product, service or outcome. They may be either predictive, iterative, incremental, adaptive or hybrid. *Table 14.1-1* shows the definition of each one of them:

Table 14.1-1 Project’s life cycles

Life cycle type	Features
Predictive (or waterfall)	Requirements are defined before creating the deliverables The delivery is a single end product at the end of the project timeline Changes to the scope are restricted
Iterative Incremental	Requirements may be defined at intervals during the creation of deliverables There may be partial deliveries Changes to the scope may be introduced at regular time intervals
Adaptive (or agile)	Requirements are often defined during the creation of deliverables There are frequent deliveries Changes are introduced “in real time”
Hybrid	A combination between predictive and adaptive life cycles Known project deliverables follow a predictive cycle while uncertain deliverables or those that require further evolution follow an adaptive cycle

Source: Prepared by the author based on the Project Management Body of Knowledge (PMBOK®) Sixth Edition

Information technology projects, mainly in software development, follow an adaptive life cycle. Current agile approaches for this type of project start from Lean Thinking, whose principles are to create value, manage small lots and eliminate waste (PMI, 2017). The subsets of methods associated to agile include Crystal, Scrum, Kanban, Agile Unified Process, and others.

It is important for senior management, heads of division, project managers and team members to broaden their knowledge about the various project management areas (for example scope

management, schedule management, risk management, stakeholder management, acquisitions management, among others). Moreover, at the level of strategic management in tax administrations, agile methods should be added to project management processes in recognition of the restrictions inherent to the public sector, society and culture.

14.2. Project implementation

Having explained the conceptual framework of project management, we shall explore the current practices that work teams may implement when executing world-class technology innovation projects in tax administrations.

According to the study “*The Relationship Between Project Success and Project Efficiency*”, the dimensions for measuring the success of project implementation are determined by several factors, noteworthy among which are compliance with cost restrictions and deadlines, the team’s morale, fulfillment of technical and functional specifications, and customer satisfaction (Serrador & Turner, 2015).

To influence the elements mentioned above, working teams must use customized tools and techniques according to the project life cycle in addition to the on-going assessment of the environmental factors surrounding the project.

The role of the project sponsor in project execution

Undertaking a project in a tax administration or any other organization requires **people’s commitment** to invest the time, money and effort it takes to achieve the intended benefits.

By the sponsor or sponsors we mean the management or executive teams, who commit their active participation in the project (Englund & Bucero, 2015). This means that they have the will and have decided to allocate time on a regular basis to monitor progress, make decisions as requested, provide support in problem-solving, secure funds and other necessary actions for the project to reach its goals.

As part of project implementation, the role of the sponsor warrants special attention, for their involvement means there will be a greater likelihood of remaining a priority for resource allocation and reduce the time it takes to overcome the hurdles that emerge throughout the life cycle phases of the project.

In tax administrations, this role is usually held by a higher-ranking officer than the project manager. It could be the highest authority in radical transformation initiatives (Director General or Minister) or executives from the line management (Division Heads) in the case of projects with less strategic impact.

From the project management area, it is important to carefully select this stakeholder even before the project begins. For this reason, it is vital to understand the key features that will help to determine the extent to which a sponsor is fit for the project in question. These include:

- Experience and knowledge as part of the organization.
- Knowledge about portfolio and project management.
- The high regard and recognition the person has earned within the organization.
- How the person handles relations with their peers.
- The main feature being a commitment of time and direct involvement.

Finally, we may highlight the following behaviors that the sponsor should adopt to ensure the project's success: being able to correctly convey the sense of urgency, proactive involvement, and fast and accurate decision-making.

Planning a project

Organizing project activities appropriately increases the likelihood of delivering the products and services that meet customer or end user needs. In initiatives that involve developing or implementing technology components, it is imperative to place special emphasis on managing the project scope and the risks that may arise throughout its execution, mainly resulting from the uncertainty of having variable requirements.

Currently, PMI's Guide to Project Management Essentials includes planning considerations for projects with adaptive and agile life cycles which have been used for more than a decade in the development of technology applications. Some of the principles behind this benchmark which are worth underscoring and should be internalized when preparing a work plan include:

1. **The highest priority for the team is customer satisfaction.** This should be understood as putting compliance with the requirements set by end-users first, in addition to obtaining the benefits defined by the executing organization, such as efficiency or the leveraging of opportunities from the environment. This principle is of the utmost importance when defining the scope.
2. **Delivering a steady functional outcome, preferably in a short timeframe.** Because society currently experiences significant variations in shorter time periods compared to the last century, it is useless to design projects that will only yield benefits more than one year into the future. Thus, instead of selecting large scale implementations, it is more fitting to deploy deliverables in an incremental fashion.
3. **The business staff and colleagues must work together daily on project execution.** The best way to ensure that the requirements are met is by constantly engaging the user in verifying the products at work.

In view of the above, it is important for project teams to understand that whenever there is an agile cycle, such as in software development or the research of new services, the project management plan should be prepared progressively and will rarely be complete given that projects are not executed on controlled and static scenarios, but built as we obtain more information about the environment, and our team expands its capabilities, while the opportunity or problem the project seeks to solve continues to change.

Regarding the activities that should be undertaken to design a project plan, we recommend: i) identifying the main players who need to be part of this task (stakeholders and team members); ii) ensuring at least their minimum awareness as to the planning and investing the necessary time to standardize such knowledge; iii) defining the work calendar from the first day, which will even orient the tasks involved in preparing the plan; iv) prioritizing subsidiary plans beginning with the scope and moving on to scheduling risks, the budget and communications; v) at the beginning, focusing on adding details only to what is to happen immediately (four to eight weeks); and, vi) verifying the plan in iteration with the customer and stakeholders rather than reviewing the entire plan at the end. There should be successive meetings or workshops.

Lessons learned in project execution

In the sphere of project and quality management, the lessons learned become an asset of organizational processes that allow project teams to obtain information from previous experiences. These lessons, called retrospective in agile environments, are extremely useful for purposes of continuous improvement because they enable the replication of good practices and/or prevent the repetition of past mistakes.

Historic information such as that contained in planning documents, progress reports, decisions on project selection or risk registries are knowledge sources that help to attain a successful project.

Regarding the implementation of world-class projects and technology innovation within tax administrations, there are important lessons to be learned from the strategic and operational perspectives, namely:

- It is important for executive directors of the tax administration to be familiar with project management with a view to improving the implementation of the organizational strategy. A lack of understanding of notions such as the fact that a change of scope may affect one or several project restrictions such as risk, deadlines or costs, may prompt directors to make wrong decisions or feel frustrated about the progress being made.
- Ensuring a project's success starting at the project design phase before planning. It is important for tax administrations to have a project portfolio management process that establishes the necessary activities to perform a good technical and economic assessment of each strategic initiative, based on the availability of resources and **the technical and behavioral**

capabilities of the human talent. Furthermore, this process should be carried out with enough time to allow for comprehensive analysis commensurate with the complexity and resort to experts on: project design methodology (logical framework, for example), acquisitions, finance, human resources, law, in addition to technical experts.

- To ensure that portfolio management process activities are repeatable, measurable and improvable, it is imperative for an area in the institutional organization chart to be appointed as the process owner. This could be done by adding functions to the management division in charge of strategic planning or by creating a corporate project office.
- The progressive delivery of products, services or outcomes is a good strategy on the way to achieving political support inside and outside the organization. “Big bang” project execution lasting more than 12 months with no partial deliveries by sponsors and/or beneficiaries wear out the work teams while sponsors and beneficiaries lose confidence, for results are more likely to arrive in untimely fashion. Thus, the longer the delivery deadline, the greater potential for products becoming outdated.
- Change management is an essential organizational capability for project implementation because it helps those impacted by the project to learn about and embrace the products, services or outcomes, thus increasing the rates of adoption and usage. The use of this tool should not only be considered in the implementation or delivery phase but all the way from project design. This book contains an in-depth analysis of this subject in a dedicated section.
- The scope of the project should be managed in such a way that it meets the stakeholders’ expectations, which does not mean that all their requests should be served. Only the requests aligned toward meeting the goals and showing a positive cost-benefit ratio should be included as part of the product stack or work breakdown. It is advisable to avoid additional features or deliverables included merely because there is already a project underway with a resource allocation.
- Professional risk management raises the likelihood of success and anticipation of potential events that might have a negative impact on project goals. To achieve it, it is enough to create a risk management plan aligned to the environment where the project takes place. One needs to make a qualitative assessment, which is nothing else than prioritizing risks based on their likelihood and impact, and to create a response plan by appointing a risk owner and a planned action owner; and, communicating the status at least once a month and building discipline among the project team regarding information monitoring and updating.
- The goods and service procurement processes necessary for project execution must consider as a critical activity the definition of terms of reference. Putting together specifications engaging potential market bidders through practices such as Requests for Information (RFI) may be of great support in identifying the contractual conditions that may or may not be met by the market and avoid wasting time in tender processes that might ultimately have to be cancelled.

14.3. International cooperation for development

14.3.1. Introduction

There are many reasons why a government may not be able to reach or maintain reasonable development levels, including recurring natural disasters, wars or civil conflicts, mismanagement of resources, and others.

As applied to countries, the notion of development is comprehensive and implies numerous indicators. In addition, it can be assessed from different perspectives. For example, it could be asserted that a country whose macroeconomic indicators are optimistic is becoming more developed. However, there are experiences where the economic growth or high per capita Gross Domestic Product (GDP) have not necessarily implied reduced inequality or a generalized higher standard of living for its citizens.

Regardless of their strategy, every State should pursue the welfare of its citizens. Currently, a country that fails to use technology to raise its efficiency, reduce transactional costs and operate in an environmentally friendly manner cannot be regarded as developed. This equation is difficult to solve even for the countries labelled as “developed”, for the structure of society and the changing context, characterized by new ways of doing business and new relationships among different players, impose on the States the need to identify innovative solutions that provide their citizens with the goods and services they deserve.

In this sphere of action, international cooperation plays a key role. One of the most successful experiences has been the so-called “Marshall Plan”, which aimed at providing resources to rebuild Europe after World War II, which was wrecked by economic and social havoc. The plan slogan was, “Whatever the weather, we only reach welfare together”. As a result of political will, mutual cooperation among countries and many other factors, Europe has since become one of the most developed regions in the world and a benchmark of integration.

Raising the revenues that enable the necessary public goods and service provision to finance development is critical to avoid the States’ reliance on international cooperation, in particular of the financial type. Technical cooperation may be necessary in all cases given the dynamic context we live in.

Tax policies tailored to meet a given country’s characteristics and needs are of the essence. However, **a developed tax administration will make the difference when it comes to raising public revenues**, especially in countries that lack non-tax resources such as dams, canals, mining or oil and therefore rely on the tax system. Following this reasoning, strengthening tax revenues must clearly consider complementary programs such as those that help to raise the quality of government spending and prevent or attack corruption to achieve definitive results as per a “full cycle” approach.

The tax administration: A key institution that should be strengthened

Regardless of whether countries are in the developed or developing phase, revenue agencies are a highly sensitive component in most of them, for they are relied upon to provide the resources that will enable a public spending plan, which is in turn based on the states' strategy to ensure minimum standards of health, education, safety, social security or infrastructure.

In some countries, the tax administration has a higher weight within government because its functions include managing tax and customs revenues, monitoring foreign trade and/or social security resources. In other countries, the tax administration is charged with formulating tax policy proposals.

In this regard, cooperation programs aimed at strengthening tax administrations are supporting one of the States' main pillars. Cooperating with these organizations is no easy task, for these organizations are highly complex and require heavy investments and specialization in numerous fields. Horizontal cooperation among government agencies may cover the tax administrations' technical needs partially if it is not possible or feasible to recruit and retain experts for specific subject matters.

In the past decade, the global financial crisis declared officially in the year 2008 resulted in tax administrations gaining greater specific weight in both domestic and global agendas and, consequently, in the agendas of international donors. Most countries in the world have committed to the international standards that aim to improve transparency and the exchange of information among states for tax control purposes, as well as measures to avoid tax base erosion and profit shifting.

All of the above are ambitious endeavors, especially for the tax administrations in the least developed countries, for they call for active involvement in overall agendas, informed decision-making and the implementation of new tasks and functions in a context where many of the basic needs of the tax administrations remain uncovered. These needs include adequate functioning of the taxpayer registries, the current account, systems for identifying and managing compliance risks, invoicing and collection systems, and the need for constant innovation to adapt operations to the context, among other challenges.

The international trend towards joint tax administration efforts such as simultaneous audits, assistance in international enforced collections or exchange of information, is replicated domestically by creating bonds with various agencies to achieve synergies in pursuit of an acceptable development standard for these institutions. These institutions include law enforcement bodies, prosecutor's offices, regulatory entities, decentralized tax administrations, the financial systems, and others.

Given the wide scope and interconnectedness of the subject matters served by the tax administration, designing of cooperation plans for tax administration strengthening include such complex goals as:

- Achieving an on-going and enhanced impact in the area of tax management;
- Becoming autonomous in the area of cooperation by capitalizing knowledge; and;
- Innovating by promoting, for example, new developments tailored to the local context that can prove useful in peer-to-peer cooperation.

14.3.2. *The role of cooperation intermediaries*

The “cooperation intermediaries” are organizations that work with cooperation agencies or donors to achieve the efficient and effective rollout of technical cooperation projects. These organizations have vast experience in specific issues and strong regional or international networks.

Below is an example of these entities and a summary of their work on the basis of consultations of their respective websites and related publications.

IADB – Inter-American Development Bank¹⁵⁰

The IADB is one of the main funders of tax reform or modernization projects in Latin America and the Caribbean, which include ICT components. There are 26 borrowing member countries, divided into two groups (I and II), according to their per capita income, with the objective of better distribution of loans. The financed tax projects include national and sub-national governments.

Geographical scope of action: Latin America and the Caribbean

IMF – International Monetary Fund¹⁵¹

The IMF supports tax reform and/or modernization projects around the world, using ICT components as a key part of them. It usually does not finance these projects; it only provides technical assistance and advice. For financing aspects, the IMF relies on donor/borrower institutions. Procurement and implementation are carried out by the countries themselves. The recommendation is the use of tax information systems in the COTS modality, but own developments are accepted.

Geographical scope of action: Global

World Bank¹⁵²

The World Bank is one of the largest donors in tax reform/modernization projects. By 2014, it owned approximately 100 tax administration projects, 60 financed by the bank itself and 40 financed by the International Finance Corporation¹⁵³. The World Bank's projects in the tax area are based on the exchange of experiences and lessons learned. Projects usually involve information systems and hardware/software, staff development, legal framework assessment, re-engineering processes and change management.

Geographical scope of action: Global

KfW & GIZ (Germany)¹⁵⁴

KfW (Credit Institute for Reconstruction) and GIZ (Society for International Cooperation”) are the main implementing agencies of projects of the Ministry for Economic Cooperation and Development (BMZ, as per the acronym in German). These agencies work with other international facilitating agencies or national agencies in the selected countries for the implementation of projects. KfW finances projects to reform or modernize tax administrations, including the acquisition of Information Systems, hardware and software. GIZ operates mainly in the area of technical assistance focused on training and institutional development.

Geographical scope of action: Global

SECO (Switzerland)¹⁵⁵

SECO (State Secretariat for Economic Affairs) is the agency responsible for Economic Cooperation and development in Switzerland. Strengthening public finances is one of its lines of action, including tax reform or modernization projects. SECO acts in conjunction with other international organizations, private companies, non-governmental organizations and national agencies.

Geographical scope of action: Africa, Asia, Latin America, Eastern Europe, and Central Asia.

USAID (United States of America)¹⁵⁶

USAID (United States Agency for International Development) is a major donor to tax reform and modernization projects, with strong information and communications technology components. It operates on a decentralized basis, with representation in several countries. The programs are designed according to the beneficiary countries. The agency usually works with previously designated specialized contractors, who develop working papers on best practices that are used in projects. Most programs are coordinated through the US Treasury Department and the US Embassy in the respective country.

Geographical scope of action: Global

DFID (United Kingdom)¹⁵⁷

The DFIF (Department for International Development) acts strongly in projects of reform or modernization tax, with investments of approximately £ 97 million between 2007-2011 in the support of the tax area. The required investments in information and communication technology are dealt with in each specific project.

Geographical scope of action: mainly Commonwealth countries

ADB – Asian Development Bank¹⁵⁸

The ADB (Asia Development Bank) has defined a strategy for the use of ICT in the projects it finances, based on: 1) Creating a favorable environment, based on the strengthening of

institutions and provision of relevant infrastructures; 2) Promoting human resources with professional skills in information and communication technologies; and, 3) Developing systems based on ICT by means of projects supported by the Bank.

Geographical scope of action: Asia

AFDB – African Development Bank¹⁵⁹

The AFDB (African Development Bank) has an overall strategy for the use of ICT in its projects. The main focus of investment in the AFDB are the mobile phone networks, which exhibit large growth in Africa and are used for payment of taxes and other services to the taxpayers. The most recent project to modernize the tax administration financed by the AFDB is in Togo, worth US\$ 29 million (October 2019).

Geographical scope of action: Africa

Facilitating organizations

Inter-American Center for tax administrations¹⁶⁰

CIAT has as its mission to promote international cooperation and the exchange of experiences and information and to provide technical assistance services, studies and training, thus contributing to the strengthening of the tax administrations of its member countries. CIAT acts as executor or contractor of projects for the reform or modernization of the tax administration, with extensive experience on the subject. This chapter provides a more comprehensive description of this organization's activities.

Geographical scope of action: Latin America and Caribbean countries and Africa (4 member countries)

ATAF – African Tax Administration Forum¹⁶¹

ATAF primarily provides a forum for its members to reflect on tax issues, exchange ideas and exchange experiences. It provides training and technical publications.

Geographical scope of action: Africa

IOTA – Intra-European Organisation of Tax Administrations¹⁶²

The Intra-European Organisation of Tax Administrations (IOTA) is a non-profit intergovernmental organization that provides its members with a platform to exchange experiences and best practices on tax administration. IOTA's main activity is to organize workshops and forums that offer participants from various member tax administrations the opportunity to share their views and experiences and develop best practices with the aim of improving the tax administrations of their members.

Geographical scope of action: Europe.

An expert organization that engages in cooperation actions can more accurately assess the consistency and feasibility of given projects. Such organizations have in-depth knowledge about the context where tax administrations work, they maintain a friendly relationship with tax administration authorities and technical officials, they keep expert databases and are familiar with the profile of the participating tax administrations, which is an added value when it comes to assessing and deploying cooperation programs.

It is advisable for donors to rely on these institutions and view them as advisors and executing units for bilateral or multilateral programs. In the next section we provide a few ideas, based on the experience of CIAT, that might be useful when defining and implementing a strategy.

14.3.3. Effective strategies to undertake cooperation actions for the strengthening of tax administrations

International cooperation for the development of tax administrations can be provided through cooperation programs of various kinds (bilateral, multilateral, with grants or own country funding, among others), through international organizations, countries' cooperation agencies, non-governmental organizations or others, or directly between counterpart organizations. Each case has unique features although, generally speaking, it is advisable to follow the steps described next.

The first step consists in assessing the needs, which include strategic priorities determined with a view to achieving the desired outcome. This is no easy step, since a diagnosis should be made of the tax administration to enable an assessment of the specific weight of the aspects to be strengthened. To this end, objective methodologies supported internationally such as the Tax Administration Diagnostic Assessment Tool (TADAT), are extremely useful. The International Survey on Revenue Administration (ISORA) is another tool designed to assess the positioning of the tax administration in different aspects relative to its peers from different countries. This enables the identification of areas where there is room for progress and good practices. CIAT has numerous data sources that could be useful in the decision-making process at the strategic and operational levels.

The second step is to perform a more detailed assessment of the potential processes targeted for strengthening. In particular, there is also an assessment of whether the necessary conditions are met for purposes of implementing a project successfully. For example, it would be difficult to think about implementing an electronic invoicing system if the taxpayer registry does not work properly and there is no previous project to enhance it. In other words, it is essential to assess every technical detail so as to define the feasibility of a given project.

For contractual or financial reasons, some cooperation agencies or cooperating organizations are required first to identify the areas of work that give rise to a logical framework so that after signing the contract (or the agreement) and defining the scope, they can execute a budget to perform the assessment. This may lead to a strategic mistake if the cooperation agencies identify the project as not feasible due to any of several reasons such as the lack of budgetary allocation, out-of-scope

sub-processes, or duration that is not commensurate with the size of the work at hand. For this reason, it is desirable for the beneficiary tax administrations to be aware of their limitations and propose projects whose implementation is feasible.

To ensure the feasibility of short- or medium-term cooperation projects, at the time of submitting requests, countries should rule out the most ambitious projects on which the tax administration has never worked before or ever included as part of its operating plans unless there is adequate funding available to undertake them successfully. For example, the creation of an integrated risk management system should not be proposed in the framework of a multilateral cooperation program that has limited funding unless the requesting administration has sufficient budgetary resources, technology and human resources to embark on such project. It is also advisable to point out the risks that could be faced during the project execution period, the likelihood for these to materialize and the respective mitigating strategies.

The third step consists in defining the tasks required in meeting the objective, and to sort them depending on whether they will be performed by consultants, the beneficiary, the cooperation intermediary (for example, donors, international organizations or executing agencies), or cooperating third parties (international organizations, other donors, other tax administrations or other organizations in the beneficiary country). This will help to organize the tasks more effectively, ensuring that no action remains outside of the plan and, if possible, efforts should be coordinated to create synergies.

