

FINANCIAL MANAGEMENT INFORMATION SYSTEMS (FMIS) - PROJECT GUIDE

Strategic, Functional, Technological, and Governance
Issues in the Design and Implementation of New
Platforms for Public Financial Management Systems

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Carlos Pimenta
Antonio Seco

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Foreword

Public finances across the Latin American and Caribbean (LAC) region have been greatly affected by the COVID-19 pandemic. Sustainable, green recovery will require access on the part of decision-makers to timely, high-quality financial information.

Public financial management (PFM) is essential for ensuring efficiency and transparency in the use of public funds, with the application of systems and tools for financial management, programming, and control, as well as the consolidation of fiscal and budgetary information.

A strategic vision of PFM modernization in the LAC countries encompasses functional, institutional, and policy elements, in addition to a strong digital component. Our vision is to support national and subnational governments in the region in building institutional capacity in all the different dimensions of PFM, promoting a comprehensive functional model of PFM and all associated systems with the aim of enhancing the efficiency and transparency of revenue collection and public expenditure management. In this context, it is very important to provide assistance not only in the functional, institutional, regulatory and policy areas, but also for the renewal of IT systems for managing budget expenditure, such as financial management information systems (FMIS).

Although FMIS are essential for achieving economic stability and greater fiscal efficiency and transparency, many of the systems in the region are close to obsolescence and require modernization. It is increasingly important that FMIS offer comprehensive functional coverage, as well as flexible, modular architecture and technologies and rapid adaptability to new conditions without any loss of efficiency or effectiveness. FMIS should also be supported by effective IT management, thus helping to ensure high-quality service and extend the useful life of the systems. At the same time, governments should foster greater interoperability between administrative and PFM systems, with a view to ensuring that these are as integrated as possible.

Technological advances have been exponential and are increasingly accessible and cost-effective, and this should encourage the renewal of these systems. Countries need to continue to leverage substantial opportunities for improving required functionalities and promote the intensive use of new IT technologies in PFM, such as cloud services, chat bots, Big Data, artificial intelligence in public finance, robotic process automation,

distributed ledger technologies such as blockchain, open source code for sharing systems and algorithms, data analytics, data visualization, etc. These, in turn, provide tools for combating fraud and corruption.

Implementing and executing public management projects is no simple task, particularly where these involve complex new information systems. The same can be said of FMIS projects used by governments to prepare and execute public budgets, thus supporting good cash management, the generation of government accounts, and many other functions that seek to foster efficient, transparent fiscal management.

In the United States, a report by consulting firm The Standish Group found that only 13 percent of major government software and systems projects are successful. This is a particularly serious problem in the procurement sector, and many entities lack the experience needed to ensure that projects involving complex systems perform as planned. Government bureaucracies do not appear to be much help. Staff may wish to benefit from modern technology, but change is costly and resources are usually insufficient to retain the necessary personnel and ensure project success.

One strategy for improvement involves modular contracts—that is, shorter contracts of a size that is easier to replicate. At the same time, governments should treat users' opinions seriously, and the goals of the new system should be well defined before contracts are awarded.

Based on the experience of LAC countries in implementing FMIS projects, this Guide addresses all key aspects of these types of projects, deepening the analysis in the case of critical issues and proposing alternatives. Topics covered by the Guide include (i) strategic, governance, and political economy aspects of projects; (ii) organizational, functional, technological, and operational factors in successful project implementation (results indicators, institutional arrangements, and the conceptual model for the system); (iii) legal, functional, and process issues; (iv) the treasury single account; (v) subnational governments; (vi) data and information security models; (vii) the use of emerging technologies; and (viii) management models for operations.

In summary, this Guide addresses all significant aspects of the diagnostic assessment, design, implementation, and operation of an FMIS, proposing and describing alternatives in the various areas that are considered critical so that they can be used in projects with or without financing from the Inter-American Development Bank or other multilateral organizations. It offers basic guidance to help ensure that FMIS projects are successfully implemented and remain sustainable over the long term.

Emilio Pineda
Chief of the Fiscal Management Division
Institutions for Development Sector
Inter-American Development Bank

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Executive Summary

The COVID-19 pandemic has had a truly global impact on public finances, leaving no jurisdiction untouched, including every country in Latin America and the Caribbean (LAC). Governments have responded swiftly, and as the pandemic has continued to unfold, so have economic interventions. In addition to the type of intervention, it is important for decision makers to have up-to-date financial information if they are to assess available capacity for future interventions, both during the pandemic and after it. Financial management information systems (FMIS) are the main source of such information.

The role of these systems is to provide an essential operational and informational foundation for public financial management (PFM), and achieving this objective has increased the importance of ensuring that FMIS are comprehensive in terms of their functional capabilities. This includes flexible, modular architecture and technologies, rapid adaptability to new conditions, and effectiveness and efficiency at all times.

The experience of the LAC countries in implementing successive generations of FMIS since the end of the 1980s—often with the support of multilateral organizations such as the Inter-American Development Bank (IDB)—has allowed the identification of the strategic, organizational, functional, technological, and operational features required for successful implementation of these systems. In addition, new information technologies (including a number of disruptive ones) provide significant opportunities for improvements in the required functionalities. These include cloud services, chatbots, Big Data, artificial intelligence, robotic process automation, blockchain, data analytics, and data visualization, which in turn provide tools for combating fraud and corruption.

This guide is divided into 14 self-contained chapters that may be read separately. They cover all of the significant aspects of designing, implementing, and operating an FMIS, and they provide detailed coverage of issues considered critical (mainly those that presented challenges in previous FMIS projects), including alternative approaches for addressing them. Although most of the information presented in this guide relates to IDB-financed FMIS projects (including those to support both the implementation of new systems and the modernization of existing ones), it can

also be used in other FMIS projects, whether or not financed by the IDB or other multilateral organizations.

In terms of the elements that are key to the success of an FMIS project, governance and management arrangements should be addressed first, with the design of a suitable structure for project management. Projects can be carried out at three levels: (i) executive and strategic management, (ii) operational management, and (iii) operational. However, it is essential to secure the participation of officials and executives from the different functional areas that make up an FMIS, such as treasury, budget, accounting, and debt management. Both users and those responsible for oversight of the system should be involved, whether in new processes or adjustments to existing ones. Without the effective participation of these stakeholders, functional decisions will be subject *ex post* to criticism, require modification, or potentially not even adopted. Such situations entail delays and increased costs, primarily affecting the information technology (IT) system.

It is recommended that specialized consulting services (firms or individual consultants) be identified and contracted at an early stage to ensure consistency in functional and technological decisions. The conceptual model for the FMIS should be treated with the same level of priority. This establishes the desired public expenditure management framework (coverage and functional scope), including the IT system that will support it and—where appropriate—its interaction or interoperability with other public and private sector systems. This is no easy task. It requires time and resources, yet it contributes significantly to aligning visions and increases the likelihood of success and project sustainability. In terms of identifying and producing indicators for PFM and the FMIS itself, this should begin at the design stage, including public expenditure and financial accountability (PEFA) indicators and other operational, quality, and system coverage indicators.

Political economy factors play an important role in the success of FMIS and PFM—for example, the interagency coordination required to implement an FMIS and the introduction of coordination mechanisms (generally in the form of committees comprising users and other stakeholders). The creation of a treasury single account (TSA) also requires strong institutional arrangements between the government and its ministries, the central bank, and private banks. In this context, the quest for sustainable financing models for financial administration is also included, to ensure that the resources needed to maintain and update systems are available.

Once the strategic and organizational framework for an FMIS project has been established, the functional features required to structure PFM should be determined and described in detail. These features flow from the initial proposition of the project (conceptual model) and are refined through a modernizing analysis of PFM processes performed by a team of specialists, both internal and external (consultants). Challenges in building the conceptual model stem mainly from pressure to implement the system as soon as possible, often without a clear vision of the system and the general framework it seeks to support. Weak stakeholder participation and underestimation of the complexities of PFM and the system are additional problems.

Underestimating complexities can lead to failures or increased costs and delays in delivering an FMIS.

The main functional features should (i) ensure a minimum level of institutional coverage of the central government, decentralized entities, extrabudgetary accounts, social security funds, and the multiyear budget (where necessary), and should include all expenditure, loans, debts, grants, and subsidies with a view to administering them through the FMIS; (ii) ensure control of the public debt; (iii) capture all relevant data to ensure the control of public expenditure; (iv) allow monitoring of multiyear expenditure on investment projects; (v) support TSA operation; (vi) issue budget reports consistent with the criteria established by international standards; (vii) record cash flow in a timely manner; (viii) establish electronic payment methods; (ix) ensure that payments are made within the established time frames; (x) provide information on the stock of arrears; (xi) ensure consistency between the chart of accounts and budget classification; (xii) certify that all accounting and registry data are classified appropriately; (xiii) develop and implement fiscal reports that are timely, exact, and adaptable to the needs of users; (xiv) issue financial statements in a timely manner; and (xv) create a database of timely, reliable, and exhaustive information on all public expenditure.

FMIS also require a sound legal foundation to operate effectively. An FMIS can be launched without a complete financial administration law, as the practice in some countries shows, but this is not ideal. It is preferable to have laws or regulations in place that establish—at a minimum—a common classification, the alignment of budget classifications and accounting classifications in the chart of accounts, and the types of entities covered by the law.

The IT system to be implemented automates all of the desired functionalities and should incorporate flexible, modern elements of IT architecture. Given that FMIS already exist in several LAC countries, the choice of whether to modernize an existing system or implement a new one should be considered, along with all of the pros and cons involved in such a decision. Likewise, the choice of implementation and deployment model for a new FMIS—custom-made and self-financed, custom-made and externally financed, or adaptable/customizable software solutions (commercial off-the-shelf, or COTS)—constitutes an important challenge, with lessons learned and recommendations that should provide a foundation for the decision-making process and subsequent deployment.

IT security issues should be considered as part of a holistic vision, particularly in the current context of complex, wide-ranging digital threats. Security policies must be implemented that include processes, users, systems, and technologies. Such policies will guide the implementation of cryptography, digital signatures, access management, and service continuity, among other things. According to specialized companies, the most significant security breaches occur at the user level, reinforcing the need to provide constant user training and orientation.

Implementing an FMIS is no easy task. The implementation strategy—particularly the decision regarding whether to adopt a “big bang” approach (all at once) or a

phased one (in gradual stages)—should be determined in advance, as this will influence whether specific software modules need to be prepared and/or different institutional arrangements negotiated. At the same time, a specific management group will need to be created to ensure final testing and data migration, preparation of the physical user environment prior to deployment, training, printed and online guides, preparation of support teams, creation of a help desk, and earmarking of human and financial resources. The managers of participating entities should be involved from the very beginning of the planning stage.

Once an FMIS has been implemented, updates and adjustments to the system should be possible throughout its entire useful life. There is also a need to ensure that the life cycle is long, with robust management structures and application of international good practices in the area of maintenance, such as Information Technology Infrastructure Library (ITIL) or Control Objectives for Information and Related Technologies (COBIT).¹ Required budgetary resources must be planned for and set aside, or the effectiveness and useful life of the FMIS will be curtailed. The alternative of establishing autonomous PFM entities or agencies (a model adopted by some countries, similar to tax agencies) may be considered in such a situation.

Subnational FMIS have their own implementation and operation strategies, in which deployment, operation, and maintenance costs can play a critical role in terms of quality. In some countries, central governments have developed general-purpose systems for subnational entities, usually with internet-based access (Bolivia and Honduras). Meanwhile, some subnational entities join forces to develop a common FMIS,² while others develop or contract out development of their own FMIS. In the latter case, the entities own the source code and system rights and may share this with other entities, usually (but not necessarily) hiring the same provider to make the necessary adjustments. Some of the Brazilian states are adopting this approach, leading to lower licensing costs and shorter implementation periods.

Issues of scale, budget, and the availability of qualified human resources mean that it is very difficult for many municipalities and provinces/states to build data centers with adequate physical facilities and management processes. In such cases, cloud services may be an alternative solution for reducing investment costs, improving operability, and obtaining better services for managers and citizens. The same comments apply to smaller national financial administrations.

The contracting of external support—either individual consultants or firms—is recommended at various stages of the project; accordingly, it is important that the project have the capacity to adequately and efficiently manage consultancies during both the design stage (terms of reference) and selection and contracting processes. Monitoring and

¹ ITIL and COBIT are structured compendiums of good practices in the area of IT system life-cycle management.

² This example is also valid for national governments in small countries, and some of the Caribbean island nations have used this approach.

follow-up capabilities will also be required to ensure good consulting performance and satisfactory assimilation of outputs by the permanent structure of the ministry or other government units.

As described in this executive summary, a large number of issues need to be addressed in launching an FMIS, and all of them must be taken into account for the system to be successful. The objective of this guide is to provide basic guidance aimed at ensuring that FMIS projects are successfully completed and are sustainable over the long term.

Acronyms

AEAT	Agencia Estatal de Administración Tributaria de España (Spanish State Tax Agency)
BPMN	Business process model notation
BSS	Budget subsystem
BPR	Business process reengineering
COBIT	Control Objectives for Information and Related Technologies
DGTP	Dirección General del Tesoro Público (Public Treasury Department), Peru
eRA	Electronic reverse auction
FMIS	Financial management information system
GFR	General functional requirement
GRP	Government resource planning
IaaS	Infrastructure as a service
ICB	International competitive bidding
ICT	Information and communication technologies
IDB	Inter-American Development Bank
IMF	International Monetary Fund
IPSAS	International Public Sector Accounting Standards
IT	Information technology
ITIL	Information Technology Infrastructure Library
ISMS	Information security management system
LFPRH	Ley Federal de Presupuesto y Responsabilidad Hacendaria (Federal Budget and Fiscal Responsibility Law), Mexico
MEF	Ministry of Economy and Finance
NCB	National competitive bidding
OFDP	Open fiscal data package
PaaS	Platform as a service
PEFA	Public Expenditure and Financial Accountability
PFM	Public financial management
PEU	Project execution unit
PI	Performance indicator

R&D	Research and development
RFB	Request for bid
RFI	Request for information
RFP	Request for proposal
RPA	Robotic process automation
SaaS	Software as a service
SDDC	Software-defined data center
SFP	Secretaría de la Función Pública (Ministry of Public Administration), Mexico
SHCP	Secretaría de Hacienda y Crédito Público (Ministry of Finance and Public Credit), Mexico
SIAFI	Sistema Integrado de Administração Financeira [Integrated Financial Management System), Brazil
SIAF-RP	Sistema Integrado de Administración Financiera-Recursos Públicos (Financial Administration System for Public Funds), Peru
SIGFE	Sistema para la Gestión Financiera del Estado (State Financial Management System), Chile
SIGEF	Sistema de Información de la Administración Financiera (Financial Management Information System), Dominican Republic
SII	Sistema Integral de Información de Ingresos y Gasto Público (Integrated Information System for Public Revenue and Expenditure), Mexico
SIIF	Sistema Integrado de Información Financiera (Integrated Financial Information), Uruguay
SII	Suministro inmediato de información (Immediate supply of information)
SLA	Service-level agreement
SMS	Short message service
TOCAF	Texto Ordenado de la Contabilidad y Administración Financiera del Estado (Consolidated Text on Accounting and Financial Administration), Uruguay
TSA	Treasury single account
USSD	Unstructured supplementary service data
VA	Virtual assistant
VAT	Value-added tax
VfM	Value for money

About the Authors

Carlos Pimenta



Carlos joined the Inter-American Development Bank (IDB) in 2001 and is currently Principal Specialist in the Fiscal Management Division. He has worked on public management modernization projects in more than 20 Latin American and Caribbean countries, including the areas of public financial management and other institutional and technological issues. Before joining the IDB, he worked in Brazil's federal government, where he held the positions of Executive Secretary of the Council for State Reform, National Secretary in the Ministry of Administration and State Reform, Vice-Minister of Labor and Public Administration, and President of the National School of Public Administration. He also previously worked for the Government of the State of São Paulo. He holds a degree in public administration with a specialization in economics, as well as a Master's in Public Management from the Getulio Vargas Foundation in Brazil. He has published several books and articles on public management modernization.

Antonio Seco



Antonio is from the city of Cabo Frío in Brazil. As an independent consultant of the Inter-American Development Bank and the Inter-American Center of Tax Administrations, he has led ICT components in projects to modernize tax and public finance administrations in different countries of Latin America. He has also undertaken multiple technical assistance missions to countries in Latin America, the Caribbean, and Africa. He holds a degree in electrical engineering, with a Master's in Information and Communication Technologies Management and a post-graduate degree in tax administration. He was an official in the Federal Data Processing Service of the Ministry of Economy of Brazil, where he participated in the implementation of the integrated financial administration system and other public finance systems. Antonio has published several books and articles on the application of information technologies in public finance. He is a Senior External Consultant for Jupiter Systems & Solutions in Angola.



In this chapter:

- 1.1 Introduction
- 1.2 FMIS in Latin America and Worldwide
- 1.3 Summary Review of the FMIS Literature
- 1.4 Conceptual Model for an FMIS
- 1.5 Document Content and How to Use this Guide

Introduction and General Overview

1.1 Introduction

The main objective of this document is to consolidate the experience of the Inter-American Development Bank (IDB) with respect to *integrated financial management system* (FMIS) projects and support those working in the preparation and execution of such projects. This includes the project teams of international organizations financing the systems, as well as government FMIS project teams (mainly in the LAC region). A “project” can be described as a set of interrelated activities with a predefined duration and budget. This document may be useful for both FMIS project teams and those responsible for administering the systems once installed and operating. Analysis of some of the factors underpinning the successful operation of these systems (as indicated in the literature and in surveys of FMIS project team leaders) leads to identification of the key issues addressed in this guide, as well as the main challenges and bottlenecks, among other operational, strategic, technological and institutional coordination factors. The aim is to present strategic alternatives that should be taken into consideration, as well as models, concrete examples, and general recommendations.

FMIS support budgetary, financial, and accounting management in the public sector in accordance with the principle of single, timely recording of revenue and expenditure operations. They enable process integration, payments, and the generation of associated financial statements (Pimenta and Pessoa, 2015). The current concept behind FMIS is that of a single public financial management (PFM) system for the government as a whole, with a central database and the ability to devise and operate a treasury single account (TSA).¹

¹The TSA is a single bank account or set of linked bank and subaccounts that allow the government—through a single administrator (the treasury)—to process its collections and payments, obtain a consolidated financial position at the end of each day, and manage resources in a centralized manner (Fainboim and Pattanayak, 2011). The TSA consists of a set of systems, processes, and rules applicable to a government’s PFM.

In addition to the usual PFM activities, which are complex in their own right, the COVID-19 pandemic has had a truly global impact on public finances, leaving no jurisdiction untouched. This has included every country in LAC. Governments have responded swiftly, and as the pandemic has continued to unfold, so have economic interventions. Government interventions have varied between countries, but generally fall into the following categories: (i) direct government expenditure, including support to those most affected; (ii) support to individual citizens (e.g., expanded access to income transfers and other social benefits); (iii) support to companies and other public sector entities; and (iv) support for financial systems, including monetary policy instruments.

In addition to the type of intervention, it is important for decision makers to have up-to-date financial information, so as to understand the available capacity for future interventions both during the pandemic and after it (International Public Sector Accounting Standards Board, 2020). FMIS are the key source for such information.

In striving to meet this objective, the growing importance can be seen of having FMIS with flexible, modular architecture and technologies, rapid adaptability to new conditions, and effectiveness and efficiency at all times.

Another important feature of FMIS that has stood out during the pandemic is the ability to make electronic payments, particularly in the case of social benefits. In countries with low levels of banking access among the population, these types of payments require new and creative solutions that make use of previously disregarded infrastructure.

1.2 FMIS in Latin America and Worldwide

1.2.1 General Overview

As a single system for PFM, FMIS have been introduced in most countries since 2000. Ninety percent of the systems currently in operation worldwide have been introduced since that year, including a similar proportion of the FMIS in LAC (88 percent).

Multilateral organizations and donors provide significant funding for PFM and FMIS. From 2000 to 2020, the IDB provided 59 loans to support PFM and FMIS investment projects. The total amount of these loans exceeds US\$1.77 billion, with an average project value of US\$30 million including the subnational level (Pimenta and Uña, 2015; updated by Pimenta, 2020). Since 1985, the World Bank has committed about US\$4 billion in PFM and FMIS projects through 134 operations in 74 countries, with an average project value of about US\$30 million (Hashim and Piatti, 2018: 13). Project outcomes have generally been considered unsatisfactory due to problematic implementation, cost overruns, and delays in execution. Despite this, the demand for FMIS projects remains high (Hashim, Farooq, and Piatti-Fünfkirchen, 2020).²

² The average amounts included in this paragraph may refer to more than FMIS costs, as the projects may include other activities (such as the strengthening of tax administration). The financial

T A B L E 1.1

FMIS by Year of Launch						
Year of launch	Worldwide		Latin America & Caribbean		Latin America	
	No. of FMIS	%	No. of FMIS	%	No. of FMIS	%
< 2000	19	9.8	4	12.1	2	10.0
2000–05	47	24.2	11	33.3	7	35.0
2006–10	61	31.4	9	27.3	8	40.0
> 2010	67	34.5	9	27.3	3	15.0
Total	194		33		20	

Source: World Bank Database, FMIS Community of Practice, 2018 (Cem Dener et al.).

Note: Latin America includes Cuba, Haiti, and the Dominican Republic.

T A B L E 1.2

FMIS: Custom-Made Systems versus Licenses (COTS) ^a						
FMIS	Worldwide		Latin America & Caribbean		Latin America	
	Total	%	Total	%	Total	%
Custom-made	105	53.0	18	54.5	16	80.0
Licensed	87	43.9	15	45.5	4	20.0
Unknown	6	3.1	0	0.0	0	0.0
All countries	198		33		20	

Source: World Bank Database, FMIS Community of Practice, 2018 (Cem Dener et al.).

Note: Latin America includes Cuba, Haiti, and the Dominican Republic.

^a As distinct from custom-made solutions, COTS (commercial off-the-shelf) products are customizable software solutions that are adapted to meet the needs of clients.

Most FMIS in Latin America are custom-made, while systems in the Caribbean are licensed.

1.2.2 FMIS in Latin America and the Caribbean: Characteristics and Challenges

The IDB has carried out two surveys in the last two years with a view to better understanding the characteristics and challenges of the FMIS already in place in LAC.

The first, carried out in 2018, is an internal survey of specialists that were (or had been) team leaders for projects with FMIS components. It focuses on the strategic elements that are critical for successful implementation of these projects and their internal organization.

The second, from 2020, includes LAC countries that use FMIS, addressing mainly the legal, functional, and technological features of the systems that are in operation.

costs associated with World Bank FMIS projects are significant, ranging from US\$5 million in small countries to US\$100 million or more in large and medium-sized countries. In Nigeria, for example, they reached US\$200 million, and in Russia, US\$663 million.

1.2.3 The IDB's Perspective: Survey of IDB Specialists

In 2018, the IDB carried out an opinion survey of 18 specialists who had served as team leaders for FMIS projects (or projects with an FMIS component) financed by the Bank in the last 15 years. Participants were asked to share their perceptions of the main problems faced in these types of projects, the most important strategies, challenges in system maintenance and documentation, and use of newly emerging technologies, among other topics. This FMIS project guide covers all of these issues.

The most important strategies identified in the survey for this type of project were technical and political leadership and commitment on the part of the government authorities, process integration, a focus on system users, and controls to prevent expenditures from occurring outside the FMIS. Ranking second to these in importance were system maintenance, a gradual approach to FMIS implementation, and TSA coverage.

The most serious problems identified in the survey were project execution and borrower performance,³ followed by consultancy management capabilities. Second in importance were sustainability, project design, and resistance to change.

With regard to maintenance, the most significant problems were a lack of procedures for documenting the system and a scarcity of technical resources. Respondents also identified as a lesser issue the absence of capabilities for selecting and contracting technology services. These problems are related to the need to create institutional capacity in the entities responsible for maintaining the FMIS, with the aim of extending its life cycle. Respondents did not list lack of hardware as a major problem.

According to the survey, functional processes are documented, and in some cases there is a unit responsible for keeping this documentation up to date. However, there is often no complete or up-to-date documentation of the code (computer programming)

In Latin America, out of a group of 18 Spanish-speaking countries and Brazil (excluding subnational governments), 3 countries use COTS financial management systems—Costa Rica, Nicaragua, and Panama—and another is being implemented in Ecuador. In the Caribbean, COTS systems are the most commonly used. Low-cost, shared FMIS have been developed in 6 out of 12 Caribbean countries: Barbados, Belize, Dominica, Grenada, St. Lucia, and St. Vincent and the Grenadines. Modules have been used from the commercial systems offered by SmartStream (purchasing, payables, funds control, human resources, payroll, and general ledger) and Infor CPM with custom-developed modules (budget), covering a variety of PFM areas (Hashim, Farooq, and Piatti-Fünfkirchen, 2020). Trinidad and Tobago is currently in the process of implementing a COTS system.

³ Performance is affected by delays with respect to originally expected execution periods, as well as the difficulty of carrying out required procurement and achieving initially proposed outcomes.

for these processes. Two thirds of respondents replied that international best practice frameworks—such as Information Technology Infrastructure Library (ITIL)⁴ or Control Objectives for Information and Related Technologies (COBIT)⁵—were not used in the projects for FMIS life cycle management.

With regard to the use of new technologies, such as cloud services, the biggest obstacle is uncertainty over the security of information outside the FMIS administrator's data centers. The biggest obstacles to code and system sharing are a lack of confidence in the robustness of open systems and a lack of know-how. According to the survey, data analytics are still rarely used in FMIS databases (two thirds of the project team leaders surveyed had no knowledge of the use of data analytics in the FMIS supported by their projects). There is almost always a help desk for users, but without virtual assistants such as chatbots, and there is no measurement of user satisfaction or incident response time. This guide covers all of the issues addressed in the internal IDB survey.

1.2.4 Survey of Latin American and Caribbean FMIS Managers (Current Situation)

The IDB and the International Monetary Fund (IMF) developed the survey “Personnel Payroll Payment Systems & FMIS in LAC Countries,” consisting of a self-reporting questionnaire with 88 questions. The FMIS heads participating in the survey were from 19 countries representing 92 percent of the region's GDP. They attended an event at IDB headquarters in Washington DC in November 2019, where the Working Group of FMIS Heads in LAC (GTFin) was formed.

The results of the survey provide a picture of the current situation of FMIS in the region. An analysis of the survey points to significant progress on functional issues, such as an expansion in TSA use (89 percent of countries have a TSA); broader institutional coverage (100 percent of FMIS heads stated that their systems cover the central government, while 58 percent have systems that also cover decentralized entities and 32 percent extend to subnational governments, although the proportion of coverage in each group was not specified); alignment of the chart of accounts and budget classification; increased use of International Public Sector Accounting Standards (IPSAS); and consolidation of the synchronized control of expenditure stages (89 percent of countries have implemented synchronized control of commitments, accruals, and payments). An emphasis can also be seen on recording revenue in a timely manner (74 percent of tax and nontax revenues), direct integration with tax administration entities, and the use of information from electronic invoices to support payments and procurement management (32 percent). In addition, more than 50 percent of FMIS are reported to share automatic links with human resource, procurement, and public debt systems.

In terms of technological features, Oracle and Java dominate databases and programming languages, respectively. Thirty-nine percent use some type of open-source software

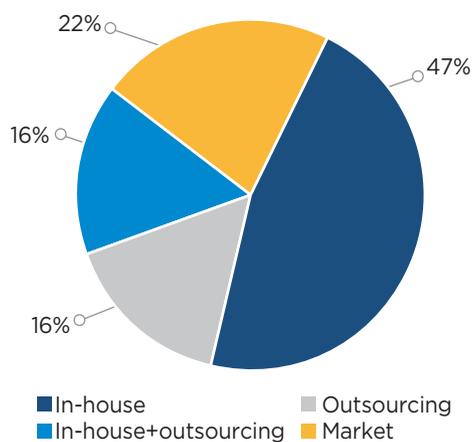
⁴ ITIL is a good-practice framework that guides organizations in the use of information technology as a tool for facilitating growth, change, and transformation in business.

⁵ COBIT is a good-practice framework for IT governance created by the Information Systems Audit and Control Association (ISACA).

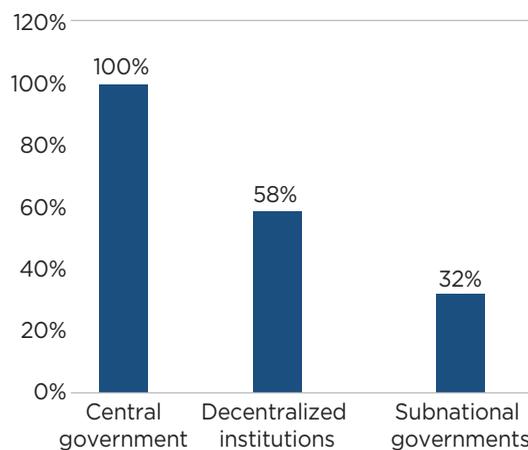
FIGURE 1.1

Sample Questions and Answers: Survey of FMIS Heads

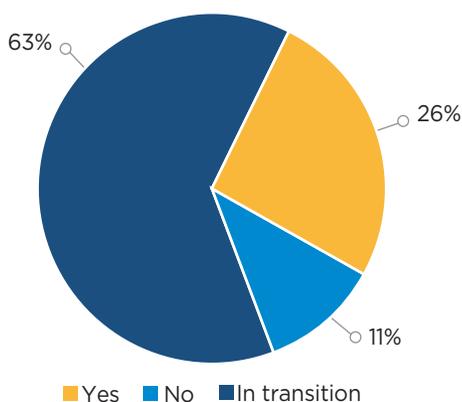
FMIS development



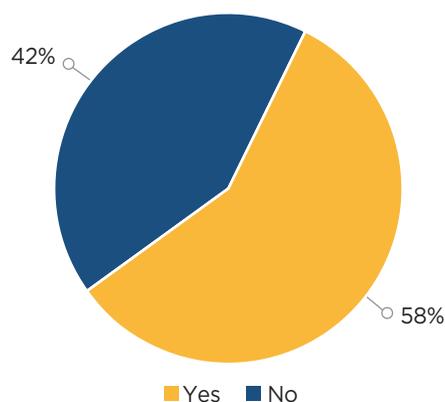
FMIS Institutional Coverage



Adoption of IPSAS



Automatic validation of provider tax identification number by the tax collection authority



Source: Authors' elaboration.

in their IT environment;⁶ 33 percent use electronic signatures for at least some transactions; 56 percent use some form of agile software development methodology; the most frequently used means of communication are optical fiber/internet; 28 percent use some type of cloud service; and 89 percent state that they have some kind of information security policy in place (although only 3 of the 18 countries use cryptography in their database and network and only 11 of the 18 countries have adopted a service management framework).