It is extremely relevant to distinctly define the cooperation resources to be allocated to the project, the funding provided by the country by way of financial resources or in kind, and third-party contributions. One of the main weaknesses in cooperation programs is the impossibility to invest in infrastructure. The effects from consulting work can be limited in the medium and long term unless there is associated investment, for example, in technology, to enable the effective implementation of recommendations.

The fourth step is defining indicators to meet the beneficiary's needs as well as the expectations of the donor or cooperating party. In general, indicators are of two kinds: those aimed at the fulfillment of tasks (for example, the preparation of a handbook, staff training or the implementation of a process); and, those aimed at measuring impacts (for example, in terms of taxpayers sanctioned, adjustments assessed and/or collected, or shorter response times). In both cases, indicators should define a target and the timeframe of expected completion. Indicators should be reasonable or feasible, and they should be measured regularly. At this stage, the "cooperation intermediary" and/or the donor should assess the consistency of the projects relative to available resources and the proposed indicators.

The fifth step is identifying the right consultants to address the beneficiary's needs. There are different working modalities depending on the project's features. For example, some projects require consultants who reside in the beneficiary country for some time, while others call for a consultant to travel regularly for a given period, while in very specific cases, it is possible to provide assistance

remotely. Cooperation between peers is highly productive and is often provided in various stages. For example, in early project stages it may be necessary to conduct “study visits” that will provide a detailed view of the way a given process works in a tax administration. This information will help to decide whether it can be replicated in the context of the beneficiary country or with the purpose of considering cooperation options.

When applicable, cooperation may be conducted between tax administrations by making entire working teams available and, if necessary, open source information and communications technology (ICT) systems. The latter has an extremely high added value for the beneficiary country, although it is clearly difficult to expect cooperation between peers if the project calls for full-time presence for a long period of time. Given the right conditions, cooperation between peers is highly effective because it enables access to highly skilled staff who know the tax administration’s “business” in great detail. This might require less resources than would be necessary if independent consultants were retained. There are cases of tax administrations that have received cooperation and are currently providing it to their peers under similar programs. A few such examples are the tax administrations from the Dominican Republic (DGII), Uruguay (DGI), Chile (SII), Ecuador (SRI) or Peru (SUNAT). (Each particular tax administration’s Spanish-title acronym is indicated in parentheses.)

The sixth step has to do with the implementation of cooperation programs. The implementation should be preceded by a negotiation between the tax administration and the consultant, with the sponsorship of the intermediary of the cooperation. The logistics can be complex in some cases, especially when the availability of consultants on a specific subject matter is scarce while the tax administration needs to implement the project urgently. Throughout the implementation, it is very important for the donor and the different players involved in the cooperation to be flexible enough to adapt the project to emerging circumstances.

The seventh step is project evaluation. To this end, a report-based mechanism should be in place and, if warranted by the size of the project, “onsite evaluations” should also be in place. The latter are useful to work on correcting any deviations. If necessary, the beneficiary of the cooperation should receive advice on strategic aspects.

The eighth step consists in giving visibility to successful projects, by showcasing with tangible results that cooperation works and inspiring cooperating organizations to continue cooperating. In turn, this visibility serves as accountability to the stakeholders on the efficient use of the cooperation resources.

14.3.4. Other cooperation tools for tax administrations

There are other ways of cooperating which are not necessarily in the scope of cooperation programs. The Inter-American Center of Tax Administrations delivers online eLearning courses specifically designed to meet tax administration needs. Such courses, mostly delivered by tax administration officials, have proven successful and the number of subject matters and languages in which they

are offered has been growing. Other organizations, universities, research centers and private enterprises also provide training and assistance.

The Inter-American Center of Tax Administrations relies on its network of tax administrations for support with a view to providing better service when replying to strategic queries so that tax administrations may learn from comparative experiences for decision-making or to justify decisions that should be reported to different areas of government. This product is called “Consultation Service” and has proven highly effective in that it provides reliable and timely information.

In addition, the Inter-American Center of Tax Administrations has specialized networks which lend themselves to promoting interaction between technical officials in the area of identifying good practices that may be useful when defining cooperation programs or driving changes in the tax administrations. These networks deal with technology, international taxation, human resources, ethics, collections, public information, tax compliance risk management, among other topics.

14.3.5. Lessons learned

Cooperating with governments is no easy task, especially when the expectation is for governments to capitalize the knowledge obtained from the cooperation actions and to build on this learning so as to avoid dependency on international support. However, oftentimes expectations differ greatly from reality and cooperation programs must factor in enough flexibility to adjust to various contexts and yet reach the expected outcomes despite adverse conditions.

Successful cooperation does not necessarily bear a direct or linear relationship with the quality of technical work performed, and the experience in managing relations with beneficiary countries is relevant, in addition to being familiar with the culture in that country and the organization receiving assistance. The technical work relates to the motivation of officials in the beneficiary country and the support from its authorities. Planning is extremely important for purposes of determining a project’s feasibility. An honest process assessment and the definition of measurable and attainable targets are also critical.

Cooperation is teamwork. Every member contributes from their own perspective: the beneficiary commits to making improvements and makes decisions, the donors commit to financing an initiative either fully or partially and cooperation intermediaries and advisors perform the assessment, formulate proposals and improve, design and implement processes together with the beneficiary.

14.4. Public procurement strategies in tax administrations

A tax administration organization is part of the government administration, where both pre-contractual and contractual processes are ruled by public sector laws and regulations. However, when an international organization is involved, there may be specific requirements to be met as well, in addition to domestic rules.

According to (Arrowsmith, 2012), “Public procurement refers to the government’s activity of purchasing the goods and services which it needs to carry out its function”. The terminology “public procurement” or “government procurement”, and “public contracts” or “government contracts” is used interchangeably in the different countries and agencies, and their definitions are applicable to this publication.

According to (Dávila et al, 2014), (Jiménez & Roca, 2017), (OECD & IADB, 2014), (Djankov, Islam, Saliola, 2016) and (European Commission, 2016), national public procurement may account for 10% to 20% of the GDP. In the areas of social protection, sanitation, education, security, healthcare, energy, communications and transport, it is customary for the public sector to be the main buyer. Thus, public contracts are used by governments as a means to influence economic growth, job creation, social inclusion, innovation, efficiency promotion, which elements are deployed to a large extent through projects.

Public contracts have been promoted to achieve the following objectives (Arrowsmith, 2012) and (Claro de la Maza & Camblor, 1998):

- **Efficiency and economy.** Obtaining the best outcome for each expense unit;
- **Integrity.** Preventing corruption and conflicts of interest;
- **Transparency.** Publishing every act and reporting on all decisions;
- **Non-discrimination and fair treatment.** Awarding the same opportunities and treatment to all bidders; and,
- **Responsibility.** Recording all events clearly and accurately and fulfilling every control requirement.

In addition to these objectives, public procurement may also include elements conducive to national strategies and local interests including job creation, a given economic sector or region’s development and security.

National legislation usually provides safeguards and protections for contractors (public sector), simplified contracts for public sector vendors or non-profit organizations, benefits for sector consolidation, small- and medium-sized enterprises, among others. Likewise, national legislation further establishes extraordinary conditions that enable the direct acquisition of goods and services.

Public procurement regulations adopt specific weightings to make up the objectives pie. In any case, according to the statement from Trepte (2005) later quoted by Arrowsmith (2012) “procurement systems are not to be analyzed or criticized by reference to some universally acceptable and perfect procurement law: they are to be analyzed in their context”.

The United Nations Commission on International Trade Law (UNCITRAL) has published a “model law” to guide the enactment of national procurement legislation. Since its first version in 1993,

the model has experienced updates and improvements. The model provides for the emergence of changes in the situation of public administrations, social and economic conditions and the know-how and expertise of purchasing entities to enable solutions that accommodate each new reality.

Generally speaking, public procurement is carried out according to one of these three methods:

- Minimum price criterion.
- Quality criterion.
- Quality-price ratio.

In a study sponsored by the IADB (Jiménez & Roca, 2017) on innovation in public procurement in Latin America and the Caribbean, the authors recommend including social, economic and environmental sustainability as an additional criterion in public contracts.

The minimum price criterion is applicable to commodity purchases, i.e., goods and services that are readily found in the marketplace. The quality criterion is only used in very specific situations. The quality-price ratio, which uses a weighted composition of quality and price, is used widely. The latter criterion provides better conditions for achieving the target of efficiency and economy.

Regarding how vendor competition and selection procedures are conducted, OCDE (2011) has been classified into four types:

1. **Open Procedure.** The contracting agency announces the specification of the good or service, vendor requirements, method of remuneration and the procurement model. Any vendor who meets the requirements may choose to participate in the competition and, if they do, they should make an integral proposal without any prior negotiation.
2. **Restricted Procedure.** This modality consists of two steps. The first step is similar to the open tender and seeks to select potential vendors to participate in the bidding process. The second step consists of selected vendors submitting a complete bid (with no prior negotiation).
3. **Competitive Dialogue Procedure.** Like restricted procedures, these are also held in two steps. The negotiation rounds with potential vendors are held in the first stage and may include quality (specification of goods and services) and price. The vendors selected in the first stage may submit bids and participate in the tender process.
4. **Short List Competition.** This modality is also carried out in two steps. In the first step, requirements are discussed with potential vendors. In the second step, these vendors submit their bids.

There are other forms of competition applicable in specific situations, such as public utility concessions, public subsidies and design competitions. The details of each modality can be found in “SIGMA Public Procurement Briefs: What are the Public Procurement Procedures and When Can

They Be Used?”. The web of OCDE lists several publications on public procurement prepared in OECD-member countries, both generic and by topic.¹⁶³

The regulation of public procurement also covers the ways in which procedures are held. The range is broad and encompasses from direct vendor contracts (limited by amounts or situations determined by law) to adhesion to the existing public procurement by way of conventional tenders, reverse auctions and eProcurement.

The objectives driving public procurement (efficiency and economy, integrity, transparency, non-discrimination and fair treatment, responsibility) must be present in every selection criterion and competition modality.

In 2018, the European Committee for Standardization (CEN) published “A Guide for referencing standards in public procurement in Europe”.¹⁶⁴ This kind of standards may prove very useful in specifying requirements, increasing security and accuracy, and facilitating dialogue between buyers and sellers. However, it is worth noting that not all standards and technical standards are valid in a given region.

The public procurement of information technology goods and services must meet the regulations established in each country and situation. With the launch of new solutions and technologies in the near term, the dynamics inherent to this type of acquisitions poses new and greater challenges in goods and service procurement. Gartner Group’s Hype Cycle shows a good outlook of this situation as a benchmark to assess technologies that may be useful to the tax administration (Seco, 2018). The study considers the traditional cycle whereby some of the new technologies will consolidate and gain market share, while others will not be adopted or could even be abandoned.

Traditionally, tax administrations have not used non-consolidated, disruptive technologies, although there is no reason for that. According to the phases in Gartner’s Hype Cycle, revolutionary organizations or those tapping strongly competitive markets are using breakthrough (recently launched) technologies (**peak of inflated expectations**). The final phase achieved by a technology once it has stabilized, reaching recognition and success by crossing over the “trough of disillusionment” has proven fruitful and beneficial to its users.

Generally, tax administrations seek to adopt technologies that might bring about the best outcomes in line with the objectives of efficiency and economy. In other words, tax administrations have traditionally sought to adopt technologies which are in the plateau of productivity phase. Nevertheless, the procurement of ICT goods and services is no longer simple. A procurement process seldom repeats the same circumstances as previous processes.

Some of the types of procurement usually undertaken by tax administrations is ICT goods and services that could be classified as commodities or widely used products, and complex solutions targeting specific needs or plugged into other technologies. All of these must comply with applicable

regulations and target the essential objectives of public procurement, with emphasis on efficiency and economy.

The specifications used in procurement processes, also called requirements or terms of reference, are an important piece of the acquisition procedure. A well-defined specification may be time-consuming and labor-intensive for the tax administration, either from its own professionals or external consultants. In addition to translating the meaning of the outcome, it enables the materialization of the public procurement goals and reduces the likelihood of contractual conditions being restricted to few bidders in the marketplace where the process is taking place.

According to the publication “*The public procurement of information systems: dialectics in requirements specification*”:

When acquiring information systems, public entities face a dilemma. On the one hand, they want to procure the system that best suits their needs, which often requires lengthy dialogues with vendors. At the same time, they are restricted by government regulations that mandate limited dialogue in the interests of transparency and equal opportunities for all vendors. (Moe, Newman, & Sein, 2017)

In general, the paper proposes that one solution is to choose the right procurement option according to the legal requirements. Another solution is to learn from similar entities in a formal or informal collaborative network about specifications used previously, such as a payroll system, or the use of know-how from other entities or consultants with safeguards against vendor favoritism.

In a survey carried out by the Norwegian public sector (Moe & Päiväranta, 2011) where they worked with three focus groups (Procurement Managers, Chief Information Officers (CIO) and Vendors) to look into the current challenges in the system’s procurement, the main challenge for procurement managers was “changing the work processes and achieving benefits”. The group of CIOs indicated that “specifying clear requirements” was the most relevant challenge, followed closely by the selection of assessment criteria and solution integration. The vendor group identified “too much focus on costs” as the main challenge faced in the public procurement of ICT systems.

The elements mentioned above are similar to the situation in many countries. There is no one-size-fits-all type of solution. However, it is important to take into account that it seems reasonable to use efforts and resources in designing a good specification and only deciding on the issues of procurement once the specification has been completed.

One good practice worth considering in the definition of contractual specifications is the development of a Proof of Concept (PoC), where the buyer assesses an actual use case. In this approach, there is closer proximity between the buyer and seller. On the other hand, the vendor has the opportunity to present the features of their offering, while on the other hand there is a risk of neglecting the objectives of non-discrimination and fair treatment. In addition, proofs of concept

represent a significant expense both for the buyer and the seller. For this reason, proofs of concept are often obtained from consulting services and are generic in nature, or else they are carried out after the solution has been purchased with a view to validating the proposal.

In the procurement of ICT goods and services, which usually follows quality-price criteria, the following approaches are recommended:

- **Sharing knowledge and experience.** Exchanging knowledge and experiences with other public administration agencies may contribute significant gains in the way of time, risk and cost reductions. In addition, it facilitates the transition of the goods and services in daily operations, given that there will be human talents available with the necessary capabilities to solve possible failures.
- **Reducing technical characteristics to a minimum without having assessed the profitability.** The requirements included in the terms of reference represent a price increase and should produce benefits commensurate with the highest amount payable. For example, a three-year guarantee for the replacement of a faulty piece of hardware in a maximum period of six hours. In such a case, the fast response time required will incur additional costs that the vendor will include in the final price.
- **Using standards to the extent possible.** In accordance with applicable legislation, using technical standards backs the specification and enhances the clarity and accuracy of requirements.
- **Meeting regulations while preventing them from blocking the use of technical and operational best practices.** Due to control and accountability mechanisms, it is not uncommon to find situations where the procurement meets the legal and regulatory requirements but with reduced attention to technical and operational matters.
- **Creating a knowledge base.** Recording the knowledge and experience obtained in a procurement process, for it will no doubt be useful in future situations where the context is similar.

Regarding the public procurement of complex ICT solutions for the tax administrations, the following considerations and recommendations will be useful in addition to the records made to this point:

1. **Exchanging knowledge and experiences.** According to the paper called “Study on best Practices for ICT procurement based on standards in order to promote efficiency and reduce lock-in”, best practices compiled for regulations in the European Union countries can be adjusted to other legislation and inspire new solutions to address the difficulties of public procurement (PwC, 2016).
2. **Caring for technical specifications and terms of reference.** The main difficulty in the procurement of complex solutions is producing clear, thorough and accurate language for the technical specifications, which will guide the preparation of vendors’ proposals and the

terms of reference. Given the exceptional nature of the procurement of complex systems, a government agency is unlikely to hold know-how and experience on the given matters among its staff. If this is the case, the use of specialized consultants is recommended.

3. **Maintaining or building internal capacity to support the architecture of the complex solution.** If everything goes well, a complex solution will be specified, procured, implemented and operated, which will require technical and administrative support, as well as a possible expansion, supplementation and interconnection with other components. These situations indicate that the tax administration must trust that their staff includes professionals capable of caring for the architecture of the solution. Although highly specialized activities may be retained from outside the organization, internal architects are indispensable in the procurement of both complex monolithic solutions and complex modular solutions built by incremental module aggregation. External consultants may support the process and develop the necessary technical competencies among the human talent.
4. **Minimizing risks.** A complex technological solution will always be associated to a complex project. There are many records of total and partial failures in large ICT projects, with higher costs, delayed delivery and even interruptions. One way of mitigating risk is to use an approach that leads to partial deliveries and shorter delivery deadlines, although this form of modular execution requires much more careful planning and integration of the pieces. The other approach, with monolithic or complete execution (turn-key solutions) may require less management efforts by the tax administration although, on the other hand, there is a risk that the final product is not delivered timely and completely.

Finally, when procuring ICT goods and services, it is important to remember that purchasing a product, however excellent it may be, does not guarantee the desired results will necessarily be achieved. It is essential to plan the procurement and work on the implementation, operation, support and management in line with organizational strategies.

14.5. Change management in technology innovation projects within tax administrations

14.5.1. Introduction

Both private and public organizations have had to face deep changes throughout their history. Moreover, it is inferred that those which failed to achieve their expected outcomes have lacked the adequate capacity to face and overcome the different variables implied by change. Whether change is the result of a strategic decision or external circumstances (which requires significant adaptation capacity from the organization) change represents a huge challenge for organizational leaders. Thus, the outcomes and the capacity to sustain changes is a measure of the administration's success or failure.

Public management is no exception. Pressure from citizens for new and better service, government administrations with greater demands for control and effectiveness in the fight against organized

crime, new leaders with the will and promises to enhance the use of public resources, among others, demand both knowledge and experience in effective change management.

Tax administrations are not free from the pressure to implement increasingly demanding changes both in terms of improving taxpayer services and translating tax legislation and the spirit of the lawmaker into actions, processes, structures, information systems, as well as constantly adapting and responding to the new schemes of tax evasion and avoidance.

Change management within the public administration is a discipline that seeks to have change decisions embraced and adopted by those impacted through the active involvement of officials, staff, taxpayers or citizens. It is worth stressing that every organizational effort in the area of productivity, effective results, efficient use of resources or growth is met by changes to the processes, roles, information systems, physical assets and even changes in the structures and authority positions. Unless they are accepted and adopted by those responsible for implementing these decisions, change will not occur.

Change must be understood as a state of transition where the organization is clear about a design of that which it should attain, understanding this as a future state. The state of transition is nothing but the journey taken by the institution from its current condition toward its future condition.

The proposal to adequately manage change arises from the rate of change adoption, the number of persons who will effectively become involved and the desire to be part of the change process, as well as the quality with which the new changes are being used. The combination of all three elements determines the effectiveness with which the change strategy has been implemented.

The quality of the variables set to sustain the current status of the organization as a lever to achieve the future condition will determine the change effectiveness to a large extent. Thus, three important considerations should be made to face organizational change: firstly, recognizing and highlighting the variables that make up the institution's competencies and skills to face change (maturity); secondly, being clear relative to the future condition desired, which implies knowing what kind of changes will be implemented; and thirdly, the capacity to manage the transition, i.e., the rate and efficiency of change implementation, in the awareness that the longer the change implementation phase, the greater the wear to the teams and staff, which will lead to low morale and the lack of expected results in change implementation.

14.5.2. Individual change

Major historic changes in humankind have been the result of the strong willpower of persons who were clear about a better future condition. The different leaders who brought about change have recognized the importance of individuals in their personal change decisions. States or institutions do not change unless the persons in them embrace the change being proposed. The sum total of such decisions and willpower make change happen. But, how does a change decision work in each individual?

There is a natural process to which individuals relate in any change decision. For this change to be effective, people must first be aware of the need for change (awareness). In absence of this first element, people will fail to recognize that there is room for improvement, for in their current state (comfort zone) no changes are needed. In this regard, leaders must develop essential communication strategies so that the different individuals are informed as to the importance and urgency of implementing changes. If the need for change is not properly understood, the employees will simply not own the process of change and stay in the status quo. This is the first major step.

Once people have become aware of the importance of implementing changes, the next step is owning the process (desire). Leaders must strive for people to not only reflect on the need to perform changes, but to be a part of them, too. In this regard, it is important to deploy motivational strategies that identify what motivates each individual who will be impacted by the changes (impacts). Answering the question of what will happen to them and what role we want them to play in the transition phase is of the essence in this connection.

Being aware of the need and having the desire to become involved are not enough to implement change. We should provide the working teams with technical skills so that they are aware of the amount of effort required and the type of change that will take place in practice. One of the most common mistakes when implementing change in institutions is to assume that the change design comes from senior management with no participation from the work teams, and to make a third party responsible for the implementation. Teams are trained without any previous communication or needs identification. Thus, the technical training provided does not yield encouraging results. Mere technical know-how without any awareness as to the need or the will to participate is a waste of time and money.

Finally, for change to be effective, work teams need skills. The mere fact of having the know-how enables individuals to effectively implement changes. Controlled spaces should be provided, in addition to a definition of the type of change strategy that can be used so that the teams may experience the new processes, roles, facilities, information systems or regulations, and in turn, be empowered to participate and achieve proficiency in the new environment.