Based on the observed results, it can be concluded that there is a need in the functional area to continue efforts to expand the coverage and functional scope of FMIS,

⁶Not necessarily in the FMIS environment.

ensure the timely recording of revenue, adopt IPSAS, strengthen and expand TSAs, and adopt data analytics tools to support managers.

In terms of IT platforms, emphasis should be placed on adopting a satisfactory methodology or framework for system maintenance, as well as consolidating cybersecurity actions by adopting a comprehensive information security policy (spanning the encryption of system components through to the adoption of electronic signatures and evaluation of the use of cloud services as an alternate data center). This guide covers these and other issues in full. General Annex 1 summarizes the results of the survey.

1.3 Summary Review of the FMIS Literature⁷

Based on a review of the FMIS literature, 10 important strategies have been identified that constitute factors for success, as follows:

1. **Gradual and modular approach to system implementation or updates:** Every computing system has a life cycle, and FMIS are no exception. For custom-developed systems such as those used in most Latin American countries, preventive, gradual, and ongoing maintenance is key to avoid having to periodically replace the entire system. Additionally, due to the complexity of FMIS, implementation is time-consuming. Having a modular development and implementation strategy allows for better process management over time and ensures greater project sustainability. Moreover, since the authorities frequently pressure project managers to show short-term results, a modular strategy allows intermediate results to be delivered.
2. **Adequate technical and budget resources for system maintenance and updates:** The FMIS administrator must have adequate financial, technical, and technological resources to conduct ongoing preventive maintenance of the system, in addition to developing new functionalities, improving existing ones, and adopting new management approaches (such as implementing international accounting standards). The system administrator must have sufficient resources and know-how within the organization or, failing that, must procure them elsewhere.
3. **The FMIS must be user-centered:** One of the fundamental principles of an FMIS is that it is a single system with a central administrator, operated in a decentralized manner. In other words, FMIS users are scattered across all sectors, agencies, and other government units. It is the thousands of users that determine the quality and timeliness of the data recorded. It is therefore important to meet their needs and provide ongoing training and technical assistance. The trend is to strengthen the user focus of FMIS, both by encouraging greater participation in system design and implementation (through user committees) and by improving usability and providing adequate services and training.
4. **Protocols in place and controls for preventing transactions outside the system:** Some countries use FMIS as an advanced computing tool but fail to tap into their

⁷ This section is based on Fritz, Verhoeven and Avenia (2014); Gupta et al. (2018), Hashim and Piatti (2018); Pimenta and Pessoa (2015); and Pimenta and Seco (2019), among others.

full potential; that is, users do not input all the information required for each phase of the expenditure cycle (pre-committed, committed, accrued, and paid) into the system in a timely manner. Used in this way, the system cannot generate the timely and complete information needed to facilitate effective cash management (as, for example, in the Dominican Republic and other countries in the region).

5. **TSA with broad coverage:** The broader the TSA coverage in an FMIS, the better the conditions for more efficient cash management, avoiding idle resources in accounts outside the treasury's control. Most Latin American and Caribbean countries have adopted the concept of TSA as a principle. However, many still lack complete coverage, with resource transfers from the treasury to other entities, agencies, or units (e.g., other branches of government, universities, or even pension payments) that are not processed directly through the FMIS.
6. **Integration of budget information with payments and accounting records** (single record): A single record should be maintained wherever possible by integrating both processes and budgetary and accounting classifications. Such integration means that system users do not have to enter the same information more than once and ensures the consistency and quality of the information, allowing greater automation in accounting processes.
7. **An FMIS is more than an accounting project; it is a public expenditure management project:** An FMIS is the foundation for public accounting and should support both accounting records and the automation of financial statement preparation. These systems offer much more than accounting functions, however; they support most PFM functions, including budget preparation and execution, treasury cash management, electronic payments, and public debt management. Some FMIS are even integrated with other ancillary administrative systems, such as procurement, payroll, and asset management.
8. **Adopting International Public Sector Accounting Standards (IPSAS) in the FMIS:** IPSAS are accounting standards for the public sector that focus on accrual accounting rather than cash flow alone, as the majority of FMIS were designed to do. Accordingly, FMIS still need to be aligned with these new standards, including the timely recording of public sector assets and liabilities in system-generated financial statements.
9. **Sufficient resources to implement, operate, and update an FMIS:** In LAC, salaries for public sector IT workers are commonly lower than those of their peers in the private sector. This problem often pushes some countries to request recurring loans from multilateral organizations to maintain their FMIS, since executing units for these loans have greater administrative and budgetary autonomy. This practice helps mitigate the problem but is not a permanent solution, as it reemerges once project execution is completed. In some cases, more than 100 individual consultants have been hired at market rates to develop a system, yet funding for their contracts has ended with completion of the project. This is despite the fact that they are still required—in part at least—to operate, maintain, and conduct ongoing updates of the system. As a result, new loans are sometimes requested with the aim of sustaining the public sector's ability to keep the FMIS running, with adequate maintenance and the required updates. In countries such as Argentina, the Dominican Republic,

Guatemala, and Paraguay, new loans have been approved with FMIS funding after completing the execution of earlier loans with resources for an FMIS.

10. **Technical and political leadership and commitment (political economy of systems):** FMIS are highly complex and far-reaching systems in the public sector and are therefore subject to the political economy of the competing interests of different institutional stakeholders and system users. Adequate technical and political leadership is essential for aligning these interests, together with proper operation and maintenance of the FMIS and a regulatory framework that strengthens this leadership.

This guide covers all of these strategies and factors for successful FMIS operation.

1.4 Conceptual Model for an FMIS

The main objective of a conceptual model is to convey the fundamental principles and basic functionality of the system that it represents. Chapter 5 discusses the development of the conceptual model as a priority task in FMIS projects, presenting alternatives and examples. The conceptual model proposed in Hashim, Farooq, and Piatti-Fünfkirchen (2020) is didactic and can be used to aid in the understanding of a complex system such as the FMIS, while also covering its main properties.

The conceptual framework identifies the different phases required to align FMIS investments with PFM results. The three major dimensions identified are (i) the diagnostic phase, which identifies weaknesses in PFM, including political and institutional factors; (ii) the life cycle of system development; and (iii) coverage and usage.

There is a link between the activities/phases in each dimension and the dimensions, demonstrating the importance of the sum of the parts. A programmatically coherent commitment is required to achieve the expected improvements in budget management. At the same time, achieving the objectives of FMIS planning requires optimization across all dimensions, and focusing on just one may be insufficient.

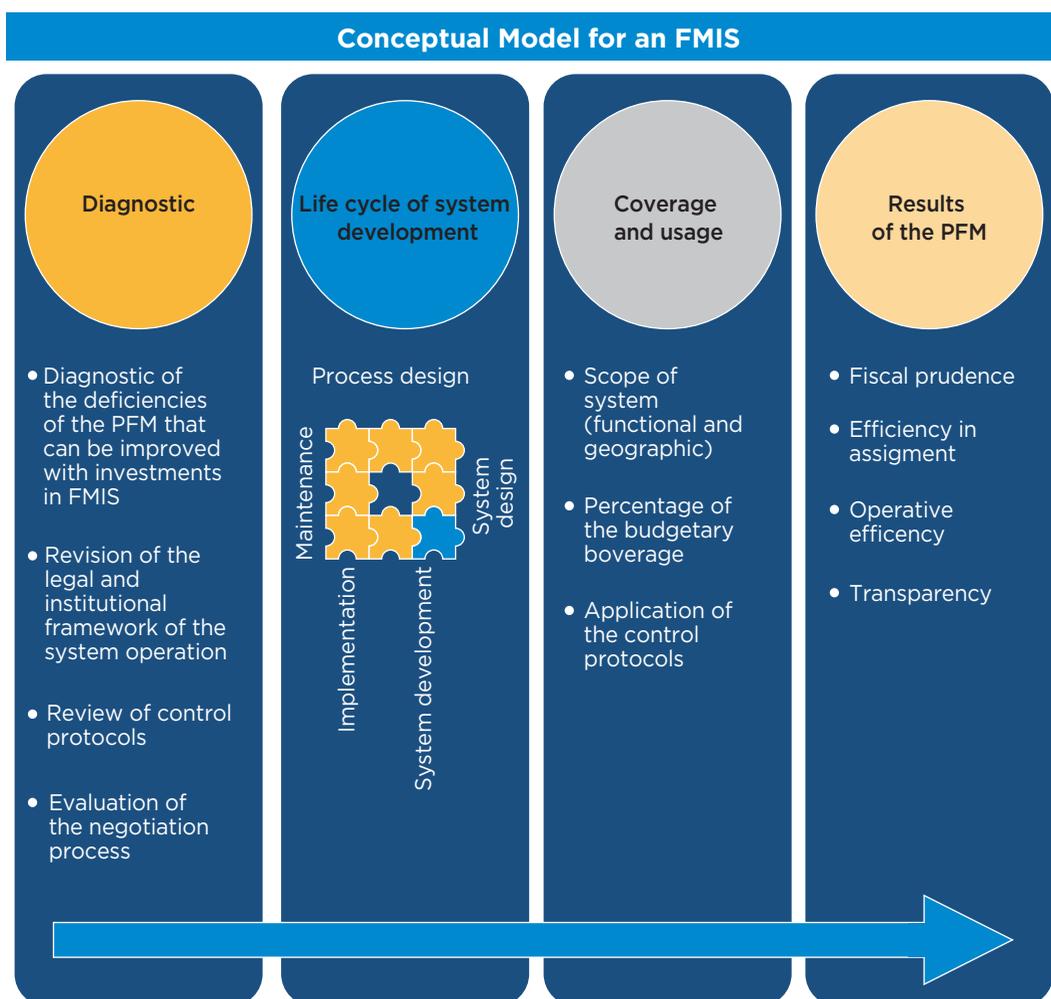
Likewise, the satisfactory operation of a PFM system requires an enabling environment and crosscutting support, as follows:

- Strong government commitment (needed to drive change and tackle political economy issues).
 - Regulatory compliance.
 - Training and change management.
- Adequate system coverage and usage.

The professional experience of entities, officials, users, and consultants that

This guide covers all of the important aspects of FMIS implementation, updating, and operation. It provides detailed coverage of issues considered critical (mainly those that presented challenges in previous FMIS projects) and includes alternative approaches for addressing them. It also recommends that development of a conceptual model be included in all FMIS projects as a priority activity. To this end, it includes alternatives and examples of conceptual models prepared as part of previous projects.

FIGURE 1.2



Source: Authors' elaboration based on Hashim, Farooq, and Piatti-Fünfkirchen (2020).

have been involved in FMIS projects remains indispensable, and the importance of the support that they can provide for new projects is constantly highlighted.

1.5 Document Content and How to Use this Guide

The structure of the document allows it to be consulted without following a specific sequence. That is, the reader can consult the chapter of interest at any point in time.

The content of each chapter is summarized below.

Chapter 1: Introduction and General Overview

What is an FMIS?; overview of the PFM context and the current situation of FMIS in LAC and worldwide; operational, strategic, technological, and institutional coordination issues;

key areas of progress, success factors, critical issues, challenges, and bottlenecks identified in the available literature and the IDB-led surveys (IDB team leaders and FMIS heads in LAC countries); reference conceptual model for a holistic vision of an FMIS; description of document content and approach to using the guide.

The topics addressed in the document are divided into 14 chapters and 2 general annexes. Each chapter is self-contained, including the relevant annexes. Where there is overlap in a given topic, the reader is referred to other chapters.

Chapter 2: Design and Organization of the Governance Arrangements, Management, and Indicators for an FMIS Project

Principles and recommendations for creating the project management unit; responsibilities and participation models for the PFM functional area in developing system specifications; required advisory services and contracting alternatives; strategic policy committees for an FMIS.

Chapter 3: Legal Framework: Features of Laws and Regulations to Address Institutionalization of the FMIS in the PFM Context

Key elements of a legal framework for PMF and FMIS; specific characteristics of an FMIS law; examples of legal structures for PFM and FMIS in countries in the region; comparative tables on legal frameworks.

Chapter 4: Institutional Arrangements for FMIS Operation

Leadership and political economy factors in an FMIS project (responsibilities, interagency coordination, hierarchical position of the FMIS unit); experiences of institutional arrangements that do/do not work; the TSA and its features; ongoing training; strengthening of the role of users.

Chapter 5: FMIS Conceptual Model

Objectives of the conceptual model; the conceptual model as a tool for clarifying and reaching agreement on critical issues that help to define the FMIS and guide the team during implementation and operation; relevance of the model; steering committee; diagnostic assessment and challenges; proposed content; management model; functional conceptual design of the system; processes; subsystems; related systems and interoperability; conceptualization of the IT system; use of international standards.

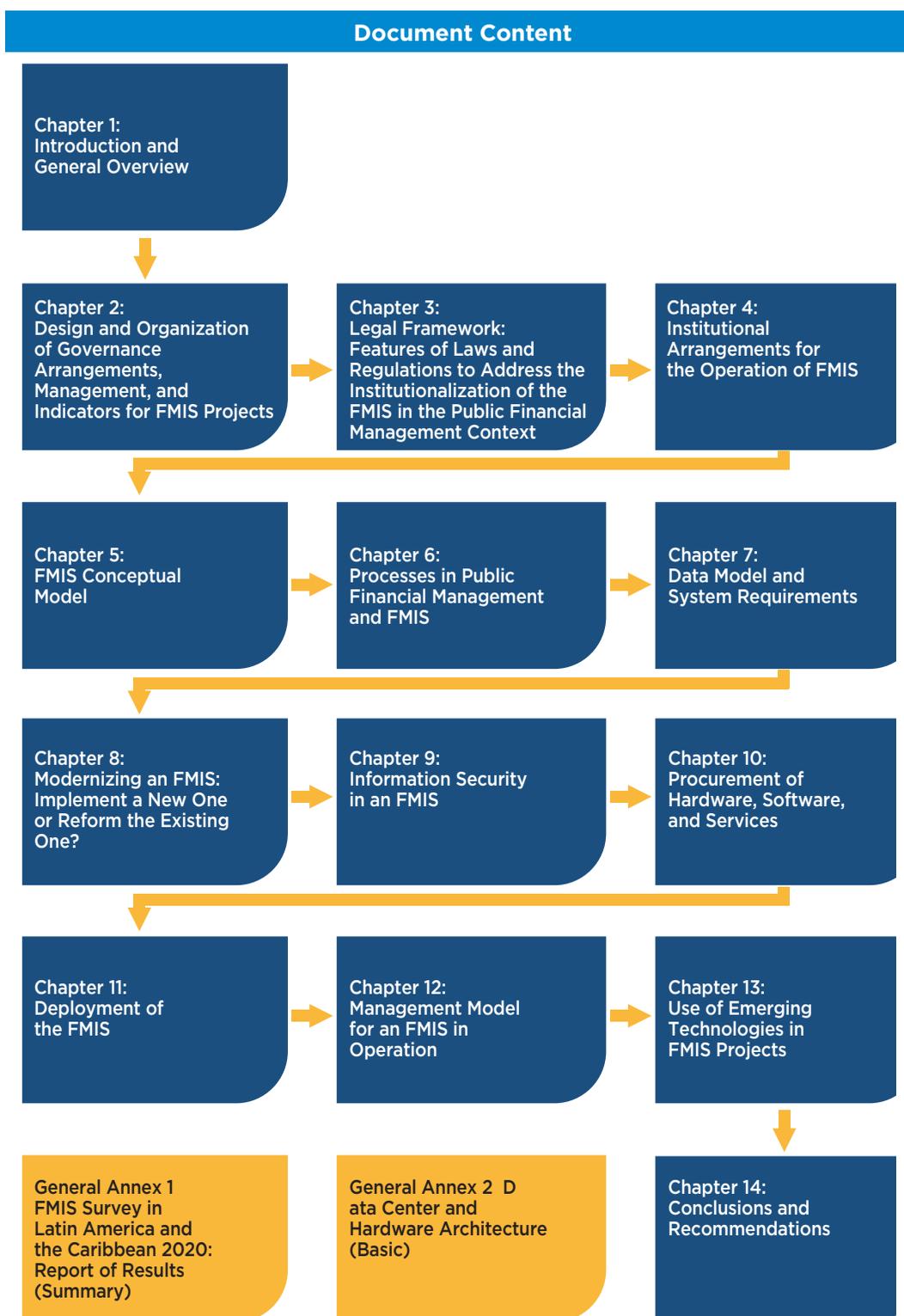
Chapter 6: Public Expenditure Processes

Review and improvement of PFM processes such as budget preparation and execution; process life cycles; process notation (Business Process Model and Notation, or BPMN); meetings to document and modernize processes; synchronization of processes and the IT system.

Chapter 7: Data Model and System Requirements

Process, data, and requirement interdependencies: a basic FMIS; data model (conceptualization and representation); data governance; introduction to functional and nonfunctional

FIGURE 1.3



Source: Authors' elaboration.

requirements, use cases, business rules; data model; critical functional and nonfunctional requirements of an FMIS: TSA architecture, accounting and reporting, debt management, public procurement, revenue administration, audit; examples of business rules; testing, access, and data exchange.

Chapter 8: Modernizing an SIAF: Implement a new system or upgrade the existing one?

Implement a new FMIS or upgrade the existing one?: procuring COTS solutions; custom development by staff or external consultants (individual or companies); advantages and disadvantages; open source software; modular approach; estimated development costs.

Chapter 9: Information Security in an FMIS

Road map for developing an information security system: projects, planning, and implementation; priorities; role-based security; audit records and trails; cloud security; outsourcing security; sample information security policy.

Chapter 10: Procurement of Hardware, Software, and Services

Organizing advisory services for procurement and quality control; procurement methods in IDB-financed projects; use of requests for information (RFI), requests for bid (RFB), and requests for proposal (RFP); procurement in IT systems developed by staff versus those developed externally; procurement of COTS systems; sample RFI and bidding documents.

Chapter 11: Launching the FMIS

Migration to the new system; final testing; planning, institutional arrangements, and dissemination; preparing the physical environment and IT equipment; user training and manuals; support teams; administrative arrangements; situation room and help desk; monitoring and indicators.

Chapter 12: Management Model for an Operational FMIS

Maintenance with ITIL and priority disciplines (configuration management); change management (examples), version management (examples), incident management, help desk; support tools; priority practices and recommendations; process maintenance; list of ITIL practices.

Chapter 13: Use of Emerging Technologies in FMIS Projects

Cloud services; distributed ledger technologies/blockchain; artificial intelligence applications, data analytics and machine learning (chatbots, predictive analytics, improved macroeconomic supervision, budget formulation, combating fraud and corruption, robotic process automation); data visualization; open fiscal data; mobile money and targeting of social subsidies.

Chapter 14: Conclusions and Recommendations

Summary of the main issues addressed; general recommendations.

General Annex 1: Summary of Survey of FMIS Heads (2020)

General Annex 2: Hardware Architecture Considerations



In this chapter:

- 2.1** The Importance of a Conceptual Model
- 2.2** Governance and Management of FMIS Projects
- 2.3** Executive and Strategic Management Level
- 2.4** Operational Management Level
- 2.5** Operational level
- 2.6** Hiring External Consultants: Specific Aspects of the Use of COTS Solutions and Cloud Services
- 2.7** FMIS and PFM Project Performance Indicators
- 2.8** General Recommendations
- 2.9** Final Observations

Annex 2.1 Sample Terms of Reference

Design and Organization of Governance Arrangements, Management, and Indicators for FMIS Projects

2.1 The Importance of a Conceptual Model

In some cases, the conceptual model is developed as an initial phase in the project itself instead of before it, although this is not recommended. Where this is the case, funding to develop the model can be included in overall financing for the project. In both cases—before or at the start of the project—design of the conceptual model is a complex task that will affect the success of the project. Chapter 5 addresses the conceptual model and its implementation in detail.

2.2 Governance and Management of FMIS Projects¹

Once a decision has been made regarding the functional and IT scope of the FMIS project

FMIS projects are generally based on a conceptual model that establishes the desired public expenditure management framework (coverage and functional scope), including the IT system that will support it. In other words, the conceptual model is prepared before the FMIS project is created and helps to ensure that the approach used in the project is more focused. Thereafter, the project is structured on the basis of the components and scopes set out in the conceptual model, which should be validated by all relevant stakeholders, including users.

¹ Project governance ensures that stakeholder needs, conditions, and options are evaluated to determine balanced, realistic objectives; setting direction through prioritization and decision making; and

and the approach to implementing it, the next step involves organizing its governance and management structures.

A separate project unit is usually created to facilitate accountability and the streamlining of activities.² The location and hierarchical position of the project execution unit is important. Attaching the unit directly to the principal sponsor or relevant authority in the Ministry of Finance facilitates important decisions, while also sending a strong signal to the entire public sector regarding the importance of the project and high-level support for it. At the same time, it is best to avoid locating the project unit in an ICT department to avoid its being seen as little more than a technology upgrading project. Instead, it should be treated as a comprehensive modernization process aimed at optimizing and strengthening public financial management (Uña and Pimenta, 2015).

The project unit is made up of full-time staff who are experts in specific areas. Staffing the unit with part-time Ministry officials is not recommended.

The experience of implementing FMIS projects in Latin America and the Caribbean (LAC) suggests that governance should be structured at three levels, as shown in Figure 2.1. This proposal may be adapted to the specific circumstances of each country.

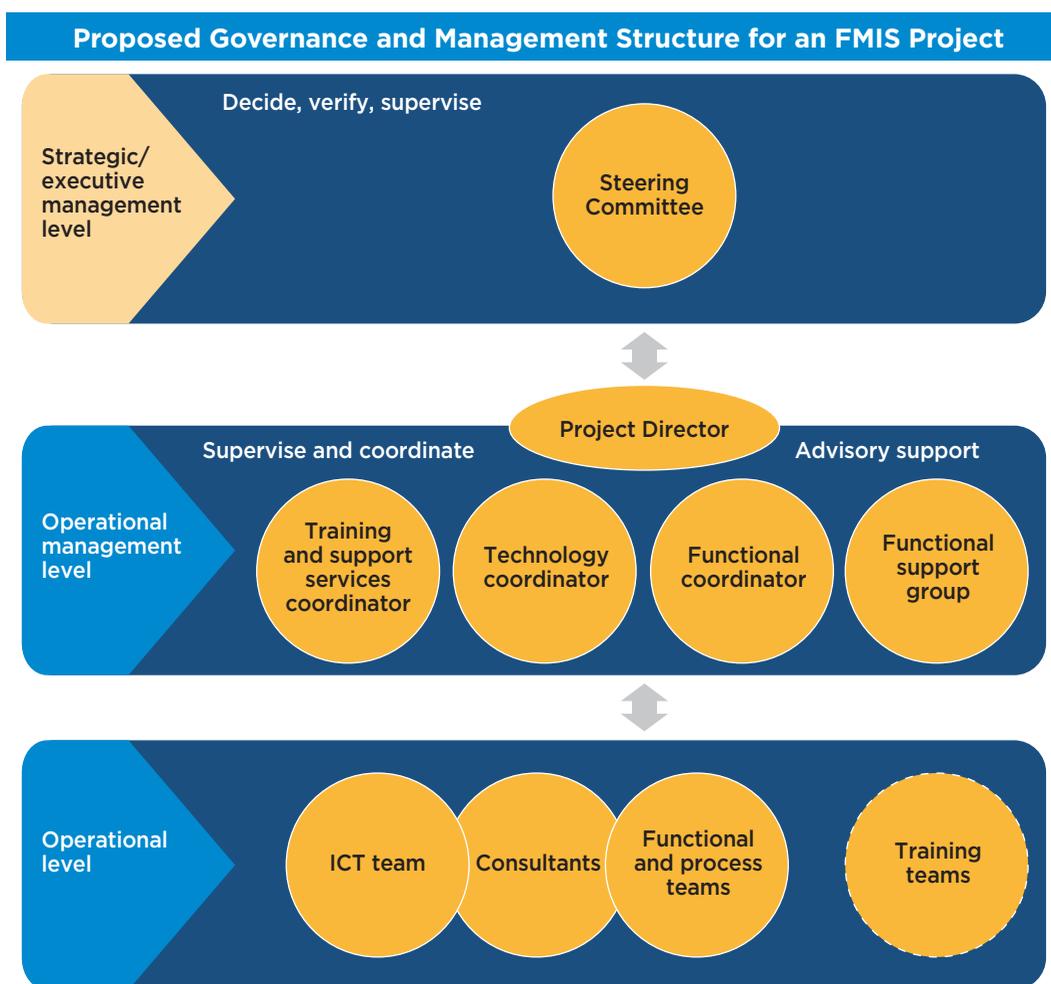
Operational level participants are subordinate to the coordinators at the operational management level, consistent with the respective fields of responsibility. The composition of each level should take into account the political economy principles for an FMIS project, as discussed in Chapter 1.

Nonetheless, it is essential that officials and executives from the different areas that make up an FMIS—treasury, budget, accounting, and debt management—participate in functional decisions regarding the system, including both changes and new processes. Without the effective participation of these areas, functional decisions will be subject to criticism, require modification, or possibly even be abandoned. Such situations are reflected in delays and changes, primarily affecting the information technology system (longer lead times and higher costs). Participation should be formalized and is of critical importance throughout the entire process, particularly in the determination of use cases and system testing and acceptance. The structure of the FMIS project unit should make formal provision for this participation.

monitoring performance and compliance (Information Systems Audit and Control Association, or ISACA). Meanwhile, project management is aimed at planning, building, executing, and monitoring activities that are aligned with governance objectives and support their attainment.

² There are differing opinions regarding the creation of project units. Some feel that they contribute to the successful management of FMIS projects, while others believe that they may create “knowledge islands”: separate from the structure of the Ministry of Finance, with a negative impact on the dissemination of the new methods and processes adopted by the institution. To achieve balance in such cases, the project should include actions to disseminate technical and management knowledge as part of institutional strengthening actions.

FIGURE 2.1



Source: Authors' elaboration.

The number of staff assigned to each level of governance and management will depend on the local context and the size of the project. Each level of governance should include a representative from the subordinate level, with the aim of ensuring effective communication between the two.

2.3 Executive and Strategic Management Level

This level is usually implemented by means of a steering committee, which is responsible for determining project strategy and making decisions that influence that strategy. A number of steering committee participants usually participate in determining the framework for the FMIS project and the conceptual model, which are developed to support

project approval. The Minister of Finance or equivalent Vice Minister should head the committee and should be advised in this role by other members of the different public financial management areas.

The committee's central role is to ensure that the project's strategic lines of action are adhered to or modified where necessary. Another important task is to maintain a dialogue with officials of equivalent seniority in other institutional stakeholders (ministries, agencies, etc.) with the aim of securing the necessary cooperation for stable development of the project.

One example of an executive and strategic steering committee for an FMIS project is that of Uruguay, which from 2015 to 2019 consisted of the Budget Coordinator in the Ministry of Finance, the Accountant General, and the National Treasurer. In the case of Peru, the committee was led by the Vice Minister for Financial Administration in the Ministry of Economy and Finance and consisted of the Directors General for the Budget, Accounting, Treasury, and Public Debt. It is very common for these high-level committees to have the budget, treasury, and accounting directors as members, as these functional areas are the ones most involved in an FMIS.

Some countries have lead agencies for information technology or electronic government.³ In these cases, consideration should be given to the merits of including a representative for this institution in the committee, with the aim of aligning system technological decisions with current policies and improving the Ministry of Finance's institutional capacity, in addition to potentially expediting the procurement of IT products and services. The inclusion of the Agency for Electronic Government and the Information and Knowledge Society (AGESIC) in the Steering Committee for Uruguay's SIIF2 project was an attempt to bring additional knowledge to the table and ensure more fluid project development.

Steering committees may also be responsible for decision making and high-level supervision of execution of the FMIS project, reporting to the Minister of Economy and Finance. The main objective of this is to ensure effective coordination of the different technical and operational elements of the project, so that the determinations and guidelines made by each unit take into account their implications for the work and remits of other participants in the financial management system.

The directors of business units involved in the FMIS—such as budget, treasury, accounting, public debt, asset management, audit, IT, and others where necessary—should be considered for inclusion in the committee. The Project Director should also be included, serving as an interface with operational management. The committee should decide on a coordinator who will be responsible for all management activities.

This level is the first instance for problem solving and execution-related decisions, and heavy demands may be placed upon it. Accordingly, it may be advisable to create a permanent executive secretariat, with a professional staff member responsible for supporting committee meetings (including organizing the agenda, making the necessary contacts,

³Details of lead agencies in the region can be found through the Latin American and Caribbean Electronic Government Network (Red GEALC) website <https://www.redgealc.org/>.

drafting associated minutes and correspondence, and coordinating logistical resources, etc.). In some countries, a specific strategic leadership structure may be needed to ensure cross-agency support for the project, potentially comprising the Minister of Finance and executive-level representatives.

2.4 Operational Management Level

This level is represented by a project management entity (or project unit) led by a project director who is responsible for administering project execution based on the conceptual model and rules developed at the upper levels. The project director may create specific offices or advisory units to ensure closer oversight of critical or common areas, such as quality and project management. Depending on the size of the FMIS project, it may be advisable to create organizationally equivalent units for information security, system architecture, and others.

Administration of contracts and project staff may be assigned to a secretariat or management support group. When hiring consultants or external staff, terms of reference from other projects are useful as a starting point for preparing one's own, particularly when hiring coordinators and consultants (positions that are key for obtaining good results).