14.5.3. *Organizational change*

Change management is an individual competency in leadership roles. In addition, it should also be regarded as an organizational capability. Institutions should promote and build teams capable of leading change under a working standard, whether it arises from a decision or as a consequence of external factors. Establishing a methodology will reduce the risk from an impact and avoid improvisation.

There is no prescription or *silver bullet* type of method to ensure that the changes proposed serve the purpose for which they were designed. There is the adoption of a series of policies and procedures whereby the institution guides its change efforts and enables more professional and consistent

progress. The organizational change capacity is built, experienced, learned consciously and intentionally so that work teams gradually adopt better approaches and correct their own mistakes, allowing the organization to learn from itself.

One good way of providing a consistent organizational change is by identifying three stages in change management. The first one is preparing for change. In this stage, the institution must become aware of its current condition relative to the change capacity (aspects such as sizing the desired change, i.e., how many processes will be affected, how many teams or what power and authority structures will be affected). On the other hand, the cultural features distinguishing the organization should be identified, such as the way it makes decisions, how work teams are organized, what gets rewarded, what gets punished, how information flows, what is valued, which behaviors the people show when their performance is assessed. By combining both the features of change and the cultural attributes, we can establish the amount of risk involved in adopting a change for the institution.

Another important exercise in this first stage is mapping the sponsors and leaders of change. A sponsor is a person who exerts direct influence on change implementation, either positively or negatively. Unlike a stakeholder, a sponsor who influences through his vision, behavior and attitude to change may affect the final outcome of the change being introduced. Sponsors have authority in the organization and their influence may result in the effective implementation of the change strategy. The sponsorship map seeks to identify all the individuals with decision-making power relative to change, their interrelationships and relationships with peers and higher authorities, but mostly, their capacity to build alliances, become actively engaged in the project and their communication skills. With this mapping, we can anticipate resistance strategies and unlock relevant decisions relative to change.

A third element that is built during the first stage of change preparedness is the identification and creation of a first team of change managers. Initially, recognizing that the institution is not mature enough in terms of change competencies, no specific area needs to be defined in the organizational structure. It will be enough to identify a multidisciplinary team in the central administration with competencies in ICT, processes, procedures, human talent, and knowledge about the main processes of service and control. This team will also be responsible for deploying the best change methodology and establishing technical support in implementing the changes. Profiles and responsibilities will be agreed upon based on needs and, above all, the members of this team will know that they must make their work visible and institutionalize change management as a formal activity in the organization.

The second stage in organizational change management implies two tasks which are easy to say but extremely complex to implement, namely designing and executing change plans. These include:

1. Communications Plan – what is communicated, who, when, through which means, and why.
2. Education and Training Plan – knowledge and skills gap.
3. Change Resistance Plan – identifying areas and strategies to unlock the reasons for resistance.

4. Sponsorship Plan – strategies for alliances, active engagement of senior authorities and messages passed on by senior management.
5. Coaching Plan – training the middle management and opinion leaders as change agents in their work teams.

Each plan is configured based on the results from the first stage. They are tailored to the need and urgency for change, as well as the nature of the project being implemented. On this point, it is worth noting that projects are the best change drivers in organizations. Designing, setting the purpose and planning a project is the best opportunity for changing the order of things and the way of doing business in the organization. However, conceptualizing and executing a project may address the *what* is to be done, but not the *why*. While project management covers the technical piece involved (for example integration of activities, definition of resources, deadlines, processes, roles, information systems, structures, locations), change management covers the human piece, i.e., the individual decision to adopt a new way of doing business, the use and adoption of this technical piece. The best technical device may be in place but change management will ensure that it is used and adopted. Ultimately, the latter will determine the return on investment established for the project if achieved.

An appropriate change strategy that contemplates the five plans mentioned above takes into account two important variables – the timing for strategy execution, and the justification of why the strategies are executed. The time alignment with the project's technical execution is very important when establishing change. If the project timeline is delayed, change plans should be delayed accordingly. Change plans should be flexible enough to be adjusted to new circumstances in case the technical project warrants it. The technical project will set the pace of change. There is no worse change strategy than the misalignment between the project technical teams and the change management team. We must remember that in the change management context, the most relevant factors are not what is being implemented but why and when.

Finally, the third stage in the change process is reinforcement. The worse change strategy is that which is not met. The longer the work teams remain in the transition phase, the more wear and demotivation, and thus, fewer results. Throughout the transition, there may be changes with regard to definitions, teams, leadership, and initial conditions. Therefore, the reinforcement stage will allow the institution to reassess the conditions and effectiveness of the use and adoption of change. Implementation controls and valuations are established, in addition to their effectiveness, continuity and institutionalization. There will be reinforcement tasks carried out in the areas, processes, offices, and teams, where changes have not been effective.

14.5.4. *What is the influence of change management in technology innovation projects?*

Currently, the widespread use of technology impacts organizational changes as never before, and tax administrations are no exception to this reality. Until slightly more than twenty years ago, information and communication technologies were a luxury only affordable to few organizations. On

the one hand, the cost of procuring new technologies and the complexity of their implementation represented a high cost for the organizations that wished to have them. In addition, information and communication technologies were seen as a support to central processes and the institutional strategy.

The current situation is different. The impact of technology has changed our colleagues and contributors' habits and reasoning regarding the tax administration. Accessing information more transparently and directly, using free and open service outlets, and the interconnection among different citizen services, have opened up a new dimension for tax administration officials and taxpayers. Nowadays, there is direct empowerment and, thus, a shift in information consumer habits and demand for services. The tax administrations must be aligned to these new trends and listen more attentively to their colleagues and contributors in such a way as to add value to their services and increase their effectiveness in the collection mission.

Tax organizations should react to new trends in technology in a way that makes them more responsive and more quickly adaptable to changes in the environment and in taxpayer and government preferences.

14.5.5. The Influence of organizational culture on the use and adoption of new technologies

We have indicated that tax administrations do not escape the impact and influence of ICT's, and that it is their organizational capacity to adopt them that makes the difference. It is now important to consider the role of organizational culture.

We cannot expect a modern tax administration to adopt new technologies if it uses processes that are obsolete or guided by control and standardization and has leadership styles that are based on command and control. For new technologies to be properly harnessed, it is essential to take a direct look at the cultural component. Organizational culture, understood as the way in which a tax administration acts and the way in which those that work in it behave, becomes a fundamental factor when it comes to implementing technology projects.

The culture of a tax administration is determined by the way in which decisions are made, how teams are organized, how investments are prioritized, how a communication crisis is addressed, what is valued, what is punished and what is rewarded. All these aspects have a direct bearing on an organization's capacity to adopt new technologies. How effective have technology projects been in the last year? To what extent have taxpayers used and adopted new technology-based services? How are work teams more adaptable to changes in the environment and to new demands from taxpayers and/or government?

An organization's culture plays an important role when it comes to establishing service and/or control strategies based on new technologies. If the technology strategy is not in line with the organizational culture, the effectiveness of the technology adopted is likely to be very low. Certain fundamental organizational and functional adjustments need to be made in order to enable new

technology, which entails changes in the way decisions are made and even in the way in which tax administrations are structured. The proposal is for tax management to make room for innovation based on new parameters to prioritize the technology portfolio; to set value metrics for taxpayers and, with that, create room for experimentation based on hypotheses and an accelerated development of software applications. Results should be measured in short periods of time so that it is possible to react on time and decide whether to continue applying the technology in question or whether it is necessary to move to a new one.

There are many sources of change in tax administrations, but, together with regulatory changes, new technologies have become the natural drivers and accelerators of change in organizations. Change management should be part of the strategy when adopting new technologies. As stated before, the way in which staff and taxpayers accept and adopt new technologies determines success and return on the investment. Thus, implementing change management strategies and actions is part of any technology adoption strategy.

Whereas until not too long ago, technology was considered to serve as process support, currently new technologies determine new ways of doing things and new management models which were unthinkable before. The capacity to generate relevant information when recording or making a transaction enables tax administrations to apply new management approaches; therefore, change strategies should be a pre-requisite to the approval of a project of this kind.

14.5.6. How should change be managed in a technology innovation project?

Habits and behaviors of both staff and taxpayers have changed. New generations now have access to information in an easier, more immediate and shared manner. The use of highly connected devices and the capacity to store data usher in opportunities and responsibilities for government entities, as well as new challenges derived from new demands and the higher quality expected from public services. ICT's play a dominant role and, as indicated before, the tax administrations organizational capacity to adopt new technologies will enable them to meet new demands from society in the digital era.

Tax administrations with high levels of maturity in terms of technology adoption have some of these features in common:

- They have automated most of their critical processes, like taxpayer registration, massive controls, and collections.
- They have sound data mining tools to screen and combine relevant information when designing a control plan, exchanging both structured and unstructured databases.
- They have used technology to empower the work teams in the various administrative offices so that they can be self-sufficient in the development of applications that can facilitate their work and be more collaborative and productive.

- They solve their operational and tactical management issues with technology developed by their own teams without relying on a specific technology unit.
- They make decisions focusing on improving taxpayer services and facilitating voluntary compliance, narrowing the tax gap.
- They have room to experiment with new services and controls, which allow them to validate hypotheses for new management models without harming ongoing operations.

How do they achieve It?

The technology adoption maturity process is achieved by means of organizational capabilities for change, for which there are several stages. An organization is at the initial stage when it has sporadically implemented communication and technical training strategies and actions in some of its emblematic projects. The second stage comes with the implementation of more deliberate change strategies but only for critical, complex and highly visible projects. The third stage is that in which the tax administration has dedicated teams to manage change together with the technical project teams. The final stage comes when the tax administration is clear about the effectiveness of change strategies and actions and can choose the best strategy based on the impact of each project. At this stage, the tax administration has highly developed teams to manage change and middle managers have prior training and experience leading changes successfully.

A proposed change management model and road map for technology transformation starts by viewing change management at four levels. The first level is the authorities. Senior management should be aware that new technologies represent an opportunity to have tax administrations that are not only more efficient but also more effective. Change management at this level should be aimed at maintaining high morale and support from senior management for new technology projects.

The second level in change management is technology units. The structure of units and the technology processes traditionally established do not lend themselves to the adaptation, collaboration and creativity that the fast pace of innovation requires. It is necessary to develop new ways for technology units to work, starting with their leaders, who should change their mindset regarding the potential to be developed; also addressing team capabilities, and the infrastructure that maintains the portfolio of applications, which should enable the release of new and better software versions.

The third level of change is that of the teams that develop applications. The traditional way to develop software does not meet the needs for adaptation in the vulnerable, complex, uncertain and ambiguous environment of the digital era. It is necessary to incorporate new software development processes, methods and practices so that value propositions are effective and can be put into production at market speed. This entails a new mindset and new knowledge in the technology teams. It is essential to break silos within technology units to start the technology transformation journey.

The final level has to do with managing change for the end users of the new software applications. The degree of usage and adoption of the new applications and technology-based services offered

by tax administrations will determine the success of the value propositions, which should translate into new and improved services as well as increased voluntary compliance and revenues, and less tax evasion and avoidance.

What is the starting point? A good way to start is to simplify the management model. Tax processes and regulations are complex, numerous and sometimes confusing. A good exercise is to simplify processes by means of a high-level value mapping and to identify bottlenecks, points of delay, rework and the work teams' response capacity on the map. With a value map in place, it is possible to come up with a management model that focuses primarily on what taxpayers value.

The next step is to understand what taxpayers expect from the tax administration. Simplicity, transparency and information integration are examples of such expectations. If taxpayers were asked how much they are willing to pay for the services they receive from the tax administration, what would they answer? That would determine what we are developing for taxpayers and the impact we are having on them. If the proposed digital processes and services are found to be at odds with what taxpayers value, then the decision should be to direct efforts towards offering what taxpayers are willing to pay for (figuratively speaking).

Once we have a clear idea about what taxpayers value in a tax administration, the next step is to choose the metrics for such value. What is the current result? Had this been measured before? What can be done to improve these metrics? We have to seek to improve the metrics by alignment with one of the objectives in the tax administration's strategy as well as with the various teams involved in improving it, regardless of the areas and processes it belongs to. This will bring visibility and strategic priority, on the one hand, and concentration, focus and integration of work teams, on the other. This should be considered the pilot change project for technology transformation.

Since it is considered a hypothesis, the results expected from this change and technology adoption project will be measured according to the rate of change in processes, procedures, regulations, ICT systems, and roles. In addition, the effectiveness of change will be given by the number of teams and individuals that adapted to changes; and finally, the quality with which end users -either staff or taxpayers- use the new processes, regulations, and ICT systems will determine the return on the investment in the transformation project.

Building the capability for organizational change in tax administrations is a sizeable challenge because of the structures and regulations in place and the complexity of taxpayer demands. There is a way to address organizational change considering that change happens one person at a time, and if the tax administration manages to answer the question about the impact staff will have and the value that will be created for taxpayers, it will then be in a better position to develop a change management practice which will ultimately contribute a management advantage when devising strategies to bridge tax gaps.

Notes

150. For more information, see: www.iadb.org
151. For more information, see: www.imf.org
152. For more information, see: www.worldbank.org
153. IFC International Finance Corporation is a financial institution that is part of the World Bank Group and operates in less developed countries.
154. For more information, see: www.kfw.de and www.giz.de
155. For more information, see: <https://www.seco-cooperation.admin.ch/secocoop/en/home.html>
156. For more information, see: <https://www.usaid.gov/>
157. For more information, see: <https://www.gov.uk/government/organisations/department-for-international-development>
158. For more information, see: www.adb.org
159. For more information, see: www.afdb.org
160. For more information, see: www.ciat.org
161. For more information, see: www.ataftax.org
162. For more information, see: <https://www.iota-tax.org/>
163. For more information, see: <http://www.oecd.org/gov/public-procurement/publications/>
164. For more information, see: <https://ec.europa.eu/docsroom/documents/33421>

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15.

NEW DISRUPTIVE DIGITAL TECHNOLOGIES AND SERVICES – OPPORTUNITIES AND CHALLENGES

In today's world, the evolution of digital technologies and services is a constant. Some of these technologies and services are disruptive, which means that they can promote radical changes in the work methods of tax administrations, with a significant potential to obtain better fiscal results, modify the manner in which the tax administration and taxpayers relate to one another, and even to make way for modifications of tax policy.

A disruptive technology allows one to move from an unfavorable situation to modernity without having to go through any intermediate phases, which are generally costly and require a long period of implementation. For example, some African nations that were previously lagging in the field of telecommunications have migrated directly to mobile telephony without having to install costly land-based infrastructures of communications lines.

It is estimated that in 2022 Sub-Saharan Africa will have a total of 1 billion mobile telephones for a population estimated at 1.2 billion persons. With such a leap, these nations also will be able to lead and implement specific types of cutting-edge technology such as 5G (IEEE, 2019). Tax administrations can take advantage of these technologies to provide increasingly more electronic services to taxpayers, collect information, and establish data exchanges with other institutions, thereby improving collection and control.

New hardware and software technologies provide greater ease to accumulate and handle these data, making it possible for tax administrations to stop investing in traditional data cross-referencing techniques to invest in data analytics and artificial intelligence (AI), powerful weapons to battle against tax evasion and avoidance.

On the global level, it is estimated that adopting digital technologies could help increase the collection of indirect taxes up to 2% of the GDP per year, and in the future digitalization could help to charge taxes on assets hidden in tax havens, which are estimated at 10% of the global GDP (IMF, 2018).

In this Chapter we are going to present some of these technologies and services with the most potential for tax administrations: **advanced analytics and artificial intelligence; blockchain; IoT**

(internet of Things) and sensors; app's (applications for mobile devices); APIs (Application Program Interfaces); interoperability and standards; digital twins.

Also, we are going to provide the basic concepts, strategy options, adoption tools and areas for use, and describe examples of proof of concepts (PoC) and ongoing implementations.

15.1. Advanced analytics and artificial intelligence

The concepts of Big Data, data analytics and artificial intelligence are not new, but some technological advances over the past few years have made possible their intensive use in business and public administration as well as having a positive influence on tax administrations. The principal advances made are:

- The large expansion of processing and storage capacity on computers associated with the reduction of their costs;
- The growing availability of communications networks and broadband Internet;
- The development of effective models to capture, store, and process massive data and advanced cognitive¹⁶⁵ algorithms; and,
- The emergence of new sources of data (e.g., sensors, GPS, social networks, etc.), including electronic invoices and the exchange of fiscal information between countries (OECD, 2019a).

Consequently, these advances are based on the tripod made up of computing capacity, data and algorithms.

The handling of data begins with Big Data, which is based on the concept of the five “V” as follows:

Volume: Related to the large amount of data generated;

Variety: The sources of the data are highly varied, which increases the complexity of the analyses;

Velocity: Due to the large volume and variety of data, all the processing needs to be agile to generate the required information;

Veracity: Directly related to the reliability of the information; and,

Value: This refers to the “useful information” that can be obtained from the data.

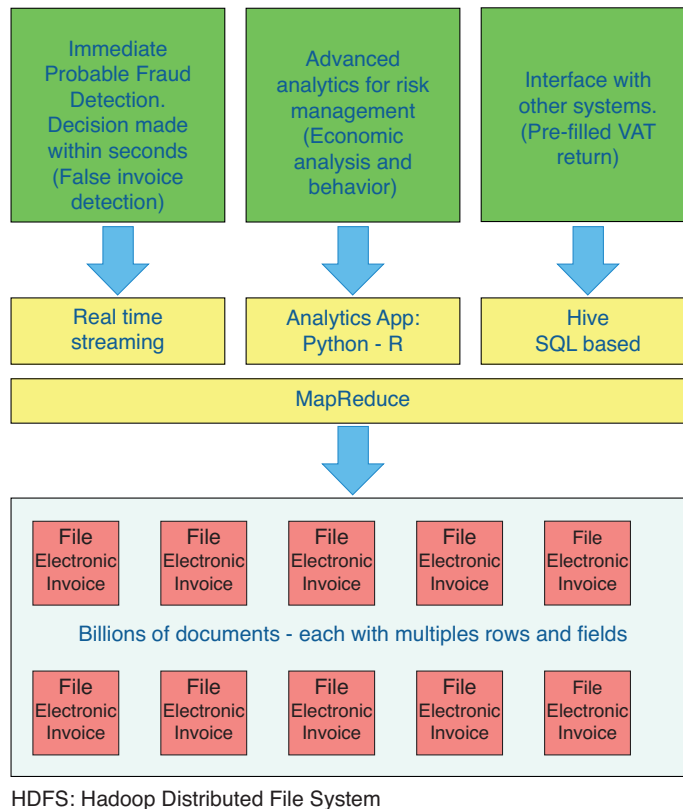
The importance of Big Data is underscored by the global production of data, which is estimated at 2.5 exabytes¹⁶⁶ per day (Northeastern University, 2016). Preparation of the stored data with tools such as Hadoop, Spark, and column-based systems with access like MapReduce and Cassandra, allow the organizations to make the maximum use of opportunities. In other words, Big Data serves as the foundation for data analytics applications that can be powered with artificial intelligence.

Regarding algorithms, data analytics and artificial intelligence are based on pattern recognition algorithms. Data analytics discovers patterns through the sequential analysis of data, sometimes

cold data,¹⁶⁷ or data that was not recently collected. Hadoop, the basic framework for analysis by Big Data, is an assembly of software tools designed to process mass amounts of data using highly distributed computer equipment and storage and a MapReduce administration model with the capacity to administer and to recover from failures. This storage model, designed for an analytical focus of large amounts of data and its administration, is fundamentally different from the more traditional model based on relational tables, which is quite common in tax administration and is highly appropriate for transactional operations.

The example in *Figure 15.1-1* illustrates a possible use of Hadoop in a tax administration. In the example we have a full set of electronic invoices, billions of those documents, with dozens or hundreds of new invoices being incorporated into the dataset per second. This data is stored on different nodes, based on a distributed files system, in a manner that allows highly efficient parallel processing of the data. The top tier shows the possible applications for a tax administration. In the first example, the monitoring and analysis of the transactions is in real time, as they arrive, and its analysis of the environment in order to identify possibly fraudulent operations and simulated operations to try to lower tax liability. The second example of use shows the comprehensive analysis of the invoices for sectoral economic analyses, behavior of the economy, trends, and so forth. The third example shows the use of the invoices and the relationship with other data and systems of the tax administration to draft the pre-filled VAT returns.

Figure 15.1-1 An example of the use of Hadoop in a tax administration

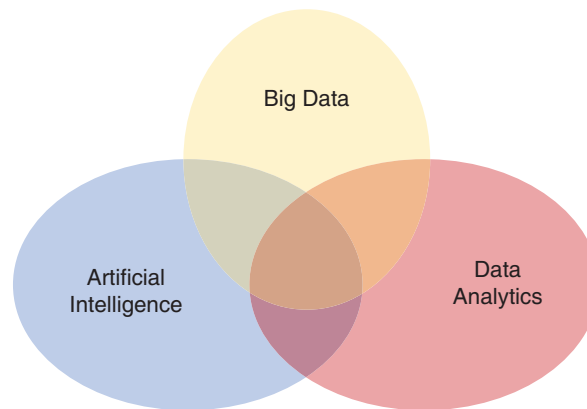


Source: Prepared by the author

Nevertheless, machine learning, one of the principal areas of artificial intelligence, learns from the data collected and continues to collect. An autonomous automobile never stops collecting data, and it continues to learn and to improve its processes. Data always arrives fresh and always is applied (Patrizio, 2018).

It is difficult to define the exact border between Big Data and data analytics, or between data analytics and artificial intelligence. Likewise, artificial intelligence is increasingly applied to Big Data and data analytics problems. *Figure 15.1-2* attempts to present this interdependence in a graphic manner.

Figure 15.1-2 Big Data, Data Analytics and AI



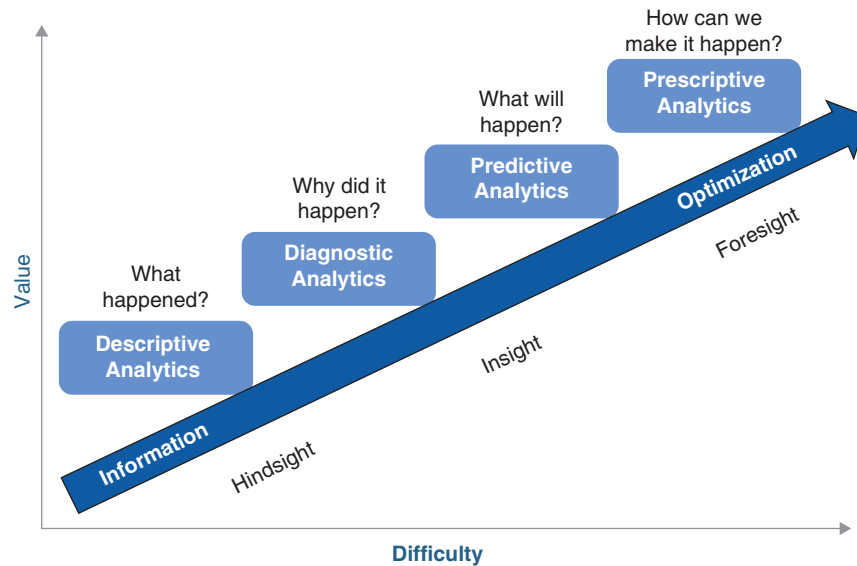
Source: Prepared by the author

15.1.1. Data analytics

Concepts

Data analytics or advanced analytics is the autonomous or semi-autonomous examination of data or content using sophisticated techniques or tools, generally beyond traditional Business Intelligence (BI), to discover more profound knowledge, make forecasts, or generate recommendations. In addition to regression mechanisms and *logit* regression, advanced analytical techniques include other mechanisms such as dynamic decision trees, data mining and/or text, machine learning, pattern match, forecasting, visualization, semantic analysis, network and cluster analysis, multivariate statistics, Bayesian models, chart analysis, simulation, complex event processing and neural networks.¹⁶⁸ Summing up, data analytics uses inductive statistics and concepts of nonlinear systems identification to infer laws (e.g., regression, nonlinear relationships and causal effects) starting from large datasets with a low density of information to reveal relationships and dependency or to promote forecasts of results and trends. The availability of large amounts of data is a prerequisite for the use of advanced analytical techniques.

The main types of data analytics are presented below.

Figure 15.1-3 Types of data analytics

Source: From "ITScore for Data and Analytics," by T. Oestreich, & A. White, 2017, October 23, *Gartner*. Copyright 2017 by Gartner Inc.

- *Descriptive analytics (What happened?)* - To reveal what is happening, based on the input data. Real-time dashboards or reporting tools are commonly used.

This type of analytics is used in tax administration, for example, to monitor the collection of revenue that is entering the treasury.

- *Diagnostic analytics (Why did it happen?)* - To view past performance in order to determine what happened and why it happened. The result of the analysis is often presented with an analytical panel.

This type of analytics is used in tax administration, for example, to identify situations of tax default, such as the use of ideologically false tax documents.

- *Predictive analytics (What could happen?)* - Analyze what scenarios may occur. Deliverables are usually a predictive forecast.

This type of analytics is used in tax administration, for example, to anticipate significant fluctuations in collection, or, anticipating a drop-in collection. It can also identify taxpayers that could enter into non-payment situations associated with the conjuncture of a sector.

- *Prescriptive analytics (What should we do?)* - Used to reveal what actions should be taken. This type of analysis is the most valuable. The results include rules and recommendations for the next steps (decision making).

This type of analytics can assist in making immediate decisions, for example, on the authorization or not of electronic documents in countries that require prior authorization from the administration, based on the identification of high signs of fraud.

Advanced analytics creates opportunities in different areas of tax administration management. The example in *Table 15.1-1* presents an analysis of factors that affect compliance; the use of *clustering* mechanisms has allowed for the identification of cases of fraud through phishing, or issues as specific as evaluating the effectiveness of electronic mail communications depending on the moment in which they are sent.

Table 15.1-1 Factors that affect taxpayer's compliance

Variable	Coef.	SE	Z
Tax knowledge	0.68	0.45	1.51
Probability of Auditing	0.31(*)	0.18	-1.72
Perception of Government Spending	-0.1	0.14	-0.72
Perception on Equity and fairness	-0.1	0.17	-0.56
Penalty rates and enforcement	-0.14	0.17	-0.83
Personal financial constraint	-0.25(*)	0.15	-1.71
Changes on current government policy	-0.26(*)	0.15	-1.78
Referent group	-0.21	0.17	-1.29
The role of the tax authority	-0.09	0.13	-0.66
Log likelihood	-75.36928		
LR chi2(23)	29.2		
Number of obs	99		

Notes: ***p < 0.01, **p < 0.05, *p < 0.1.

Source: Determinants of tax compliance. From "Factors influencing taxpayers' compliance with the tax system," by G. Abera, and T. Engida, 2014, November, E-Journal of Tax Research, 12, p. 443. Copyright 2014 by E-Journal of Tax Research

15.1.2. Artificial intelligence¹⁶⁹

Concepts

There are many definitions of AI. For our purposes, we will take the definition of AI as "the application of advanced analysis and logic techniques, including machine learning, to interpret events, support and automate decisions and act." Furthermore, according to Bloomberg Finance L.P. (2017), the characterization of a system such as AI must be based on the existence and joint use of five abilities: discover; predict; justify; act; and, learn.

Together with the advances in computing, new research mainly in the areas of linguistics, psychology and sociology applied to computer-based techniques of machine learning, cognitive computing and knowledge management enabled considerable progress, with the successful application of AI in actual cases. Also, natural language processing algorithms (NLP) enable interaction between humans and specialized computer systems, through text and voice, in various languages as well as their regionalisms.

These systems can currently participate in games, recognize faces and human voice, learn and make informed decisions. According to (Accenture, 2018, p. 3), more than 2/3 of US federal agencies plan to invest in AI in 2019.

It is likely that AI, associated with automation, will eliminate some jobs, lead to the redesign of others and create completely new professions. The McKinsey Institute indicated that 1/5 of the total global workforce will be affected by automation (Kettley, 2018).

15.1.3. Implementation alternatives

The implementations of Big Data analytics and AI-supported systems are based on market products and the use of free software packages. In both cases, it is a dynamic market, subject to improvements or changes of platforms in short intervals of time. The information below refers to April of 2019 and should only be used as a reference in profounder evaluations of specific cases.

Market platforms

There are a large number of market platforms, some focused on specific business cases and others in the modality of a product suite, which are intended to cover a broad spectrum of business cases. Product suites can be seen as a Lego game, in which the institution identifies and uses the necessary modules to complete its business case.

Gartner and Forrester, two consulting companies in the ICT sector, published comparative studies between data analytics and machine learning suites. These evaluations can support the preliminary selection of platforms to be evaluated by a tax administration.

A summary of some evaluations is presented below.

Company/Product	Gartner ¹⁷⁰	Forrester ¹⁷¹
SAS	Essential and reliable market brand; product robustness; receives excellent scores for the user interface and data exploration and visualization, data preparation, automation and data augmentation ¹⁷² ; operational excellence to support worldwide data growth. There are 2 platforms not fully interoperable; you need to expand open source support tools.	It has a data mining and visual machine learning, which allows the round trip between the machine learning pipeline and coding, with integrated features. It includes a growing set of effective visual tools to create models, including deep neural networks. Codes with Python or “R” may be embedded.
IBM WATSON	Strong invisibility and mind share; complete roadmap, with product integration; supports multiple business cases; excellent scores on the overall user experience. Multiple products are required to complete its capabilities.	It offers access to pre-trained machine learning models, such as visual recognition, natural language classifiers and others. It has workflow capabilities with open source libraries for machine learning. It has visual tools and access to open source routines through coding interfaces.

(continued)

Company/Product	Gartner ¹⁷⁰	Forrester ¹⁷¹
SAP	It enables SAP-centric organizations for data science operations: many SAP customers identify the alignment with existing data and analytical investments as a key reason for choosing this platform. Smart business vision; fragmented tool chain.	It is a critical component of its “Intelligent Enterprise” architecture; they consider that business data is the original fuel of machine learning projects, so SAP improved its data management platform to meet the needs of all professionals involved.
TIBCO	On a single platform, TIBCO brings together powerful visualization capabilities, solid descriptive analysis and visionary functions of predictive analysis; cutting-edge analytics for IoT; end-to-end process, from data ingestion to model management. Performance and stability reported below optimal.	TIBCO has two alternatives for data science: one for sophisticated analysis and machine learning models, to build industrial class models and manage them; and, another for collaborative use in projects generated by intuitions (insights).
MICROSOFT	Infrastructure approach in the cloud; wide range of components and associated companies (for example: Databricks and Apache Sparks); offers a highly qualified GUI for all types of data scientists. On-premise capabilities are limited; new capabilities were recently launched and were not covered in this report.	Azure Machine Learning Studio is a visual tool for creating machine learning pipelines; new services come to help in deploying and managing models in production; Microsoft has plans for new functions for machines’ automatic learning and to promote <i>deep learning</i> .
RAPID MINER	Sophisticated simplicity, a favorite of citizen data scientists (freelancers); GPU support, deep learning, data augmentation and improved time series; consistent end-to-end platform: from scalable repository management to real-time (models) scoring. Licensing schemes and complicated prices.	User friendly virtual environment, with automated model creation function; each model is a standard workflow that can be inspected, customized and built. It is a particularly good option for organizations looking to scale the use of machine learning.

It is important to invest time and resources in the selection of a broad-spectrum platform for an institution, mainly due to the trend of increasing the use of data analytics and AI in all business areas.

There are still no prevailing licensing and pricing schemes, so negotiations tend to be individualized.

The development of Virtual Conversational Assistants (VCAs) is feasible on many broad-spectrum platforms, but there are specific platforms for this application.

Open source platforms

Large amounts of talent and resources are being used to accelerate the growth of AI and data analytics technologies. As a result, there are dozens of AI platforms, or even libraries of models, algorithms and routines, based on open source. They are constantly evolving, both in quantity and quality. Several institutions decided to build at least parts of their AI applications using these open source platforms.

Some of the most used platforms/libraries are (Seco & Muñoz, 2019):

- Tensorflow: machine learning framework built and sponsored by Google, available in Python, C++, Haskell, Java, used in AI projects by Dropbox, eBay, Intel and Twitter, among others (<https://www.tensorflow.org>)
- Rasa: machine learning framework for developers to create chatbots and contextual virtual assistants, maintained by a community of more than 1,000 members, used in AI projects by Allianz (insurance company), Yellow Pages and UBS, among others (<https://rasa.com>)
- Keras: API for neural networks written in Python and capable of interacting with other AI technologies (<https://keras.io>)

As a reference, a list of the best libraries for machine learning and deep learning implementation is provided, according to Heller (2019) Keras, MXNet, PyTorch and TensorFlow are deep learning structures. Scikit-learn and Spark MLlib are machine learning frameworks.

According to Roe (2018) other features needed for a robust AI platform are:

- The machine learning models used must be able to explain their conclusions (traceability), in order to provide more effective work between the AI team and business specialists, demonstrate credibility and meet compliance requirements.
- Organizations should not allow their data to be incorporated into the provider's data models, benefiting external organizations. Platforms must provide segregation mechanisms between the models of their own data and those of customers.
- The platform must support structured and unstructured data.
- The platform must provide collaborative tools that make it easier for AI teams and business specialists to work together to assess model performance, label data, adjust on the fly, etc.

The development of AI solutions usually involves the use of different platforms, models and algorithms, integrated according to the type of problem and domain (business area) of the solution. Institutions that decide to develop solutions in-house should properly advise and strengthen their teams in number and profile, creating a group with experience in the management of free software, in addition to the skills in AI techniques. This is justified by the constant and accelerated transformations in the sector. With specialized external advice, the appropriation of the advances by the team can be achieved. The model to be adopted for this advice could consider agreements with universities¹⁷³ or contracts with specialized or emerging companies (start-up).

Modalities of Implementation

Commercial and open source platforms can be implemented in some modalities, according to the assignment/origin of the human (technical) resources used. An evaluation of some alternatives is presented below, according to certain selected characteristics:

Table 15.1-2 Relative comparison between implementation modalities and selected features

Features Modality	Implementation Time	Cost of contract of use / maintenance	Need for in-house training	Own ICT Infrastructure	Number of Internal technicians	Flexibility for changes
Commercial platform / internal customization	Medium	High	High	Low	High	High
Commercial platform / external customization	Low	Very high	Medium	Low	Low	Medium
Free software / internal development	Very high	Low	Very high	Very high	Very high	Very high
Free software / external development	High	Medium	Medium	High	Low	Medium

Source: Comparison between implementation modalities and selected features. Adapted from “Asistentes conversacionales virtuales en las administraciones tributarias: Principios, modelos y recomendaciones,” by S. Antonio, and A. Muñoz, 2019, September, Inter-American Development Bank, p. 26. Copyright 2019 by Inter-American Development Bank

15.1.4. Examples of ongoing implementations in tax administrations

Data analytics and AI are applicable in virtually all segments of tax administration. There are examples of implementations and PoC¹⁷⁴ in all continents. Below are some examples of these applications, which grow in number every year.

Assistance to taxpayers / Virtual Conversational Assistants (VCAs) – Spain and Brazil

➤ Virtual Assistants in the Spanish Tax Administration

The Spanish tax administration (AEAT), in conjunction with IBM, developed a project of a Virtual Assistant aimed at supporting taxpayers, initially addressing issues related to the delivery of electronic VAT invoice information.

In 2017, the AEAT determined that the information contained in the invoices issued by certain taxpayers was sent to the tax administration up to four days after its issuance. This is why it created the SII (Immediate Supply of Information), which reaches more than 63,000 taxpayers: large companies (invoicing more than 6 million euros); VAT groups; and, those registered in the Monthly VAT Refund Registry.

Complying with tax obligations, especially taking into account that regulations issued by tax administrations are frequently rectified, can be a complex process for many professionals in accounting and financial departments.

Looking for an innovative way to help these professionals solve their doubts, a Virtual Assistant was developed with the Watson cloud technology platform, capable of answering questions that may arise. Its implementation, with the support of the provider, took 12 months for the interface and orchestrator software, and more than 3 months for the content and learning by the Virtual Assistant.

There is a welcome message to the user that warns, among others, about the legal consequences of the answers obtained. In Spain, only the Tax Administration agency (AEAT) can issue responses that are binding for the Administration. In the same way as with information provided over the telephone or in offices, the response from the Virtual Assistant will not be legally binding. However, if you act in line with the criteria indicated, you cannot be punished (Sanchez, 2019).

According to the Spanish newspaper *Expansión* (2018), since its implementation the Agency's Management Department noted an 80% reduction in the number of emails received: from 900 messages to 165 per week. Simultaneously, the virtual assistant consultations have multiplied by ten - from 200 requests in the first week of use to a peak of 2,000 in November of 2018.

Given the good results, the Virtual Assistant is being extended to other areas of activity of the tax agency, such as all of the VAT, with plans to extend it to the Income Tax.

With this milestone, the AEAT becomes a benchmark in digitalization within the public sector in Spain, being the first organization of the Spanish administration that opens a new channel of communication with the user based on artificial intelligence.

- Virtual Assistant of the Secretariat of Finance of the State of Piauí - SEFAZ-PI (Brazil)
- In the federal structure of Brazil, the States are responsible for the administration of the ICMS (Tax on the Circulation of Goods and Services, similar to VAT), IPVA (Tax on Motor Vehicles), Transmission and Donation Tax of Assets (ITCMD), through its State Finance Secretariats (SEFAZ). SEFAZ-PI has two Taxpayer Assistance Centers, in the state capital, with face-to-face, telephone and email service. Tax agencies in provincial cities also have functions of face-to-face assistance to taxpayers.
- The development of the Virtual Assistant, called “**Teresa**,” was contracted by the Secretariat of Finance of the State of Piauí through public tender. The main goals for the Virtual Assistant of the Secretariat of Finance of the State of Piauí - SEFAZ-PI (Brazil) were:
 - ❑ Improve the relationship between taxpayers and the State tax administration;
 - ❑ Increase collection;
 - ❑ Grow the efficiency of the tax credit process;
 - ❑ Obtain better information for the analysis of taxpayer behavior, aiming to inhibit tax evasion;
 - ❑ Modernize citizen access to tax information; and,
 - ❑ Facilitate tax consultations by officials of the Secretariat of Finance (internal use).

The contracted Virtual Assistant should answer requests made online, orally or in writing, considering the terms used in the tax sector and the given regionalisms, from the institution's web portal and with an interface via Facebook and Telegram. The Virtual Assistant received cognitive training to provide information on ICMS and related subjects (such as statements

with economic-fiscal information and transit of goods), electronic tax documents, vehicle tax (IPVA), and the “*Piauí Note*” (tax lottery system for the final consumer).

The contract was awarded to a private company for the approximate total value of USD 320,000 for one year. The contract includes the use of the *IBM Watson Assistant* product in the cloud, the training of the model with a maximum of 500 “intentions,” and the training of the personnel of the Ministry of Finance in the management of the system. A maximum of 10,000 “consultations” per month were provided by taxpayers and officials of the Ministry of Finance, but with no penalties should the number of “consultations” exceed the limit agreed to in the contract. Questions and answers can be submitted by the taxpayers orally or in writing.

It is important to highlight two concepts used in the metrics of this contract:

- ❑ “Intention”: An “intention” is the purpose for which the user sent a specific message. The same purpose can be expressed through different questions, such as: “Does my car have any non-payments?” or “Good morning, I want to know if my car has unfulfilled IPVA payments.” A maximum set of five different questions that have the same meaning, or the same answer for a maximum of five similar questions, make up an “intention.” Some questions may generate other questions or *sub-questions* (called “broken answers”). These *sub-questions* also enter into the previous scheme of computing “intentions.” The universe of questions, *sub-questions* and the calculation of “intentions” comes from interactions with the client, aiming at the definition of scope and field research during the project. The practice of the development of commercial Virtual Assistants shows that, once the system has been put in place, the identification of new “intentions” grows.
- ❑ “Query”: A “query” covers up to five questions asked by a user, in a single session.

Initially, Virtual Assistant was trained by the supplier to refine vocabulary and regionalisms, with the participation of contractor technicians (SEFAZ-PI). In a second phase, the Secretariat of Finance will take over the systemic monitoring of performance and effectiveness. It is estimated that two technicians in different work shifts are enough for this purpose.

TERESA was initially available for testing by state government officials, and as of the second quarter of 2019 it is available to citizens.

VAT management / Identifying anomalous transactions that do not correspond to a specific economic activity

➤ Tax Administration of Chile (SII)

One of the major problems detected in the management of VAT is the improper use of tax credit by taxpayers.

To improve the detection of such irregularities, the SII set up a system, in the proof of concept (PoC) mode, which uses AI tools - especially machine learning - whose main source

of information is the electronic invoices presented by taxpayers. Note that the issuance of electronic invoices is mandatory in Chile for all taxpayers, since 2018.

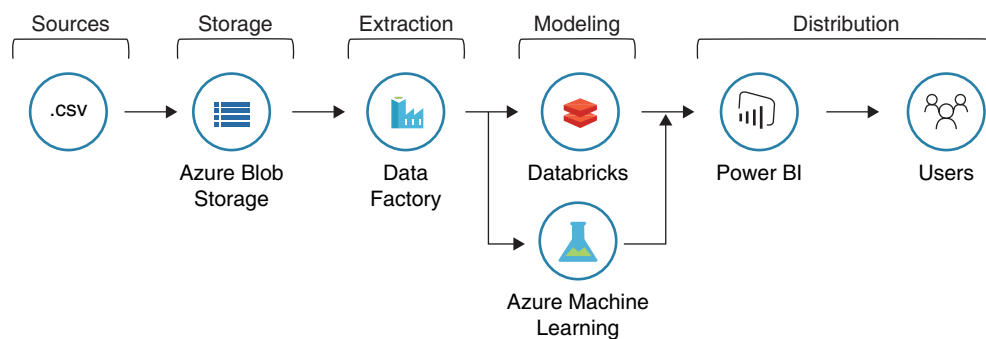
The main stages of the system are:

- ❑ Cataloging products based on glosses.
- ❑ Determination of the relationship between products and economic activities.
- ❑ Identification of transactions that do not correspond to the specific economic activity of the buyer.
- ❑ Generating signaling and visualizations.

The system was developed with the support of a local private company, using Azure AI (Microsoft) tools in the cloud, in addition to Python and “R.”