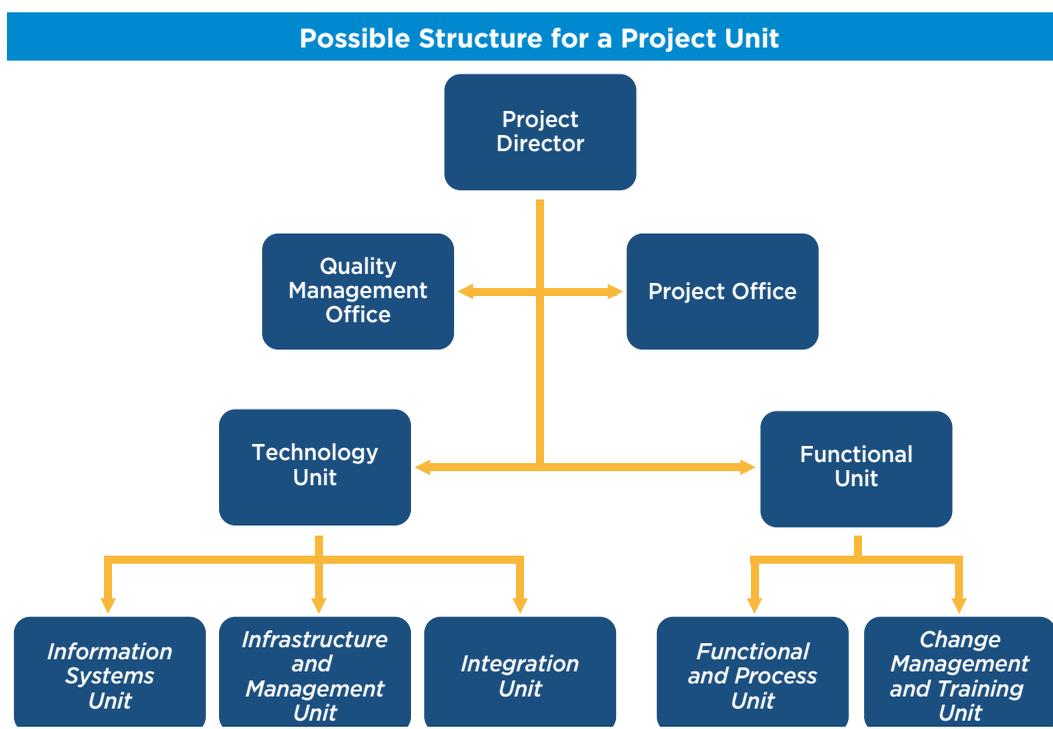
Project Management Office

Depending on the size of the project, operational management of an FMIS project should be conducted through a project management advisory unit or office (PMO) attached to the operational management level. Continuous monitoring of project activities should provide information to all management levels, based on internationally recognized management methods. The PMO develops and follows the execution master plan for the project, which is then used to draw up detailed plans for each area (functional, IT, training, etc.). The PMO is responsible for coordinating these plans and ensuring that they remain consistent with established objectives and timelines. In more complex cases, the PMO may rely on external support (specialized firms).

Quality Management Office

Quality management is one of the project management knowledge areas listed by the Project Management Institute (PMI). In the case of projects with large external software contracts, however, it may be advisable to either create an internal quality management office, outsource this function, or obtain advisory services from external specialists, with a view to ensuring improved evaluation of purchased or self-developed products.

In the organizational chart in Figure 2.2, dissemination and communication activities are the responsibility of the change management and training unit. Communication with stakeholders is an ongoing, planned activity that is executed professionally. Effective communication ensures that those involved are committed to moving the project forward, and it is critical for achieving positive results.

FIGURE 2.2

Source: Authors' elaboration based on FMIS projects in LAC.

2.4.1 Technology Unit

This unit is responsible for activities in the area of information technology, including systems development, IT management, infrastructure, networks, and the preparation of terms of reference for hardware and software procurement. Modular and system integration is an important task given modular architecture and the need to interconnect with other systems. At the same time, close coordination with the project and quality management offices is needed to facilitate product development in a timely and appropriate manner, consistent with the agreed quality specifications.

2.4.2 Functional Unit

This unit is responsible for managing the operational teams working on functional development, including organizational aspects, processes, functional specifications, change management, and training. There may be a functional support group made up of staff specialists in key FMIS project areas, such as budget, treasury, and accounting. This group supports all of the functional activities, particularly in terms of their operational impacts and final validation. It may consist of individuals working either full or part time on the project. For projects requiring a large volume of resources to support training in participating institutions, a specific unit may be required for these activities.

COMPREHENSIVE ADVISORY SERVICES

The procurement and launch of hardware, software, and services play a critical role in the success of FMIS projects. Given the wide range and complexity of currently available alternatives, projects may use specialized advisory services to support the procurement and launch of products and services. These types of services were previously limited to formal aspects of the procurement process but have now been extended to support market scouting (local and international) with the aim of identifying products and suppliers, proposing procurement strategies, identifying important contract features, proposing appropriate procurement methods, and monitoring the implementation of contracts and other activities in this area.

These types of advisory services can be obtained by hiring specialized individual consultants or an independent firm with a good reputation in the market. Specialized firms can respond more swiftly in the case of innovative, complex projects, as they enjoy access to a wider range of solutions and have technical teams that are easily accessed with a variety of experience. Some national and subnational FMIS projects have adopted this strategy with good results. To ensure that the advisors concerned can participate and benefit from all of the planned activities, the project director should make this type of decision at the start of the project, with the agreement of the steering committee.

2.5 Operational Level

The operational level encompasses all of the technical staff responsible for implementing the FMIS. It is divided into specific work groups.

2.5.1 Information and Communications Technology Work Group

Subgroups may be created in the areas of system development, system IT architecture, information and communications technology (ICT) management, hardware and software, networks, security, data management, data analytics, and others depending on the scope of the project. The number of technical specialists will depend on the size of the project and the technology options selected. For example, outsourcing system development reduces the need for on-staff developers (although it requires more quality control specialists); the use of customizable commercial software (COTS) also reduces the need for software developers (though it requires software configuration specialists); and cloud services reduce the number of technical specialists needed for data center operation (although more staff are required to monitor services and negotiate contracts).

2.5.2 Functional and Process Work Group

Functional subgroups may be created, with a functional system architect, specialists in each area (budget, treasury, accounting), process management and optimization, use cases, and system testing.

2.5.3 Functional and IT Consultants

External consultants should be used in FMIS projects because they bring new experiences and concepts in key areas. The decision regarding the number of areas to consider for support will depend on the project team. In general, priority in the IT area is placed on system architecture, data analytics, and development methods/use cases, while in the functional area, PFM, budget management, treasury, accounting, and process management and optimization are emphasized.

Consultants with experience of FMIS projects in other countries provide essential knowledge for adapting best practices and avoiding similar mistakes. In the case of complex or innovative projects, the decision may be made to procure advisory services from specialized firms, with the aim of securing access to a wider range of functional/technological alternatives and specialized knowledge.

2.5.4 Training Teams

Adequate user training is critical to the success of a project. Together with external staff, the use of technical specialists from participating institutions (lead, managing, and executing agencies) should be considered when creating training teams for those same institutions. Training materials should be prepared to a professional standard, with emphasis on practicing using the FMIS system (training environment).

It is also important that each type of training include formal testing and grading of each participant in the content covered. An introductory course in public finance may be needed in some countries, as staff turnover means that the required knowledge in this area is often lacking.

In the case of institutions with their own training body, this body should be taken into account and project teams should seek to have them lead the effort. Training is an ongoing activity that should be maintained even once the FMIS has been implemented.

2.5.5 Change Management

Change management applies particularly to changes that are required in processes and in the functions of the different organizational units when developing an FMIS. It includes dissemination and communication activities with stakeholders at both the strategic and operational management levels regarding project activities. Change management activities are critical to project success and should be guided by experienced professionals. The

team should promote a positive attitude to cooperation, learning, and change as essential elements in improving institutional capacity in participating institutions.

Some projects have created special user groups with a consultative role. These consist of users with experience in general public financial management techniques, as well as specific areas such as accounting, budgeting, and treasury. New processes and beta versions of system modules will be submitted as a priority to this group for examination and assessment. The information obtained from these discussions is used to improve the system. The users will also transmit knowledge of the new processes and system changes to their peers.

2.6 Hiring External Consultants: Specific Aspects of the Use of COTS Solutions and Cloud Services

2.6.1 COTS Solutions

The main impact of using COTS solutions is on the technical profile of the staff to be hired/trained. These professionals should have experience with the parameters for negotiating software contracts (details of the technical support that will be provided, response times, penalties, fixed and variable costs, features of payments for maintenance services, and total cost of ownership,⁴ among others) and of organizing the operational support to be provided.

2.6.2 Cloud Services

Where an institution lacks experience with using cloud services, this option requires specialized technical consulting services to be contracted to develop conditions and terms of reference for bidding documents, service-level agreements (SLAs), and others. There should be a technical team responsible for monitoring SLAs and maintaining ongoing dialogue with providers. Also important for the success of this type of initiative are the availability of a specialist in complex technology service contracts (usually an attorney) and cooperation with other public institutions with experience in this service modality.

2.7 FMIS and PFM Project Performance Indicators

In designing an FMIS project, it is important to identify indicators and baselines that facilitate the subsequent evaluation of project performance and results. In projects financed by multilateral organizations, these indicators make up the results matrix.

⁴ The Gartner Glossary defines total cost of ownership (TCO) as a comprehensive assessment of IT or other costs across enterprise boundaries over time. It includes hardware and software acquisition, management and support, communications, end-user expenses, and the opportunity cost of downtime, training, and other productivity losses (source: Gartner Glossary).

This section discusses indicators that can be generated through the FMIS, as well as broader PFM measures, and provides descriptive examples and formulas for calculating them. Given their functional and technical characteristics, FMIS can serve as a source of indicators for the systems themselves and for PFM in general, as is the case for a number of the indicators used in the Public Expenditure and Financial Accountability (PEFA) methodology.⁵

2.7.1 Examples of FMIS-generated Indicators

Tables 2.1, 2.2, and 2.3 list sample indicators, as follows: indicators generated by the FMIS, indicators relating to operation of the FMIS, and indicators provided by the project management group.

T A B L E 2.1

Examples of FMIS-Generated Indicators				
Indicator	Formula	Type	Concepts	
I1 - Coverage: Budget executed through the FMIS	Amount of FMIS-executed budget / total executed budget amount * 100	%	May be used to calculate budget coverage indicators for the central government, the expenditures of decentralized entities, or subnational/sector entities.	
I2 - Coverage: Participating project execution units (PEU)	Number of PEUs using the FMIS / total number of PEUs * 100	%	In the case of the central government, the number of PEUs should be used to measure coverage. In the case of decentralized entities, the number of entities may be used.	
I3 - TSA coverage via the FMIS: Budget executed in the TSA via the FMIS	Amount of budget executed in the TSA via the FMIS / total budget amount * 100	%	TSA coverage of the budget. Should ideally be 100%.	
I4 - TSA timeliness: Payment times	Average number of days from issuance of payment order to receipt by the final beneficiary, for all payments made through the TSA	M	This indicator can be used for ranges of payment amounts, thus limiting the number of payments analyzed.	

(continued on next page)

⁵ The PEFA methodology provides a framework for evaluating and preparing reports on strengths and weaknesses in the area of public financial management. The PEFA program is led by multilateral and national organizations (www.pefa.org).

T A B L E 2.1 (continued)

Examples of FMIS-Generated Indicators				
Indicator	Formula	Type	Concepts	
15 - Payments: Cost of payment	Average in \$ of the total amount paid to the financial system / number of payment transactions made through banks	\$	Does not apply where payments are made indirectly by floating funds in the banking system.	
16 - Payments: Electronic payments (number)	Number of payments made electronically / total number of payments * 100	%	Some payments may still be made by check or cash.	
17 - Payments: Electronic payments (value)	Total value of electronic payments / total value of payments * 100	%	Some payments may still be made by check or cash.	
18 - Payments: Targeting	Number of payments issued directly to beneficiaries / number of payments issued * 100 ^a	%	Some payments, particularly social subsidies, are issued to intermediate organizations rather than directly to beneficiaries. The objective should be to pay beneficiaries directly.	
19 - Accounting: Use of IPSAS	Number of IPSAS standards adopted / total number of applicable IPSAS standards * 100	%	Determines the degree of adherence to IPSAS standards applicable to PFM.	
110 - Accounting: Automated generation of accounting records	Number of automated accounting entries / total number of accounting entries used * 100	%	Determines the degree of automation of the accounting entries that can be used by the FMIS.	
111 - Accounting: Financial statements issued automatically and within the stipulated time period	Number of financial statements issued / total number of financial statements proposed * 100	%	The number of automated financial statements and the time period for issuing them are defined in the project.	
112 - Budget: Value of budget adjustments	Total value of budget adjustments introduced / initial approved value of the budget * 100	%	The value of budget adjustments reflects the quality of budget formulation.	
113 - Budget: Number of budget adjustments	Number of budget adjustments introduced	K	The number of budget adjustments reflects the quality of budget formulation.	
114 - Security 1: Payments	Specification: validation of tax IDs through online access to the tax administration's database	Y/N	Improved quality of payments data.	

(continued on next page)

T A B L E 2.1 (continued)

Examples of FMIS-Generated Indicators			
Indicator	Formula	Type	Concepts
I15 – Security 2: Payments	Specification: business rules for high-risk payments that require dual approval	Y/N	Improved security for high-risk payments.
I16 – Security 3: Electronic signature ^b	Number of transactions with electronic signatures / number of critical transactions requiring the use of electronic signatures * 100	%	Security of transactions and critical documents.
I17 – Transparency and coverage: Budget execution reporting in the FMIS ^c	Number of FMIS transactions published in a given period / total number of transactions published in the same period * 100	%	Measurement of the coverage of FMIS transactions.
I18 – Transparency: Access to budget execution reports	Number of times information is accessed through the website	K	Record of the number of page visits.
I19 – Transparency: Payments	Number of payments made / number of payments listed on a transparency portal * 100 ^d	%	Measurement of completeness in the publication of payments.
I20 – Transparency: Data downloads	Function enabling downloads in a machine-readable format (e.g., Excel worksheets)	K	Number of downloads completed.
I21 – Transparency: Dashboard visualizations	Number of dashboard visualizations accessed by citizens	K	Interest of citizens in accessing data panels on expenditure.
I22 – Transparency: App for visualizing budget data on mobile devices	Number of times the app has been installed Number of times the app has been used	K	Interest of citizens in accessing information on expenditure.

Source: Authors' elaboration.

Notes: % = Value in percent; Y/N = yes/no; M = mean; \$ = local currency value;

K = whole number (quantity); R = ratio; IPSAS = International Public Sector Accounting Standards.

^a May only be calculated for social benefit payments.

^b Transactions requiring electronic signature are determined in advance by system administrators and the security department.

^c Preferably disaggregated by function, economic classification, project, program, ministry, district.

^d May be limited to payment categories or amounts.

2.7.2 PEFA Indicators

The PEFA methodology provides a framework for evaluating and preparing reports on strengths and weaknesses in the area of public financial management. It draws on international PFM standards and good practices identified by researchers and professionals

TABLE 2.2

Examples of Indicators Relating to FMIS Operation			
Indicator	Formula	Type	Concepts
O1 – Processes: Number of processes documented	Verification of the number of processes with updated documentation.	K	Verification by the process unit.
O2 – Processes: Number of computerized processes	Verification of the number of processes that have been computerized.	K	Verification by the process unit.
O3 – Processes: Number of processes optimized / period (e.g., month or year)	Verification of the number of processes optimized in a given period.	K	Verification by the process unit.
O4 – Adherence to rules: Timely recording of all stages of expenditure	Check for indications that the stages of expenditure are not being recorded in a timely manner.	K	These may be identified where all of the stages of expenditure for an operation are recorded on the same day, for example.
O5 – Maintenance: Use of guidelines and methodologies for system life cycle management	Basic disciplines implemented and in use.	Y/N	Examples: ITIL, COBIT.
O6 – Maintenance: Availability of sufficient annual funding for FMIS maintenance	Required vs. available.	Y/N	Budget assessment.
O7 – Interfaces: FMIS interfaces/ interoperability with other systems in operation	Number of systems with online interface or interoperability with the FMIS / total number of systems requiring interfaces * 100	%	Online interfaces are preferable, but other types of interface may be used.
O8 – Performance: Transactions processed by the database per second	Processing capacity of the database environment.	K	Obtained from the database manager.
O9 – Performance: Average response time	Measured as the interval between receipt of the inquiry by the system and return of the response, in seconds.	K	This should be divided into categories (transaction types and physical location of user).
O10 – Users: Number of registered users in the system	Number of users registered in the FMIS that are able to access the system.	K	—
O11 – Users: Number of active users in a given period	Verification of the number of unique users accessing the FMIS during a given period.	K/ period	Number of different users accessing the FMIS during a given period. Stipulation of the period to be analyzed (week, month, etc.).

(continued on next page)

T A B L E 2.2 (continued)

Examples of Indicators Relating to FMIS Operation			
Indicator	Formula	Type	Concepts
O12 – Support: Number of regular calls to the user help desk	Obtained from the help desk management software.	K/ period	By means of access (telephone, email, etc.).
O13 – Satisfaction: Conduct user satisfaction surveys	Use of automated survey systems, such as Survey Monkey.	–	Evaluation of results by user type (special users, general users / different surveys may be proposed)
			Use direct, simple questions.

Source: Authors' elaboration.

Notes: K = whole number (quantity); Y/N = yes/no; ITIL = Information Technology Infrastructure Library; COBIT = Control Objectives for Information and Related Technologies.

T A B L E 2.3

Examples of Project-Related Indicators Provided by the Project Management Group			
Indicator	Formula	Type	Concepts
P1 – Project: Execution period (complete or by stage)	Effective execution period / estimated execution period	R	Verification by the PMO.
P2 – Training: Number of individuals trained	Number of individuals receiving more than one hour of training	K	Verification by the training manager.
P3 – Training: Average hours of training per person (period)	Number of hours of training provided / number of individuals trained (P2)	R	Amount of training provided.
P4 – User support: Number of FMIS manuals published online	Number of FMIS manuals published online	K	General FMIS manuals.
P5 – User support: Rapid access manuals available online (app)	Number of manuals available in app form for critical FMIS functionalities (for use on mobile devices)	K	For core FMIS functionalities (e.g., “How to register a supplier”).
P6 – Sustainability: Sufficiency of annual budget funds	Totals allocated to FMIS operation and maintenance (available/required) * 100	%	Semiannual or annual verification.

Source: Authors' elaboration.

Notes: R = ratio; K = whole number (quantity); PMO = Project Management Office.

with broad practical experience, and it provides a foundation for reform planning, dialogue on strategy and priorities, and progress monitoring.

Of the 31 indicators proposed in the PEFA methodology, 12 are directly related to FMIS.

The methodology consists of 31 performance indicators divided into seven pillars: (i) budget reliability; (ii) transparency of public finances; (iii) management of assets and liabilities; (iv) policy-based fiscal strategy and budgeting; (v) predictability and control in budget execution; (vi) accounting and reporting; and (vii) external scrutiny and audit.

These performance indicators (PIs) are described below with reference to the 2016 PEFA Manual (Volume II),⁶ in which further details of the respective components and measurement models can be found. The PIs were determined based on a detailed examination of all PEFA indicators that require a robust FMIS to obtain good scores, as well as a review of the results matrices of IDB FMIS projects that have used PEFA indicators.

PI-1. Aggregate Expenditure Outturn

This indicator measures the extent to which aggregate budget expenditure outturn reflects the amount originally approved, as defined in government budget documentation and fiscal reports. There is one dimension for this indicator: 1.1. Aggregate expenditure. Measures the accuracy of budget estimates: Executed budget / planned and approved budget.

Impact on Budgetary Outcomes

Actual aggregate expenditure that deviates significantly from the original, approved budget undermines fiscal discipline and the ability of governments to control the total budget and, subsequently, to manage risk. It also affects governments' ability to effectively and predictably allocate resources to strategic policy priorities. Service delivery may also be affected where large deviations from planned expenditure result in the contraction of services, limitations on essential expenditures for key inputs, or the suspension of certain services. It should be noted that aggregate fiscal discipline may also be affected by extra-budgetary expenditure (indicator PI-6).

PI-4. Budget Classification

This indicator assesses the extent to which the government budget and accounts classification is consistent with international standards established in the IMF Government Financial Statistics (GFS) manual and the United Nations classification of the functions of government (COFOG). There is one dimension for this indicator: 4.1. Budget classification.

Impact on Budgetary Outcomes

A robust classification system allows transactions to be tracked throughout the budget's formulation, execution, and reporting cycle according to administrative unit, economic category, function/subfunction, or program. This is essential for allocating and monitoring

⁶Second edition, December 2018. PEFA Secretariat (Washington DC).

expenditure to support aggregate fiscal discipline, the allocation of resources to strategic priorities, and efficient service delivery.

PI-9. Public Access to Fiscal Information

This indicator assesses the comprehensiveness of fiscal information available to the public based on specified elements of information to which public access is considered critical. There is one dimension for this indicator: 9.1. Public access to information.

Impact on Budgetary Outcomes

Fiscal transparency depends on whether information on government fiscal plans, positions, and performance is easily accessible to the general public. Similar to PI-5 (Budget documentation), the range and relevance of information available to the public affects their ability to engage with government and understand how public resources are being used. Fiscal transparency can contribute to better resource allocation by strengthening dialogue between government and interested stakeholders, and can also lead to improvements in service delivery. If the public is more aware of the trade-offs being made by government in allocating scarce public resources, it can reduce pressure on the government to adopt unrealistic and unsustainable fiscal policy options.

PI-16. Medium-term Perspective in Expenditure Budgeting

This indicator examines the extent to which expenditure budgets are developed for the medium term within explicit medium-term budget expenditure ceilings. It also examines the extent to which annual budgets are derived from medium-term estimates and the degree of alignment between medium-term budget estimates and strategic plans. It contains the following four dimensions and uses the appropriate method for aggregating dimension scores:

- Dimension 16.1. Medium-term expenditure estimates
- Dimension 16.2. Medium-term expenditure ceilings
- Dimension 16.3. Alignment of strategic plans and medium-term budgets
- Dimension 16.4. Consistency of budgets with previous year's estimates

Impact on Budgetary Outcomes

A medium-term perspective on budgeting supports aggregate fiscal discipline by establishing forward year estimates that provide the baseline for future budget allocations. This promotes greater predictability in budget allocations and expenditure planning and prioritization and enables the government, parliament, and the public to track expenditure policy decisions. The implications of policies often extend well beyond the current budget year, and a medium-term perspective allows the effects on future years to be more apparent. A medium-term perspective can also provide a more useful framework for managing incremental changes in resource allocation.

PI-17. Budget Preparation Process

This indicator measures the effectiveness of participation by relevant stakeholders in the budget preparation process, including political leadership, and whether that participation is orderly and timely. It contains the following three dimensions and uses the appropriate method for aggregating dimension scores:

- Dimension 17.1. Budget calendar
- Dimension 17.2. Guidance on budget preparation
- Dimension 17.3. Budget submission to the legislature

Impact on Budgetary Outcomes

An orderly budget process ensures that adequate time and information on procedures and assumptions are provided to allow budget proposals to be developed taking into account all important factors. This increases the likelihood that the process will support fiscal discipline, efficient resource allocation, and efficient service delivery. If there is insufficient information in advance of preparing budget proposals, or inadequate time to produce fully considered submissions, the chances of weak and ill-considered proposals increase, thereby undermining the potential results for budget outcomes.

PI-21. Predictability of In-year Resource Allocation

This indicator assesses the extent to which the central Ministry of Finance is able to forecast cash commitments and requirements and to provide reliable information on the availability of funds to budgetary units for service delivery. It contains the following four dimensions and uses the appropriate method for aggregating dimension scores:

- Dimension 21.1. Consolidation of cash balances
- Dimension 21.2. Cash forecasting and monitoring
- Dimension 21.3. Information on commitment ceilings
- Dimension 21.4. Significance of in-year budget adjustments

Impact on Budgetary Outcomes

Effective service delivery and execution of the budget in accordance with work plans requires that budgetary units receive reliable information on the availability of funds so that they can control commitments and make payments for nonfinancial assets, goods, and services.

Fiscal discipline requires that resources owned by the government are used effectively to achieve fiscal objectives. Cash should be available to meet obligations when they fall due and, when not required for other priorities, should be used to minimize debt management costs or increase investment returns. This requires an effective cash management system and detailed information on the amount and timing of all receipts and payments. Budgetary units need to be sure that the approved budget will be available when it is

needed, so there must be good communication between budgetary units and the custodians of resources on cash requirements and commitment limits. If there are adjustments in budgets during the year, they are likely to have less impact on the efficiency of service delivery if the size and timing of the adjustments are known sufficiently in advance to allow service providers to make adjustments to accommodate more or fewer resources than originally anticipated.

PI-22. Expenditure Arrears

This indicator measures the extent to which there is a stock of arrears and the extent to which a systemic problem in this regard is being addressed and brought under control. It contains the following two dimensions and uses the appropriate method for aggregating dimension scores:

- Dimension 22.1. Stock of expenditure arrears
- Dimension 22.2. Expenditure arrears monitoring

Impact on Budgetary Outcomes

Arrears can cause increased costs to the government: creditors may adjust prices to compensate for late payment or the delayed supply of inputs may affect service delivery. A large volume of arrears may indicate a number of different problems, such as inadequate commitment controls, cash rationing, inadequate budgeting for contracts, under-budgeting of specific items, and lack of information.

Arrears can have a significant impact on fiscal discipline because they constitute a failure in controlling commitments and making payments when obligations are due. If arrears are allowed to occur and grow, they can place a burden on future budgets to meet the unauthorized or excessive obligations of the past. Arrears can also indicate an unintended expansion of expenditures that could distort the allocation of resources. They can be an indication that more resources are needed to achieve the service levels expected, which cannot be attained without incurring unauthorized additional expenditures. Arrears can also be an indication that cash is not being provided to meet obligations when needed, implying that cash allocation arrangements are not fully effective.

PI-23. Payroll Controls

(Applicable where there is a connected human resources or payroll system, or where there is an FMIS with a payroll module)

This indicator is concerned with the payroll for public servants only: how it is managed, how changes are handled, and how consistency with personnel records management is achieved. Wages for casual labor and discretionary allowances that are not part of the payroll system are included in the assessment of nonsalary internal controls (PI-25). This

indicator contains the following four dimensions and uses the appropriate method for aggregating dimension scores:

- Dimension 23.1. Integration of payroll and personnel records
- Dimension 23.2. Management of payroll changes
- Dimension 23.3. Internal control of payroll
- Dimension 23.4. Payroll audit

Impact on Budgetary Outcomes

The wage bill is usually one of the biggest items of government expenditure. It may be susceptible to weak controls and hence corruption. Payroll controls affect fiscal discipline by ensuring that the expenditures on payroll are contained in accordance with the laws and authorized allocations established by the country. Weak payroll controls can result in unintended expansion of payroll costs or unmet obligations to employees. These in turn result in lower allocative efficiency and demotivation of staff with wider implications for the quality of services and incentives for unauthorized behaviors by staff to compensate for weaknesses in the payroll system.

PI-24. Procurement

(Applicable where there is a connected procurement system, or where there is an FMIS with a procurement module)

This indicator examines key aspects of procurement management. It focuses on transparency of arrangements, emphasis on open and competitive procedures, monitoring of procurement results, and access to appeal and redress arrangements. It contains the following four dimensions and uses the appropriate method for aggregating dimension scores:

- Dimension 24.1. Procurement monitoring
- Dimension 24.2. Procurement methods
- Dimension 24.3. Public access to procurement information
- Dimension 24.4. Procurement complaints management

Impact on Budgetary Outcomes

Significant public spending takes place through the public procurement system. A well-functioning procurement system ensures that money is used effectively in acquiring inputs for, and achieving value for money in, the delivery of programs and services by a government. The principles of a well-functioning system need to be stated in a well-defined and transparent legal framework that clearly establishes appropriate policy, procedures, accountability, and controls. The description of the legal framework for PFM is included in the PEFA report narrative in section 2.3. Key procurement principles include the use of transparency and competition as means to obtain fair and reasonable prices and overall value for money.

PI-25. Internal Controls on Nonsalary Expenditure

This indicator measures the effectiveness of general internal controls for nonsalary expenditures. Specific expenditure controls on public service salaries are considered in PI-23. The present indicator contains the following three dimensions and uses the appropriate method for aggregating dimension scores.

- Dimension 25.1. Segregation of duties
- Dimension 25.2. Effectiveness of expenditure commitment controls
- Dimension 25.3. Compliance with payment rules and procedures

Impact on Budgetary Outcomes

Internal controls provide assurance that transactions are performed as intended and resources are used only where appropriate authority has been verified. This process ensures that fiscal discipline is maintained at both the micro and the macro levels. It also ensures that resources for service delivery are allocated as intended and used for those purposes only, in accordance with applicable legal and regulatory provisions.

PI-27. Financial Data Integrity

This indicator assesses the extent to which treasury bank accounts, suspense accounts, and advance accounts are regularly reconciled and how the processes in place support the integrity of financial data. It contains the following four dimensions and uses the appropriate method for aggregating dimension scores:

- Dimension 27.1. Bank account reconciliation
- Dimension 27.2. Suspense accounts
- Dimension 27.3. Advance accounts
- Dimension 27.4. Financial data integrity processes

Impact on Budgetary Outcomes

Reliable reporting of financial information requires constant checking and verification of the recording practices of accountants. This is an important part of internal control and a foundation for good information for management and for external reports that underpin aggregate fiscal discipline, strategic allocation of resources, and the efficiency of service delivery.

PI-28. In-year budget reports

This indicator assesses the comprehensiveness, accuracy, and timeliness of information on budget execution. In-year budget reports must be consistent with budget coverage and classifications to allow monitoring of budget performance and, if necessary, timely use of corrective measures. This indicator contains three dimensions and uses the appropriate method for aggregating dimension scores:

- Dimension 28.1. Coverage and comparability of in-year budget reports
- Dimension 28.2. Timing of in-year budget reports
- Dimension 28.3. Accuracy of in-year budget reports

Impact on Budgetary Outcomes

Information on budget execution that includes revenue and expenditure data is required to facilitate performance monitoring and, where necessary, to help identify action needed to maintain or adjust planned budget outturns. Regular reporting is part of an effective monitoring and control system to ensure that budgets are executed as intended, and that deviations from plans, if any, are highlighted for consideration by the decision makers responsible for adjusting budget execution, with the aim of better meeting objectives and achieving desired outcomes.

2.8 General Recommendations

A number of important issues can influence the quality of an output in terms of its costs, timing, completeness, usability, and desired functional and technical specifications. The topics outlined below will be addressed in subsequent chapters but are listed here in light of their importance.

- **Training of IT specialists**
Appropriate training of the technical specialists participating in implementation of the FMIS is a clear requirement. Where these specialists belong to the staff of the institution concerned, the required training is easily organized, regardless of whether it involves IT, process management, project management, or others.
Where third-party specialists are involved, however, closer attention should be paid. The proposals submitted by companies generally include top-tier resumes, yet the specialists involved at the outset will not always be the same ones. Substitutions are natural, but the contracting party should be cautious in accepting them, evaluating in detail the level of training of the proposed candidate as compared to initial specifications. An interview should also be conducted to assess their effective experience and ability to work as part of a team. Many projects experience serious difficulties when they accept such substitutions without thorough evaluation.
- **Training of users in lead agencies and administrating and executing entities.**
Poorly trained users are the source of serious problems in many FMIS, rather than difficulties directly created by the system itself. These users represent an additional burden for the FMIS, as many work cycles have to be canceled and repeated; they also unintentionally introduce serious errors that others must work to correct. Providing a system access code—password, USB with a digital code, or others—is a

⁷ <http://www.in.gov.br/web/dou/-/instrucao-normativa-n-3-de-9-de-janeiro-de-2020-248563297>.

great responsibility for both authorizer and user. Accordingly, there should be formal procedures with defined rules for obtaining, maintaining, and canceling access codes, as well as penalties for unauthorized use. In Brazil, for example, rules for the different FMIS user categories are published in the Official Journal.⁷

FMIS are dynamic and users need ongoing training, and it therefore is important that online courses be available for the main roles. Users can retrain using these courses, sharply reducing the need for in-person training.⁸

- **Hiring technical specialists and/or consultants**

Technical specialists and/or consultants hired directly by the project unit should fulfill the skill and experience requirements previously identified, as set out in the terms of reference.

Publication of these requirements is the best approach for securing a wider pool of candidates to choose from.

- **Software and equipment procurement**

In light of the importance of goods procurement for FMIS projects, this document contains a specific chapter on this topic. It is the most demanding activity in terms of time and can easily become the Achilles heel of a project.

The main recommendations of the chapter are to (i) use standards where possible, (ii) avoid including additional requirements that will lead to higher costs without first evaluating the associated benefits, and (iii) exchange experiences and knowledge about hiring with other public officials.

- **Ongoing accountability (communication)**

The project official responsible for communication should seek constant contact with stakeholders, creating appropriate mechanisms for obtaining their opinions and suggestions.

- **Change management**

In the field of project management, the change management segment is considered one of the most critical to project success. Changes in operating procedures, roles, and work tools—common in FMIS projects—generally provoke negative attitudes at the staff, group, and also institutional levels; these hinder and can often even prevent a technically good project from being implemented. A specialist is needed to spearhead these activities.

- **Continuous interaction between the main actors**

The main actors should interact throughout the entire implementation cycle for a new FMIS. There are usually groups of representatives named by the different institutions participating in the process. In practice, however, these groups meet infrequently, and IT specialists are usually called upon to resolve any gaps (mainly in the functional area). This is a serious problem with adverse future repercussions. Where full-time user representatives are not a realistic option, meetings should be sought at least weekly, and the project leader should bring pressure to bear on other

⁸ Brazil's basic FMIS course is one such example: <https://www.escolavirtual.gov.br/curso/212>.

top-level officials in participating institutions to ensure that these meetings are both attended (without permanent changes in representation) and productive.

Full stakeholder interaction is particularly important for developing FMIS use cases.

- **Testing and implementation**

Exhaustive system testing should be based primarily on use cases. System testing specialists are very useful for creating and implementing testing procedures. Tools for performing automatic tests are also essential, particularly in the case of regression testing.

A phased approach to implementation is generally preferred, starting with lead agencies, followed by administrating entities and then executors. The initial mix of participating entities is determined based on the context in each country. The implementation plan should be widely disseminated and the necessary resources (human, communication, transportation, paperwork, etc.) planned and made available in advance.

FMIS implementation is usually synchronized with the budget cycle (although mid-year implementation is also an option): the new budget is prepared in both the new system and the legacy system, with backup plans and procedures that can be activated if the new system fails or performs poorly (Uña, Allen, and Botton, 2019).

2.9 Final Observations

Developing suitable strategies and models for operating an FMIS project management unit is a key success factor. Previous experience with FMIS projects has allowed the identification and use of successful organizational models adapted to local circumstances. The recommendations and good practices included in this chapter emanate from the experience and lessons learned through FMIS projects in LAC countries. Essential issues relating to coordination, strategic management, and indicators have been highlighted, as well as more operational ones that support good management, such as the PMO or quality management.

One of the key tasks for ensuring success in an FMIS project is the creation of a team of consultants (individual or firms), with emphasis on identifying the areas in need of support and the skills and qualifications required. To ensure greater consistency and maximize their contribution, these consultants should participate in the project from the very beginning.

ANNEX 2.1

SAMPLE TERMS OF REFERENCE

These samples may be used as a starting point for preparing terms of reference tailored to the circumstances in each country.

Project director

- **Objectives**
 - Plan, organize, direct, and control allocated resources with the aim of satisfying the technical requirements that will allow successful completion of the project.
- **Main Scope of Work**
 - Decide or agree upon the definitions and guidelines required to develop the work plan for the project.
 - Determine project scope and objectives.
 - Ensure that project objectives are met and the agreed scope is maintained. Analyze and approve any changes, evaluating consequences with respect to the selected objectives.
 - Coordinate work with the project director of the consulting firm hired.
 - Determine the methodological approach and prepare a detailed work program (activities, resources, etc.).
 - Direct, coordinate, and manage the resources allocated to the project (human, material, etc.).
 - Determine arrangements for approving advances, activities, materials etc.
 - Establish project monitoring and control mechanisms.
 - Analyze and approve outputs generated over the course of the project.
 - Monitor progress by the consulting firm.
 - Serve as the point of contact for the designated Ministry of Finance counterpart.
 - Determine actions in response to conflicts.
- **Required Profile**
 - Qualifications: Degree in engineering, accountancy, or economics.
 - PMP certification preferred.⁹
 - Skills:
 - Project management.
 - Public finance process in [country].
 - Information technology.
 - Experience:
 - At least 10 years experience of managing large projects with technology components.

⁹Project Management Professional.

Functional Coordinator

- **Objectives**
 - Coordinate project analysis, functional design, and documentation activities.
- **Main Scope of Work**
 - Serve as the functional counterpart for the company selected to implement the project.
 - Allocate activities and determine objectives and timelines for those responsible for the functional areas.
 - Support the Project Director by ensuring coordination between the different functional areas.
 - Detect and resolve coordination conflicts and engage in problem solving.
 - Request progress reports on the activities in the work plan and ensure that these are aligned with project objectives.
 - Monitor the activities executed by the functional areas and prepare status reports for submission to the Project Director.
 - Make daily functional decisions aligned with FMIS objectives.
- **Required Profile**
 - Qualifications: Degree in accounting, economics, or business administration.
 - Skills:
 - Accounting and finance (strong knowledge of public debt, treasury, accounting, and budget)
 - Project management
 - Experience:
 - At least seven years in positions with similar responsibility

Information Technology Coordinator

- **Objectives**
 - Coordinate project activities to develop the IT tool supporting the FMIS.
- **Main Scope of Work**
 - Allocate activities and determine objectives and timelines for those responsible for system design.
 - Support the Project Director by ensuring coordination between the different areas under his/her responsibility.
 - Detect and resolve coordination conflicts and engage in problem solving.
 - Request progress reports on the activities in the work plan and ensure that they are aligned with project objectives.
 - Control the activities executed and prepare status reports for submission to the Project Director.
 - Design the transactional platform.
 - Make daily decisions aligned with FMIS objectives.
 - Verify or manage the development process.

- Coordinate activities with the consulting firm’s IT team.
- Ensure that technical requirements are met in relation to system transactions, reports, and architecture, as agreed with the functional manager.
- Supervise program testing (module and integration testing).
- Together with the functional manager, ensure that the conditions are in place for launching the system, including the relevant contingency plans.
- **Required Profile**
 - Qualifications: Degree in systems engineering.
 - Skills:
 - Software development and programming
 - Project management
 - Databases
 - Requirements analysis
 - Testing
 - Project management
 - Experience:
 - At least seven years in the design and development of large-scale systems

Head Of The Project Management Office (Pmo)¹⁰

- **Objectives**
 - Ensure effective project management and documentation, creating points of control for the different processes and anticipating, averting, and mitigating potential risks that may arise.
- **Main Scope of Work**
 - Provide the necessary coordination, support, and discipline to ensure project execution.
 - Standardize work and communications frameworks for use by area of work.
 - Provide broad, updated information for use by the Project Director in making decisions.
 - Control and manage work plans consistent with expected timelines, costs, and quality.
 - Identify risks that may arise in the project with a view to averting them. Manage any risks that materialize and identify mitigation actions.
 - Monitor the quality of progress in project execution and generate progress reports for submission to the Project Director.
- **Required Profile**
 - Qualifications: Degree in accounting, business administration, economics, or engineering.
 - Skills:

¹⁰ The quality management function falls under the responsibilities of this position. In some projects, however, a specific position is created for this function.

- Project management
- Project management software
- PMP certification preferred
- Experience:
 - At least five years in positions with similar responsibility



In this chapter:

- 3.1** Structure and Key Features of the Legal Framework
- 3.2** Specific Characteristics of an FMIS Law
- 3.3** Observations Regarding a Number of FMIS Laws
- 3.4** Verification of Key Features of the Legal Framework in Peru, Mexico, Uruguay, Brazil
- 3.5** Additional Notes

Annex 3.1 Availability of FMIS Laws in LAC Countries

Annex 3.2 Summary of the Main Public Finance Laws in Peru, Mexico, Uruguay, and Brazil

Legal Framework: Features of Laws and Regulations to Address the Institutionalization of the FMIS in the Public Financial Management Context

3.1 Structure and Key Features of the Legal Framework

The internal operations of the public sector are governed by laws approved by the legislative branch and implemented by the executive branch. Therefore, a financial management information system (FMIS) requires a sound legal foundation to operate effectively. This ensures that it will be implemented in accordance with legal requirements, while also identifying the basic rules it must follow and the agencies or bodies that will supervise it (the oversight or lead entity for the FMIS and the lead entities for each component or subsystem). Lead agencies or bodies develop specific regulations and directives based on this law.

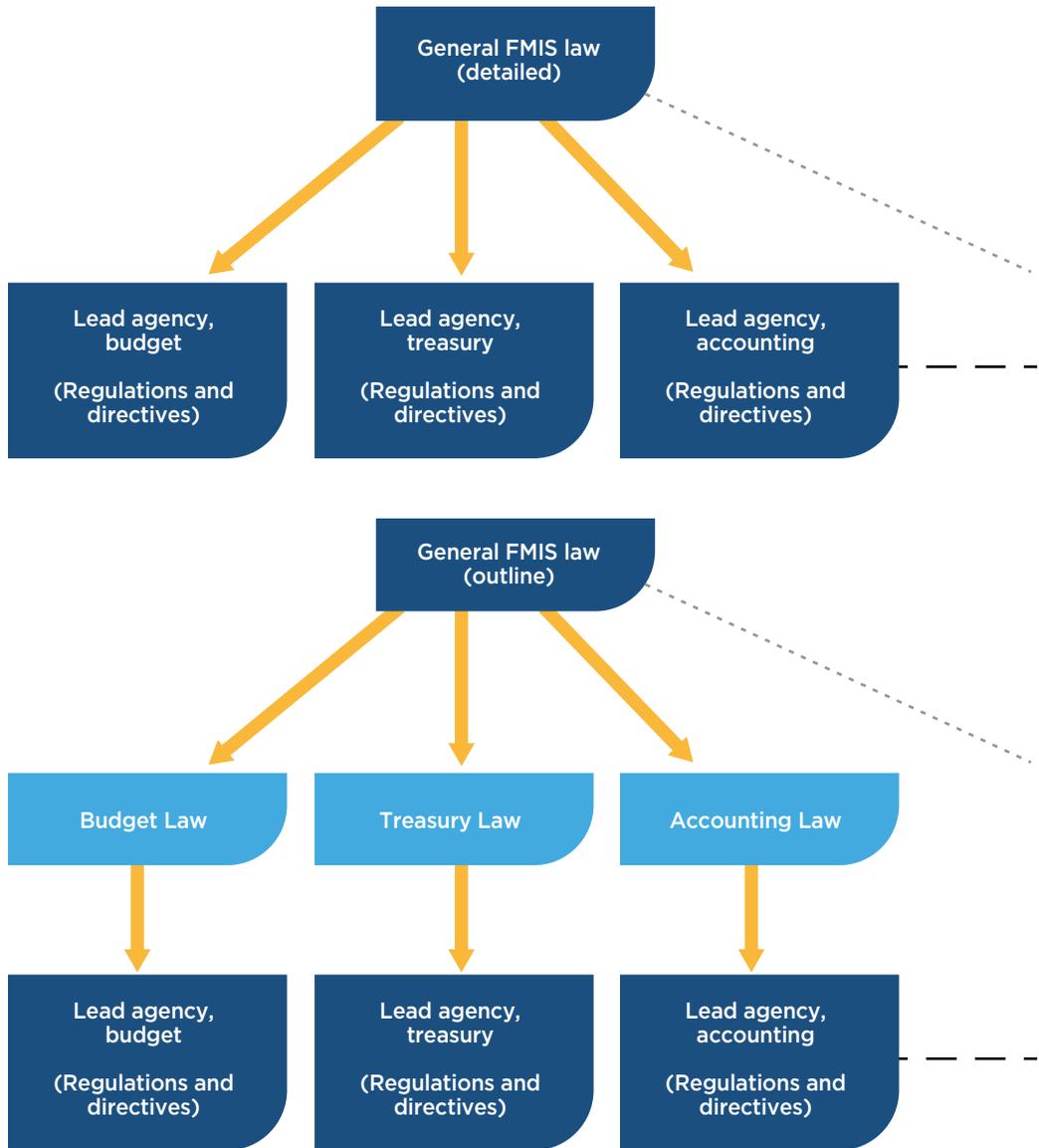
Each country's legal system has its own specific features when it comes to structuring the framework for public financial management and the FMIS. The aim of this chapter is to present the minimum requirements and a summary of some of the laws that make up the legal framework for public financial management and FMIS, for use as a point of reference in FMIS projects.

In general, there may be a general or organic law for financial management overall, accompanied by other specific laws applicable to each system (e.g., budget, treasury, public accounting, and FMIS).

FMIS may be implemented without a comprehensive financial management law, although this is not best practice. The first FMIS versions in Brazil, Guatemala, Nicaragua, Panama, and Paraguay were implemented without a complete legal framework (Bartel, 1996).

FIGURE 3.1

Structure of the Legal Framework: Detailed versus Outline Legislation



Source: Authors' elaboration.

3.2 Specific Characteristics of an FMIS Law

The level of detail in a general FMIS law can vary. Shorter laws emphasize the regulations and standards to be prepared outside the political and legislative process, while detailed laws provide a more comprehensive and coordinated foundation for the FMIS. The initial legal framework is generally prepared when there is the greatest interest and coordination between the different offices responsible. Where the FMIS is developed comprehensively, with the inclusion of specific details in the legal framework, the system's integrity is preserved over a longer period (Bartel, 1996).

Whatever the alternative chosen (a shorter or more detailed law), regulations and procedures will be needed to implement the approved legislation. The legal framework should provide a method for circulating drafts to stakeholders and collecting comments during preparation of the regulations and procedures pursuant to the law. This measure is even more important where the law is a short one.

Box 3.1 provides a list of key features that could be included in the legal framework for an FMIS, prepared by the authors based on World Bank work and other experiences.

BOX 3.1. KEY FEATURES OF THE LEGAL FRAMEWORK FOR AN FMIS

1. Establish a common classification system.
2. Align the budget classification with the accounting classification in the chart of accounts.
3. Clearly establish responsibility for ensuring that accounting principles and policies incorporate, to the extent possible, internationally accepted professional standards and accounting principles applicable to the public sector.
4. Define the types of entities subject to the law, i.e., coverage of the system (e.g., central government, agencies, state-run companies, regulatory bodies, local governments receiving federal resources, and semi-public companies).
5. Clearly define the central agencies involved in the FMIS and their functions, e.g., the Ministry of Finance as the central agency, with budget, accounting, public debt, and treasury operating under the Ministry of Finance.
6. Provide for the use of a single information system.
7. Provide for one-time data entry, avoiding duplication of effort.
8. Provide for a treasury single account (TSA) and specify its coverage.
9. Address the possibility of creating or using an internal audit office for each operating entity.
10. Address the possible creation of an external audit office with absolute independence from the executive branch (both operational and financial).

Source: Prepared by the authors based on Bartel (1996).

3.3 Observations Regarding a Number of FMIS Laws

General FMIS laws in Latin America vary depending on the legal contexts in each country. Nonetheless, common features can be identified in terms of the formulation of basic public finance laws, with emphasis on elements that address the key features mentioned above. The legal frameworks of Peru, Mexico, Uruguay, and Brazil are described and analyzed below.

3.3.1 Peru

The legal basis for Peru's public finance system, including its Integrated Financial Administration System for Public Funds (Sistema Integrado de Administración Financiera de los Recursos Públicos, or SIAF-RP), rests on the following legislative decrees issued in 2018:

- DL 1436 – Public Sector Financial Management Framework¹ Supplemented by:
- DL 1438 – National Accounting System²
- DL 1440 – National Budget System³
- DL 1441 – National Treasury System⁴

Public Sector Financial Management Framework Law

DL 1436 is a short law that establishes the following public sector financial management principles: (i) articulation (integrated management across systems), (ii) regulatory centralization, (iii) operational decentralization, (iv) a multiyear framework, (v) probity, (vi) fiscal responsibility, and (vii) fiscal sustainability.

It designates the Ministry of Economy and Finance (MEF) as the lead entity for public sector financial management, which is made up of several systems: budget, treasury, debt, accounting, procurement, multiyear programming, and investment in human resource management. Specific legislative decrees determine the coverage of each system. The law also establishes a Coordination Committee for Public Sector Financial Management, which includes its components and responsibilities, as well as a Committee for Fiscal Matters, which is responsible for developing guidelines and strategies to manage fiscal risks and financial assets and liabilities.

Public sector financial management consists of the following processes: (i) programming of public resources; (ii) management of public resources; and (iii) evaluation of the management of public resources.

¹ https://cdn.www.gob.pe/uploads/document/file/536042/DL_1436.pdf (2018).

² https://cdn.www.gob.pe/uploads/document/file/206023/DL_1438.pdf (2018).

³ https://cdn.www.gob.pe/uploads/document/file/206025/DL_1440.pdf (2018).

⁴ https://cdn.www.gob.pe/uploads/document/file/206026/DL_1441.pdf (2018).

The MEF has the authority to adjust its organizational structure to increase the efficiency of public sector financial management.

It should be noted that Peru is the only country in the region where the FMIS covers the entirety of municipal finances, as municipalities are legally required to use the same SIAF-RP as the central government.

Nonfinancial state-run companies under the state holding company for public enterprises (Fondo Nacional de Financiamiento de la Actividad Empresarial del Estado, or FONAFE) are exempted from the law where these are part-owned by the private sector.

The law establishes the mandatory use of the SIAF-RP for public sector entities (including municipalities), placing it under the responsibility of the MEF, with functional requirements set by the Coordination Committee for Public Sector Financial Management (Articles 23 and 24).

National Accounting System

The National Accounting System establishes the scope of application of this legislative decree and identifies the financial and nonfinancial public sector entities that are governed by it. The system comprises the Government Accounting Department, the Council for Accounting Standards, and the accounting offices of public sector entities (or other bodies performing this same function). It also designates the Government Accounting Department in the MEF as the lead entity and the supreme technical and regulatory authority for the national public accounting system and sets out multiple areas of responsibility within that system (e.g., responsibilities shared with the Colleges of Public Accountants).

The Council for Accounting Standards is responsible for approving accounting standards applicable to the private sector and state-run companies, as appropriate. It also stipulates that the maintenance of accounting records is obligatory for all public sector entities and must be performed using the SIAF-RP. The Government Accounting Department is responsible for preparing and updating the Table of Operations or Table of Events.⁵

The financial, budgetary, and supplementary information used to prepare reports for the General Account of the Republic and public finance statistics is reported through the SIAF-RP. Accounting information on costs is also processed in accordance with SIAF-RP functionalities, based on budget classifications and the Government Chart of Accounts. The lead entity for the National Accounting System is responsible for the functionality of the accounting module in the SIAF-RP.

(Departmental Resolution 010-2018-EF⁶ of December 2018, issued by the Government Accounting Department, formalized the use of both the Conceptual Framework for

⁵ The Table of Events is used by management units to transform routine administrative acts and events into automatic accounting records.

⁶ <https://www.mef.gob.pe/es/normatividad-sp-2134/por-instrumentos/resoluciones-directorales/18916-resolucion-directoral-n-010-2018-ef-51-01/file> (2018).

General Purpose Financial Information in Public Sector Entities and the 2017 version of the International Public Sector Accounting Standards [issued by the International Public Sector Accounting Standards Board of the International Federation of Accountants]. The Government Accounting Department will regulate the application of these standards.)

National Public Budget System

The National Public Budget System lists the public sector entities covered by this legislative decree. At the central level, the System consists of the Public Budget Department in the MEF (lead entity), while at the decentralized level it is made up of (i) public entities, (ii) their directors, (iii) their budget offices (or units performing this same function), (iv) executing units, and (v) those responsible for budget programs. In addition to describing the responsibilities of these entities, the decree describes the ways in which the system is integrated (intra-system or inter-system).

The decree also describes budget concepts and content, including results-based budget programs and the institutional budget program, multiyear programming, budget formulation and approval, the structure of public expenditures, the budget process and its different stages, budget execution, the stages of expenditure (certification, commitment, accrual, payment), the budgetary management of revenue and expenditure, budget modifications, budget evaluation, and supplementary management rules. Evaluation data should be available in the databases that make up the SIAF-RP.

It also addresses the budgets of regional and local government entities and enterprises, FONAFE and its companies, and the Social Security Health Insurance Program, while prohibiting the creation of public entities.

National Treasury System

The legislative decree for the National Treasury System establishes the public sector entities to which it applies. The National Treasury System comprises, at the central level, the MEF's Public Treasury Department (Dirección General del Tesoro Público, or DGTP) (the lead entity) and, at the decentralized or operational level, executing units for the public sector budget (or units performing this same function). The decree also determines the functions of each component of the system.

It assigns responsibility to the DGTP for implementing collection mechanisms and payments through the TSA. The DGTP is also responsible for authorizing the opening or closure of bank accounts in banks or financial entities as required by budget executing units, as well as the implementation and maintenance of access to the SIAF-RP by those responsible for administering financial execution and treasury operations, allowing them to record the relevant information.

The DGTP is also responsible for managing relations with international financial organizations, financial planning, integrated management of assets and liabilities, treasury management, fiscal risk management, and the rules for operating the TSA. In Peru, public debt management functions are the responsibility of the DGTP: it is one of three

countries in the region that allocates these functions to Treasury (alongside Brazil and Colombia).

3.3.2 Mexico

The Integrated Information System for Public Revenue and Expenditure (Sistema Integral de Información, or SII) is a system for gathering data generated by government departments, agencies, and enterprises.⁷ Each entity may have its own IT system for financial management that follows the rules established in the legal framework. All of these operate according to the regulatory framework set out in Figure 3.2. (The federal nature of the Mexican State is important in this respect.)

FIGURE 3.2



Source: SIAF-IDB-IMF-Korea Public Finance Information Service event (2019).

Notes: SHCP = Ministry of Finance and Public Credit; SFP = Ministry of Public Administration.

Federal Budget and Fiscal Responsibility Law⁸

The Federal Budget and Fiscal Responsibility Law (Ley Federal de Presupuesto y Responsabilidad Hacendaria, or LFPRH) contains definitions of 57 terms used in the law and designates the Supreme Federal Audit Institution as the body responsible for overseeing compliance with the law.

The objective of the LFPRH is to regulate the programming, budgeting, approval, exercise, control, and evaluation of federal public revenue and expenditure. Accordingly, and with a view to improving efficiency in public resource allocation, the LFPRH includes guidelines to promote results-based planning of the federal budget, taking into account the information generated by evaluations. It also establishes the Performance Evaluation

⁷In February 2020, the Government of Mexico signed a US\$110 million loan with the World Bank to modernize the public financial management system (P169959), including the development of a functionally integrated FMIS by 2025.

⁸http://www.diputados.gob.mx/LeyesBiblio/pdf/LFPRH_200521.pdf (2021).

System and assigns responsibility for coordinating evaluations in the area of social development to the National Council for Social Policy Evaluation. The law also determines the characteristics of the budgetary autonomy granted to expenditure execution entities under the Mexican Constitution or, where relevant, under the specific provisions of the laws creating them.

It assigns responsibility to the federal executive branch, through the Ministry of Finance and Public Credit (Secretaría de Hacienda y Crédito Público, or SHCP), for the programming, budgeting, evaluation, and control of public expenditure by federal departments, agencies, and enterprises. The Ministry of Public Administration (Secretaría de la Función Pública, or SFP), in terms of the legal provisions governing its control and audit functions, will supervise compliance with the provisions of the law and any associated provisions relating to expenditure by federal departments, agencies, and enterprises. Through their respective management units, the legislative and judicial branches and autonomous entities must coordinate programming and budgeting tasks with the Ministry.

Expenditure executing entities are authorized to perform budget procedures and, where relevant, issue budget authorizations in accordance with the law, using either printed documents signed by the appropriate public official or electronic equipment, or systems authorized by the MEF (with electronic means of identification replacing the need for an original signature).

Through their respective administrative units, the legislative and judicial branches and autonomous entities must agree with the SHCP on implementation of the system within their respective areas of responsibility, for the sole purposes of periodic submission of the relevant information. The Finance and Public Credit Committee and the Budget and Public Accounts Committee of the Chamber of Deputies have access to this system, subject to the limits established under law and the provisions of the system guidelines. The information contained in the system is confidential.

The LFPRH stipulates that the SHCP, SFP, and the Bank of Mexico are responsible for determining guidelines for SII operation, organization, and requirements, as well as the confidentiality rules to be followed by officials with access to the system (Article 108).

Regulations of the Federal Budget and Fiscal Responsibility Law⁹

The regulations expand upon the general rules for public expenditure, add new definitions, and identify the budgetary control systems that must be used by government departments, agencies, and enterprises, including data entry in the SII.

They also assign responsibility to the Federal Treasury for operating and administering the TSA, the use of which is required for all government departments, agencies, and enterprises. The regulations provide for a balanced budget and principles of

⁹http://www.diputados.gob.mx/LeyesBiblio/regley/Reg_LFPRH_131120.pdf (2020).

fiscal responsibility, in addition to mandating the preparation of an SHCP opinion on the budget impact of various types of projects before they are submitted to the Office of the President for approval. They also address the calendar for programming and budget activities; administrative, functional, program, economic, and geographic classifications; and creation of a budget code.

They require the development of a budget for personal services and related expenditures. They also establish rules for federal expenditure in the states, investment programs and projects, and preparation and approval of the budget, the recording and payment of budget obligations, accounts payable, and guarantees, specifying the SII as the instrument for recording these operations.

Section II establishes the rules for the SII, including assigning responsibility for operating the system to the Technical Information Committee (Articles 297 and 298).

The Technical Information Committee is composed of officials from the SHCP and SFP, which determine the number of members from each entity. The officials should be of Deputy General Manager rank or higher, and they may designate an alternative representative of Department Director rank or higher. An official from the SHCP administrative unit responsible for coordinating operation of the SII leads the Committee. The SHCP and SFP are in charge of establishing the requirements for the SII within their respective areas of responsibility, with a view to satisfying the information requirements established in the LFPRH, the Federal Treasury Law, and the General Government Accounting Law.

Federal Treasury Law¹⁰

The Federal Treasury Law and its regulations¹¹ establish the functions of the Federal Treasury and auxiliary entities, as well as the TSA and its rules. The concept of auxiliary entities is relatively broad and encompasses the relevant administrative units of federal departments, agencies, enterprises, and administrative tribunals; state departments and parastatal agencies; federal and state legislative and judicial branches; federal and state autonomous constitutional bodies; municipal town halls; para-municipal entities; and the political and administrative bodies of the different boroughs of the Federal District. They also include the Bank of Mexico; authorized credit institutions and financial entities; private citizens; and other individuals authorized by law or as expressly authorized by the Treasury to perform treasury functions, among other functions, on a permanent or temporary basis.

The law also establishes the TSA system, which is mandatory for all government departments, agencies, and enterprises (without prejudice to situations of budgetary autonomy). In light of their purpose and nature, the accounts that make up the TSA system and its resources are indefeasible and immune from seizure and may not be the subject of administrative or judicial measures affecting their availability and liquidity. Social security

¹⁰ <http://www.diputados.gob.mx/LeyesBiblio/pdf/LTF.pdf> (2015).

¹¹ http://www.diputados.gob.mx/LeyesBiblio/regley/Reg_LTF_300617.pdf (2017).

contributions, contributions withheld from workers, and balances remaining after the dissolution of entities are managed outside the TSA. The law and its regulations establish management procedures for all funds covered by the TSA.

Government Accounting Law¹²

The Government Accounting Law determines the composition and powers of the National Accounting Harmonization Council, which is responsible for harmonizing accounting by Mexico's states, public and private institutions, and members of civil society.

It also establishes rules for the government accounting system and the responsibilities of public entities at all levels of government in terms of maintaining accounting records for their operations, including the required level of disaggregation. It defines the content of the public accounts and the rules for producing them, as well as the format that states must use for providing information on the use of federal resources and the rules for preparing reports.

This law also stipulates that the Supreme Federal Audit Institution and other oversight bodies must have access to the SII in order to carry out their activities.

Amendments to SII Guidelines (23/07/2019)¹³

This modification amends the rules governing public officials' access to the SII, requests for information and format modifications, and the confidentiality classification of SII information with respect to public access to information.

3.3.3 Uruguay

Financial management by the government of Uruguay is governed by the Consolidated Text on Accounting and Financial Administration (Texto Ordenado de Contabilidad y Administración Financiera, or TOCAF),¹⁴ which establishes that the different branches of the government, the Court of Accounts, the Electoral Court, the Court for Administrative Matters, government departments, autonomous bodies, decentralized services, and, in general, all types of public bodies belonging to the state apparatus are subject to the provisions of this law.

The TOCAF establishes the rules for the different stages of expenditure (commitment, settlement, and payment, together with the responsibilities, rules, and limits for spending and payments), while also defining State assets and the model used to manage them. It provides a definition of the State treasury, which is attached to the Ministry of

¹² http://www.diputados.gob.mx/LeyesBiblio/pdf/LGCG_300118.pdf (2018).

¹³ (2019) https://www.dof.gob.mx/nota_detalle.php?codigo=5566284&fecha=23/07/2019.