The system architecture and the main tools used are presented in *Figure 15.1-4*:

Figure 15.1-4 Architecture of the AI PoC solution - SII Chile



Source: MetricArts

The process of system development complied with the following phases:

- ❑ Business understanding - understand how the business works from the point of view of taxpayers and the tax administration, making macro decisions regarding the use of certain catalogs or data sources.
- ❑ Data sources - define the data sources to be used.
- ❑ Data used - identify the data to be used from each defined source and possible relationships.
- ❑ Creation of the data dictionary - The data dictionary is created through a process of word frequency counting of the detail fields: Name and description of the item, and a process of clustering the most frequent words.
- ❑ In order to improve the quality of the count, the fields mentioned are cleaned with the standard empty word file (*stopwords*) for the Spanish language, located at: <https://raw.githubusercontent.com/stopwords-iso/stopwords-en/master/stopwords-en.txt>

- ❑ The R and Azure Machine Learning Studio language was used to carry out the task of cleaning and frequency counting.
- ❑ Process of categorization - from the dictionary, to categorize the items identified. The “notebook” tool is used, in Python.
- ❑ Irregularity identification process - different statistical methods are used to select rejected and suspicious invoices, to be displayed to users on display panels (implemented in Power BI).

From this interaction, the system learns and becomes more judicious in the final process of proposals for rejection and suspicion.

Preliminary results are available for internal teams, with the aim of continually assessing the degree of learning of the system and making adjustments. The system still remains as PoC in April of 2019.

Debit Management / Customizing the mass collection of debts to settle or achieve late payments more quickly

➤ United Kingdom Tax Administration (HMRC)

The HMRC is one of the pioneer tax administrations in the use of Big Data analytics to improve tax management. The “HMRC Connect” system won the “UK BiG Data Project 2014” award and continues to be perfected. The system has internal data sources that comes from the public service and established agreements with banks, shared economy companies (such as Airbnb, eBay), insurance companies, data exchange with British Overseas Territories and OECD countries. In addition, it uses social networks (Facebook, Twitter) to detect “lifestyle” evidence. With the system, HMRC managed to reduce by 40% the number of analysts performing risk and intelligence functions and still raised the collection of funds (Seco & Muñoz, 2018).

Another major initiative, which uses innovative technologies, was developed in the area of tax debit management.

According to Capgemini (2017), ADEPT (Analytics for DEbtor Profiling and Targeting) is a Big Data analytics system of 13.5 terabytes (size in 2017), with a debt management system and a decision engine. It automatically combines data from 20 internal and external systems and controls a wide variety of changes, affecting up to one million debts each day. Information on the debt, such as payments made and due, the records of the field auditors’ notes and the letters returned as “impossible to deliver”, are put together with socio-demographic and other data. ADEPT transforms data and creates a unique source of intelligence for debt management.

ADEPT is also used to boost operations; it is the basis for continuous learning and improvement in debt processes. You can evaluate customer response to HMRC interventions and recalculate the behavior models and risk profiles of each individual taxpayer. The decision

rules engine assigns customized sequences of collection interventions to each debt, and the debt management system assigns each case to the corresponding channel.

The system also uses “economic nudge”¹⁷⁵ techniques, focused on the behavior of taxpayers. The reminder letters that are created indicate to the taxpayers that, without a response, the penalties will be doubled, in addition to mentioning public services financed by taxes. Such measures resulted in a 20 percent increase in payments.

A predictive model was developed that gathers debtor data in all taxes and predicts the ability to respond to alternative interventions and contact channels. It also assesses the risks of loss of income with these debtors. In addition, the system reacts to the response or lack thereof, allowing the reevaluation of the chosen collection strategy and permitting the determination of the “next best action” at any stage of the life cycle of the collection process.

The main technologies used are SAS intelligent analytics platform¹⁷⁶ and Oracle database infrastructure.

Control and risk rating for new taxpayers

➤ Norwegian Tax Administration (NTA)

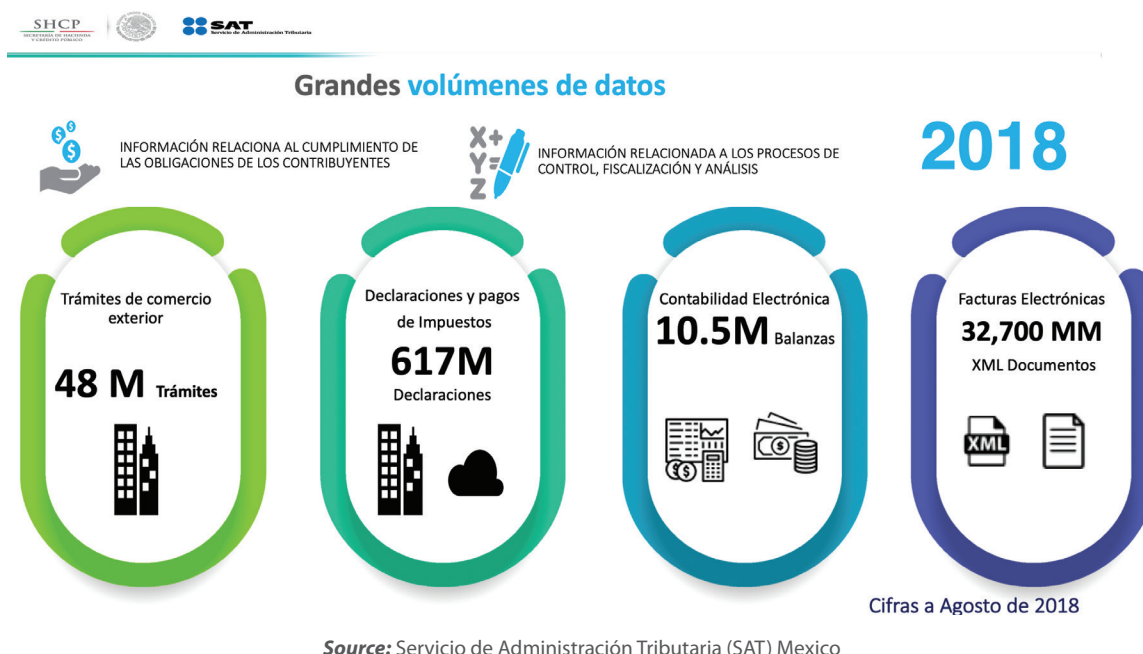
The Norwegian Tax Administration uses data analysis and automated learning techniques to improve efficiency in two fields:

On the one hand, in the selection of auditing cases, the algorithm is trained with historical data and predicts the probability of mistakes of each VAT declaration. Cases are rated with a grade and tax agents can start auditing the taxpayers with highest grades. The more declarations are audited, the more data is obtained by the algorithm to use in the model, and ultimately improving its precision. The success rates practically doubled in relation to the manual process.

On the other hand, in the second application, still under proof of concept, refers to the management of registers of new VAT taxpayers. For this case, a new model was developed classifying each company into 4 categories (1. Low risk; 2. Risk of mistakes; 3. Risk of frauds; 4. Risk of crime). Since there is no historical data for a new company, the classification is based on the past behavior of its partners, of the companies in which they participate, and in the same sector companies (IOTA, 2018).

➤ Other experiences on big data

On the other hand, various control processes have been automated, particularly those dealing with large numbers of taxpayers. A good example can be viewed within Mexico's SAT. The figure below shows the most relevant sources of information that are used in the electronic audit process. Over that information a total of 74 processes were built, going from computation revisions to cross matching. Over two million companies went through control procedures or what we can call electronic audits. These activities mark a structural change to the audit processes.

Figure 15.1-5 Electronic Audit in SAT

Currently, and in future years, an increased use of advanced analytics and artificial intelligence will be used to identify indications of fraud, behavior patterns or organized avoidance practices. There already are successful experiences in both the Spanish AEAT and Colombian DIAN.

15.1.5. Organizational impact

The extended use of data analysis and artificial intelligence in tax administration make up a scenario of disruptive changes and will have an impact on processes, people, and probably also on tax policies.

Within this context a new discipline has turned up, “data science,” which is a multidisciplinary field that uses methods, processes, algorithms, and scientific systems to extract knowledge and insights based on structured and non-structured data. Data science uses the most powerful hardware, programming systems, and algorithms to solve problems.¹⁷⁷ The expert who masters this discipline is generally called “data scientist” or data analyst.

The efficient application of these technologies requires different contributions:

- The representatives of the core business areas (tax collection, audit, etc.) supply the functional understanding of each field, the operational priorities, and the limitations;
- Data scientists can determine which statistic techniques, algorithms to use and where they can be effective or not; and,

- The ICT experts add to the understanding of data sources, computer systems, and determine where they can be effective or not.

There is yet no definitive model for the organization of these groups. In general, one starts with a pilot program, gathering all experts in one group. When these technologies extend throughout the institution, a better organization will be needed to manage the underlying know-how. It is important to consider that data analysis projects and/or artificial intelligence are not ICT projects but projects with ICT participation.

Some institutions make up multi-disciplinary groups in the core areas with a central structure in charge of defining tools and platforms. Other institutions adopt a centralized view with a specialized department that concentrates all the data analysis and artificial intelligence projects and resources.

It is still not possible to propose better practices, but some administrations indicated the wish to consolidate the governance of data analysis and artificial intelligence in a permanent group.

This permanent group could be an Analytics Center of Excellence, responsible for answering questions on metrics, generating and validating insights, and identifying the best actions for value delivery (McCarthy, 2014). It would be useful to establish groups of employees with skills related with analytics, such as technology architects, data scientists, business analysts, visualization artists, and “data ninjas”.¹⁷⁸ These groups would allow the reciprocal learning of skills, which is a key enabler to develop high-performance teams.

Given the increasing application of cognitive technologies and an increasing dependence of the institutions, institutional strategies must be defined and established. New positions must be created in the organizational structure, especially in the “C level” the Chief Data Officer (CDO). According to McCall (2015) the CDO has the important role of helping the organization to value the whole extension of its data. The CDO would be a senior executive leading the data strategy and information of the whole institution, including governance, control, development of policies and effective exploitation.

15.2. Blockchain

Blockchain is mostly known for being the fundamental technology for the implementation of cryptocurrencies like Bitcoin. It can be defined as a public ledger distributed by computer network nodes that maintains an ever-growing list of registries or transactions gathered in data blocks, which are safe from any revision or forgery and are totally traceable. Every computer in the network can be an active node, with an identical copy of the blockchain. If a node is compromised (by hacking or sabotage and/or hardware failure), all the other nodes will maintain the ledger intact. As mentions World Economic Forum (2015), it is estimated that in 2027, 10 percent of the world GDP will be stored in blockchain technology.

The components of blockchain technology are the following:

- Cryptography of private keys and time stamp;
- P2P distribution network;¹⁷⁹
- Shared database (or ledger);
- Consensus mechanism; and,
- Incentives so that the participants can process the transactions, store data, and safeguard security.¹⁸⁰

The mechanism of consensus is a special part of blockchain: a block of data will only be registered in the ledger if the participating nodes agree that it was approved by the valid consensus rules. These rules depend on the characteristics of the blockchain service: they can be very complex and costly, like those used for Bitcoins (called Proof of Work – PoW)¹⁸¹ or simpler rules.

A component that is part of the *blockchain* environment is the intelligent (or smart) contracts. It is a computer program that facilitates, ensures, and enforces compliance and executes agreements registered between people and organizations, also using *blockchain* technology. When a pre-programmed condition is triggered, the intelligent contract executes the corresponding contract clause. These contracts have the purpose of providing security superior to the law of traditional contracts and reduce the transaction costs associated to the contracting. It is said that the “computer program is the law.” As mentions Capgemini (2016), they can be implemented in any transaction that requires an agreement registered between parties, like for example the contracting of financial products or insurances, guarantee deposits, trading operations, or syndicated loans, debt contracts in installments, or management of collaterals.

There are three types of *blockchains*: **public** – classic *blockchain*, with open networks that allow people to participate anonymously. Bitcoin is a public *blockchain*; **private** – there is one individual responsible for the blockchain that defines all the rules and keeps control; and, **permissioned** – a closed ecosystem in which each participant/node is identified and has a previously agreed role. This kind of *blockchain* allows the creation of organizations or consortia of organizations for a determined business case.

Blockchain applications in tax administrations will probably be done through permissioned *blockchains*.

There are several packets of open source software in the market for the development of systems with *blockchain* technology, one of which is Hyperledger, developed by a consortium of companies under the administration of the Linux Foundation. Based on this technology, IBM developed its “IMB Blockchain” business platform, and Intel developed its “Sawtooth” platform. Microsoft has the Azure Blockchain Workbench. These platforms allow companies to develop their own blockchain.

Blockchain in the Brazilian Federal Tax Administration

The Brazilian Federal Tax Administration (RFB) currently implements a system based on *blockchain* to share data from the Registry of Individual Taxpayers (CPF) among institutions in the three levels of government (federal, states, and municipalities), called “bCPF”.¹⁸² It uses a permissioned *blockchain* based on auditable open source software in which only authorized institutions can participate. There are three kinds of participation: (i) participation only for consuming data, (ii) participation for the contribution of a data field, and (iii) participation for the modification of data; the latter one is carried out by institutions with legal prerogatives for this activity, which will be implemented by means of “intelligent contracts.” Not all nodes will be active, that is, not all nodes will have copies of the data base.

The exchange of data of the CPF with other institutions is determined by the Constitution and the RFB currently has more than 800 valid agreements for this purpose. Thus, this application will render greater automation, security, transparency, and traceability of the process, besides promoting greater quality of data from the CPF.

The system is being used as a pilot program with the Federal Council of Justice. Such models will allow the application of not only the bCPF but of future solutions to be produced by the RFB, both for the Government and for all society. The next step will also be to apply the blockchain system to the National Registry of Taxpayers/Corporations (CNPJ).

Blockchain to reduce VAT fraud in the European Union

There are proposals for other blockchain applications in the tax field, such as the development of specific cryptocurrencies to reduce VAT fraud in inter-community transactions in the European Union (Ainsworth et al., 2018) and others for customs management improvement.¹⁸³

Considerations about the future of blockchain

At a round table in the Massachusetts Institute of Technology (MIT), Simon Peffers, Intel software architect, considered that they should seek *blockchain* applications that add to the value obtained with the current technology, since one of the challenges for the implementation of *blockchain* systems is that a great number of legacy systems¹⁸⁴ should migrate to this technology, which requires money, time, and motivation.

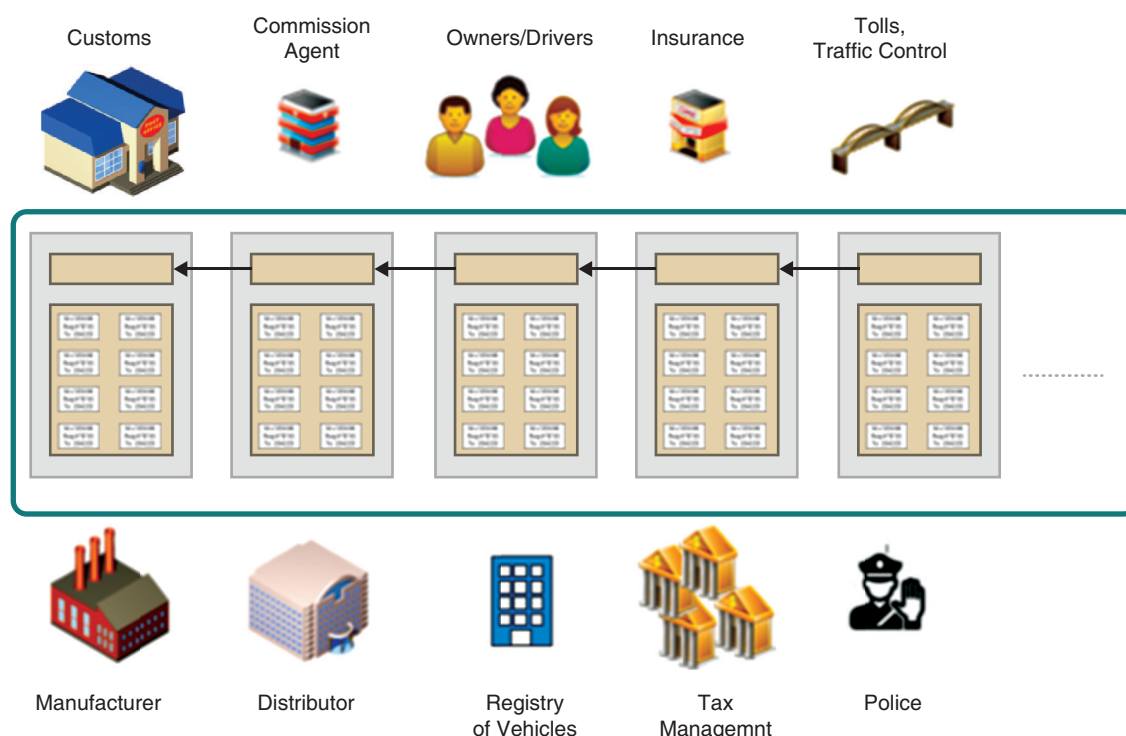
In its article Panetta (2018) predicts blockchain will take from 5 to 10 years to become a productive technology, it is observed that there currently is a strong investment in it. International Data Corp. estimates that corporations and governments will invest, by 2019, nearly \$2.9 billion dollars in blockchain technologies, an amount that should increase to \$12.4 billion in 2022 (del Castillo, 2019).

The potential use of *blockchain* technology in tax administration is mainly concentrated in processes with the participation of more than two players. These private blockchains would have different players, with different purposes in which the tax administration would be only one more of the players. The use of intelligent contracts, with operations and access restricted to specific players,

and with the capability of limiting access of data through cryptographic techniques, open great opportunities to operate cooperation ecosystems among the different players.

An example of this participation could be observed in vehicle control in a certain jurisdiction, in which players like vehicle owners, drivers, the customs service, automakers, vehicle dealers, the vehicle registry service, the traffic police, insurance companies, road toll managing companies (with the support of IoT), and the tax administration that manages vehicle taxes will all participate within their respective roles and permits to manage information. An example of this model can be seen in *Figure 15.2-1*.

Figure 15.2-1 A blockchain based vehicle ecosystem



Source: Una implementación para vehículos. From "Sesión 13: Visión del futuro: desafíos y oportunidades de la digitalización tributaria [PowerPoint presentation],” by R. Zambrano, CIAT, p. 18.

The potential that blockchain technology has also opens other avenues for cooperation, for cooperative compliance processes and particularly for information exchange between parties that are located in different jurisdictions, in a safe way.

The Netherlands Tax and Customs Administration (NTCA) conducted an evaluation of four plausible future scenarios for blockchain:

Dual Reality: in which distributed ledger technology is picked up by industry and consumers and becomes a mainstream technology, but government fails to keep up with these developments and struggles with the consequences;

Blocktopia: in which government provides room for distributed ledger technology to flourish and reach its full (open source) potential;

Govchain: in which government adopts and drives distributed ledger technology, using it to streamline its processes in permissioned distributed ledger solutions;

Beyond the hype: in which public trust in distributed ledger technology dwindles and the technology fails to take off.

As a result, three of the four scenarios would impact the tax area on society and require a more elaborate strategic assessment. The study also presents examples of how the predominance of each scenario can impact taxation (Rijswijk, Hermesen, & Arendsen, 2019).

Factoring with electronic invoice

The use of invoices as a negotiable document, at a discount value, is an alternative in the search of liquidity based in uncollected sales. However, that alternative can be difficult for smaller taxpayers or those that explore these alternatives for the first time.

Electronic invoices, digitally signed, improve trust among third parties, particularly in terms of who issued the invoice and the seriousness and paying capacity of the buyer of goods or services. A good experience of such a system can be observed in Chile, where the SII hosts a system that facilitates the verification and exchange of invoices for factoring purposes with impressive results; the total value being negotiated reach a percentage of the country's GDP.

A possible implementation of the full process could benefit from a blockchain implementation. It will allow for different actors, including sellers, buyers and factoring companies, being able to leave traces of all operations, including the initial offering of documents, auction, granting of docs, contract details, payment, reselling and so on.

In the process, different factoring firms could host a blockchain node, without the need of a centralized node. The tax administration would participate in the process confirming the emission of the invoice, the record of a payment event (and so the inability of using a document that has already been paid), the cancellation of an invoice, and other related events. Making it a very significant environment.

15.3. The internet of things (IoT) and sensors

IoT is the category of devices (i.e., objects, vehicles, and other items) that contain electronic circuits, sensors, and software with online connectivity, which allow the devices to collect and exchange data. These devices generate data for real-time monitoring and measuring and the tendency is for this type of data analysis to become a part of the standard way of doing business.

The Gartner Group foresees 20 billion “things” will be connected to the Internet by 2020. These “things” are not general purpose devices, such as smartphones and personal computers but objects

with specific functions, like vending machines, reaction engines, connected automobiles, and many other examples like these.

The cost of industrial sensors keeps decreasing, from the 2004 average of US\$1.30 to the 2020 estimate of US\$0.38. The prices for active RFID devices have also decreased, with some of them costing less than a dollar. Similar trends have resulted in miniaturized sensors, inexpensive but robust enough to collect information in different areas of the social and public spheres, from the heartbeat of an unborn child through a conductive material in the clothes of the mother to cameras located in airplane engines roaring at 35,000 feet (Raynor & Cotteleer, 2015, p. 2:58).

The government already uses sensor technology in the health and security areas (e.g., diagnosis of patients in remote locations and surveillance cameras).