¹⁴ (2020) https://www.gub.uy/agencia-reguladora-compras-estatales/sites/agencia-compras-contrataciones-estado/files/2020-08/TOCAF_%202020_LUC%20%283%29.pdf.

Economy and Finance and which, through the National Treasury, serves as a central fund responsible for centralizing all of the information needed to establish the country's economic and financial situation. The TOCAF establishes the government accounting system, which comprises the array of principles, bodies, rules, and technical procedures used to compile, value, process, and report on the economic and financial events that affect the public finances.

All acts and operations covered by the TOCAF must be performed and recorded using a uniform system for the documentation and electronic processing of data based on requirements established by the General Accounting Office, and must be reflected in accounts, financial statements, and balance sheets that allow them to be measured and assessed. The General Accounting Office, subject to the prior agreement of the Court of Accounts, will determine the principles, rules, procedures, chart of accounts, and subsidiary records needed, as well as the formats to be used on a mandatory basis for the accounting records kept by all public entities.

The General Accounting Office is the body responsible for the Integrated Financial Information System (Sistema Integral de Información Financiera, or SIIF). As such, it is responsible for the following activities (Article 101):

- Preparing the general accounts for the central government and presenting consolidated information for the entire public sector.
- Administering a financial information system that provides information on central government budgetary, financial, economic, and asset management.
- Preparing the public sector economic accounts consistent with the system of national accounts.
- Maintaining a register of uncollectible debts, in the form and manner prescribed by the regulations.
- Formulating central government financial reports.
- Through the officials designated, performing those activities assigned to the central accounting offices (or units performing this same function) under subsections 02 to 14 of the national budget.
- Processing and producing financial information to contribute to decision making by those responsible for public financial management and making it available to the general public.
- Controlling the budget execution and accounting activities of bodies covered by Article 220 of the Constitution, exercising accounting oversight over these bodies' central accounting offices.

3.3.4 Brazil

The modernization of financial management in Brazil began in 1986 with the creation of the National Treasury Department (Secretaria do Tesouro Nacional, or STN), which is currently attached to the Ministry of the Economy. The STN is responsible for treasury, accounting, and public debt.

The federal budget falls under the responsibility of the Federal Budget Department, which until 2018 was attached to the Ministry of Planning but is now part of the Ministry of the Economy.

Decree 93,872, published in December 1986, supplemented earlier laws and decrees. It contains provisions for the consolidation of national treasury funds, updates and consolidates the relevant legislation, and provides other types of guidance.¹⁵ The Decree also defines the three stages of public expenditure (commitment, accrual, and payment), together with the rules governing them, and identifies the STN as the lead entity for the federal government's Integrated Financial Management System (Sistema Integrado de Administração Financeira Nacional do Governo Federal, or SIAFI). The Decree has been updated over time and is one of the main sources for public financial management. The STN implemented the SIAFI in 1987, followed by the national TSA in 1988.

The SIAFI is legally defined as the IT system that processes and controls the federal government's budgetary, financial, asset, and accounting execution by means of terminals installed throughout the national territory. It is used by all organizational units belonging to the direct federal public administration, as well as federal semiautonomous agencies, foundations, and state-owned enterprises, and semi-state enterprises included in the fiscal budget or the federal Social Security budget. The SIAFI allows simultaneous, secure online access for all government units and has enabled the decentralization of budget operations and associated financial movements. Simultaneous, automatic accounting records are maintained as part of each operation, thus supporting management and appropriate controls. Immediately following its implementation, the TSA found support in Brazil's 1988 Constitution, which stipulated that the federal government's cash resources must be deposited in the Central Bank of Brazil (FOTEGAL, 2019)

The STN regulates the SIAFI. It issues normative instructions, execution rules, and ordinances (including associated updates). These rules codify the use of the SIAFI and stipulate that all budgetary and financial documents must be issued through the system. Since the system was implemented in 1987, its use has been mandatory for Executive Branch bodies and entities included in the fiscal and social security budgets, with the exception of financial entities (Normative Instruction, 22 December 1986 and subsequent updates). Decree 347 of November 1991¹⁶ reinforced the decision that the SIAFI be used to perform budgetary, financial, and accounting execution in those federal executive bodies and entities included in the fiscal and social security budgets (with the exception of financial entities), stipulating also that the SIAFI database should be the official source of government data for legal purposes.

Normative Instruction 05 establishes rules and levels in the area of security. In the case of SIAFI users, it establishes a registration, identification, and authorization system, with a decentralized structure for credential registration and distribution involving different levels of system access. It also stipulates that document, accounting, and operator inspections be performed on a daily basis by the different officials responsible and provides for

¹⁵ http://www.planalto.gov.br/ccivil_03/decreto/d93872.htm.

¹⁶ See https://www.planalto.gov.br/ccivil_03/decreto/1990-1994/d347.htm.

the details of all database logins to be recorded, including user identity, date and time, terminal, location, and data accessed.

In addition, the instruction establishes authority for authorizing user registration and profiles, along with the administrative and criminal liabilities of all those involved in use of the system. It introduces the concept of the “event,” which is defined as the code that identifies all actions or transactions that must be processed through the SIAFI. This concept, initially adopted in the SIAFI, is now used in several FMIS around the world.

The event performs the accounting classification task without requiring the executor recording the operation to have advanced accounting skills. For each event there is a script—a mask for the accounting entries to be made in the system after the record is confirmed by the executor.

A “table of events” lists all of the accepted events with their corresponding descriptions.¹⁷ Entering the correct information is essential for an event to be processed and the data generated automatically in the system.

At the local level, internal audit and control bodies are responsible for auditing the SIAFI, and the National Court of Auditors (Tribunal de Contas da União, or TCU) is responsible for performing operational and compliance audits. The SIAFI must provide the functionalities required to allow the responsible bodies to perform the internal and external audits provided for under law.

Sector entities in the areas of budgeting and finance, accounting, audit, and internal control represent a link between management units and the STN in their specific areas of activity.

All legislative and operational documentation relating to the SIAFI, including user manuals, can be freely accessed through the STN website.¹⁸

Annex 2 provides a summary of other important features of the FMIS laws in Peru, Mexico, Uruguay, and Brazil.

3.4 Verification of Key Features of the Legal Framework in Peru, Mexico, Uruguay, and Brazil

The analysis of FMIS-related laws in the aforementioned countries included verification of their completeness with regard to some of the key features proposed by the authors. The comparisons are based on current versions of the legislation (rather than the versions in force when the systems were implemented).

¹⁷ An example of a SIAFI table of events can be found at https://sisweb.tesouro.gov.br/apex/f?p=2501:9:::9:P9_ID_PUBLICACAO_ANEXO:7718.

¹⁸ https://conteudo.tesouro.gov.br/manuais/index.php?option=com_content&view=categories&id=721&Itemid=700.

Annex 1 describes the FMIS laws available in the Latin American and Caribbean countries, based on the survey conducted.

3.5 Additional Notes

Each country has a distinct legal system. Accordingly, it is important that FMIS projects—at least during the stages of analysis and verification of the completeness of the legal framework—include an external legal expert with experience in the financial management aspects of the local legal system. This legal expert should provide support to government experts during the analysis, proposing legal modifications when necessary.

T A B L E 3.1

Existence of Key Features in FMIS Laws ^a				
Key feature	Peru	Mexico	Uruguay	Brazil
Establishes a common classification system.	✓	✓	✓	✓
Aligns the budget classification with the accounting classification in the chart of accounts.	(*)	✓	—	—
Clearly establishes responsibility for ensuring, to the extent possible, that accounting principles and policies incorporate internationally accepted professional standards and accounting principles applicable to the public sector.	✓	✓	✓	✓
Defines the types of entities subject to the law, meaning coverage of the system (e.g., central government, agencies, state-run companies, regulatory bodies, local governments in receipt of federal resources, and semi-state companies).	✓	✓	✓	✓
Clearly defines the central agencies involved in the FMIS and their functions (e.g., the Ministry of Finance as the central agency, with budget, accounting, public debt, and treasury offices operating under it.)	✓	✓	✓	✓
Provides for the use of a single information system.	✓	(**)	✓	✓
Provides for one-time data entry, avoiding duplication of effort.	—	—	—	—
Provides for the Treasury Single Account and specifies its coverage.	✓	✓	(***)	✓
Addresses the possibility of creating or using an internal audit office for each operating entity.	—	—	✓	✓
Addresses the possible creation of an external audit office with absolute independence (operational and financial) from the executive branch.	✓	✓	✓	✓

Source: Authors' elaboration.

Notes:

(*) Provides for a table of events under the responsibility of the Government Accounting Department.

(**) Provides for a system to compile data from the individual systems of each body or institution.

(***) Other legal instruments govern the Treasury Single Account.

^a The laws and regulations covered are those mentioned in the body of the chapter above.

ANNEX 3.1

AVAILABILITY OF FMIS LAWS IN LATIN AMERICAN AND CARIBBEAN COUNTRIES^a

Country	Availability of Law	Comments	Online Availability
Argentina	Yes	Law 24,156 of 1992	http://servicios.infoleg.gob.ar/infolegInternet/verNorma.do?id=554
Bahamas	No	—	—
Bolivia	No	—	—
Brazil	Yes	Decree 347 of 21/11/1991 and other normative instructions	https://www.gov.br/tesouronacional/pt-br/siafi/mais-informacoes/biblioteca
Colombia	Yes	Decree 1,068 of 2015	https://www.funcionpublica.gov.co/eva/gestornormativo/norma_pdf.php?i=72893
Chile	Yes	Legislative decree 1,263 of 1975 and amendments	https://www.bcn.cl/leychile/navegar?idNorma=6536&idVersion=2020-04-02&idParte=
Ecuador	No ^b	—	—
Guatemala	Yes	Government Agreement 217/95	https://pt.scribd.com/document/398090727/Acuerdo-Gubernativo-No217-95 (through Scribd)
Honduras	Yes	Organic Budget Law/ Decree 84 of 2004	https://www.sefin.gob.hn/download_file.php?download_file=/wp-content/uploads/leyes/LeyOrganicaDePresupuesto.pdf
Mexico	Yes	Federal Budget and Fiscal Responsibility Law	https://www.gob.mx/cms/uploads/attachment/file/514534/LFPRH_191119.pdf
Panama	Yes		https://www.gacetaoficial.gob.pa/pdfTemp/26995_A/37337.pdf
Paraguay	Yes	Law 1,535/99, Regulatory Decree 8,127/2000	https://www.hacienda.gov.py/web-hacienda/index.php?c=421
Peru	Yes	Legislative Decree 1,436 / Public Sector Financial Management Framework	https://cdn.www.gob.pe/uploads/document/file/536042/DL_1436.pdf
Dominican Republic	Yes	Financial Management System Law 05/2007	https://www.hacienda.gob.do/wp-content/uploads/2018/06/ley-no.5-07-1.pdf
Trinidad and Tobago	No	—	—
Uruguay	Yes	Consolidated Text on Accounting and Financial Administration (TOCAF)	https://www.gub.uy/agencia-reguladora-compras-estatales/sites/agencia-compras-contrataciones-estado/files/2020-08/TOCAF_%202020_LUC%20%283%29.pdf

Source: Authors' elaboration.

Notes:

^a Based on responses received between August and September 2020.

^b Regulations will be implemented in January 2021.

ANNEX 3.2

SUMMARY OF THE MAIN PUBLIC FINANCE LAWS IN PERU, MEXICO, URUGUAY, AND BRAZIL^a

Description	Peru	Mexico	Uruguay	Brazil
Main law	Framework Legislative Decree on Public Sector Financial Management.	Federal Budget and Fiscal Responsibility Law.	Consolidated Text on Accounting and Financial Administration (TOCAF).	Decree 93,872 of 1986 and modifications.
Main supplementary laws	Legislative Decree on the National Budget System.	Regulations of the Federal Budget and Fiscal Responsibility Law. Government Accounting Law.	—	Decree 347 of November 1991 and amendments (obligatory use of SIAFI)
Level of detail in the main law	Low	High/medium	High	Medium
Reference to the FMIS	Provides for obligatory use of the MEF-operated SIAF-RP by public sector entities (Arts. 23 and 24).	Stipulates that the SHCP, SFP, and Bank of Mexico will determine guidelines for the operation, organization, and requirements of a federal financial management system (Art. 108). ^b	Establishes the Integrated Financial Information System (SIIF) under the responsibility of the General Accounting Office (Art. 101).	Decree 93,872 of 1986 and updated versions, and Decree 347 of 1991.
Committees and councils created	Coordination Committee for Public Sector Financial Management / Committee for Fiscal Matters.	Technical Committee of the Revenue Stabilization Fund / Technical Information Committee, which operates the SII (SHCP and SFP).	Public Procurement Agency Advisory Board.	
Functions included in the law	Budget; treasury, borrowing; accounting; procurement; ^a multiyear and investment programming; fiscal management of human resources.	The law establishes the processes for financial management, all of which are under the responsibility of the SHCP.	Rules for carrying out the different stages of expenditure; public procurement rules; State Procurement Agency.	Financial programming; rules for commitments, accruals, and payments; domestic and external credit operations; public debt.

(continued on next page)

(continued)

Description	Peru	Mexico	Uruguay	Brazil
Ministry responsible for regulation	<p>Budget: Budget Department / MEF</p> <p>Treasury: Treasury Department / MEF</p> <p>Debt: Treasury Department / MEF</p> <p>Accounting: Accounting Department / MEF</p> <p>Procurement: Procurement Department / MEF</p> <p>Multiyear and investment programming: Multiyear Investment Programming Department / MEF</p> <p>Department for the Fiscal Management of Human Resources / MEF</p>	SHCP and SFP, except accounting (additional law)	<p>General: MEF</p> <p>Accounting: General Accounting Office</p>	Ministry of Finance (Economy) / STN
Ministry responsible for operation	Entities linked to or that interact with public sector financial management.	<p>Legislative Branch; Judicial Branch; autonomous entities; administrative tribunal; Office of the Comptroller General; Office of the President of the Republic; federal departments; federal agencies and enterprises.</p>	Public sector entities as stipulated in the law.	Federal ministries and entities.
Operating and regulatory model	Regulatory centralization and operational decentralization.	Regulatory centralization and operational decentralization.	Regulatory centralization and operational decentralization.	Regulatory centralization and operational decentralization.

(continued on next page)

(continued)

Description	Peru	Mexico	Uruguay	Brazil
Key features of the budget system	General concepts.	Principles of the budget preparation and approval process.	Budgeting rules.	—
Key features of the accounting system	General concepts.	General concepts.	Basic public accounting rules.	General accounting rules.
Key features of the treasury system	Management of nonfinancial public sector financial assets and public sector fiscal risks.	General concepts.	Treasury management rules.	Additional STN obligations.
Key features of public debt	Manages part of the public sector debt.	General concepts.	Borrowing rules.	Public debt rules.
Key control features	—	—	National Internal Audit Office	Internal audit and control units in each body.
Key external audit features	—	Supreme Federal Audit Institution.	Court of Auditors.	Federal Court of Auditors.

Source: Authors' elaboration.

Notes:

^a The full texts of these laws are available on the internet (websites listed in Section 3).

^b System for collecting information generated by federal departments, agencies, and enterprises.

^c Effective use of resources allocated to public sector entities.



In this chapter:

- 4.1 Context
- 4.2 Political Economy of FMIS Projects
- 4.3 Treasury Single Account
- 4.4 FMIS Sustainability: A New Institutional Solution
- 4.5 Ongoing Training
- 4.6 Strengthening the Role of FMIS Users
- 4.7 Other Observations

Institutional Arrangements for the Operation of FMIS

4.1 Context

FMIS projects include the review and modernization of fiscal institutions and processes, as well as the automation of public financial management through the use of an information system. The general objective of these projects is to increase governments' institutional capacity for controlling all stages of public expenditure in a transparent, integrated, and more efficient manner. Accordingly, projects seek to influence the structures not only of the Ministry of Finance (the entity usually responsible for managing the project) but of all public sector bodies (Uña and Pimenta, 2015).

This leads to projected institutional change,¹ arising from the observation that current practices are inadequate and the resulting declaration by the responsible authorities that they need to be replaced by more efficient models. Institutional changes lead to new institutional arrangements,² and the effectiveness of new measures is dependent on the governance of these arrangements.

This chapter addresses the main institutional arrangements associated with FMIS projects.

¹Institutional change can be defined as a process of growing structural differentiation based on both the reform or modification of institutional rules, regulations, and values, and the incorporation of new actors, interests, and conflicts in the different spheres or areas of institutional performance (Adrián Acosta Silva).

²An institutional arrangement can be defined as an organizational structure or set of behavioral rules that governs a specific area.

4.2 Political Economy of FMIS Projects³

Each country's history, sociopolitical context, institutions, and actors influence political decision-making processes. The political process is thus dependent on the incentives and constraints faced by the different actors and the institutional rules that affect their interactions.

This perspective means that institutional and political economy issues need to be treated as strategic aspects of the design and implementation of an FMIS, bearing in mind that these projects have a crosscutting impact on public financial management (PFM) and, therefore, on the public sector as a whole. Based on these observations, when proposing an FMIS, it is important to create institutional arrangements that encourage acceptance and adoption of the new system.

4.2.1 Institutional and Political Support

An initial issue of importance for FMIS initiatives is achieving the support and participation—from the very beginning of the design stage—of top-level public finance officials with extensive understanding of the risks and benefits of the project. Authorities in the economic area should be the main sponsors of the project, putting their support, political capital, and leadership at the service of projects of this nature. At the same time, specific laws or regulations help consolidate the institutional framework for the new system, strengthening its enforceability and the mandatory nature of its use.

4.2.2 Hierarchical Position of the FMIS Unit

Another important issue is the location and hierarchical position of the unit responsible for the FMIS project. Attaching the unit directly to its principal sponsor or other relevant public finance authority represents a powerful signal to the public sector regarding important nature of the project and high-level support for it. In particular, it is best to avoid exclusively locating the project in an organization's information and communication technology department, as this could lead to its being seen as merely a technology upgrading project rather than a comprehensive modernization process aimed at optimizing and strengthening public financial management.

4.2.3 Interagency Coordination

Interinstitutional coordination arrangements should also be considered. Coordination structures within the Ministry of Finance—FMIS committees or information technology committees—can help build consensus around the objectives of the planned reform or modernization process. This type of coordination is very important given that responsibility for FMIS projects is often diluted across several functional line departments, in addition

³This section draws mainly on Uña and Pimenta (2015), updating it where necessary.

to the information technology area, potentially leading to political economy problems. In this context, a senior official (e.g., a vice minister) should make the decisions, while the committee discusses and promotes consensus building.

In the region, positive experiences with respect to FMIS committees have been seen in Chile and Costa Rica, together with coordination structures used recently in Honduras, Uruguay, Peru, and Mexico. In the case of Chile, a steering committee consisting of officials from the Budget Department (Dirección de Presupuestos, or DIPRES) and the Comptroller General of the Republic was established to create the State Financial Management System (Sistema para la Gestión Financiera del Estado, or SIGFE). The committee approved the objectives of the FMIS and its main functional definitions.

Costa Rica has a Financial Management Coordination Commission (Comisión de Coordinación de la Administración Financiera, or CCAF), whose objective is to ensure effective coordination of the different technical and operational elements of the project, so that each unit's determinations and guidelines take into account their implications for the work and remits of other participants in the financial management system. The CCAF consists of the Vice Minister for Revenue (who also chairs the Commission); the Budget Director; the Accountant General the Director of Public Credit; the Director of Asset Management and Procurement; the National Treasurer; the Technical Secretariat of the Budget Authority; and the Director for Information Technology in the Ministry of Finance.

In Honduras, an Information Technology Committee was created in the Ministry of Finance in 2013, with the participation of the Directors General of the different lead entities. The Committee's objective is to support the institutional framework for the country's SIAFI, which is administered by the Modernization Unit in the Ministry of Finance.

In Uruguay, a Project Steering Committee was created to develop the modernization project for the SIF, encompassing officials from the General Accounting Office, the National Treasury, and the National Budget Unit.

In Peru, the Public Sector Financial Management Coordination Committee was created under the same law establishing mandatory use of the Integrated Financial Administration System for Public Funds (SIAF-RP) by public sector entities. The Committee is responsible for heading the governance of public sector financial management and is composed of the Vice Minister for Financial Management and the Directors of Budget, Public Treasury, Public Accounting, Multiyear Investment Programming, Procurement, and Fiscal Management of Human Resources.

In Mexico, the Technical Information Committee was created under the regulations for the Federal Budget and Fiscal Responsibility Law. It comprises the deputy general managers (or above) in the Ministry of Finance and Public Credit and the Ministry of Public Administration and is responsible for harmonizing the system's information requirements and streamlining information flows.

Given that responsibility for FMIS projects tends to be diluted across several departments, these types of coordination arrangements should be used to strengthen and institutionalize FMIS projects in the region, promoting consensus building and decisions that are both swift and sustainable over time.

4.2.4 Incentives for FMIS Adoption and Use

A third political economy issue that needs to be considered is the existence of incentives for the different stakeholders in the public sector to adopt the FMIS as a management tool. Projects are strengthened by the existence of broader management improvement tools—promoted by the Ministry of Finance itself—that include use of the FMIS as a component.

FMIS implementation involves intensive fieldwork, with substantial efforts and resources required of the sector ministries and project team, and this usually generates strong resistance to change. In light of this, incentives for stakeholders to alter their behavior can be used as tools to help ensure the success of FMIS projects (e.g., the Management Improvement Program implemented in Chile).

4.2.5 Genuine Reform Efforts

It is important to understand the material changes promoted through these projects. Recent studies indicate that many countries seek to give the appearance of having reformed public financial management by adopting a range of short-term signals. The latter are unsustainable over the long term, however, as they are not tailored to the context in each country and do not ultimately represent a realistic set of solutions and change (Andrews, 2013). Andrews calls this phenomenon “institutional isomorphism,” drawing on the concept of isomorphism in biology, in which some animals seek to look like others to protect themselves in the natural environment. Similarly, it is common for some governments to wish to appear to have adopted best international PFM practices to obtain support and credibility in the short term.

Through an analysis of the quality of PFM in more than 100 countries (using independent assessments based on the public expenditure and financial accountability methodology), Andrews identifies another important issue: that reforms are often designed solely at the central level (finance ministries) and are often not implemented because they fail to involve users and systems located in other sectors.

Under the State Financial Information System 2.0 (Sistema para la Información Financiera del Estado, or SIGFE 2.0) project in Chile, a User Committee was created to serve as a channel for end users of the system to participate in the project. This experience helped minimize somewhat the problem of systems that only meet the needs of central public finance bodies.

As FMIS are systems that are constantly being refined, the creation of user committees should be considered due to their effectiveness, even where the FMIS is already operating.

4.2.6 Institutional Arrangements that Work

The experience of the Economic Commission for Latin America and the Caribbean with interagency projects in the region provides an indication of which institutional arrangements work and which ones do not.

T A B L E 4.1

What Works and What Does Not	
What works	What does not
Using existing institutional arrangements (as it takes time to establish new spaces).	Working without the support of senior government officials. Without support, there is no commitment.
Institutional leadership: an institution can encourage the cooperation of other institutions.	A lead institution that works alone.
Including key stakeholders from the very beginning and establishing work groups.	Failing to include future users of the system.
Having a work plan.	Working without interagency coordination.
Developing clear agreements and functions, with defined responsibilities.	
Disseminating and publicizing progress to key stakeholders and work groups, with a view to obtaining feedback.	Creating one-off outputs (without developing institutional capacity).

Source: Carvajal (2017).

4.3 Treasury Single Account

4.3.1 Definitions

The creation of a TSA is one of the main frameworks for modernizing public financial management. From a cash management perspective, concentrating all public funds into a TSA in a government bank is important for allowing the treasury and the ministry of economy/finance to manage large inactive balances in government accounts, which is generally difficult to control when these balances lie in commercial bank accounts.

Establishing a TSA is an essential step toward modern treasury management. It enables the management of public funds to be centralized and consolidated. It also acts as a catalyst and facilitator for cash management reform by transforming treasuries and allowing them to go beyond their traditional payment role to perform the functions of a modern financial manager, adopting efficient planning, forecasting, financing, and financial investment mechanisms, as well as actively managing cash resources (Yaker, Albuquerque, and Vargas, 2015). The TSA consists of a set of systems, processes, and rules applicable to a government’s PFM.

4.3.2 TSA Arrangements

According to Hashim, Farook, and Piatti-Fünfkirchen (2020), there are three models of TSA: (i) centralized, (ii) decentralized, and (iii) shared services (in reality, a decentralized submodel).

In the centralized model, the TSA is maintained at the central bank (or other government bank) and all payments are made through this account. The treasury-based FMIS deployment is best suited to these arrangements and is the model most frequently used in LAC.

According to the authors, TSA design under the decentralized model consists of the main account of the government and subaccounts for spending units. These accounts are linked in a hierarchical manner. The subaccounts may be either ledger accounts or discrete operational bank accounts. If the subaccounts are in the central bank, they may be ledger accounts linked to the main account. The aggregate balances in these accounts constitute the balance of the TSA, or the accounts are netted daily in the TSA.

4.3.3 TSA Design

Fainboim and Pattanayak (2011) propose that at least four key issues should be addressed in designing a TSA system: (i) coverage of the TSA, (ii) the government bank account structure in both the central bank and the commercial banks, (iii) the transaction processing arrangements and associated cash flows, and (iv) the roles of the central and commercial banks in managing the TSA and providing banking services.

Yaker, Albuquerque, and Vargas (2015) add two additional key characteristics: the fungibility of government resources available to the national treasury (i.e., the ability to temporarily use the resources of other entities while they are not required by those entities) and the possibility of temporarily using the resources not included in the TSA (e.g., by borrowing them).

4.3.4 Payment Arrangements with Commercial Banks

In the centralized TSA model, transfers and payments are channeled to beneficiary accounts held at commercial banks—a method similar to business payments. In the decentralized model, however, other contractual arrangements are required with the commercial banks to address the specific features of this model. These arrangements result in specific adaptations to the FMIS and the banks' information systems.

Governments currently make extensive use of financial entities, both for collecting taxes and paying beneficiaries. Most countries conduct simultaneous negotiations with financial entities regarding expenditure and tax collection that can lead to greater benefits for the public finances.

The publication by Yaker, Albuquerque, and Vargas (2015) is an important source of information regarding TSAs and their implementation. The Latin American Treasury Forum⁴ also provides mechanisms for cooperation and exchanging experiences that support treasuries in their modernization processes.

⁴For additional information, see <https://www.fotegal.org/>.

4.4 FMIS Sustainability: A New Institutional Solution

For an IFMIS to remain sustainable over time, according to Pimenta and Seco (2019), an adequate flow of financial resources is required for effective maintenance, with support from a technical team paid at market rates. In LAC, however, salaries for public sector IT workers are commonly lower than those of their peers in the private sector. Paying individual consultants with external financing merely serves to postpone the problem, rather than solving it.

One possibility is exploring new institutional solutions, such as creating public financial management agencies with administrative and budgetary autonomy. This is already the case for the region's tax administrations, and it could allow salaries closer to those in the market to be paid to technology officials, while also fostering more flexible, modern management to tackle the challenges of the new digital economy.

Continuing the trend that began in the 1990s, 65 percent of tax administrations in LAC (11 out of 17) currently have administrative and budgetary autonomy. A similar trend has been seen across the world: among member countries of the Organisation for Economic Co-operation and Development (OECD), 20 tax administrations (59 percent) are autonomous, compared to 14 that are not (Inter-American Centre of Tax Administrations and IDB, 2013).

Another example is in the area of public procurement. In the last 20 years, this area has seen considerable technological and functional progress in LAC, thanks in part to the creation of oversight bodies or units for e-procurement. Currently, a third of these units have administrative and budgetary autonomy (6 out of 18). Additionally, of the six Latin American countries that rank highest in terms of their public procurement systems (according to the OECD's Methodology for Assessing Procurement Systems), five have autonomy (Chile, Colombia, Ecuador, Paraguay, and Peru). This may indicate that the greater the degree of autonomy, the better the performance.

Creating autonomous agencies allows policy-related PFM activities to be separated out from operational functions, keeping the policy formulation and evaluation component of PFM in the central administration (finance/economy ministries) and operational activities in agencies. This approach is already being used in the area of tax administration and is beginning to take hold in the area of public procurement.

Some examples of PFM agencies in other countries are the Korea Public Finance Information Service (KPFIS), France's Financial Information Technology Agency (l'Agence pour l'informatique financière de l'État, or AIFE), the Federal Data Processing Service (Serviço Federal de Processamento de Dados, or Serpro) in Brazil, and the Società Generale d'Informatica S.p.A (SOGEI) in Italy.⁵

⁵Serpro and SOGEI are public IT companies fully owned by the Brazilian and Italian Ministries of the Economy, respectively; they are also responsible for the countries' tax information systems.

4.5 Ongoing Training

Training provides the foundation for institutional arrangements and should be provided at both the executive and the operational levels (with a focus on the latter). Obtaining the best possible results from an FMIS requires technological knowledge and experience at these levels. However, this type of institutional capacity is limited in LAC, due in part to excessive staff turnover in response to the absence of public service career paths and/or uncompetitive remuneration.

FMIS projects should include a strong training component, in the form of seminars, workshops, and formal courses provided to all project stakeholders. Training should address basic conceptual topics in public finance, including budgeting, accounting, and treasury, as well as the interactions among them. In addition, given that FMIS are dynamic and users need ongoing training, it is important to make online courses available for the main functions. Users can retrain using these courses, significantly reducing the need for in-person training.⁶

4.6 Strengthening the Role of FMIS Users

Experience shows that poorly trained or inexperienced users are the source of serious problems in many FMIS, rather than difficulties directly created by the system itself. These users represent an additional burden for systems, as work cycles often have to be canceled and repeated. They also unintentionally introduce serious errors that others must resolve.

Providing a system access code—password, USB with a digital code, and others.—is a great responsibility for both authorizer and user. Accordingly, there should be formal procedures with defined rules for obtaining, maintaining, and canceling access codes, as well as penalties for unauthorized use. These rules should include formal training that assesses participants (with attainment of a minimum grade) in basic public finance concepts and the area in which they work in the system. In Brazil, for example, the rules for providing access to the different FMIS user categories are published in the Official Journal.⁷

4.7 Other Observations

During the development of an FMIS project, there may be a change in government officials and, therefore, in the chain of command. Project managers should be prepared to react to this and present the objectives of the ongoing PFM modernization to the new authorities, including a status map of project measures and an explanation of how these actions will help them to fulfill their respective government program.