In the tax area, devices that use IoT-based technology can automatize the handling and tracking of merchandise, the management of taxes related to transit, such as the VAT, and customs management.

In Brazil, the Brazil-ID project uses RFID technology and road sensors that are associated with the electronic fiscal documents of merchandise and transportation vehicles, to inspect the ICMS¹⁸⁵ as merchandise moves through states. Towers installed in highways pick up the data sent out by the RFID labels in merchandise and vehicles, and send it to control centers where it will be processed. This experience has the support of the private sector, which also obtains data for the control of its vehicles and by doing so minimizes unauthorized detours and cargo theft.¹⁸⁶

Associated to blockchain technology, the use of IoT can sensibly improve customs processes, even using it for the management of the supply chain. Companies IBM and MAERSK are developing a global business platform that is based on blockchain, IoT, artificial intelligence, and data analysis, with the goal of enabling the follow-up of products commercialized through borders. At first, the platform will be equipped with two main capacities: (i) an “outbound information channel” that makes the supply chain visible from one extreme to the other; (ii) “paperless commerce” with the digitalization and automatized archiving of all commercial paperwork. The project has an Advising Council formed by specialists from private companies and government officials, including Customs managers and representatives of the World Customs Organization (WCO), so the platform can be adaptable to the requisites of these institutions. Several legal changes will be necessary for the adoption of said platform, related to internal processes and, especially, to documents that are currently required only in paper.

In broad terms, IoT should be considered for several applications, such as industrial automation, health care, home automation, and disaster recovery. One of the main problems in the use of these devices is the absence of protocols and standards for its ecosystem, related to communications, routing, network, and session layer protocols. Entities such as IEEE (Institute of Electrical and Electronic Engineers), IETF (Internet Engineering Task Force) and ITU (International Telecommunications Union) are moving forward in the development of these protocols and standards, which will allow for the simplification and expansion of the use of IoT devices.

15.4. Application programs for mobile devices or App

Mobile devices (e.g., smartphones, tablets, and the like) are ubiquitous in today's society. These devices are used to make purchases, pay bills, access bank accounts, make investments, schedule meetings, publish news, etc. The following table synthesizes the advance of mobile devices in Latin America, the Caribbean, and Africa.

Table 15.2 – Statistics of mobile devices in the selected regions

		2018	2025
Latin America and the Caribbean	Single subscribers	436 million (*)	517 million
	% Population	67	74
	% Smartphones	65	79
	% Access to Internet (in relation to the population)	50 (*)	65
Sub-Saharan Africa	Single subscribers	456 million	623 million
	% Population	44	50
	% Smartphones	39	66
	% Access to Internet (in relation to the population)	23	39

Source: Adapted from "The Mobile Economy: Latin America and the Caribbean 2018," by GSMA, 2018. Copyright 2018 by GSM Association

The supply of services to mobile devices via the Internet is carried out mostly through apps. An application (app) is a program that was specifically designed to be downloaded by a user to a mobile device.

These services should be promoted by taking advantage of the experience taxpayers have in the use of other app models - from games to bank apps. Mobile devices have their own resources, which can be very useful to new services, such as GPS (location), code reading (bar and QR), and biometric identification. Several tax administrations use apps to promote some kind of service, such as Argentina, China, Mexico, and others.

One of the most comprehensive ones is provided by the Australian Tax Office (ATO). In its current version, the app offers functions that allow: (i) to register deductions and income for their subsequent use, transferring them directly to the tax returns; (ii) to register non-taxable income and expenses with the sole intention of transferring them to the tax return; (iii) to verify the public data of a business taxpayer through his/her Australian Business Number (ABN) (i.e., whether he is active or not, if he is registered for the VAT, if he has alternative names); (iv) to measure the performance of the company (you can compare annual data with more than 100 types of businesses, compare the cost of bought and sold goods, etc., with similar businesses); (v) to calculate tax credit in the purchase of fuel; (vi) to show the calendar with important tax dates (the taxpayer can set the dates he wants to be reminded of); (vii) to estimate payment plans; (viii) to anonymously report tax evasion; (ix) to estimate retentions; (x) to define the permit to access through biometric means

(access security can depend on voice recognition, in the case of natural persons); (xi) to employ GPS to register travel locations; and, (xii) to use the photographic camera to read bar or QR codes.

The user can connect to the taxpayer account in the **MyGov** application to have access to additional services, such as making payments and scheduling payment plans, to update details of the account, control the progress of reimbursements, and other, more general services such as medical services, veteran aid, etc. **MyGov** is an initiative to access all government services with a single username and password.

The app is available for download in the digital Apple, Google, and Microsoft stores.

The apps can also be developed with the goal of aiding officials of tax administrations in their remote jobs, especially regarding examinations.

15.5. Application Programming Interface

An Application Programming Interface (API) is an interface that grants access, via computer programs, to functionalities and service data within an application or a database.¹⁸⁷

The use of business information management systems internally developed or in commercial packages (ERP), by small and medium enterprises allows for the systematic integration of all their activities and operations, as well as with third parties (suppliers and clients). According to CIO Magazine (2019), in Brazil, 77% of medium and large enterprises use an external API to create a business ecosystem. Tax administrations can be considered important “clients” of these companies and this creates the need to integrate them into their management systems, becoming a part of said ecosystem and facilitating the fulfilment of tax obligations and their control.

This integration would prevent the preparation of special tax returns and files, in specific and fundamentally with a large quantity of data, which would have to be subsequently transformed within the tax administration.

A solution would be to offer specific APIs to business taxpayers, the way it is currently done in Australia, New Zealand, and the United Kingdom, among others.

The general specification and development of APIs is jointly carried out by the interested companies and private software companies. Companies that provide ERP, particularly, are interested in incorporating these APIs in their products as a standard, like a commercial differential. The security regarding the information of the companies and the tax administration, as well as the mechanisms used to evaluate the exactitude of information that was sent or received, is very important in these products.

The United Kingdom Tax Administration (HMRC) adopted the APIs as a strategy to improve interaction with its business taxpayers. This strategy intends to:¹⁸⁸

- Promote a priority focus of “software for third parties” destined for companies and agents;
- Stimulate wider access to APIs;
- Share rules and logic;
- Publish performance figures; and,
- Create more complete APIs that allow the products of third parties to operate with the HMRC systems without issues.

The vision of the HMRC is to supply better, richer APIs to software developers, that allow them to innovate and bring more sophisticated software products to the market.

The commitment of HMRC to this strategy is made evident by the allocated resources, including a site for developers, which includes the publication of all the documentation of all available APIs, tutorials, and makes a (“*sandbox*”) testing ground available to anyone interested.¹⁸⁹

The IRAS (Inland Revenue Authority of Singapore) launched the API Marketplace, which is a community platform for software developers to access IRAS’ services or data for the creation of tax-related services. Collaborating with developers will enable rapid adoption of APIs developed by IRAS, and lead to the development of meaningful, effective and taxpayer-centric digital solutions.

API allows integration of tax effortlessly into the natural systems of taxpayers. Examples of such services are: direct transmission of Goods and Services Tax (GST) returns and transactions listings and seamless ACRA (Singapore’s corporate registry) and IRAS filing for small businesses using XBRL - a freely available global framework for exchanging business information (Khim, 2019).

OECD has published an interesting guide to government API development, which is worth consulting (OECD, 2019b).

15.6. Interoperability and standards

A solid tendency that will continue in the forthcoming years is concentrated on accessing information about taxable events that will have tax consequences much sooner. The use of electronic documents that are integrally sent to the tax administration, sometimes before the transaction is completed, is already a reality in several countries. Electronic invoices, the use of electronic withholding certificates, social security payment receipts, electronic payroll, and transportation guides are all examples of this trend.

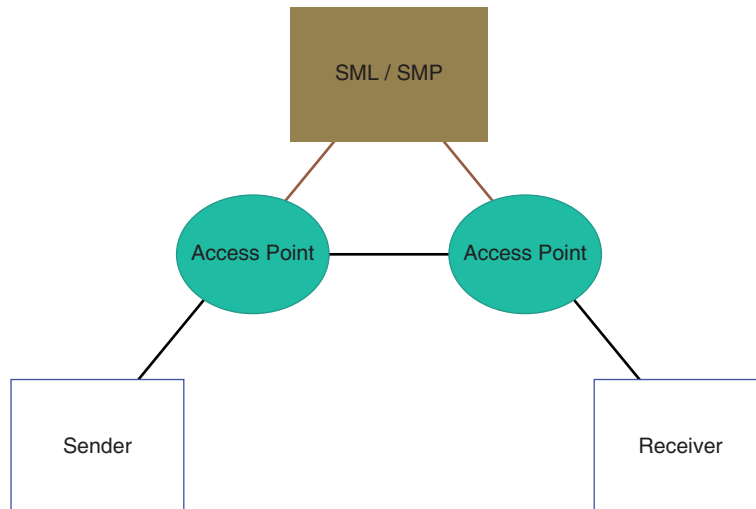
The definition of data standards for the delivery of information or for its broadcast extends to increasingly complex scenarios. Local environments have standards such as local XBRL taxonomies, used to report information that is of private interest (for example, for company stock owners) as well as public regulators, among them tax administrations; or, the SPED system in Brazil. In the international arena, there are standards for sending information such as FATCA/CRS for the report

of financial entities about the fiscal situation of their international clients or CbC to report information about operations with linked parts of multinational companies in several countries.

New developments are added to this scenario, such as the one achieved by PEPPOL, which seeks to develop interoperability solutions for e-procurement, particularly in the B2B and B2G environments, based on the exchange of standard electronic documents, for example, purchase orders, invoices, credit notes, catalogs, contract assignment notes, answers to messages, answers to orders, interest rate display, management notes, and others. Along with the existence of intermediaries, called access points, which facilitate the exchange of those documents, from and to the information systems of the parties that participate in the transaction.

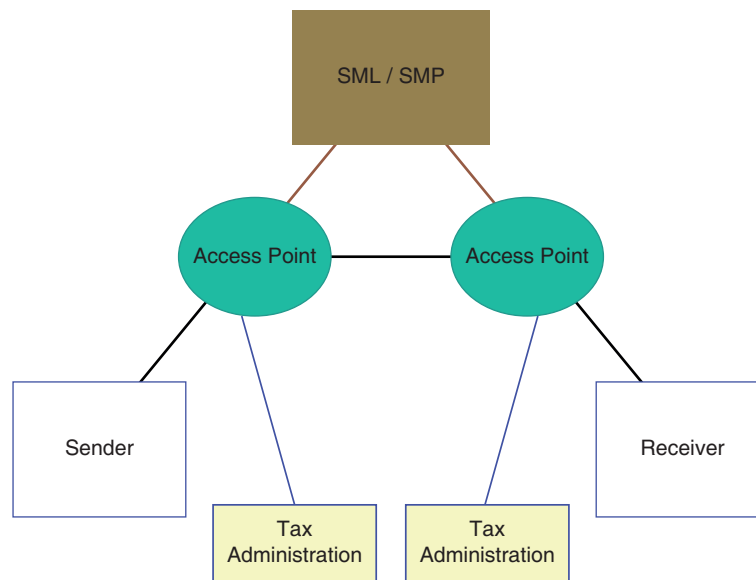
As illustrated in *Figure 15.6-1*, sending a document from the source to the receiver goes through an access point, which acts in the name of the sender, to another access point that acts in the name of the receiver, which finally sends it to the receiver. The access points use the Service Metadata Locator and Service Metadata Publisher to determine which access point can act in the name of the receiver. It should be noted there is no direct connection, nor there is any previous agreement between the sender and the receiver of the electronic document for them to be able to exchange the documents, after they have adopted the standard.

Figure 15.6-1 Basic schema of PEPPOL operation



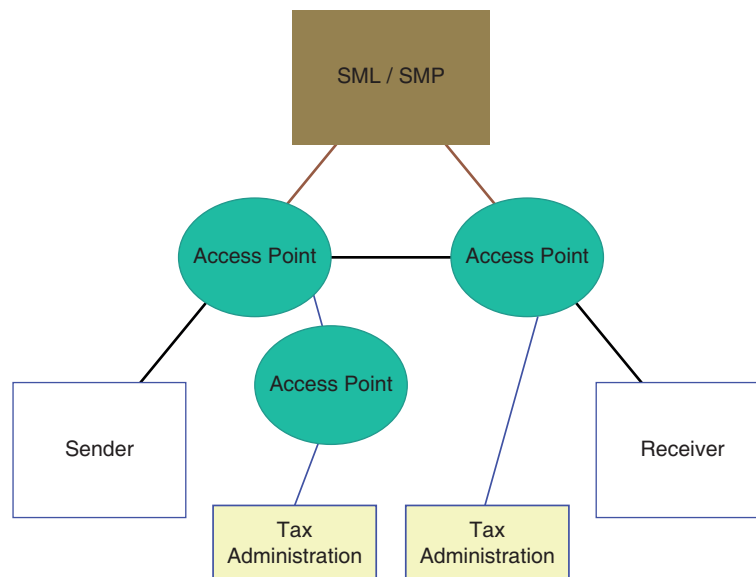
Source: Prepared by the author

Tax administrations can become a part of this ecosystem and, as is shown in *Figure 15.6-2*, receive the electronic documents that correspond to them on time. In this case, the access point that acts in the name of the sender sends the electronic document to the tax administration that handles the jurisdiction of the sender. If the transaction needs it, the access point that acts in the name of the receiver sends the standard electronic document to the tax administration of the jurisdiction of the buyer, which may or may not have the same tax administration.

Figure 15.6-2 Schema with tax administrations

Source: Prepared by the author

The model works even if the tax administration of a jurisdiction cannot be reached by an access point. By using the SML/SMP services, it would be possible to locate the access points that act in the name of a tax administration ([Figure 15.6-3](#)).

Figure 15.6-3 Participation of the tax administration via access point

Source: Prepared by the author

With this type of mechanisms, even without the direct connection of the applications and services of taxpayers to the tax administration, or between them for these purposes, the taxpayers and

the tax administration can directly exchange documents about operations, balances, and financial statements, using public-access protocols and standards.

15.7. Digital Twins

Digital Twins is an emerging technology that, in a very simplified way, seeks to create a twin of a real object in a virtual world. This trend basically aims to create objects that are connected through IoT sensors that supply permanent information about the states of different variables of these objects and the things they are related to. It is not just about monitoring a complex system but about generating simulations that focus on identifying anomalous or inconvenient situations before they take place. It is more convenient, for example, to test some innovation or important change in a system on a digital twin and not on the engine of an aircraft or the chemical effects of a medicine in an organ inside a human body.

In the short to medium term, this type of technology could, for example, foresee the type of interaction that taxpayers will have with new services offered by the tax administration through different channels of service, including self-managed applications or through the use of virtual assistants.

This technology opens spaces for scenarios in which complex realities can be modeled, a city for example. It is in this precise scenario where tax administrations will find, in the middle- to long-term and when the technology is mature enough, new opportunities for the use of these digital twins, understanding that these twins are associated to taxpayers and that, instead of using information generated by IoT sensors, they will use the information that is directly obtained from the operations of the taxpayer, through electronic invoices or withholding certificates, his or her ledger; or, through third parties and the operations reported by them.

With these mechanisms, this technology will allow us to conduct simulations and “what if” type of models about the behavior of the taxpayer when facing the control actions of other economy players, but even more interestingly, to specifically evaluate the impact of changes in tax policies or the application of possible benefits or fiscal incentives.

15.8. Conclusions

New digital technologies simultaneously represent opportunities and challenges for the fiscal areas of governments. The same technology that allows for improved effectiveness of tax administrations brings new challenges to the execution of their regulatory tasks. For example, online commerce, particularly that of services, shared economy, and “application companies,” grows every day and challenges authorities on the focus they should give to taxation and audit.

Furthermore, the adoption of a digital agenda by tax administrations, as well as the public sector, requires overcoming numerous barriers, regarding culture, rules, institutional inertia, and risk aversion, which can only be overcome with leadership and with the development of new capacities (Pimenta, 2017).

The Accenture consulting firm proposes the critical factors needed by government institutions to successfully achieve high performance through digital transformation:¹⁹⁰

- Responsibility and solid management, in the form of an excellence center or units devoted to the supply of services, to boost results, and keep up the pace.
- Adequate collaboration, including (value-based commercial arrangements) to tackle limitations in financing, and guarantee the long-term benefits of these changes
- Clear direction and support from the leadership, starting from the top down, to make sure the focus of the transformation is communicated and underscored throughout the organization, backed by a transformation roadmap.

On the other hand, the legal aspects associated to the implementation of solutions that are based on digital technologies are frequently relegated to the background but could become deterrent or restrictive if they are not considered at the beginning of the projects.

Finally, multilateral organizations, such as CIAT, IOTA, ATAF, IMF, IADB, and the World Bank, have an important role in speeding up the dissemination of technological practices and trends that are applied to the tax arena, by organizing events, financing pilot programs, and testing concepts.

Notes

165. These are algorithms capable of interpreting and extracting significance from the structured and unstructured data of a specific field of action.

166. 1 exabyte = 10^9 gigabytes

167. Cold data refers to data that is not accessed frequently or is not actively used.

168. Definitions adapted from the *Gartner Group's* glossary of terms available at: <https://www.gartner.com/it-glossary/>.

169. Mostly based on Seco & Muñoz, 2019

170. Based on “Magic Quadrant for Data Science and Machine Learning Platforms”, Gartner Group, Jan 2019

171. Based on “The Forrester Wave: Multimodal Predictive Analytics and Machine Learning Solutions”, Q3 2018, Forrester Research

172. The increase of data increases the value of basic data, by adding information derived from internal and external sources within a company.

173. The New Zealand tax administration adopted this model for the development of data analytics and AI solutions.

174. According to Wikipedia a Proof of Concept (PoC) is an implementation, often summarized or incomplete, of a method or an idea, carried out with the purpose of verifying that the concept or theory in question is capable of being exploited in a useful way.

175. According Wikipedia, Nudge is a concept in behavioral science, political theory and behavioral economics that proposes positive reinforcement and indirect suggestions as ways of influencing the behavior and decision-making of groups or individuals.

176. For more information, see: https://www.sas.com/en_us/home.html

177. Wikipedia adapted definition

178. According to Technopedia, “a data ninja is a person who reviews large quantities of data and analyzes, organizes and moves it in such a way that it improves overall data retrieval processes, thus allowing the data to reach end users much more quickly.”
179. P2P (*peer-to-peer*) network or peer network is a network of computers in which all or some of the aspects work without fixed servers or clients, but with a series of nodes that behave as equal peers among themselves.
180. Incentives may be monetary like Bitcoin or legal or regulatory as in private or government *blockchains*.
181. For more information see: <https://keepingstock.net/explaining-blockchain-how-proof-of-work-enables-trustless-consensus-2abed27f0845>
182. For more information, see: : <http://receita.economia.gov.br/noticias/ascom/2018/novembro/receita-federal-publica-norma-sobre-compartilhamento-de-dados-utilizando-tecnologia-blockchain>
183. For more information, see: <https://www.youtube.com/watch?v=LeKapqAQimk> (process description)
184. Computer systems of an organization that despite being old, render essential services.
185. Tax on the Circulation of Goods and Services, with characteristics similar to VAT
186. For more information, see: <http://brasil-id.org.br/>
187. Adapted from *Gartner IT Glossary*
188. For more information, see: <https://www.gov.uk/government/news/hmrc-launches-ambitious-api-strategy>
189. For more information, see: <https://developer.service.hmrc.gov.uk/api-documentation/docs/api>
190. For more information, see: <https://www.accenture.com/mu-en/insight-dispelling-myths-preventing-government-transformation>

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16. HUMAN RESOURCES

16.1. Brief context

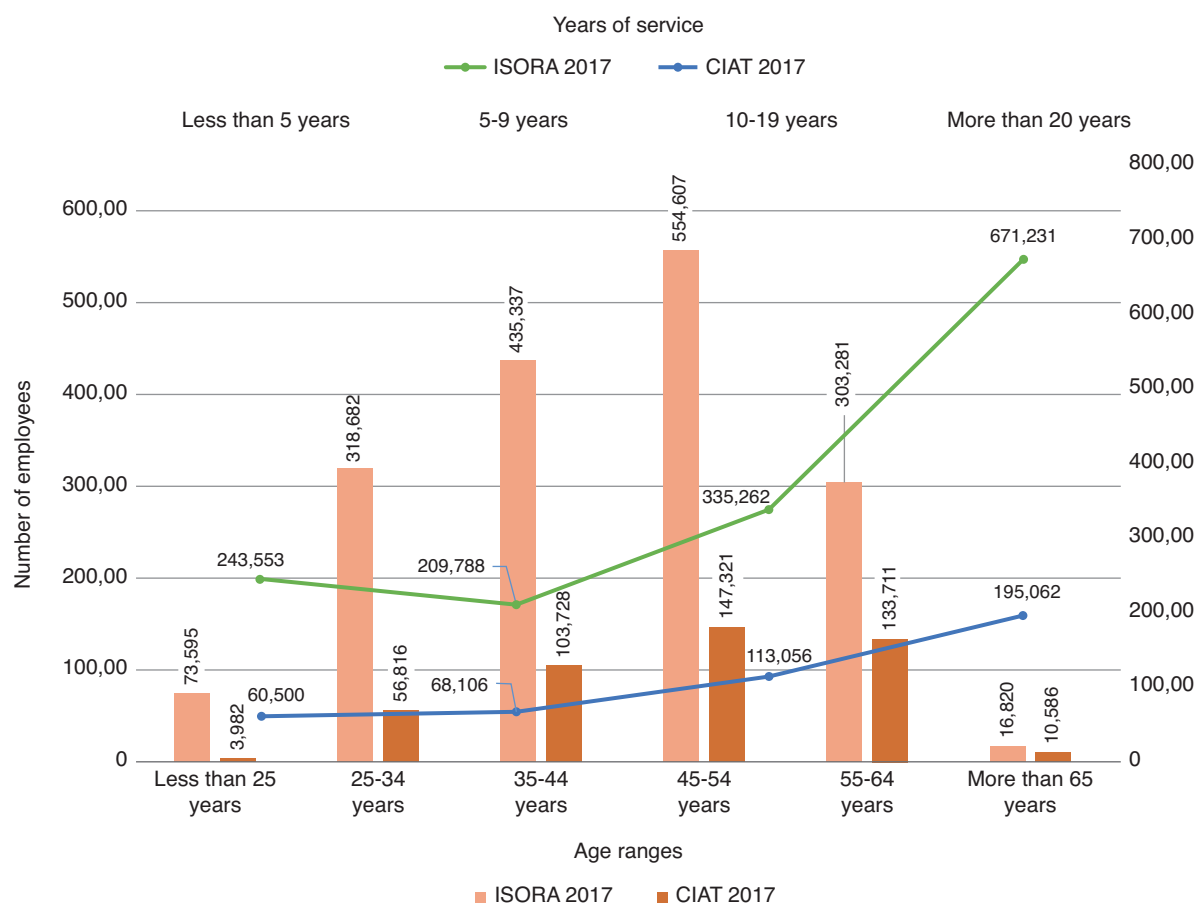
Tax administrations experience the emergence of disruptive elements in their daily activities. This increasingly frequent phenomenon bears significant impact. Presently, we are called to understand such elements as constants rather than variables in the management of institutions. We must embrace change as a discipline that we prepare for and develop strong as well as timely and efficient response capacities. Present and future changes should be met by an uncontested success factor, namely *Human Talent*.

On analyzing the background of Talent Management, we find different approaches towards understanding its relevance and implementation. Some tax administrations have weak management profiles, with minimum non-standardized processes to sustain operations (mainly, recruitment and education). Others, instead, show robust models of *Human Talent Management*. They include Career Paths and Performance Assessment as vital elements, but between these two extremes, we may find various practices with commonalities and significant differences.

Tax administrations with poor institutional management face highly complex scenarios: serious salary inequality, high employment instability and, occasionally, low qualification and performance. This results in an unhealthy attrition and turnover rate, which ultimately poses a risk to efficiency and security.

More developed tax administrations that have established career paths face different yet equally complex circumstances. The latter include ensuring that permanence is not detrimental to efficiency, relying on education as a resource to avoid obsolescence among employees, and overall, their talent. Moreover, they will create the conditions to face new talent needs and source the skills required of new employees.

One of the most striking consequences in recent years has been the aging of our organizations. We have increasingly more employees over 55 years old, and fewer under 25. The generational transition is relatively slow, although not all the consequences of aging are approached in the same manner.

Chart 16.1-1 Average Years in Service by Tax Administration Officers

Source: Prepared by the author with data from ISORA (2017)

To quote two examples, Portugal features a Senior Talent strategy, which acknowledges the importance of working with individuals for whom age is an advantage in order to continue encouraging and promoting high performance. Conversely, Cuba and Nicaragua are developing a strategy underpinned by young talent in the form of recently graduated university students willing to pursue a career in the tax administration.

It is worth mentioning that many tax administrations have undertaken to improve tax operations on different fronts such as the legal framework, tax processes, taxpayer service quality, international taxation and, of course, the use of technological tools to serve such purposes.

Along these lines, improvements in any direction will produce the future impacts that talents within our organizations will face.

16.2. Technologies as triggers in talent development initiatives

Technologies adopted within tax administrations have proven that we should not change in order to remain the same. It is not merely about innovation; technology can also be used in improvement and enhancement actions.

People management follows the same condition. Based on the OECD publication called “Comparative Information on OECD and other Advanced and Emerging Economies”, the workforce in tax administrations are subject to dual pressure. Firstly, overall institutional budget cuts and technological changes that translate into administrators facing official restrictions in hiring new employees. In turn, the latter fosters reductions in operation volumes and a resizing of the tax administration apparatus.

Secondly, the workforce faces a new context that is equally challenging in connection with potential salary cuts, (the Mexican experience in 2019, to mention a very recent example), demands for new skills, redesign of talent management processes and the natural effects on the levels of performance, motivation or job satisfaction.

Technological resources have changed the way people work. They have enabled faster data analysis, improving the quality of results, anticipating specific or potential situations that erode tax bases, identifying bad practices or perpetration of tax crimes and non-tax crimes. Moreover, technology has contributed in bringing down tax administrations’ operating costs, thus improving the cost-benefit of our enforcement activities.

Nonetheless, not all the workforce is experiencing technological change in a way that results in successful performance of their roles. In the view of the author, large segments of our population of tax officials find serious difficulties in adapting to technological transformations, although this is not sufficiently documented. These transformations have an impact on such things as email communications, auditing tasks on spreadsheets or using specific tax audit applications on the intranet in the stringent security and control context in which officials carry out all their tasks. Many such examples are available, but it goes beyond the scope of this study, for they may arise from various root causes.

If we look in a different direction, technologies have also led us to a new collective need in the tax administrations, that is, Knowledge Management, with at least four trends: *i)* Systematization in knowledge production to make it compatible with the electronic management thereof, by way of virtual libraries, shared databases or internal management systems to execute business and support processes; *ii)* Preservation of the knowledge produced, which refers to institutional knowledge preservation and security mechanisms, namely, historical querying of cases, case law, individual taxpayer records, or change control of such processes; *iii)* Dissemination of knowledge in the different tax administration areas of competence, for natural stakeholders in the tax administration as well as occasional information users (the latter includes accountability, oversight, reporting or transparency bodies, legislatures, academics, officials and taxpayers at large); and, *iv)* Adding value

to knowledge (use), which means, in addition to dissemination or social implementation, incorporation into our daily lives, under the public duty outlook. In this context, we find resources like education for tax officials and citizens, systematic assessment of institutional results, contributing to the work planning cycle and the prospect of tax management scenarios, resulting from new tax policies.

Consequently, in all these trends the adoption of technologies enables the creation of technical rationality that contributes to tax administrations not only by the conceivable possibilities but also by different execution mechanisms. Said mechanisms include taxpayer registration, collection, auditing, control of social security tax obligations and control of incoming and outbound traded goods, as well as operating the administration of available financial and material resources, among others.

In the case of Human Talent, the impact of technologies is equally important. They have changed the way in which we interact with the environment and our daily work. Presently, it seems that the core business of the tax administrations has shifted towards managing large information volumes from a tax perspective. Hence, how can we describe the effect of such transformations in the Human Talent scenario of tax organizations?

We may mention the effects on the structure of the tax administrations' workforce, in which the share of Information and Communications Technology (ICT) professionals has grown in recent years. Without undertaking a historical comparison, let us refer to the situation as of 2017.

Table 16.2-1 ICT Staff in CIAT Member Tax Administrations

Countries	Full-time Total Employees	Full-time Employees per Role - ICTs	Full-time Employees per Role - ICTs % of Total Employees
Angola	N/A	N/A	N/A
Argentina	13,222	409	3.1%
Aruba	342	17	5.0%
Barbados	N/A	N/A	N/A
Belize	141	3	2.1%
Bermuda	23	0	0.0%
Bolivia	2,033	160	7.9%
Brazil	17,559	520	3.0%
Canada	38,728	3,634	9.4%
Chile	4,971	196	3.9%
Colombia	6,531	140	2.1%
Costa Rica	942	0	0.0%
Ecuador	3,348	185	5.5%
El Salvador	1,001	32	3.2%
Spain	25,152	1,706	6.8%
United States of America	76,832	6,646	8.7%

(continued)

Table 16.2-1 ICT Staff in CIAT Member Tax Administrations (*continued*)

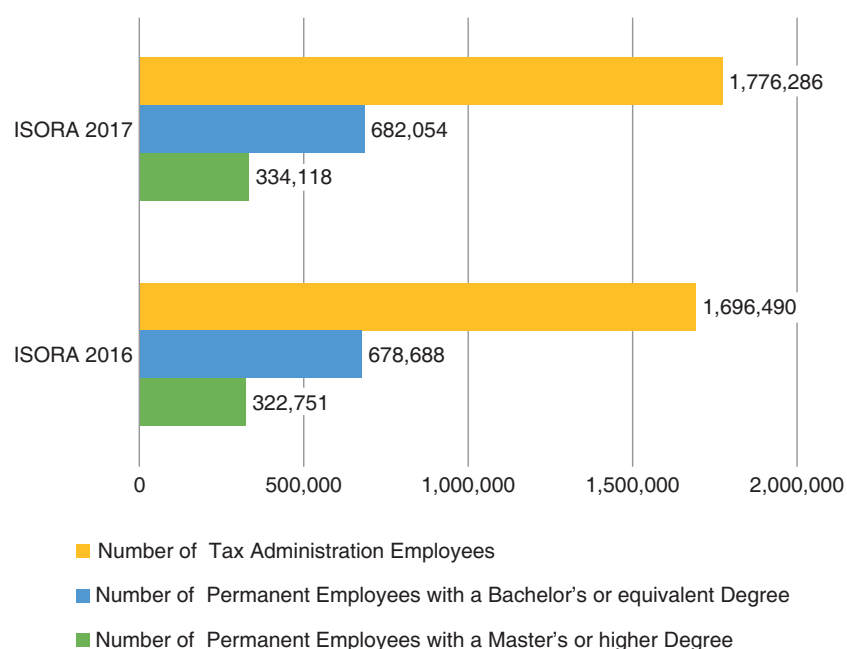
Countries	Full-time Total Employees	Full-time Employees per Role - ICTs	Full-time Employees per Role - ICTs % of Total Employees
France	49,550	2,513	5.1%
Guatemala	4,948	156	3.2%
Guyana	N/A	N/A	N/A
Honduras	1,252	73	5.8%
India	N/A	N/A	N/A
Italy	39,033	570	1.5%
Jamaica	2,163	74	3.4%
Kenya	N/A	N/A	N/A
Morocco	5,190	204	3.9%
Mexico	27,534	1,163	4.2%
Nicaragua	1,541	103	6.7%
Nigeria	5,176	71	1.4%
The Netherlands	20,082	2,371	11.8%
Panama	886	53	6.0%
Paraguay	1,006	200	19.9%
Peru	7,882	588	7.5%
Portugal	9,476	103	1.1%
Dominican Republic	2,960	118	4.0%
Suriname	660	0	0.0%
Trinidad and Tobago	1,015	65	6.4%
Uruguay	1,343	98	7.3%
Total CIAT Sample	372,522	22,171	6.0%

Source: Prepared by the author with data from ISORA (2017)

The overall share of full-time officials is 6% of the workforce, which is undoubtedly positive. The areas of opportunity detected are not only the countries with unavailable data (5), but the 3 countries that report 0% (Bermuda, Costa Rica and Suriname), contrary to The Netherlands and Paraguay, which report a ratio above 10% (11.8% and 19.9% respectively). Another consideration would be the impact of such profiles on the outcome, a question that is anything but easy to answer.

Out of this sample, 86% of tax administrations (32) report that they not only employ ICT-savvy staff, but also specific ICT positions.

This trend was driven by two factors. Firstly, the generalized improvement in education among tax administrations staff members in the last two decades; secondly, the explicit intent to strengthen technology functions within tax administrations. The latter, in turn, is connected with the technological management model itself. Brazil, Spain and Cuba are examples of tax administrations that develop most technological solutions in-house, while other administrations such as Mexico resort to a large number of external technology vendors.

Chart 16.2-1 Evolution of Tax Administration Officials with University or University Degrees

Source: Prepared by the author with data from ISORA (2016 and 2017)

This poses increasingly more questions. Let us address only a few: How are we attracting, developing and retaining such valuable staff in the tax administrations?

16.3. Attracting ICT staff

For decades, the merit-based model has imposed conditions for talent development. More education equaled good positions, better salaries or better benefits and incentives. Nevertheless, the trend is absolutely consolidated at present. In the case of professional ICT profiles, numerous education programs are available worldwide in this field.

Notwithstanding, not all countries benefit from the merit-based model, since more positions are increasingly available, and the number of ICT professionals follows the trend. Consequently, the market adjusts to such conditions.

In line with Mendoza (2019), the offer for professionals with this profile has shifted from full-time positions and fixed salary, to alternative recruitment and hiring models, where the scenario is project-based work, teleworking, performance-based bonuses or flexible arrangements, which shows that there is broad supply although contracts may be of doubtful “quality”, since outsourcing is frequently the source of recruitment.

Even in the same sector, certain niches exist that broaden the offer, with their respective salary proposals. This study sets forth the case of JavaScript or Data Scientist developers. In turn, such conditions foster their own distortions, to place ICT professionals under traditional hiring systems.

Interestingly, the data gathered herein from interviews with ICT professionals indicate that professional development opportunities are held in greater importance than salary or benefits. It is particularly interesting for tax administrations, since they are ruled either by national or institutional regulations that determine the employment supply or the hiring system or hiring by way of outsourcing, but as a matter of public procurement rather than a direct mechanism to search for ICT professionals.

Furthermore, it is worth noting that many tax administrations are not attractive from the salary standpoint, since the employment supply elasticity in this sector may be extreme due to salary scales.

On the other hand, tax administrations are a highly demanding, even challenging, work environment. Within our organizations, ICT professionals may find a major opportunity to put their talent to the test and develop their competencies exponentially, not only in a context that requires creativity and results, but also one that connects with a very broad network of ICT professionals from tax administrations in specific regions and globally. A practical example of this is Latin America, which leads the world in electronic invoicing and vast exchange of experiences on this subject in the region.

On such grounds, we face a dual demand to enable technologies within the tax administrations in connection with Human Talent. Firstly, staffing organizations with the experts needed to develop the applications and infrastructure required in performing key processes; secondly, developing the competencies of the existing staff, which becomes a user of technological transformations.

This description requires further explanation. Prior to that, it is necessary to come to terms with the idea that technological changes will continue, and we will encounter new practices that will become trends, or the present ones will consolidate. Worth mentioning is the widespread expansion in the use of technological services, native applications or cloud services; extensive adoption of artificial intelligence tools in organizations, vertically as well as horizontally; ongoing reinvention in ICT-based business models to improve business competitiveness and profitability; and, the increasingly deeper integration of services and ICT in the digital economy.

Under such circumstances – returning to ICT Human Talent attraction - our organizations must carefully develop the skills profile for the ICT staff they plan to recruit. This includes business skills (technical – taxation skills), and those that enable them to work and develop within the organization (organizational skills, and management skills, as applicable).

For example, let us consider data scientists. Instead of defining what they are, let us think in terms of what we want them to be. Data scientists are required to be skilled in mathematics, statistics, language programming, databases, big data, as well as business, teamwork, work under pressure and resilience. All of the above describe an individual capable of organizing and translating large volumes of data into information that is understandable and adds value to a tax administration in

different forms. One of such forms of value is offering predictive visions on the behavior of our processes, namely, sector-based revenue, type of taxpayer or tax system, among many others.

It is also worth considering that we must demand basic ICT awareness from the rest of our staff-members (other than ICT professionals). We are not only referring to office software, but also skills to understand technological processes of higher complexity, by way of data processing, their value chain, identifying technological requirements in their control tasks, and using information in reports or dashboards for decision-making purposes.

This implies a challenge in rendering tax administrations attractive for ICT professionals, and likewise, the great opportunity to redefine the current strategies to retain this kind of professionals. The reference framework in place that compels us to follow specific regulations that limit our work must be revisited and improved in light of new demands.

16.4. Development of ICT skills or digital business competencies

As mentioned previously, tax administrations must strengthen the ICT skills of staff-members who are not professionals in that field. An absolute outplacement plan is not very recommendable, since it is costly and complicated, in the best of cases. Education remains the key tool to develop such skills among our human resources. To that end, we must work on different fronts: improved planning of the talent we manage, including onboarding, offboarding and retaining personnel. Moreover, we must create better people development programs and use a considerable effort in the regulatory framework of our tax administrations.

Far from any romanticism and based on a critical and productive approach, tax administrations must define the ICT skills' profile that their personnel require. This is not so much about programming tools, but rather those that facilitate and improve the understanding of information.

Very likely, we will soon have recruited a large number of young officials who are better equipped for using ICT from the outset although, as we mentioned earlier, the number of young resources being hired (under 25), is generally small.

Development strategies may be designed for active officials, for example:

- Defining the institutional profile of tools.
- Creating cross-interaction of toolkits and related officials.
- Establishing user security profiles.
- Defining the education strategy (methods and instruments), especially ongoing education.
- Adopting such tools in performance management.
- Bolstering such actions as tools evolve or change.

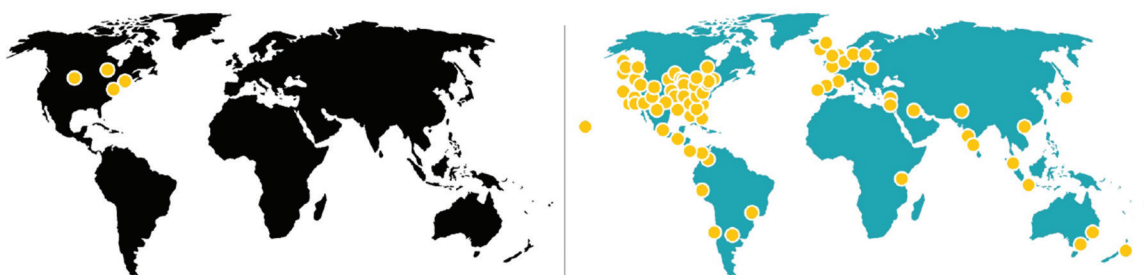
It is worth remembering that we must adjust our skills' profile to new demands, in line with Alison Cathles and Juan Carlos Navarro who set forth:

Digital skills are being developed across a continuum, and they constantly are being updated alongside developments in technology. As such, there are two implications for today's workforce: (i) many workers will need to 'upskill' continually so that they can work more effectively in their current positions with digital technologies; and, (ii) many people will need to reskill in order to prepare themselves for work in new roles. (Cathles & Navarro, 2019, p. 5)

One could add, not only to start in their role, but also to keep it.

Upon admitting the growing demand for ICT knowledge (for non-technical roles or tasks), evidence is compelling: most professions have adopted ICT in their fields. Tax administrations are no exception.

Figure 16.4-1 Bootcamps between 2011 and 2018



Source: LinkedIn and Bootcamp

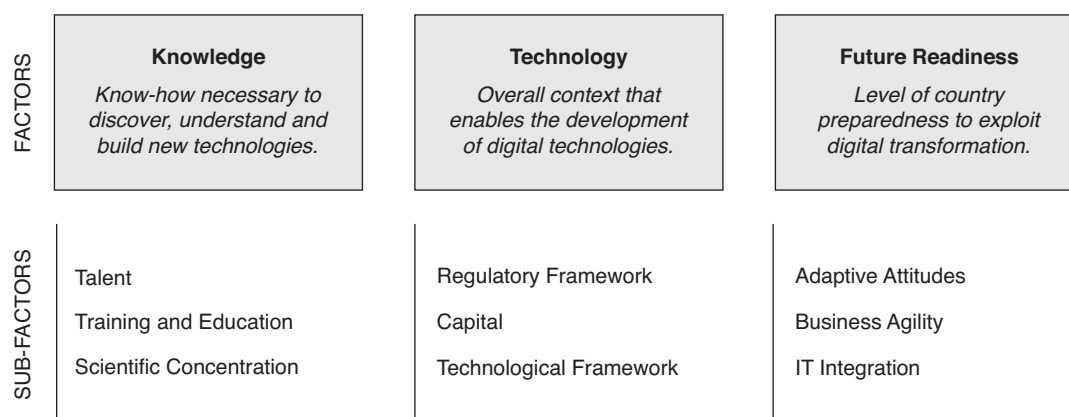
In the specialized ICT sector, as Cathles and Navarro explain, Programming Bootcamps are successful schools that teach programming tools. The number of Bootcamps has grown exponentially between 2001 and 2018, with an estimated 300 globally for 2018.

This may be an interesting model to develop such skills in the tax administrations. When compared with the institutional weakness of not having specialized staff to face the challenges of process automation, it may not be so expensive.

Hence, we may envision a training program to develop digital skills, under the preliminary name of Business Training (CDN, as per the Spanish acronym), not to be mistaken for digital programming skills. It is delivered according to a blended training model that includes online and classroom education. Such experiences must be designed and executed with great care. Beyond the uncertainty from ongoing change, we must incorporate CDN into the culture of tax organizations. It should not spur a discussion about its benefits, but rather a dialog about its feasibility.

Tax administrations should not lose sight of the close connection of the latter with the technological maturity that each country develops. Therein, “Talent” (regarding people) is also a means of measuring such levels of maturity. In this respect, in the last two years, Latin American countries have ranked under 50 (out of the 63 countries surveyed), in the International Institute for Management Development (IMD) World Digital Competitiveness Ranking (2019). The latter precisely includes Talent, Training-Education and Scientific Concentration in the measurement of the Knowledge Factor that analyzes the know-how necessary to discover, understand and build new technologies.