⁶ Brazil's basic FMIS course is one such example: <https://www.escolavirtual.gov.br/curso/212>.

⁷ <http://www.in.gov.br/web/dou/-/instrucao-normativa-n-3-de-9-de-janeiro-de-2020-248563297>.

For example, during the first stage of the Integrated Financial Management Program (Programa de Administración Financiera Integrada, or PAFI) in the Dominican Republic, there was a change in government following the presidential elections in 2004. The informative, persistent work of PAFI management with the new authorities strengthened program actions, allowing them to successfully implement the Financial Management Information System (Sistema de Información de la Gestión Financiera, or SIGEF) and move forward with new proposals.



In this chapter:

- 5.1 Objectives of the Conceptual Model
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Annex 5.1 Sample Process Model, Integration with Subsystems, and the Functional Requirements of an FMIS

FMIS Conceptual Model

Broadly speaking, a conceptual model is a representation of a system, made up of a set of concepts that are used to help people understand or simulate the subject represented by the model. In the case of financial management information systems (FMIS), a conceptual model can be defined as a statement of the objectives, scope, and coverage of the system, together with a general description of the public financial management (PFM) framework, user requirements, the key business processes that the system should support, and an overview of the planned IT architecture. The preparation of a conceptual model, even where implementation of a COTS IT system is planned.¹

5.1 Objectives of the Conceptual Model

A conceptual model is a tool for clarifying and reaching agreement on fundamental issues, such as the objectives of system design, the functional requirements and business processes that the FMIS should support (scope), the public sector entities that it should cover (coverage), and the expected nature and functional scope of the system (functionalities), as well as other critical issues that help to define an FMIS and guide the team responsible for its implementation. The conceptual model is therefore a critical element of a successful FMIS project. There is no single rule regarding the level of detail that should be included; instead, the conceptual model should provide a reasonable understanding of the system, its operations, and the responsibilities within it.

A conceptual design is different from the detailed functional specifications of a system. A conceptual design should be strategic and should indicate, in broad terms, the major functionalities the FMIS is expected to provide. These broad requirements

¹ Commercial Off-the-Shelf (COTS) systems are commercially available, customizable software solutions generally involving the payment of licensing fees.

provide the foundation for developing more detailed specifications of functional requirements.

To provide a robust basis for institutional agreements—a key ingredient for the success of an FMIS—the authorities should include detailed specifications, particularly in the areas covered in this document.

The degree of detail in each component of the conceptual model is a matter of judgment. Including a greater level of detail facilitates institutional understanding and agreement, yet it reduces flexibility should future adjustments be required.

5.2 Importance

In the field of software engineering, the development of a conceptual model is viewed as an essential foundation for the effective implementation of an information system.

Successful examples of FMIS implementation have generally been associated with the development of a clear vision or model for the planned system, as well as the associated budgetary and financial management framework.

5.3 Issues Not Covered by the Conceptual Model

A good conceptual model is a necessary but not sufficient condition for ensuring the success of an FMIS project. There are other important elements that are required but not addressed in this chapter. These include (i) project management arrangements, including the project plan and budget; (ii) reforms to the PFM framework, including institutional changes; (iii) change management; (iv) detailed functional requirements; (v) a detailed description of the IT and communications environment and architecture (including the decision of whether to adopt a centralized system or a decentralized one); (vi) system performance requirements; (vii) a custom-built system or a standard one; (viii) procurement of hardware and software; (ix) the selection of system implementation/integration advisors; (x) coordination with donors and suppliers; (xi) the implementation sequence (pilot program, parallel execution, implementation plans); and (xii) post-implementation review.

5.4 Steering Committee and Stakeholders

The project steering committee is made up of the stakeholders in the FMIS conceptual model, and it is responsible for providing guidance to the team in charge of implementing the model, as well as approving the final document. The following officials should be considered for participation:

- Minister of Finance/Economy (chair)
- Budget Director

- Treasury Director
- Accounting Director
- Director of Internal Control
- Director of Taxation
- Line Minister 1
- Line Minister 2

In addition to these participants, legislators and auditors from the Court of Accounts may also be included, as well as end users of the system.

5.5 Conceptual Model Preparation and Implementation Team

The development of an FMIS conceptual model requires the creation of a high-level implementation team with specific skills, accountable to a steering committee made up of the most senior officials from stakeholder institutions. This committee is responsible for initial approval of the conceptual model document.

5.5.1 Possible Structure of the Conceptual Model Implementation Team²

- **Team leader**
The team leader should have access to the lead minister on the steering committee and other key counterparts where necessary, and should also have the technical, managerial, and political skills needed to build consensus and achieve good results.
- **Project manager**
The project manager has ultimate responsibility for the planning, execution, and monitoring of team activities.
- **Public finance economist**
This team member should have a good understanding of public finance and flexibility in seeking solutions, as well as extensive knowledge of the IMF's Government Finance Statistics and the United Nations Classification of the Functions of Government (COFOG).
- **Certified accountant**
The accountant should be open to the way an economist approaches accounting and public finance, and should have a solid understanding of the chart of accounts, International Public Sector Accounting Standards (IPSAS), International Financial and Reporting Standards (IFRS), and government adaptation of/to these standards.
- **Change management/training expert**
This specialist should be able to visualize the system's impact on institutional arrangements, responsibilities, and relationships, and should be able to work with counterparts to design programs to eliminate knowledge gaps and develop capabilities.

² Some of the functions performed by the implementation team may require more than one specialist.

SPECIALIST IN THE DESIGN OF FMIS CONCEPTUAL MODELS (EXTERNAL CONSULTANT)

This consultancy expedites production of the document by accelerating the dissemination of concepts and alternatives.

In complex or innovative projects, this consultancy may be awarded to a specialized external firm that, in addition to methods for preparing the conceptual model, can offer new insights and proposals for modernizing public financial management. Chapter 2 covers the issue of key consultancies in FMIS projects in detail.

- **IT systems expert**

The IT systems expert should have the skills and experience necessary to develop information systems and architecture, preferably in the area of public finance, and should also have the creativity needed to overcome any obstacles that might emerge in the new system.

- **Logistics expert**

This team member is responsible for organizing resources and meetings, and should therefore have consensus-building skills to support the rest of the team wherever necessary.

5.6 Challenges to Successful Execution

The pressure for something to work as quickly as possible often leads to a rush to develop and implement systems without first articulating a clear vision for the system and the general framework it is intended to support. Underestimating complexities can lead to failures or increased costs and delays in delivering an FMIS.

Weak or absent stakeholder participation can lead to a conceptual model that fails to identify real needs, as reflected in complementary functionalities that remain unplanned, or a need to redo parts of the system. Although flexibility is required during system implementation (enabling adjustments in the conceptual model), projects are more likely to succeed where the initial degree of conceptual consensus is high and maintained over time.

5.7 Document Notation and Structure

There is no single format for the conceptual model document. It generally consists of a text covering all required topics, organized by chapters. Figures can be provided where greater clarity is needed, including the graphical representation of macro processes.

Unified modeling language (UML) diagrams may be used to help describe parts of the conceptual model. Although this format is more precise and clearer for IT experts, it does not meet the requirement of being easily understood by different audiences (mainly non-IT stakeholders). The conceptual model document serves to disseminate the project to stakeholders, users, and related areas of government, as well as strengthening the project, its level of priority, and its sources of government financing.

5.8 Proposed Content of the Conceptual Model Document³

5.8.1 Conceptual and Methodological Aspects of Government Financial Management

Definitions are provided for the conceptual and methodological factors that guide government financial management. The following example is taken from the conceptual model for the Dominican Republic's Financial Management Information System (SIGEF):

Financial management is defined as the set of systems, bodies, regulations, and procedures that are involved in collecting public revenue and in making use of this revenue to accomplish the objectives of the State. It shall be governed by the principles of legality, efficiency, solvency, transparency, responsibility, fiscal balance, and macroeconomic coordination. The basic financial management systems are budget, public debt, treasury, and accounting, each of which shall be attached to the Ministry of Finance and shall act under the coordination of central agencies.

A financial management model is integrated where the systems and units that comprise it act in a fully interrelated manner under the direction of a single coordinating entity that has sufficient powers to regulate their operation, and when the set of principles, rules, and procedures applicable to the system are coherent and enable automatic coordination of its activities.

Integrated financial management systems are information systems that support public sector budgetary, financial, and accounting management with a view to improving the management of public finances, with single, timely recording of revenue and expenditure operations by the different areas of the government administration, enabling process integration, payments, and generation of the associated financial statements.

The system comprises the following subsystems: budget, accounting, treasury, public debt, and internal control (adapt to each context). All of these incorporate their own internal controls and are responsible for recording, processing, and submitting information on the execution of public financial resources.

³There is no standard format for the conceptual model document. The structure presented here is intended as a non-exhaustive example.

Consistent with the foregoing, the objectives of financial management systems are as follows:

- *Support the process of revenue collection through the use of methods that allow institutions to link planning and budgeting.*
- *Administer public revenue with a view to ensuring that fiscal policy objectives in particular and those of economic policy in general are met.*
- *Support the economy, efficiency, and effectiveness of operational management, including budget programming and execution, public sector payments, and treasury cash management.*
- *Generate reliable, timely information for decision making, including accounting and other financial information.*
- *Ensure absolute transparency of the public accounts.*
- *Cooperate to fight corruption and ensure public entities are held responsible.*
- *Connect administrative and control systems with a view to enhancing their effectiveness.*

Most FMIS in Latin American and Caribbean (LAC) countries are based on regulatory centralization and operational decentralization. These principles should be made explicit in the conceptual model, as in the following example (taken from the Dominican Republic's SIGEF conceptual model):

The proposed conceptual design seeks to achieve the integration of subsystems based on the principle of regulatory centralization and operational decentralization, in which the issuance of rules and methodologies is concentrated and operational or management functions are deconcentrated. To ensure successful application of this principle, it is important for the functions and responsibilities of central agencies and other entities to be clearly delineated, avoiding situations of co-management or co-administration that sometimes arise.

In concrete terms, centralizing means:

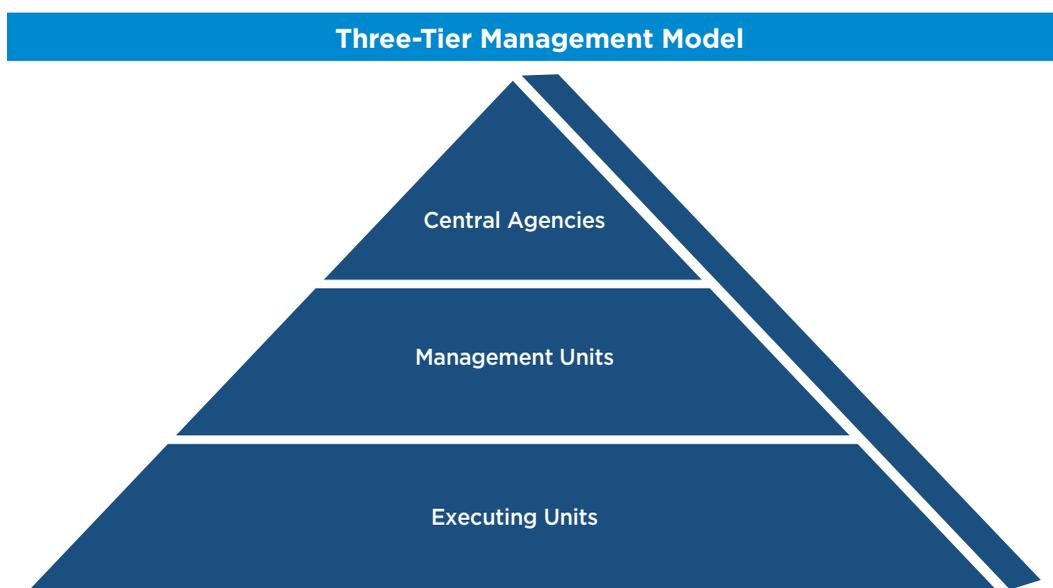
- *Establishing general policies that govern the operations of each specialized subsystem.*
- *Preparing and supervising the application of general and common rules, methodologies, and procedures that regulate system operation (notwithstanding any adaptations that must be made due to the specific characteristics of some public bodies).*
- *Administering basic system-related information.*
- *Assessing compliance with policies.*

Operational decentralization involves building administrative capacity in public institutions so that they can efficiently execute their objectives, participate in budget programming and execution, order payments, and report all financial activity.

5.8.2 Management Model

This section describes the management model for public financial management. The management model in LAC countries tends to be made up of three tiers, as shown in Figure 5.1.

FIGURE 5.1



Source: Authors' elaboration.

The responsibilities of each of the tiers should be clearly described, as shown in the following example (adapted from the conceptual model for the Dominican Republic's SIGEF):

Central (upper) tier

This level comprises central agencies that are responsible for issuing the rules and instructions that govern operation of the system, in addition to supervising compliance with these rules. They are also responsible for preparing policy proposals for approval by the appropriate levels of authority, supervising policies, and centralizing fiscal and financial management information.

Units belonging to this upper level are known as "central agencies."

Actions emanating from these offices are applicable to public institutions. In a number of specific areas, these units are authorized to execute expenditure execution transactions on behalf of third parties; these cases generally involve national treasuries and public debt directorates.

Management (intermediate) tier

The intermediate level comprises government ministries or budget chapters. A Management Unit or Financial Management Services Unit will be created in

each of these, comprising the budget, planning, internal control, and general administrative units.

These institutions' functions are focused essentially on complying with the policies, rules, and processes established by the central agencies; verifying compliance with the internal control rules issued by the appropriate body; ensuring and verifying compliance with institutional policies; and providing support to program executing units in procuring inputs. In some cases, these units have the same responsibilities as executing (or basic level) units in terms of their own budget process.

These actions are brought together in consolidated program requests to the central agencies, which are then entered into the system through a coordination mechanism linked directly to the manager's office.

This office will also intermediate between the central agencies and the institution concerned for both operational and functional administrative processes. The structure of the coordination mechanism should be based on the institution's own organizational structure, as decided by its director. Units belonging to the intermediate level are known as "management units."

Executing (basic) tier

This level encompasses programs and their activities in the field. These units are responsible for executing the budget—in other words, for the decision to request inputs from the management units in the quantities, quality, and time frames necessary to achieve programmed targets.

This level also initiates the processes of planning, formulation, and programming of financial execution of the budget by obtaining the necessary resources.

All of this information is permanently available for the exclusive access of the management unit, which in turn consolidates it and submits it to the upper level. Units belonging to the basic level are known as "executing units."

In light of the foregoing, the basic functions of the executing units are as follows:

- *Formulating budget submissions.*
- *Formulating periodic programs for the execution of commitments, accrued expenses, and payments.*
- *Requesting budget modifications.*
- *Submitting requests for the procurement of goods and services.*
- *Recording the production of goods and services under the responsibility of the respective unit.*

These functions entail entering the associated information in the database. The executing units are also responsible for performing the relevant consultations.

It is advisable to establish which bodies will perform the central, management, and executing roles.

Coverage

System coverage must be determined. For example:

Coverage of the FMIS will extend to those bodies included in the National Budget (central government and decentralized bodies), the legislative branch, and the judicial branch. In addition, the possibility should be considered of extending the accounting module to the general government by adding Banco de Previsión Social and departmental governments to the aforementioned bodies.

Greater system coverage generally leads to better results: costs are reduced by avoiding the excessive proliferation of systems, PFM-related processes can be better integrated, and greater coverage of the treasury single account (TSA) is enabled.⁴

5.8.3 Conceptual Design Of the System (Functional)

This section addresses the processes of each of the central agencies for the subsystems that make up an FMIS, in terms of their definition, functions, characteristics, and rationales. It also indicates the data recording centers involved, the most significant information produced by them, and the points of integration with other PFM systems. The objective should be to identify all of the necessary functionalities and relevant processes that allow each of the subsystems to achieve their objectives.

Where the conceptual model is concerned, functional requirements can be established at the macro level, with detailed specifications left until a later stage, when the functional requirements for developing the FMIS are defined. Before detailed functional specifications are developed, processes must be described in detail. Some conceptual models already include this detail, avoiding the need for a subsequent stage for this activity.

Annex 7.5 (Chapter 7) provides a sample set of functional requirements that are typical of a modern FMIS, together with the associated processes.

The main PFM subsystems (or modules) are as follows: (i) budget subsystem/module, (ii) treasury subsystem/module, (iii) public debt subsystem/module, (iv) accounting subsystem/module, and (v) internal control subsystem/module.

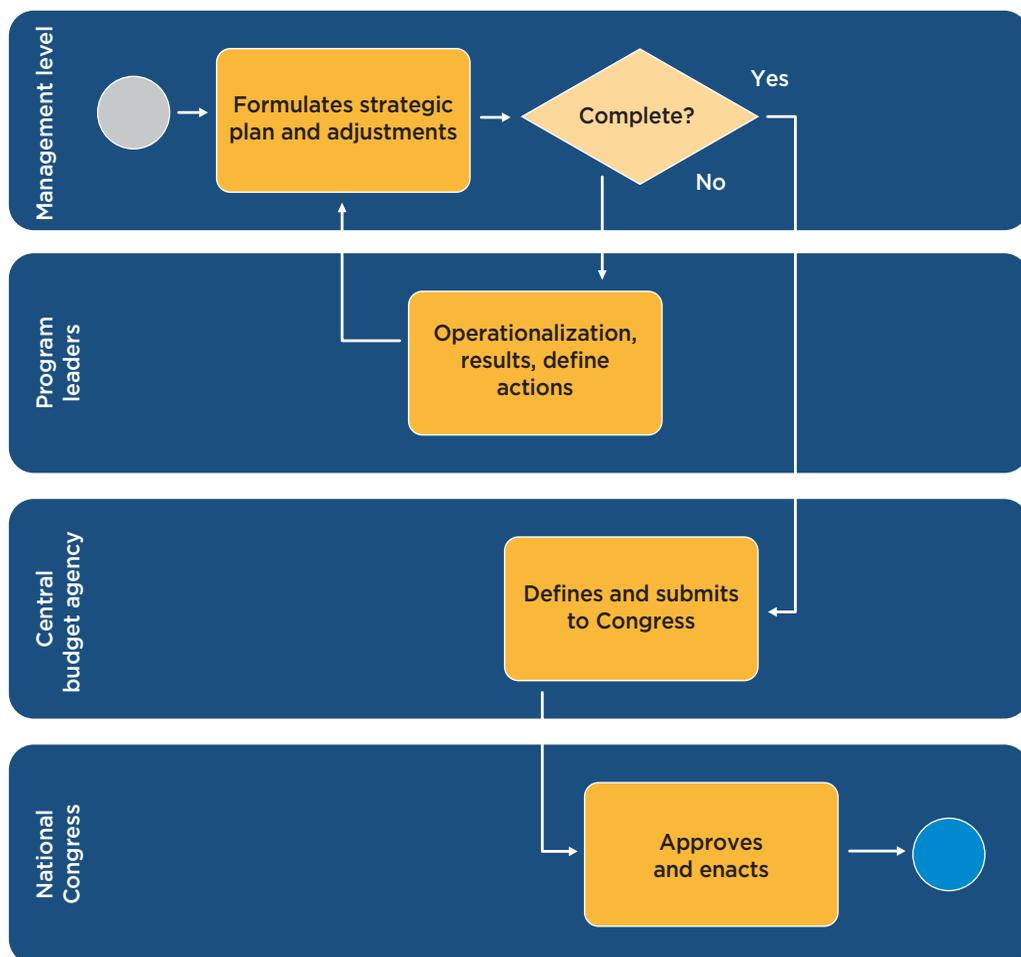
Processes

Business Process Model and Notation (BPMN) 2.0 can be used to model processes, with the support of IT tools such as Bizagi, Aris, etc. (Figure 5.2).

⁴ The TSA is a single bank account or set of linked bank and subaccounts that allow the treasury to process collections and payments in a centralized manner (Fainboim and Pattanayak, 2011).

FIGURE 5.2

Sample BPMN 2.0 Diagram of a Simplified Process



Source: Authors' elaboration.

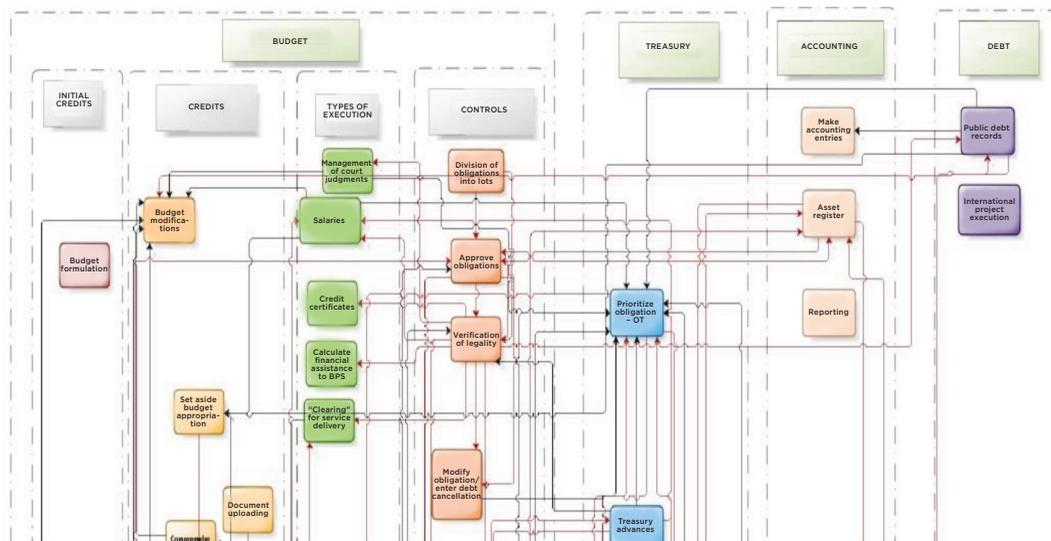
The description of the process should preferably be as detailed as possible. Otherwise, this activity should be carried out in a subsequent stage.

Another document that can be included is a process map with a systems approach, which places the specified process models in their respective modules and indicates the precedence and invocation relationships between them using connecting arrows. It also indicates the outputs of each process and the objective supported by each output. The result is a graphical representation of the interdependent relationships between all of a system's processes, outputs, and objectives (Figure 5.3).

Annex 5.1 provides an indicative list of typical processes in an FMIS, including the process and system module integration map and the linkages between processes and functional requirements.

FIGURE 5.3

Process Map: Systems Approach (Partial View)



Source: SIIF2, Uruguay.

Description of Subsystems

The features of each subsystem should be described, covering the following aspects: (i) general description, (ii) definition and objectives, (iii) processes, (iv) data recording centers,⁵ (v) the information produced (including reports), and (vi) points of integration with other subsystems. Processes and associated diagrams may be presented in a separate annex.

Annex 7.5 (Chapter 7) provides a number of suggestions regarding key issues that should be considered when designing a modern FMIS.

Document Status

The following is a sample description of the different statuses and general rules for system documents, based on Uruguay’s Integrated Financial Information System (SIIF) 2.

Draft: *Initial status in which the transaction entry has begun but has not yet been verified. Draft transactions can be deleted (completely removed from the system).*

⁵ Data recording centers are the administrative units authorized to enter data into the system. These centers should be as close as possible to the locations in which the transactions occur.

Verified: *Status in which a transaction has been finalized. Where a budget appropriation is involved, the amount associated with the appropriation is set aside. Verified transactions may be rejected, in which case the amount set aside for the transaction is released.*

Confirmed: *Final status of accounting entries, commitments, income statements and Treasury operations, prioritizations, and payments. This status signifies that the transaction has been approved at the appropriate level. An approved transaction may not be deleted from the system. To modify an approved transaction, an adjustment transaction must be generated and submitted to the appropriate approval process.*

Approved: *Final status of obligations (execution of expenditures). This status signifies that the transaction has been approved by the central accounting authority.*

Suspended: *An additional status indicating that the control body has intervened.*

Reconciled: *Final status of the income statement document. This status signifies that reconciliation has been performed at the appropriate level.*

Expired: *An obligation's status is changed to expired after the legal time period has come to an end without any payment being issued, extinguishing the debt and reducing available funds.*

Settled: *Payment status that indicates payment has been accepted by the agent bank.*

Placed or reconciled: *Applicable to settled payments that have been reconciled.*

Transactions with a definitive status can only be adjusted by means of modification transactions (in relation to the original documents); these must undergo the same validation process as the original transaction. The simultaneous existence of modifications in generated status is not permitted. For a transaction to be readjusted, all previous adjustments must have been approved.

Legal/Regulatory Framework

Legal and regulatory requirements relating to the budget management framework must be analyzed and described in the conceptual model in order to ensure that the FMIS is capable of supporting the relevant requirements. Chapter 3 addresses this topic in greater detail.

Institutional Arrangements

The organizational charts of stakeholder institutions, including their internal regulations, should be assessed to ensure that they are suited to the management model

established for the FMIS. There is generally a need to create institutions and/or redefine functions coordinated with the management model. Chapter 4 addresses this topic in greater detail.

Classifiers

All of the classifiers to be used in the system should be stated, including their structure, description, and relationships. The classifiers should have a structure that is balanced, flexible (number of elements per level), and variable (allowing modifications) and they should be traceable (i.e., modifications should be traceable over time).

Some examples of primary classifiers are institution, object of expenditure, resources, financing, program area, programs, projects, type of credit, currency, and chart of accounts. With the exception of the program area and the chart of accounts, budget lines or codes are drawn from these classifiers. Integration between the budget and accounting classifications is essential for an FMIS to meet its objectives and must be achieved using a conversion matrix.

The timing of each accounting entry should be stipulated, to ensure that the interface between the modules is maintained. This timing is determined in the processes included in the diagram, giving rise to accounting practices consistent with the definitions included in accounting records and the conversion matrix (e.g., approved credits, commitments, accruals, recognition of assets, etc.).

The analysis used to determine business rules for the budget and accounting execution process should focus on business rules relating to the process of automatic integration of the financial and accounting cycle (budget/accounting/treasury/public debt) that governs public financial management, stipulating whether accruals-based⁶ or cash-basis⁷ accounting is to be used for expenditure and revenue. In a February 2020 report, the International Federation of Accountants (IFAC) and the Association of Chartered Certified Accountants (ACC) stated that the benefits of accruals-based accounting include transparency, accountability, fiscal credibility, and the production of useful information for decision-making. Forty percent of countries surveyed by the two bodies plan to migrate to accruals-based accounting by 2023.

The conceptual design of the accounting framework often receives insufficient attention. The choice of accounting basis, other key accounting policies and principles, and the structure of the general ledger and the chart of accounts can have a large impact on the configuration and usefulness of an FMIS; accordingly, they should be included in the conceptual model.

Reporting

Reports are critical outputs of the FMIS, and the most important ones should be stipulated. These are separated into groups for illustrative purposes (taken from Uruguay's SIIF2).

⁶ Revenues and expenditures are recorded when they are incurred.

⁷ Revenues and expenditures are recorded when payments are received or made.

- *Search report: Relates to the transaction system. Provides a list of the main system entities based on a set of predefined filters. Target users are all those using the transactional system to record information or audit recorded information.*
- *Operations report: Relates to the operations of an executing unit. Provides more disaggregated information than searches. Target users are those responsible for executing units and operations staff within the executing units.*
- *Analytical report: Shows information at the subclassification level or for all institutions covered by the SIIF2; provides more disaggregated information than operations reports. Target users are staff with a tactical or strategic profile who have analytical responsibility for specific subclassifications (or all of them).*
- *Strategic report: Shows information by area of coverage. Provides information in the form of indicators and graphs that allow monitoring of the main management and government objectives. Target users are staff with a strategic profile who have analytical responsibility for the central government. One should bear in mind that the FMIS will be the data source for existing or future business intelligence tools, thus extending strategic reports.*

Annex 7.5 (Chapter 7) provides a number of recommendations relating to essential FMIS reports.

5.8.4 Related Systems

Interfaces or points of contact determine relationships with other systems used to administer real resources (known as related systems). These systems must be identified and described, with emphasis on points of contact and the information exchanged. The main examples of related systems are (i) the tax administration system, (ii) the human resources system (payroll and other functions), (iii) the procurement system, (iv) the public investment system, and (v) the asset management system.

Interoperability or the interface between these systems and the FMIS should ideally occur online, using the technology tools agreed by the parties. The use of standard technology tools, such as Application Programming Interface (API) and Enterprise Service Bus (ESB), is recommended. These tools are described in other chapters of this document. The interoperability tools used will be the same as those stipulated for the required interfaces with the central bank (TSA), together with any others that may be necessary.

Another option could be to completely merge all of these functionalities into a single enterprise resource planning (ERP) system. This is more commonly the case in private sector companies. Interoperability with other systems should be ensured.

5.8.5 Conceptualization of the IT System

The conceptual view of the IT system must be described together with the macro requirements for the system's IT architecture vis-à-vis the conceptual design of the functional system.

General Features

In this case, the general conditions for system operations are described. An example of the general provisions that an FMIS conceptual model should include is the conceptual model for the Dominican Republic's SIGEF, as follows:

The information managed by the FMIS is critical for public administration, and it is the responsibility of the IT sector to use appropriate technologies and procedures for maximizing its availability to authorized users, as well as maintaining its integrity and protecting it from equipment or infrastructure failures.

FMIS data will be stored in a central database, and any data entry or alteration may be performed just once by users with the proper authorization. None of the data entered will be physically deleted from the database, and only logical deletions will be performed. All transactions will be recorded in an audit file.

Operational decentralization of the FMIS requires that the system be accessed from different geographical locations in the country. To this end, a network architecture will be established that allows the use of the most commonly available communication media in the country, such as the internet.

The security system is essential for the effective use of the computer application. Technological solutions should therefore be employed to minimize the likelihood of unauthorized access and detect attempts to circumvent transaction security and monitoring (audit) mechanisms. In this context, the computer center (or cloud solution) must have satisfactory physical security infrastructure. Combined with the design and implementation of a security policy, this will ensure a comprehensive approach to this issue.

The software and hardware to be procured should have mission-critical characteristics, with the redundancies and recovery mechanisms considered appropriate. In the event that cloud solutions are adopted, contracted services should have the same characteristics.

The IT solution to be adopted should be compatible with market trends, with sufficient resources to support at least five years of operation of the system as a whole, as well as scalability for horizontal and vertical growth (this paragraph should be adapted where cloud services are contracted).