Figure 16.4-2 Digital Competitiveness and Sub-factors



Source: Digital Competitiveness Factors and Sub-factors. From “IMD World Digital Competitiveness Ranking 2019,” by IMD, 2019, p. 29.
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It is also worth assessing the impact of ICTs in talent management, in which the adoption of human resources analytics should be the path towards talent management. Not only the availability of automated management systems, but also management itself, in a context of interoperability with a very large number of sources for different purposes; namely, recruitment, education and performance measurement.

Staff retention

Finally, the retention of talent in tax administrations must be considered. A dual approach should be adopted: improve the recruitment system while also improving retention.

Tax administrations feature a large number of officials in non-technical in ITC roles (94% on average). Hence, this includes different professionals that conduct tax administration processes. On the other hand, we rely on a smaller group, of equal importance, who are ICT professionals and are directly influencing change within our organizations.

New hires feature a group of officials who may be included in any of the two previous groups, on the grounds of their profile.

Lastly, the fourth group is made up by officials who are near retirement, although this is a relative statement, since labor laws may be ambiguous in connection with retirement ages. Nonetheless, this group remains active in organizations.

This scenario requires unique strategies for every group. Although it is possible to adopt broad Human Talent policies applicable to everyone, a differentiated treatment is required to reap the best from each group.

The *Professional Challenge* is one of the possibilities to attract talented individuals that find the appropriate context to channel their energy and potential. This would enable to determine whether they are creative individuals, who seek to change, redo, rethink or be radical in their workplace. However, one may also encounter individuals who are more focused on the task, repetition, and results, without implying that either one is better. Rather, it is worth reflecting upon whether they are both necessary. What is being done to attract them? Some believe that a potential strategy is to guide them to work on a per-project basis, in order to perceive: *i)* their contribution, *ii)* the results, *iii)* the time outlook, and *iv)* their reward.

On the other hand, the other group may be guided to work towards the goal, to fulfill high operation volumes by means of: *i)* clear processes and procedures, *ii)* specific routines (which does not imply static ones), *iii)* vertical organization structures with low variability, and *iii)* acknowledgment based on the achievement of goals.

Both groups require a development plan designed to incorporate the latter and other observation parameters. The many nuances between both groups may call for additional adjustments.

The *Emotional Salary*. Although salary has been typically an employment satisfaction factor, it has been recently proven insufficient to promote employee loyalty. In other words, engagement does not have a price, but it may be managed.

Engagement management is enabled through different instruments, implemented in Human Resources or Human Talent Policies, in the framework of organizational practices like Teleworking, Flexible Schedule, and Special Dates. Recreation or rest facilities, value-added services on premises (restaurants, shared canteens), adequate physical environments, family services, or scholarships. Although such benefits bear a financial impact in real terms, they are not included in the regular salary of a tax official.

Should the foregoing seem irrelevant, let us refer to interesting statistics from the Excelsior newspaper with data from OCC Mundial:

- Emotional salary increases staff productivity by 33%.
- Emotional salary reduces downtime due to low efficiency or failure to meet goals by 66%.
- Emotional salary reduces absenteeism due to employee accidents, health issues or personal issues by 51%.

Labor Reconversion is undoubtedly a controversial issue. Notwithstanding, we must admit that due to different reasons (bad bosses, low satisfaction, poor pay, etc.) an employee may lose performance. The only solution, assuming that the tax administration wishes to retain this individual, is to change his/her role, relocate to a different business unit, or change their position. In other words, shake his ground, to offer the opportunity to renew energies and channel potential in a new direction. It is worth highlighting that this is not a matter of age. We may be equally referring to Young Talent with little tolerance to frustration, or Senior Talent serving in the same role for 25 years.

This may be one of the most complex options to materialize, owing to the multiple detrimental factors, most of them, of their own will. Notwithstanding, it is valid to include it among our set of solutions. In any case, Labor Reconversion is an additional resource available.

Internal Competition. Professional Challenge has been mentioned herein. Internal Competition is based on a traditional approach towards competition among peers in order to achieve promotions, raises, new positions, or even new projects. It may be deemed another retention alternative.

The two essential requirements are absolute transparency of rules and assessments of Internal Competition, and absolute respect for the results of such processes. The internal credibility thereof and the preservation of the merit-based approach depend on them.

Insourcing. It is important to keep in mind that retention is the focus of this discussion. Insourcing means lending personnel to participate in specific projects. In this context, they are task groups created to serve in extraordinary situations, great changes, or long-term projects, in which people make important contributions and subsequently return to their previous positions.

No reference has been made to salary, since, as mentioned previously, in certain contexts tax administrations are not competitive in salary terms. In fact, according to Indeed,¹⁹¹ some countries feature a growing offer of underqualified employment, but the offer of specialized ICT positions is difficult to cover. Hence, very significant salary distortions exist. One of them is the large number of candidates per position, but some ICT positions remain difficult to cover, namely, system administrators, developers and Web designers, and this impacts salary and compensation structures. Salary is undoubtedly another instrument to achieve retention.

Many organizations have adopted these five strategies; some have systematized them more and others less, with greater or lesser degrees of success. Talent Management and Technological Innovation are to remain the core ideas. Tax administrations will be constantly facing new challenges to harmonize technological innovations with the profiles and performance of tax officials.

Tax administrations still face significant demand to cover positions and have even gone through massive recruitment processes like the one in Honduras in 2016, Argentina 2018, and Peru 2019, or Mexico, which for years carried out massive processes to cover vacancies in their customs security and surveillance unit. Individual onboarding per position also entail inherent complexities.

It is the tax administration's responsibility to develop institutions with the best conditions in order to fulfill their public role and support compliance with public development policies in their countries, directing talent and technology towards the same strategy.

16.5. Coexisting with outsourcing

Outsourcing may enable tax administrations to reduce costs, expedite implementation times and benefit from external experience, assets and/or third-party intellectual property. In addition to these main motivations, for the tax administrations and public sector in general it may also be mentioned the reduction of staff positions, since in many countries, the number of staff positions assigned to an institution is legally limited and/or preferentially oriented at the activities that are the purpose thereof. The strategic and technological context of outsourcing is defined in Chapter 11 (*Roadmap to Modernize a Tax Information System*), section 7.

Likewise, outsourcing ICT services impacts the human resources area, in the number of technical staff required and their competencies. When a service or activity is outsourced, the tax administrations lose technical staff and the required competencies change; the professional profiles of the tax administration technical staff in the outsourced areas will be more focused on specification of services and contract management.

The core competencies of these professionals are:

- Outsourcing notions;
- Outsourcing and contracting alternatives and processes;
- Management of outsourcing projects;
- Key outsourcing factors, including financial aspects;
- Preparing outsourcing feasibility studies;
- Preparing RFI¹⁹² and RFP¹⁹³;
- Due diligence¹⁹⁴ and contract negotiation;
- Vendor selection.

These competencies are not individual, but inherent in the group in charge of the task. As the institution grows the number of outsourced services and activities, the more important it becomes to endow the outsourced group with technical resources with the appropriate competencies.

The professionals in charge of managing the outsourcing process not only rely on courses to develop the competencies required, and the potential support from external consultants, but also hands-on expertise to achieve personal and process maturity, with skills that will enable them to undertake more complex negotiations in the future.

Note

191. For more information, see: www.indeed.com, a global job search platform.
192. **Request for Information.** The RFI is a standard business process whose purpose is to collect written information about the capabilities of various suppliers. Normally it follows a format that can be used for comparative purposes. (Cobalt)
193. **Request for Proposals.** The RFP informs vendors of customer needs and expectations. In turn, vendor proposals should respond specifically to the requirements outlined in the RFP. (Technopedia)
194. Due diligence is a comprehensive appraisal of a business undertaken by a prospective buyer, especially to establish its assets and liabilities and evaluate its commercial potential. (Oxford)

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17. CONCLUSION

The readers who may have had the time and courage to reach this point of the book will probably be grateful to know that there is no attempt here to synthesize what has already been presented in the previous six hundred pages. It would be a pointless effort since it would make no justice to the concepts, practices and lessons that have been presented.

17.1. A brief history of the book

The first part of this conclusion rather follows *a journey, and not a destination* approach. Compiling a book with 16 chapters and 36 authors is, by all means, an interesting, yet challenging task. The process started in the last quarter of 2018 when Vishal Gujadhur, from the Gates Foundation, talked about having a *Flagship Report* as one of the outcomes of the cooperation being established by the two organizations. “It has to be useful; it has to be practical,” he said.

All of us at the CIAT Executive Secretariat believe that information technology is indispensable for tax administration. There is no other way to manage taxes and improve compliance with limited resources within the expected levels of efficiency. But we also believe that, if properly used, information technology could make leap-frogging viable. That is a real opportunity for developing countries to improve their capability to raise revenue while, at the same time, deploying an inclusive and accessible service platform to facilitate service delivery. If ignored, on the other hand, the inaction from one will exacerbate the differences among countries at different stages of digitalization, thus resulting in higher inequality in technology adoption.

With that in mind, Márcio F. Verdi, the Executive Secretary, Santiago Díaz de Sarraalde, Juan Redondo, Gonzalo Arias, David Borja and myself sat down to draft the initial index of the document. We ended up with what can be identified as two sets of chapters. One, covering tax administration functions supported by information technology systems or applications, the other covering the effective corporate use of information technology within the organization. At that point, we recognized that it was going to be quite a task, and we needed help. Therefore, we invited Antonio Seco and Socorro Velazquez to join the team.

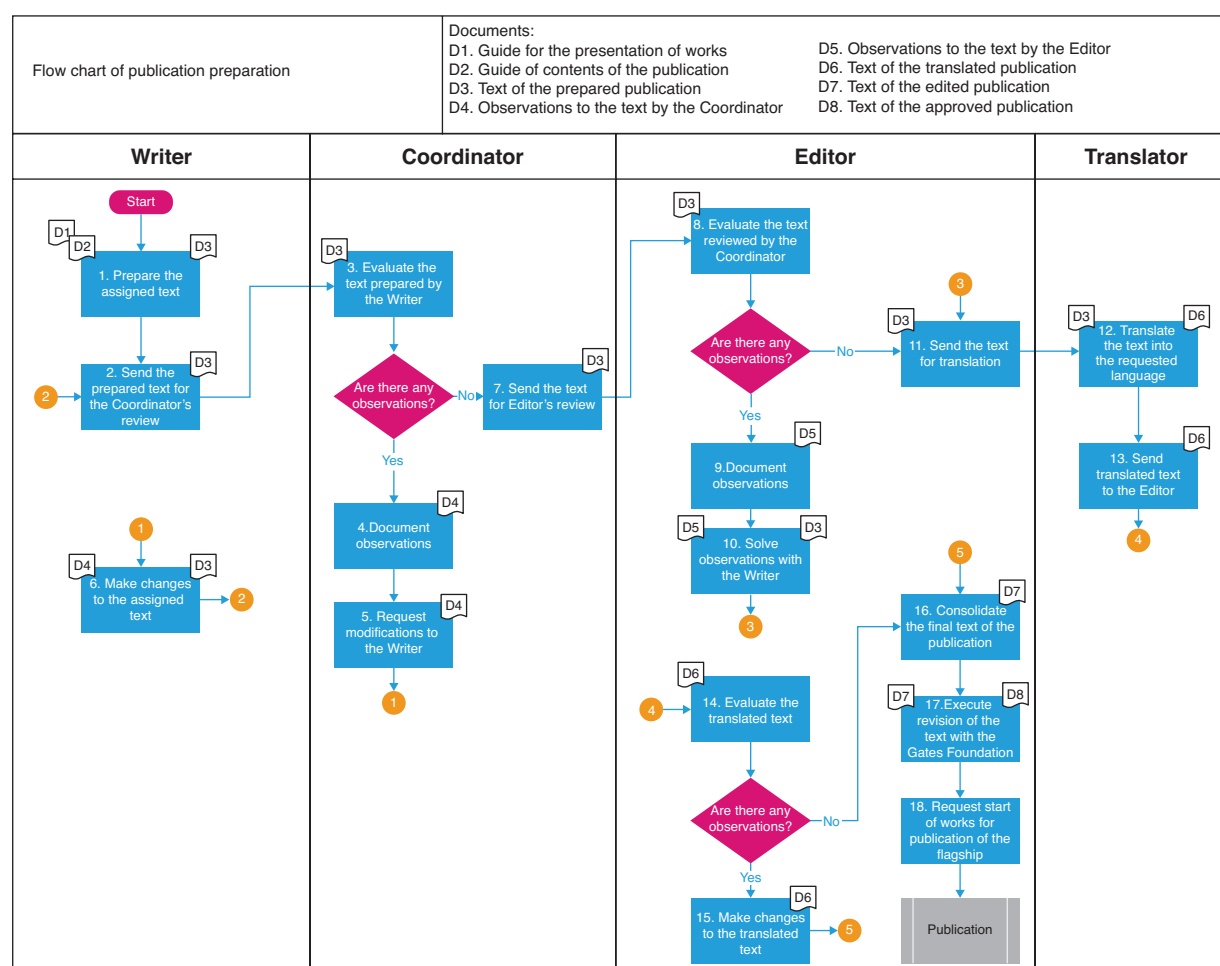
The next step was to identify the relevant experiences in each of the topics. The selected experiences come, in general, from developing countries – all of whom are CIAT members. All of them have been tested in the field, with good results. We think some of them can be easily adapted to local

realities by other countries, while others can inspire people to undertake new projects and test some boundaries.

We ended up with 36 authors from 16 countries, writing in three languages. The pool included four active Commissioners (Chile, Peru, Portugal, and Spain), one CIO from a national tax administration (Paraguay), current tax administration officials (Brazil, Kenya, Portugal, Peru, Spain), CIAT executives and consultants, and representatives from the private sector.

A set of guidelines was prepared, covering such aspects as from fonts and sizes to referencing and quoting, to differences between charts and figures. It was sent to authors together with a workflow (shown in the figure below).

Figure 17.1-1 Workflow for the preparation of the book



Source: Prepared by the editing team

We had to quicken the pace since it was crucial to meet the deadlines. Not only did we commit ourselves with the foundation to publish the “flagship” within the timeframe of our project, since

we knew then, as we know now, that the changing nature of information technology creates the threat of publishing something that could be outdated in a couple of years. Some chapters needed extra coordination with authors of very different backgrounds and experiences and, of course, very different writing styles. The translation is a different game, a constant struggle between beauty and faithfulness.

Finally, in November 2019, the book was written.

17.2. Next steps

Specific technologies mentioned and covered in the book will become a kind of commodity; others will be surpassed and forgotten. That is true; however, underlying concepts will prevail. It would be easier to build the next service platform or the next compliance control process on a well-structured foundation. Information technology applications, regardless of where they are hosted, should align with the tax administration's strategy "at least three of the perspectives identified in the model are beneficial for the administrations: the execution of the strategy, the technology as potential and the level of service" (Zambrano, 2009) under an umbrella of pressure to do more with less.

The digital transformation of tax administrations will occur everywhere, at different speeds and following different roads. Nevertheless, it requires the participation, leadership, and commitment of the tax administration's staff: the managers, the policymakers, the officers that cover the last mile (Seco & Muñoz, 2018). It will never be, as this book reiterates an information technology process, much less, a single information technology project. It will help reduce the cost of compliance, it will help increase transparency, it will also "allow innovation in tax policy" (Chen, Grimshaw & Myles, 2017).

Unfortunately, if left alone, it will probably also bring with it, if we call them that, some forgotten lessons. A lot of information compiled without enough quality that in the end will be poorly used, if used at all; relaxed recovery practices because things fail less; a constant fascination with what is new, the current set of buzzwords, on the technical side, regardless of the fact that, at least within tax administration, no single technology has produced the magical results that both promoters, from within as well as from the vendors, have hoped. Data warehouses did not find tax cheaters in the middle of the night; BPMS software did not automate every single process and, even today, could do very little to improve a process that has not been really described (not to mention about those procedures detailed in acts of law); referential integrity in the database has not guaranteed that all records are perfect.

Of course, they have allowed improvements: the speed, the level of certainty, the meeting of standards and service level agreements. The experiences presented are evidence thereof. Not only in advanced economies, but also in the developing ones. The "not a threat, but an opportunity" perspective has allowed tax administrations to design and implement procedures that could have otherwise been considered not viable. Using a single id number government-wide, speeding refunds according to their magnitude, hundred percent electronic filing of tax returns, full-scale electronic

invoice with every single invoice being transmitted on-line to the tax administration, collecting decisions of geographically dispersed judges in appeals, pre-filing tax returns for both direct and indirect taxes, transmitting information about financial transactions across borders, sharing public information among jurisdictions are all examples of use cases that would have not been successful if the significant challenges they face were not addressed properly and creatively.

This is one of the major lessons here. IT can help tax administration to leapfrog stages now, learning from success elsewhere. This book, we think, can help tax administration remember that a solid foundation is necessary, that efforts need to be made to improve current realities, that a good combination of stable systems and new developments will afford the tax administrations obtaining the resources our societies need.

We cannot expect this text to become the reference manual that will be constantly accessed whenever a system goes off-line, that is not its purpose. Neither does it need to be completely covered to be useful. In fact, we tried to make each chapter readable by itself. This explains why some aspects are covered in more than one chapter, although through the lenses of what is being covered in that particular section.

Nevertheless, it certainly covers aspects of information technology in tax administration that should the subject matter to be studied by tax administrators as well as information technology people working for tax administration.

Thanks.

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LIST OF ACRONYMS AND ABBREVIATIONS

Acronym	Description
ACID	Atomicity, Consistency, Isolation and Durability
ADB	Asia Development Bank
AI	Artificial Intelligence
API	Application Program Interface
App	Mobile devices applications programs
ATAF	African Tax Administration Forum
B2B	Business-to-Business
B2C	Business-to-Consumers
BAM	Business Activity Monitoring
BEPS	Base Erosion and Profit Shifting
BI	Business Intelligence
BPM	Business Process Management
BPMN	Business Process Model and Notation
BPMS	Business Process Management Suite
BPR	Business Process Reengineering
CAO	Chief Analytics Officer
CAPEX	Capital Expenditure
CbC	Country-by-Country (Report)
CDO	Chief Data Officer
CEO	Chief Executive Officer
CIAT	Interamerican Center of Tax Administrations
CIO	Chief Information Officer
CMMN	Case Management Model and Notation
CMS	Content Management System
COBIT	Control Objectives for Information and related Technologies
COTS	Commercial-of-the-Shelf
CRS	Common Reporting Standards
CSP	Content Services Platform
CSS3	Cascading Style Sheets version 3
DevOps	Development and Operations
DMM	Data Maturity Model
DMS	Document Management System
EAI	Enterprise Application Integration

LIST OF ACRONYMS AND ABBREVIATIONS

Acronym	Description
ECM	Enterprise Content Management
ERP	Enterprise Resource Planning
ESB	Enterprise Service Bus
EU	European Union
FATCA	Foreign Account Tax Compliance Act
GDP	Gross Domestic Product
HMRC	Her Majesty Revenue and Customs
HTML5	Hyper Text Markup Language version 5
HTTP	Hyper Text Transfer Protocol
IaaS	Infrastructure as a Service
IADB	Interamerican Development Bank
iBPMS	Intelligent Business Process Management Suite
ICMS	Imposto sobre Circulação de Mercadorias e Serviços (Brazil)
ICT	Information and Communications Technologies
IEEE	Institute of the Electric and Electronic Engineers
IMF	International Monetary Fund
iOS	Apple mobile operational system
IoT	Internet of Things
IOTA	Intra-European Organisation of Tax Administrations
IRS	Internal Revenue Service
ISO	International Organization for Standardization
ISORA	International Survey on Revenue Administration
ITIL	Information Technology Infrastructure Library
ITSM	Information Technology Service Management
ITUP	IBM Tivoli Unified Process
JDBC	Java Database Connectivity
KPI	Key Performance Indicator
LAC	Latin America and the Caribbean
LDAP	Lightweight Directory Access Protocol
LDSW	Locally Developed Software
MOF	Microsoft Operations Framework
OCDS	Open Contract Data Standard
OCR	Optical Character Recognition
ODBC	Open Database Connectivity
OECD	Organization for Economic Cooperation and Development
OLAP	On-Line Analytical Processing
OLE-DB	Object Linking and Embedding for Databases
OMR	Optical Mark Recognition
OPEX	Operational Expenditure
P2P	Peer-to-Peer
PaaS	Platform as a Service
PoC	Proof of Concept

Acronym	Description
QR Code	Quick response code (bidimensional code)
RDBMS	Relational Database Management System
REST	Representational State Transfer
RFID	Radio-frequency Identification
RPA	Robotic Process Automation
RPC	Remote Procedure Call
SaaS	Software as a Service
SAML	Security Assertion Markup Language
SOA	Service Oriented Architecture
SOAP	Simple Object Access Protocol
SSO	Single Sign On
TADAT	Tax Administration Diagnostic Assessment Tool
TCO	Total Cost of Ownership
TIER	Data center classification standard
TIS	Tax Information System
VAT	Value Added Tax
WB	World Bank
WCO	World Customs Organization
WMS	Workflow Management System
WYSIWYG	What You See Is What You Get
XML	Extended Markup Language

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