IT System Architecture

This involves a general overview of the planned IT architecture. Detailed technological descriptions are not provided at this stage; this allows decisions regarding the specification and contracting of the most appropriate solutions and technologies to be made during those phases of the system. Where COTS systems or cloud solutions are procured, the system concerned should be supportive of the conditions described in this subsection.

The following is an example of general IT system architecture provisions.

- *Layer 1: Consists of the display of information and the first level of security. Performs traffic optimization, load balancing, firewall, and presentation server functions.*

- *Layer 2: Relates to the application and involves implementation of the application logic – business rules and optimization of the use of applications between all SIGEF users. Also controls security of access to transactions.*
- *Layer 3: Relates to system data storage and access (database).*

A classification may be stipulated for the data center that will support the FMIS (whether in-house or outsourced), based on international standards (e.g., TIER 3). Hosting the FMIS in the cloud may be an appropriate solution, particularly in the case of subnational or smaller national financial administrations. A need to provide infrastructure redundancy may also be stipulated, as well as a contingency plan to ensure that the system can be used in the event of adverse or even catastrophic events.

Project cost will be highly influenced by the specified level of redundancy and contingency. At this stage, it would be advisable to have a clearer idea regarding these types of needs, but if issues of cost are left aside, the tendency will be to seek as high a level as possible. In this case, one can indicate that duly costed redundancy and contingency plans will need to be prepared and approved by the institution. Although FMIS are mainly operated using on-premises data centers, it is worth evaluating the merits of cloud services for contingency and redundancy plans.

Consistent with current trends, the IT system should have a loosely coupled architecture⁸ and should be scalable and adaptable to change, technology-agnostic,⁹ and based on Enterprise Service Bus, microservices, or similar. One possible strategy during procurement of the system may be to leave open the type of architecture to be adopted. To that end, a reference architecture may be proposed. A fixed architecture describes exactly what is sought, but the contractor loses the ability to propose an improved approach. A reference architecture gives the contractor the chance to propose a more suitable final architecture that can be negotiated with the institution (e.g., a mix of custom-made and COTS systems, technological interconnection structures, etc.) (Figure 5.4).

Any requirement regarding the type of system to be implemented (commercial customizable or custom made) should be specified. Otherwise, the decision regarding non-functional specifications can be postponed. The downside of this is that evaluating these types of competitions can be more complex or subject to complaints due to different understandings of the reference architecture.

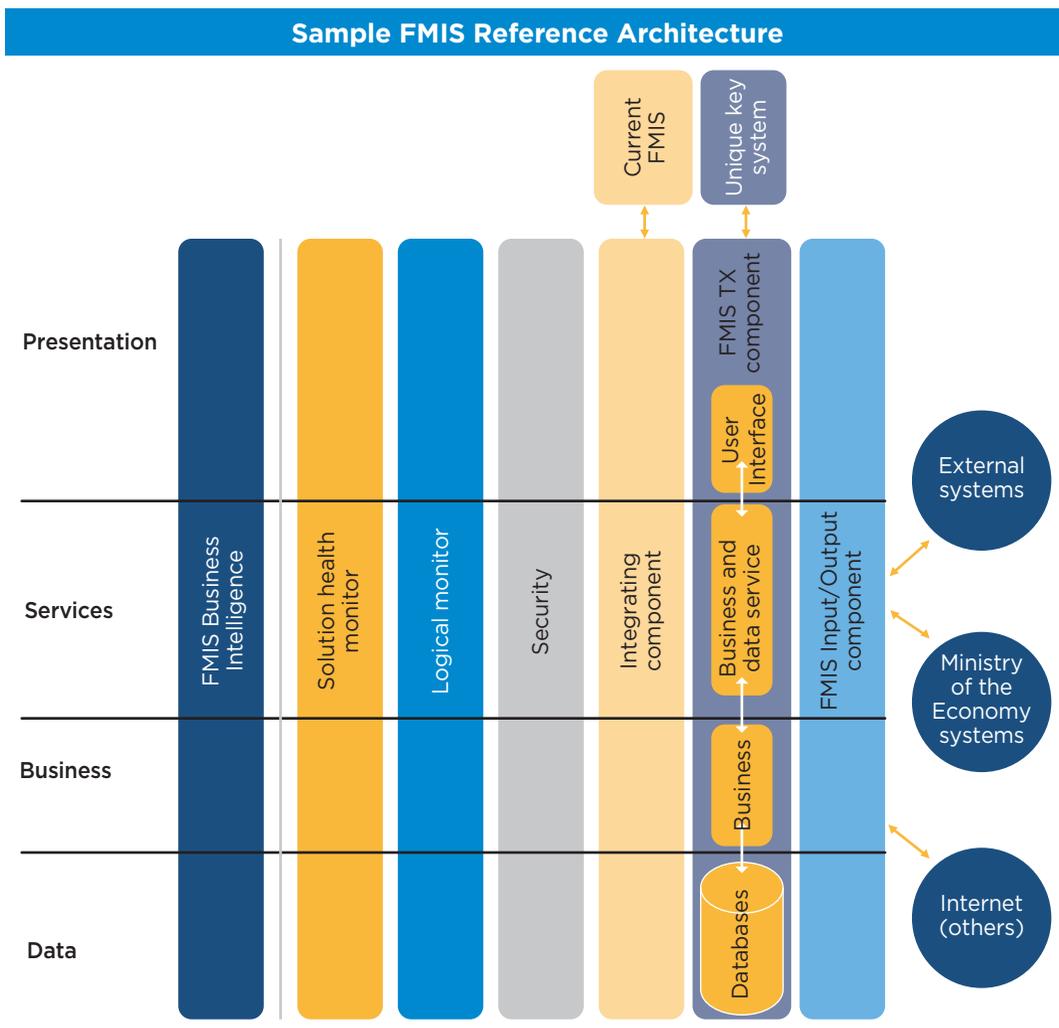
Network Architecture

The types of networks to be used or built should be mentioned and accompanied by a diagram, wherever possible. The internet is currently used as the main access network for users where remote access is required and available. However, reference may also be made to

⁸ In computing and systems design, a loosely coupled system is one in which each of its components has, or makes use of, little or no knowledge of the definitions of other separate components. Sub-areas include the coupling of classes, interfaces, data, and services.

⁹ The system does not depend on any specific technology.

FIGURE 5.4



Source: Adapted from SIIF2, Uruguay.

existing government data networks or point-to-point network connections to be contracted, as well as the more stringent connection requirements of certain bodies or institutions.

Security Policy

Security is generally a key issue in FMIS. The conceptual model should establish general security rules. The following example is adapted from the conceptual model for the Dominican Republic’s SIGEF:

The security policy for the FMIS will observe the recommendations of ISO standard 17799 (identify other standards to be applied), and the management

and technical staff of the central agencies will participate in determining and formulating the policy. The security policy should address, among other things, issues of organizational, individual, and physical and environmental security; operations and communications management; access control; systems development and maintenance; and business continuity management. An FMIS security manager will be required to implement and maintain the policy.

In addition, applying this security policy in the central FMIS environment will give rise to a set of recommendations that will be sent to institutions participating in the system to be duly implemented. The FMIS security policy may also be adopted by these institutions as a preliminary framework for developing their own security policies.

This general outline of security requirements also applies to the use of cloud services, in which case implementation should be agreed with providers.

5.8.6 Migration Plan

Where a new FMIS is intended to replace an existing system, a migration plan needs to be developed using one of the following alternatives:

- “Big bang implementation”:¹⁰ This is high risk, but deployment is swift, and costs are low. The cost of returning to the previous system, if necessary, is high.
- Phased implementation:¹¹ This is associated with a medium level of risk. Deployment is iterative and incremental, and costs are medium.
- Parallel implementation:¹² This is low risk. Implementation is slow and costs are high.

Implementation is normally phased, as shown in Figure 5.5.

One of the main characteristics of phased implementation is the need to create temporary interfaces between the new system and the remaining parts of the legacy system. These interfaces can be complex and have no long-term value as they are abandoned as soon as the new system is complete. The IT architecture should allow for these interfaces. Migration is a key stage for success and should be planned in detail and agreed with all stakeholders.

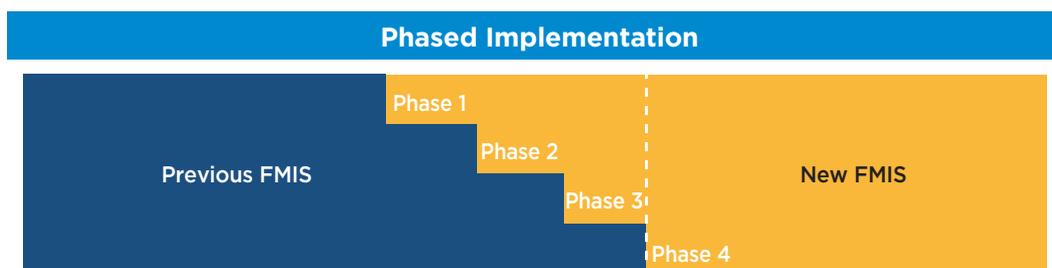
Some countries may propose FMIS deployment midyear, generating the budget in both systems (new and legacy) and designing backup plans and procedures in case of failure or and poor performance of the new system.

¹⁰ “Big bang is a hardware or software migration method that involves abandoning the existing system and transferring all users to the new system simultaneously.

¹¹ Phased refers to the fact that components of the old system are progressively replaced until the new system is completed.

¹² Parallel refers to a situation in which both the old and the new systems continue to operate simultaneously until the authorities are sufficiently confident that the old system can be eliminated.

FIGURE 5.5



Source: Authors' elaboration.

5.8.7 Implementation Strategy

Implementation is mostly carried out in sequential stages (although some stages can be carried out simultaneously). The following is an example:

First stage: design

This stage is executed jointly by the FMIS project team and the central agencies. It consists of the following tasks:

- Design of the basic conceptual model (essential), as described in this chapter.
- Preparation of detailed functional and nonfunctional requirements.
- Preparation of the rules and regulations governing use of the system.
- Preparation of the transition plan from the previous system to the new one (where necessary).
- Preparation of operating manuals.
- Definition of the IT architecture and strategy.
- Development of the IT system.
- System technical documentation.
- Operating or user manuals.
- Training of instructors for system training.

Second stage: deployment

In the institutions:

A two-stage institutional deployment strategy is recommended.

- First phase: deployment of the system in the institutions' central management units.
- Second phase: introduction of the system in the main executing agencies, i.e., those responsible for executing most of the budget.

The main activities to be performed at this level are as follows:

- Formation of launch teams in each institution, responsible for system deployment. Teams should consist of:
 - A leader who has the support of decisionmakers within the organization and who can establish leadership and support networks and help to create an interdisciplinary team.
 - Members responsible for each administrative area (budget, accounting, treasury, administration, internal control, and IT), with the aim of ensuring that the modernization process is internalized.
- State-of-the-art training of at least one user, with a view to ensuring that the lower levels of the institution are trained.
- Training of the launch team.
- Training of users in the different institutions.
- Technology transfer (where development is outsourced).
- Pilot testing and verification of the system.
- General deployment.
- Technical assistance during the deployment process.

In the central agencies:

While implementation is occurring in the institutional management units, the respective modules should be simultaneously implemented in the central agencies. Until the system has been implemented in all of the institutions, deployment in the central agencies should observe the organizational criterion indicated below. The procedures to be adopted in all foreseeable situations must be described in detail. The deployment process should be described in detail in a specific document.

Third stage: support and maintenance

This final stage relates solely to the lead central agency responsible for the system.¹³ This unit will be in charge of administering the information system and providing technical support to all participating bodies. It will also be responsible for consolidating requirements for proposed adjustments to the system in terms of the execution of revenue and expenditure.

5.9 Final Observations

This chapter has provided a general overview of the conceptual model document for an FMIS. It is not the only model that may be used, however. When designing a conceptual model, it is recommended that in addition to this overview, similar documents from other countries be reviewed to determine the desired scope and level of detail. At the same time, the best practices for modern FMIS summarized here should be judged against planned objectives and the level of maturity of local PFM.

¹³ Depending on how FMIS leadership structures are designed, this may be a management committee.

ANNEX 5.1

SAMPLE PROCESS MODEL, INTEGRATION WITH SUBSYSTEMS, AND FUNCTIONAL REQUIREMENTS IN AN FMIS¹⁴

Processes

The technical documentation includes all business processes using BPMN 2.0 notation and the process map based on a systems approach. The process map with a systems approach places the specified process models in their respective modules, indicating, through the use of connecting arrows, the precedence and invocation relationships between them.

It also stipulates the outputs of each process and indicates the objective supported by each output. The result is a graphical representation of the interdependent relationships between all of the system's processes, outputs, and objectives.

a. Identified Business Processes

The functional analysis has identified 41 processes that comprise the business process model. Table A5.1.1 briefly describes each of these.

b. Integration of Business Processes and System Modules

Although each process is identified in a module, system integration means that processes are crosscutting across several modules. Table A5.1.2 shows a diagram linking each process to the primary module (X) and the secondary modules (O). The last column indicates the process tasks that are executed in the secondary modules.

c. Integration of Business Processes and Functional Requirements

To aid comprehension, Table A5.1.3 sets out each specific requirement and its relationship to the different processes.

¹⁴ Adapted from SIIF2, Uruguay.

T A B L E A 5 . 1 . 1

Processes Comprising the Business Process Model	
“Budget” Module	
Budget formulation	Recording in the system of the different instances of approval of the five-year budget laws and annual budget reports and costs, as well as the opening of initial credits for each accounting period approved in the formulation process.
Budget modifications	Recording of modifications, allocations, and updates of appropriations, which allows the execution of expenditure.
Reservation	Process by which a user enters or modifies an appropriation (an amount reserved at the beginning of the budget execution period) for the current accounting period.
Commitment	Once the appropriation has been reserved and an order or contract awarded, this is recorded in the system and the corresponding commitments are generated. Encompasses reservations and commitments for the entire period of the contract, generating documents for commitments over the five-year budget period and storing any information that exceeds this.
Entering documentation	Recording commercial documents issued to the entity for the procurement of goods and services.
Obligation	Record of the obligation budget stage, with expenditure executed at the point at which it is accrued.
Restoration	Process by which credits that have been obligated, committed, and reserved within the accounting period are released, generating the corresponding statement of revenue for subsequent deposit to the treasury accounts.
Division of obligations into lots	Process by which verified obligations are selected and consolidated into lots for subsequent approval and intervention.
Approval of obligation	Approval of the documents from the approval stage, in which expenses (or investment) are accrued (in both accounting and budgetary terms). Includes the generation of receipts for taxes withheld and submission of this information to the tax authorities.
Review of legality	Records intervention by the National Court of Auditors in relation to Treasury obligations and operations. The Court of Auditors performs external control before payment is made.
Modification of obligations and recording of debt cancellation	Allows the obligation document to be modified subject to certain restrictions.
Expired obligations	Termination of a payment obligation once the legal period has expired.
Recording of statement of revenue	Record of revenue, other income, and third-party funds.
Third-party funds	For example, frozen deposits, special grants, guarantees, etc.
Transfers between SIR codes	Recording of transfers of available funds between a source SIR code and a receiving SIR code.
Revenue refund	Refund of revenue, other income, and third-party funds (for the current accounting period and previous ones), generating the corresponding Treasury operation.

(continued on next page)

T A B L E A 5.1.1 (continued)

Processes Comprising the Business Process Model	
“Budget” Module (cont'd)	
Remuneration	Record of the execution of remuneration expenditure in the different subsections.
Procurement, subsidies, and grants	Process by means of which appropriations are executed according to the rules established in the Consolidated Text on Accounting and Financial Administration (TOCAF). Includes procurement procedures: competitive bidding processes, abbreviated competitive bidding processes, single-source selection, and single-source selection by exception financed through the different sources of financing. Also includes the execution of expenditure funded by subsidies and grants.
“Clearing” for service delivery	Monthly procedure by which spending on delivering services (electricity, fuel, communications water, etc.) is recorded, together with the corresponding payment to service providers aimed at offsetting their debts.
Calculating BPS financial assistance	<p>Process for calculating monthly financial assistance to Social Security, automatically generating the obligations corresponding to the assistance provided.</p> <p>The calculation is based on information relating to:</p> <ul style="list-style-type: none"> • Financial assistance, advances (“Treasury advances” process) and reimbursements (“Register EI” process). • Social security-related expenses paid out of general revenue. • Withholding of taxes and the social contributions of institutions included in the national budget.
Credit certificates	Process for recording the issuance, cancellation, modification, and recovery of credit certificates issued by the DGI and BPS to holders of the debt of those institutions.
Management of court judgments	Process for managing court judgments against the state, from the moment a judgment is issued (generating budget execution documents) through to its payment.
Reimbursement of unpaid credits	Records the reimbursement of credits not paid out during the accounting period.
Execution of revolving funds	Records expenditure associated with replenishing or settling revolving funds.
“Accounting” Module	
Recording of assets	Recording of upward and downward movements and/or modifications in assets.
Accounting entries	Entry of non-automatic and monthly transactions.
Bank account reporting	Recording of credits and debits in the bank accounts of executing units, large revenue collectors, and parastatal agencies, and control of the time frames for their submission.
BROU bank reconciliation	Identifies the concepts or transactions in IFIS-registered Treasury bank accounts that are causative of the movements shown in bank statements provided by the BROU, generating the budget and accounting records that are recognized in this format and affecting the respective SIR codes.
Foreign currency	Records the impact of foreign-currency operations on budget allocations and expenditure execution.

(continued on next page)

T A B L E A 5.1.1 (continued)

Processes Comprising the Business Process Model	
“Treasury” Module	
Treasury advances	Record of Treasury advances provided to the different subsections and the reimbursement thereof.
Prioritization of obligations and Treasury operations	Prioritization of the payment of obligations by units and of Treasury operations by units or the National Treasury (as appropriate), based on the financial allocation in the SIPREF.
Payment of obligations and Treasury operations	Executes the payment of obligations and Treasury operations.
Maintenance of beneficiaries and bank accounts	Recording and updating of information on beneficiaries, government suppliers, and their bank accounts.
BPS - DGI certificate status	Loading and updating of BPS and DGI unique Certificate IDs to allow interoperability with their systems.
Revolving funds	Involves the creation and/or expansion of revolving funds provided to executing units, with the corresponding advance by means of a Treasury operation. Also includes the annual calculation and control of maximum authorized amounts, as well as the carry-over of advances to the next accounting period.
“Public Debt” Module	
Recording of public debt	Records public debt operations based on information received from the BCU and loans from domestic banks. Includes all other BCU operations, the sale and purchase of third-party securities, etc.
Execution of international projects	Records operations under international projects to allow specific information to be issued in response to requests from the projects.
General and system support processes	
Maintenance of classifications	Maintenance and updating of the different classifications and tables used by the system.
Return for modification	Generic process that reflects the recovery of a form from the last confirmed activity with a view to its modification.
Close of accounting period	Involves calculating budget allocations at the end of the accounting period with a view to executing the budgetary, accounting, and financial close-out at the end of each accounting period, consistent with the applicable rules.
Close of accounting period	Involves calculating budget allocations at the end of the accounting period with a view to executing the budgetary, accounting, and financial close-out at the end of each accounting period, consistent with the applicable rules.

Source: Adapted from SIIF2, Uruguay.

Notes: IFIS = Integrated Financial Information System

DGI = Dirección General Impositiva (Tax Bureau)

BPS = Banco de Previsión Social (Social Security Bank)

BROU = Banco de la República Oriental del Uruguay (Bank of the Oriental Republic of Uruguay)

SIR = Sistema de interconexión de registros (Registry interconnection system)

SIPREF = Sistema de información presupuestal y financier (Budget and financial information system)

TABLE A 5.1.2

Process Links with the Main Module and the Secondary Modules					
Processes	“Budget” Module	“Treasury” Module	“Accounting” Module	“Public Debt” Module	Rationale for the secondary module
Budget formulation	X (required)				
Budget modifications	X				
Reservation	X				
Commitment	X				
Entering documentation	X				
Obligation	X				
Restoration	X				
Division of obligations into lots	X				
Approval of obligation	X	○ (optional)	○		Generating accounting records Generating/ updating Treasury operation
Review of legality	X				
Modifying obligation and entering debt cancellation	X		○		Generating accounting record
Expired obligations	X		○		Generating accounting record
Recording of statement of revenue	X	○	○		Generating/ modifying accounting record /tasks relating to reconciliation/ updating of most advances Updating of funds availability
Third-party funds	X	○	○		Recording and updating most frozen deposits Generating accounting records Generating/ preparing Treasury operations

(continued on next page)

T A B L E A 5 . 1 . 2 (continued)

Process Links with the Main Module and the Secondary Modules					
Processes	“Budget” Module	“Treasury” Module	“Accounting” Module	“Public Debt” Module	Rationale for the secondary module
Transfers between SIR codes	X				
Revenue refund	X	○	○		Generating accounting records Generating Treasury operations/ updating funds availability
Remuneration	X	○			Prioritization of obligations
Procurement, subsidies, and grants	X		○		Generating accounting records
“Clearing” for service delivery	X	○	○		Generating accounting records Generating/ prioritizing Treasury operations
Calculating BPS financial assistance	X		○		Analyzing and modifying report information
Credit certificates	X				
Management of court judgments	X		○		Generating accounting records
Reimbursement of unpaid credits	X	○			Generating/ confirming/ canceling Treasury operations
Execution of revolving funds	X				
Treasury advances	○	X	○		Generating/ updating most advances Generating accounting records Modification of appropriation
Prioritization of obligations and Treasury operations		X			

(continued on next page)

T A B L E A 5.1.2 (continued)

Process Links with the Main Module and the Secondary Modules					
Processes	“Budget” Module	“Treasury” Module	“Accounting” Module	“Public Debt” Module	Rationale for the secondary module
Payment of obligations and Treasury operations	○	X	○		Generating accounting records / tasks relating to reconciliation of means of payment Generating/ confirming EI/ distributing EI amounts
Maintenance of beneficiaries and bank accounts		X			
BPS - DGI certificate status		X			
Revolving funds	○	X			Revolving funds, opening balance
Recording of assets			X		
Accounting entries			X		
Bank account reporting		○	X		Entry of monthly balance
Bank reconciliation	○	○	X		Generating EI/ reservation/ commitment/ obligation Updating of funds availability/ interoperability with BROU
Recording of public debt	○	○	○	X	Generating accounting records Generating EI/ reservation/ commitment/ obligation Updating of funds availability
Execution of international projects				X	

(continued on next page)

T A B L E A 5 . 1 . 2 (continued)

Process Links with the Main Module and the Secondary Modules					
Processes	“Budget” Module	“Treasury” Module	“Accounting” Module	“Public Debt” Module	Rationale for the secondary module
Maintenance of classifications	X	X	X	X	
Foreign currency	X		○		Generating accounting records
Return for modification	X	X	X	X	
Close of accounting period	X	X	X	X	
Balance sheets	X		X		

Source: Adapted from SIF2, Uruguay.

TABLE A 5.1.3

Relationship between Requirements and Processes	
Functional Requirements	Processes
Appropriations, Budget and Accountability Acts	Budget formulation
Transfer of budget-related laws to the execution module	Budget formulation
Initial appropriations and modifications of appropriations - Visibility in initial appropriations	Budget formulation End of accounting period Budget modifications
Adjustments to estimated appropriations	Budget formulation
Operation of budget modifications during the accounting period	Budget modifications
Cap functionality	Maintenance of classifications
Stages of budget expenditure execution	Reservation Commitment Obligation Payment of obligations and Treasury operations Procurement, subsidies, and grants Other budget execution-related processes
Budget process logic and use of appropriations	Budget execution-related processes
Information required in each document for the stages of budget execution	Budget execution-related processes
Recording of obligations with simultaneous prior stages	Execution of revolving funds Remunerations "Clearing" for service delivery Recording of public debt Bank reconciliation Management of court judgments Credit certificates Calculating BPS financial assistance
Commitments affecting future periods - Visibility in execution	Commitment Procurement, subsidies, and grants Management of court judgments
Traceability - Visibility in execution	Commitment Procurement, subsidies, and grants Management of court judgments
Adjustments to commitments due to contract provisions	Commitment
Effects of the end of period on confirmed but non-obligated commitments and unapproved obligations	Close of accounting period
Multicurrency management	Foreign currency Budget execution-related processes
Allocation of budget appropriations in other currencies	Foreign currency
Expenditure execution for budget appropriations in other currencies	Foreign currency Budget execution-related processes
Execution of foreign-currency expenditure for local currency budget appropriations	Foreign currency Budget execution-related processes

(continued on next page)

T A B L E A 5 . 1 . 3 (continued)

Relationship between Requirements and Processes	
Functional Requirements	Processes
Official leases	Commitment
Management of revolving funds	Execution of revolving funds
"Clearing" for service delivery via compensation	"Clearing" for service delivery
Generation of receipts for taxes withheld for the DGI	Approval of obligation
Close of accounting period	Close of accounting period
Recording of revenue	Recording of statement of revenue
Periodic reports to be issued	Not applicable
Description	Processes
Receipt of revenue	Bank reconciliation
Recording of income	Bank reconciliation Recording of statement of revenue
Recording of loan disbursements	Recording of public debt
Recording of debt issuance	Recording of public debt
Recording of other financial operations	Recording of public debt
Conciliation of revenues and grouped payments made	Bank reconciliation Recording of statement of revenue Payment of obligations and Treasury operations
Management of funds availability for the different subsections	Recording the statement of revenue and in all processes containing the automated task Update funds availability
Management of guarantees	Third-party funds Recording of statement of revenue Revenue refund
Financial programming of payments	Prioritization of obligations and Treasury operations
Financial allocations	Prioritization of obligations and Treasury operations
Prioritization of payments	Prioritization of obligations and Treasury operations
Means of payment	Payment of obligations and Treasury operations
Payment currency	Payment of obligations and Treasury operations
Register of beneficiaries	Maintenance of beneficiaries and bank accounts
Bank account maintenance	Maintenance of beneficiaries and bank accounts
Recording of budget payments	Payment of obligations and Treasury operations
Recording of non-budget payments	Payment of obligations and Treasury operations
Cancellation of payments made (due to invalid account)	Payment of obligations and Treasury operations
Return of payment (revenue)	Recording of statement of revenue

(continued on next page)

T A B L E A 5.1.3 (continued)

Relationship between Requirements and Processes	
Functional Requirements	Processes
Debt service payments	Recording of public debt
Withholding payments	Approval of obligation Prioritization of obligations and Treasury operations Payment of obligations and Treasury operations
“Clearing” for service delivery via compensation	“Clearing” for service delivery Payment of obligations and Treasury operations
Administration of official bank accounts	Bank account reporting
Beginning of accounting period	Close of accounting period
Automated generation of accounting entries based on budget records	All processes that generate accounting entries based on budget records
Manual accounting entries	Accounting entries
Automatic accounting entries for operations with no budget impact	Recording of assets Recording of public debt Close of accounting period
Bank reconciliation	Bank reconciliation
Asset submodule	Recording of assets
Depreciation/amortization	Recording of assets Close of accounting period
Impairments	Recording of assets
Minimum data to be provided	Recording of assets
Main output	Recording of assets Balance sheets
Reporting of accounts outside the TSA (reporting of accounts for budget subsections, large revenue collectors, and parastatal savings banks)	Bank account reporting
Generation of balances and movements - reporting of accounts for budget subsections	Bank account reporting
Financial statements to be issued	Balance sheets
Periodic accounting reports to be issued	Not applicable
Revenue from sources of financing - public credit operations	Recording of public debt
Loan contracts and disbursements	Recording of public debt
Expenditure relating to public credit operations	Recording of public debt
Public debt management information	Recording of public debt
Debt stock information	Not applicable
Reporting	Not applicable
Execution of international projects	Execution of international projects

Source: Adapted from SIFF2, Uruguay.



In this chapter:

- 6.1 Approach
- 6.2 Process Life Cycle
- 6.3 Coordination between Documented Version of the Process and Technological Implementation.
- 6.4 Additional Considerations

Annex 6.1 Proposal for “As-is” Process Discovery Workshops

Processes in Public Financial Management and FMIS

6.1 Approach

Processes are a series of steps or actions that are performed to achieve a specific objective. They are used to implement the provisions of laws and regulations governing public financial management.

As with any other computerized management system, when developing a financial management information system (FMIS), processes must be evaluated, validated, and improved prior to being automated. Processes may then be either partially or fully automated through the IT system. This is vitally important in the case of both custom-built FMIS and licensed off-the-shelf solutions, with processes used in the latter case to align and customize the system that has been procured.

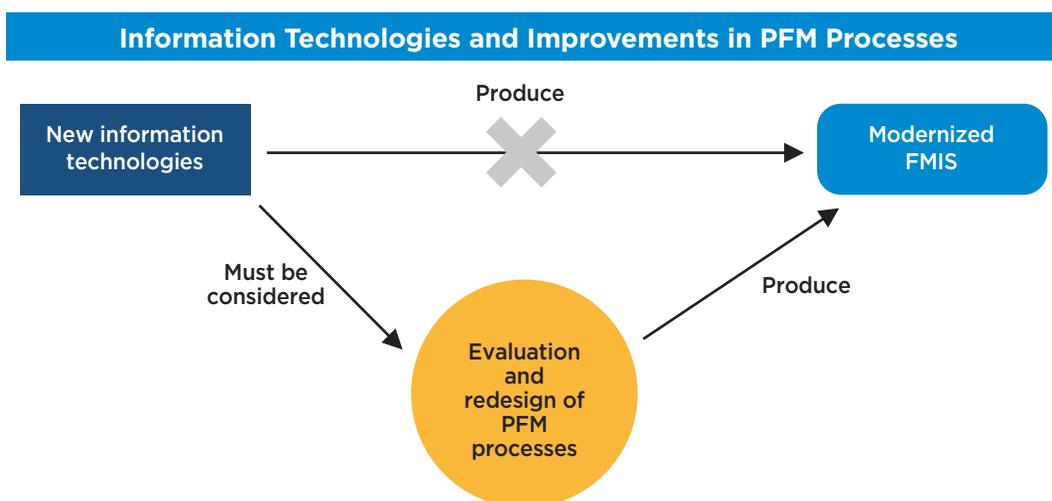
New information technologies play an important role when implementing a modern FMIS. Nonetheless, FMIS modernization cannot be achieved through the deployment of such technologies alone; instead, these should be approached as part of a wider initiative to improve public financial management (PFM) processes (Figure 6.1).

Business processes may be divided into three categories: (i) core processes, (ii) support processes, and (iii) management processes (Dumas et al., 2013). The process model essentially determines the functional model.

This document addresses core public expenditure processes, which consist, in turn, of the following macro processes: (i) resource programming, (ii) resource execution, (iii) monitoring and evaluation of the use of resources, and (iv) reporting on the use of resources. This process chain reflects financial management in each institution, as well as the consolidation activities carried out at the central level (Figure 6.2).

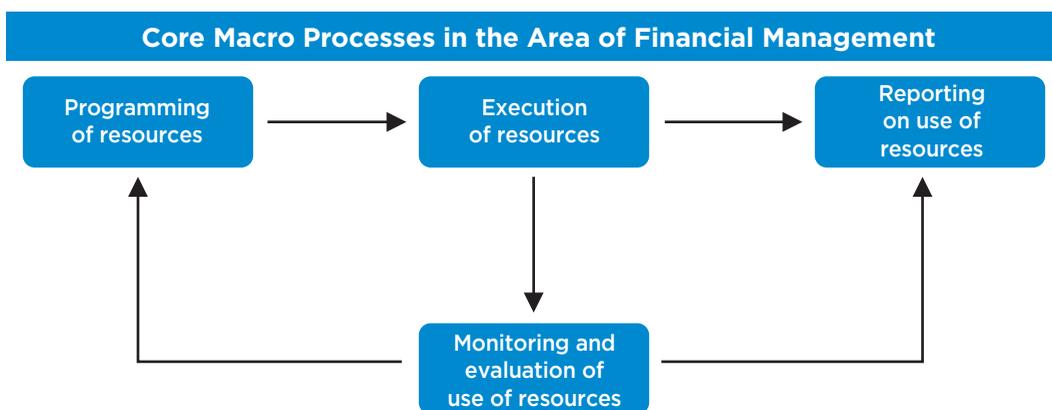
It also includes the activities that make up the budget cycle, central agencies, and control entities.

FIGURE 6.1



Source: Authors' elaboration.

FIGURE 6.2



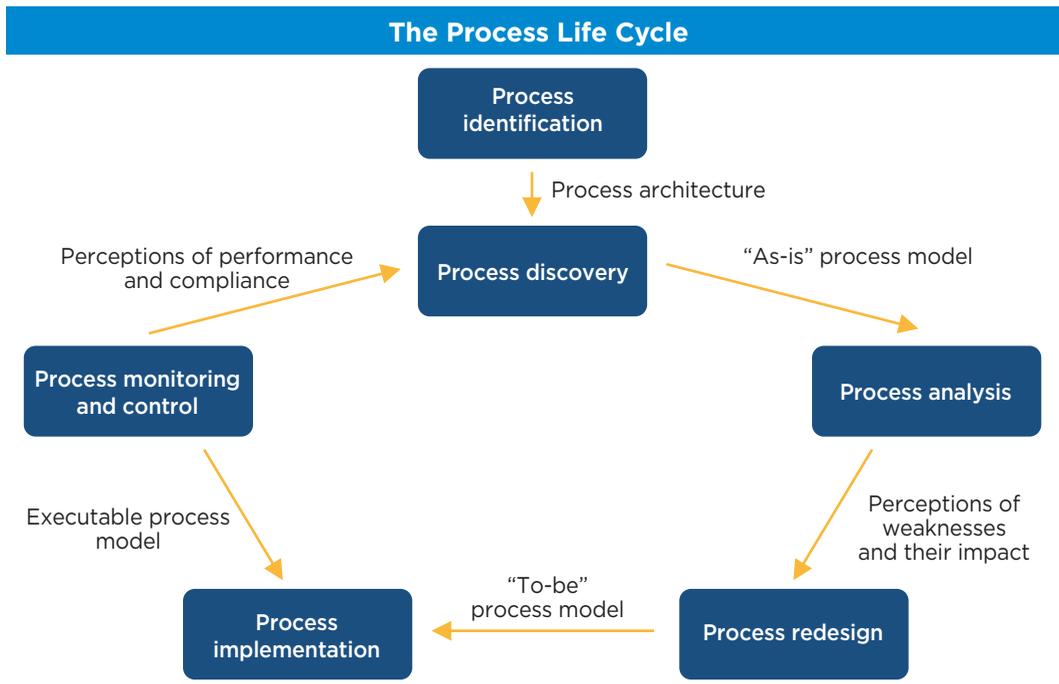
Source: Adapted from the process model for the Dominican Republic's financial management information system (SIGEF).

6.2 Process Life Cycle

Processes have life cycles, as shown in Figure 6.3, and financial management processes must be placed in the context of this cycle.

In the production phase of the conceptual model (Chapter 5), the processes to be supported by the FMIS should be identified, discovered, analyzed, and redesigned (where necessary). These stages are not usually fully completed, and they should be resumed in greater detail during the functional specification phase with a view to ensuring that

FIGURE 6.3



Source: Adapted from the presentation “BPM Techniques and Tools” by Marlos Dumas, University of Tartu (Estonia).

processes are properly automated. Once the processes have been implemented (through the FMIS), performance and compliance should be subject to ongoing monitoring and control, with a return to the discovery stage and the start of the cycle where necessary.

It may take the form of a Process Management Office, with responsibility for supervising the main processes in all financial management units. A process should also have an “owner”—the responsible party—from beginning to end. Processes are crosscutting to an organization and may cut across departmental boundaries. In such cases, the unit responsible for the process can be determined based on one of the following criteria: the department that is most interested, a consensus of the departments involved, or a higher-level decision.

In summary, the FMIS project should initially identify and examine key financial management processes, reviewing the life cycle from stage 1 to stage 4 and determining which

Process improvement should be an ongoing activity, but it must be interrupted where problems arise. To this end, it is of key importance that a unit responsible for process management be included in the organizational chart for financial management. This unit will be in charge of monitoring processes throughout their entire life cycle.

will be automated through the IT system. Thereafter, these processes will be automated during implementation of the FMIS (stage 5) or used to align and adapt the processes contained in a licensed off-the-shelf system. Lastly, the project should lay the organizational foundation for stage 6 to occur, creating an environment of ongoing improvement.

The description below of the stages in the process life cycle is intended as a basic guide and is not intended to be exhaustive. A more detailed description may be found in Dumas et al. (2013).

6.2.1 Identification

This stage entails identifying all important financial management processes that need to be automated through the FMIS, thus creating a process architecture. These processes should be identified and named, their scopes defined, and perceptions recorded regarding their interrelationships. At this stage, there is no need to enter into detail regarding the processes. The macro processes included in Figure 6.1 provide a foundation for determining which processes need to be identified.

Even where an FMIS has not yet been implemented, the process model included in Annex 5.1 (Chapter 5) uses the management model most frequently employed in Latin America and the Caribbean and can serve as a point of reference for a financial administration during this stage. It is also essential that officials with public finance experience participate in this activity, in functional areas such as budget, treasury, and public accounting.

6.2.2 Discovery

In this stage, the current, “as-is” version of the process is documented. The techniques used in this stage are interviews (with process participants), observation (of process execution), analysis of existing documentation, and workshops. These tools are not mutually exclusive and may be used alongside each other. There are two important issues in this phase:

- One of the notations most frequently used for process documentation is Business Process Model Notation (BPMN),¹ version 2.0. BPMN is an open specification that is maintained by the Object Management Group² and implemented using a number of free software packages, such as Bizagi³ and Aris Express.⁴ Both of these packages have paid versions with more advanced features, but the free versions are generally sufficient for the purposes of process documentation.⁵

¹BPMN is a notation for the business process management methodology that is made up of a series of standard symbols that aid user comprehension of process design.

²The Object Management Group is an international body that creates open standards for object-oriented applications.

³www.bizagi.com.

⁴www.ariscommunity.com.

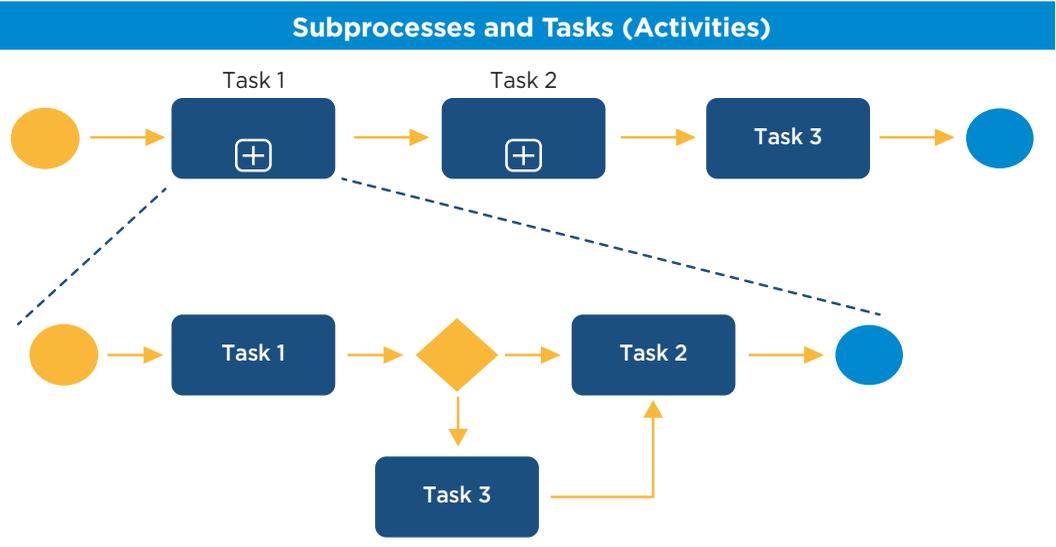
⁵The main advantage of the paid versions is that they offer support for process monitoring and improvements.

- Of the techniques mentioned above that can be used during this stage, potentially the most effective one, with the widest range of results, is process discovery workshops. As this activity involves the main actors, it is useful not only for preparing an overview of the as-is process, but also for facilitating interactions between the participants, giving each of them comprehensive insight into the process and the actions and difficulties associated with each of its activities (training and knowledge dissemination effect). This provides inputs that allow potential points of improvement to be spontaneously identified. Although this is not the objective, such information can be recorded for use in the subsequent stages. These experiences yield greater results where multiple departments are involved. Annex 6.1 expands the discussion of these workshops.

The work of discovering and documenting processes should be preceded by detailed planning, including (among other things) stipulations regarding the attributes of each task to be recorded, the capture of supporting documents, points of contact with other processes, and naming conventions (processes, tasks, documents, etc.). At a minimum, the following details should be recorded for each task or activity: name, description, executors, responsible parties, and those consulted and informed (of changes or problems with the task).

Processes can generally be documented by levels in order to facilitate their interpretation. To begin with, from a macro approach, all of the context is visualized through sub processes (which involve tasks that contain other tasks, i.e., processes). A second level describes the processes belonging to the subprocesses. The number of levels depends on the official responsible for documentation (Figure 6.4).

FIGURE 6.4



Source: Authors' elaboration.

There are a number of techniques that can be used to guide the style of process modeling, such as the proposals contained in 7PMG⁶ and others analyzed by Silver (2011).

6.2.3 Analysis

This stage seeks to identify and record problems and opportunities for improving processes. To that end, the time taken to execute each task—that is, the amount of time dedicated to both work and inactivity—should be recorded. It should also be established whether there are any steps that are repeated or share similarities with other tasks, in addition to the number of times a task is repeated and the reason for this. These observations can be analyzed with a view to identifying opportunities for process improvement. In addition to these general recommendations, there are formal process analysis methods such as Lean⁷ and SixSigma.⁸

6.2.4 Redesign

Those responsible for this stage should ensure that the purpose of the process is clearly identified and that everyone understands it. The primary goal in this phase is to determine whether the as-is process is the best possible version, or whether it should be redesigned (the “to-be” process).

An issue of particular importance within process redesign is the overall outcome that is obtained: sometimes an isolated approach to optimizing a particular aspect of a process can lead to inefficiencies in other aspects. Such effects can be seen in the Devil's Quadrangle (Figure 6.5).

Two process redesign methods are suggested:

1. Transactional redesign: This method does not question the structure of the existing process; rather, it seeks to identify problems and resolve them incrementally, step by step. A well-known technique in this category is heuristic process redesign, in which each aspect of the process is separately assessed and improved (e.g., task elimination, task composition, task decomposition, task resequencing, parallelism between tasks, resource optimization, automation, etc.). In this approach, each change improves one corner of the Devil's Quadrangle, generally to the detriment of the others.
2. Transformational redesign: This method challenges the fundamental assumptions and principles of the existing process structure. It aims to radically change the process structure. One common technique belonging to this model is business process reengineering (BPR). BPR is the practice of rethinking and redesigning the way work is

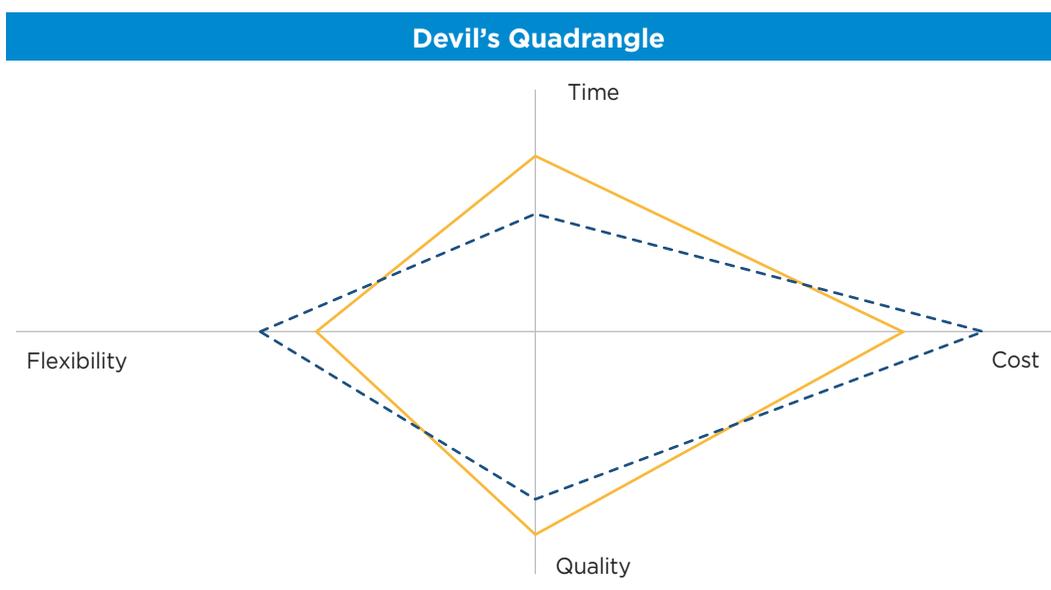
⁶ These may be downloaded at

https://www.researchgate.net/publication/222694111_Seven_Process_Modeling_Guidelines_7PMG.

⁷ <https://www.lean.org/whatslean/principles.cfm>.

⁸ <https://www.sixsigma-institute.org/>.

FIGURE 6.5



Source: Harry Sneed http://stg-tud.github.io/eise/WS15-SE-03-Software_Project_Management.pdf (page 10).

done to better support an organization's mission and reduce costs. The principles of BPR were originally set out in Hammer (1990) and have been expanded, applied, and evaluated in recent decades.

6.2.5 Implementation

The objective of implementation is to maximize process automation. Implementation of the processes to be automated (the most suitable, to-be version of the process)⁹ will be carried out as part of FMIS implementation, using the technologies selected for the system. Where a decision is made not to automate a particular process, the latter should be documented, and staff will need to be trained to perform it. Training of the staff involved in automated processes is carried out after technological development has been completed. Change management techniques should be used in units affected by the modified processes.

6.2.6 Monitoring and Control

The monitoring and control of processes require data. In systems with automated processes, such as FMIS, the data collected should be identified and stored in databases. Dashboard

⁹If there are no changes in the original process, then the as-is and to-be processes are the same.

tools can provide managers with visual representations of process performance and perceptions regarding the existence of possible problems.

A relatively new area is process mining, which relates to automated learning and data mining. The basic idea is to discover, monitor, and improve real processes by extracting knowledge from event logs in one or more information systems.¹⁰ Its applicability to financial management processes could be an interesting area of research for improving FMIS.

6.3 Coordination between the Documented Version of the Process and Technological Implementation

Two operational problems generally arise in the use of processes by financial administrations:

1. Changes are sometimes made to a process without updating the relevant documentation. Process documentation must be permanently updated, with the official responsible for the process taking on the responsibility for reflecting all operational changes in the relevant documentation.
2. Where automated processes are concerned, process documentation should reflect both the functional process and its technological implementation. Software development rules should ensure consistency between the record of the functional process and that of the technological process.

The main consequences of a failure to coordinate these activities are difficulties in maintaining the FMIS, similar to those encountered when operating poorly documented systems. Software is available that can combine the design of a process with its automation. In other words, processes are automated based on their design, without the intervention of an analyst or programmer.¹¹ In such cases, greater detail will be included in the process documentation. Uruguay's SIIF2 project—currently in implementation—is using process orchestration software to achieve this type of automation. Monitoring of this initiative could generate new lessons learned for use in other FMIS.

6.4 Additional Considerations

The identification, discovery, analysis, and redesign of financial management

It is therefore recommended that a specialized consultancy be contracted to support the project in this sphere.

Given that the functional processes and specifications of an FMIS generally overlap, it would be advisable for the consultancy to provide support in both these areas.

¹⁰ For more information and suggested tools, see <https://www.process.st/process-mining/>.

¹¹ They may also be partially automated, with the addition of programmed code.

processes are critical for the quality of an FMIS. This is no trivial task.

Change management is a complementary activity that can be undertaken to ensure successful implementation and the continuous improvement of processes. In addition to clarifying workflows, process modeling offers an opportunity to determine the requirements, business rules, and data needed for the future FMIS.

It should be noted that other techniques and methods are available in the area of process management automation. The work of Arias and Rojas (2016) and Galvis-Lista and González-Zabala (2014) is recommended for those interested.

As discussed in this chapter, activities relating to the process life cycle are necessary and critical for successful development of the IT system, irrespective of the chosen development method (custom-made, off-the-shelf, or both).

ANNEX 6.1

PROPOSAL FOR AS-IS PROCESS DISCOVERY WORKSHOPS¹²

(Sample for reference purposes.)

With the emergence of the COVID-19 pandemic, face-to-face meetings such as the one proposed should be adapted to allow for remote participation, with the support of the appropriate tools. Remote meetings will likely be more common in future.

1. Objectives

This document proposes a structure for meetings of the Department of Finance of the State of Maranhão to prepare the documentation for as-is processes, using the tools described in the Department’s Guide to Designing the Process Documentation System/ Design Guide for the Process Documentation System.

Each consultant/firm may have different approaches to organizing process documentation/improvement meetings, and the use of the model set out in this proposal is not mandatory. However, the standard Bizagi tool and the format for presenting results must be used.

2. Participants

It is essential that the following staff participate in the meetings:

- The official responsible for the process (the process “owner”)
- The main process stakeholders (key for implementation)
- The process analyst (director/coordinator for the meeting)
- The support team for the process analyst (for records, notes, etc.)

It would also be advisable for the manager supporting or requesting documentation of the process to participate at least in the initial meeting.

3. Materials (infrastructure)

The following infrastructure should be available:

- A sufficiently large room for the group
- A flip chart with blank sheets
- Markers (2 colors)
- A4 paper for drafts
- Ballpoint pens
- Laptop (process analyst)

¹² Adapted from the document used by the Department of Finance of the State of Maranhão (Brazil).

- List of predetermined features of processes and activities (a non-exhaustive list is included at the end of this document)
- Post-it notes (large enough to be visible to the group)

4. Preparing the first meeting

Before the first meeting, participants should review any existing process documentation. It may already be possible to identify weaknesses in the documentation, particularly the absence of features considered to be predetermined, as well as in the flowcharts (design). Where no documentation exists, those responsible for the process should identify and compile documents to support its description (forms, regulations, etc.).

5. Phase 1: Presentation

This is the initial meeting between those responsible for the process and the process analyst and his/her team. It should be seen as an open interaction in which the process analyst explains how the work will be carried out, the methodology and its different phases, the predetermined parameters that will be proposed, and other features of the survey. Those responsible for the process to be surveyed/documentated should also indicate their expectations, limitations, etc.

6. Phase 2: Process summary

Filling out the process summary sheet (Figure A6.1) helps to give a general idea of the process and the resources used. It can be improved at a later stage, at the end of the description.

The following information is included in the process summary:

- Process objectives
- Process description
- Required technological resources (systems, equipment, etc.)
- Related parts/parties
- Information required to carry out the process
- Outputs
- Inputs
- Outputs

7. Phase 3: Ad hoc documentation of the process (flipchart/Post-it notes)

The aim of this phase is to create a draft of the process flow (possibly using flip chart sheets mounted on the wall), including the features and activities associated with the process. The easiest approach is to sketch out the process flow on flipchart sheets and modify this as the discussion progresses. At the end, the process analyst collects the sheets for use in preparing the formal flow in Bizagi.

The features of the activity can also be written on the sheets, but it is frequently faster and easier to write them out in Word or a similar program. The process analyst can change the type of tool used if he/she and the group deem it necessary.

8. Phase 4: Preliminary formal documentation and distribution

In this phase, which is carried out by the process analyst and his/her support group, all of the elements gathered in the previous phase are transferred to the Bizagi tool (flow, features). The preliminary documentation is then published (in the most suitable format) and sent to all of the participants for their review.

9. Phase 5: Documentation review and adjustment

This meeting reviews all of the documentation generated. Wherever possible, the changes that have been proposed and approved should be entered into the tool immediately. Once the meeting is finished, the new documentation is published and sent to all of the participants.

10. Phase 6: Submission, approval, and storing of the final version

This phase involves completing the formal steps needed to approve the process documentation. It can be omitted. Where it is undertaken, however, it is advisable for the manager recommending documentation of the process to participate in the meeting.

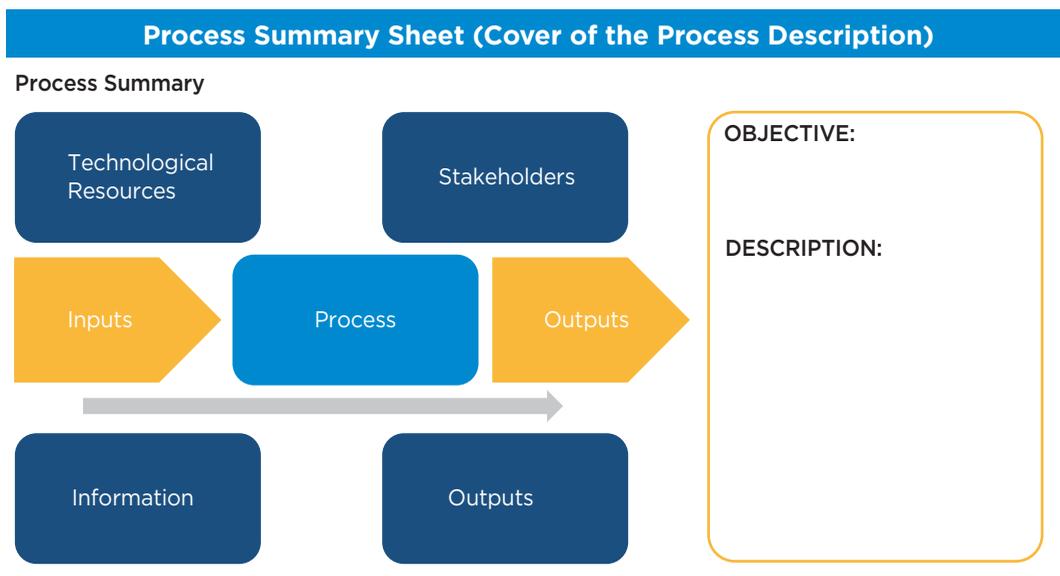
The final documents relating to documentation of the process (summary, published documentation, and Bizagi module) should be stored in their initial version consistent with the rules established by the IT department.

11. Additional considerations

- Although this process relates to documentation rather than improvement, ideas for optimizing and improving the process often arise during the discussions. These types of discussions (improvements) should not be expanded upon at this stage, but rather than discarding the ideas, they should be recorded in a descriptive document (Word) for future consideration.
Any new method or feature adopted with positive results in a process description can serve as an input into subsequent descriptions, improving the document proposed here.
- Consistent with the proposed method, the department responsible for the process (its “owner”) will be responsible for maintaining the associated documentation. Accordingly, each department should have one or more technical experts who are qualified to use the tools concerned (for documentation and versions).

In the case of the first few processes, the activity of documenting the as-is process is ideal for identifying and providing initial training to technical staff in the departments involved.

FIGURE A 6.1.1



Source: Authors' elaboration.

IMAGE A 6.1.1



Source: Department of Finance of the State of Maranhão (Brazil).



In this chapter:

- 7.1 Objectives and Context
- 7.2 Processes, Data, and Requirements: A Basic FMIS
- 7.3 The Unified Modeling Language (UML)
- 7.4 Data Model
- 7.5 Data Governance
- 7.6 Software requirements
- 7.7 Final Comments

Annex 7.1 Data Modeling with Integrated Data and Processes:
Uruguay's SIIF2

Annex 7.2 Important Non-functional Requirements for an FMIS

Annex 7.3 Business Rule: Example of an FMIS

Annex 7.4 Use Case: Example of an FMIS

Annex 7.5 Examples of Essential Functional Requirements in an FMIS

Data Model and System Requirements

7.1 Objectives and Context

Executives from outside of the information technology (IT) area of a financial management information system (FMIS) project often fail to understand some of the software development concepts or nomenclatures. They find the documents and discussions pertaining to these subjects to be partially or totally unintelligible.

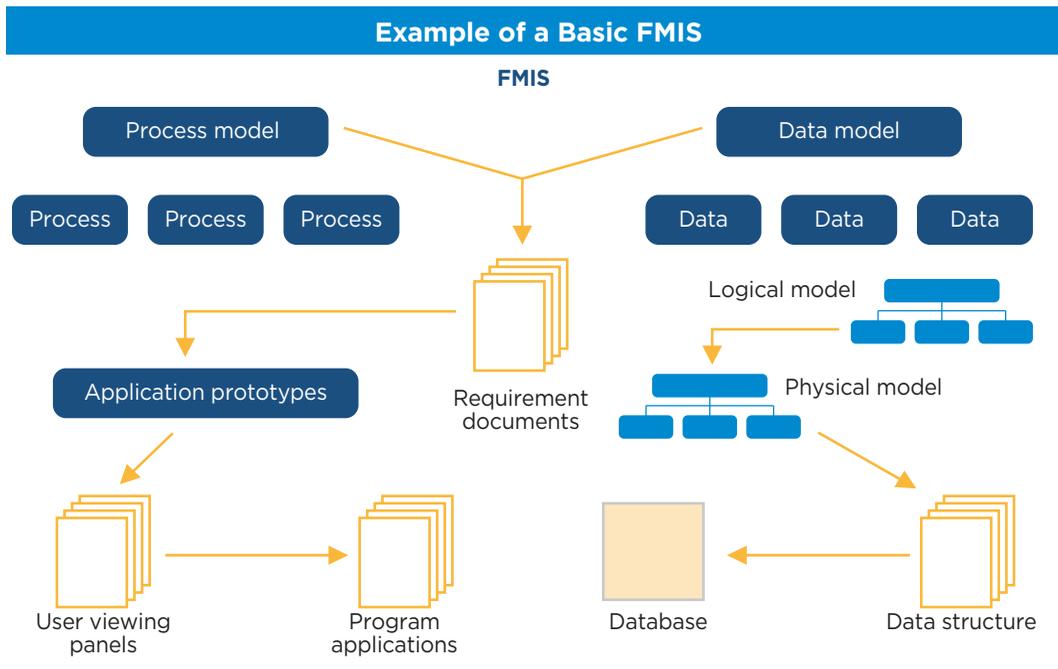
Alongside public expenditure management processes (business processes), both the data model and software requirements are important inputs to FMIS development. Data modeling is an instrument through which the data used in FMIS processes can be collected, analyzed, represented, and accurately communicated into something called the “data model.” Software requirements, in turn, are rules by which the FMIS must function, according to the legal environment and operational needs.

During business process modeling analyzed in Chapter 6, in addition to understanding work flows, it is possible to import the data that will be treated by the system and to identify the software requirements of the future FMIS.

The processes, data modeling, and the software requirements are also part of the conceptual model (Chapter 5). Nonetheless, at a later stage, before FMIS development

The objective of this chapter is to provide guidance for those responsible for an FMIS project regarding the **importance** and the **basic concepts** of a data model and software requirements in the development context. It is not meant to be a tutorial on the subject, or even to cover all the concepts, techniques, and methods available in these knowledge areas. It merely seeks to familiarize project leaders and other non-IT managers with concepts and terms that will be commonly used throughout FMIS project development.

FIGURE 7.1



Source: Authors' elaboration based on "Enterprise Modeling": https://www.wikiwand.com/en/Enterprise_modelling.

gets underway, these themes must be validated and complemented, depending on the level of detail used in the conceptual model.

7.2 Processes, Data, and Requirements: A Basic FMIS

Processes, data, and requirements comprise the basis of FMIS specifications. These elements can be arranged in a logical diagram to https://www.wikiwand.com/en/Enterprise_modelling

7.3 The Unified Modeling Language (UML)

In some parts of this chapter, the unified modeling language (UML) will also be used.¹ The UML is a graphic notation language (a way of writing, illustrating and communicating) used

¹The UML is administered by the Object Management Group (OMG). Founded in 1989, the OMG is a not-for-profit computer industry standards consortium, with open membership. See: <https://www.uml.org/>.

for designing software systems. This type of language is expressed through diagrams.² Each diagram is composed of elements (graphical forms used for the drawings) that are related to each other.

Why is a specific language used for this?

Describing a computing system in natural language—as used to happen in the past—creates many ambiguities that hamper or impede correct understanding and communication of the problem, which can sometimes produce ineffectual information systems.

Furthermore, describing the same system by using a formal language that is free from ambiguities, such as the C programming language, would alienate the users—who are the main stakeholders and experts in the business about to be computerized—due to its high complexity. Therefore, a middle term is sought, that is, a language based on well-defined diagrams (UML), which helps the entire team to understand a problem and to define ideas.

The UML functions as a universal language to specify software and to facilitate clear and objective communication among the people involved in the production process—business analysts, users, Scrum Masters, architects, developers, project/product managers, and other stakeholders. For the final users, some advanced UML diagrams are difficult to understand and must be complemented with descriptions in free text or more suitable diagrams.

There are more than 14 types of official diagrams in UML, some of which are shown below. The leader of the information and communications technology (ICT) component and its team selects the diagrams or other UML artifacts, or documents, to be used for the specification of an FMIS. Although the UML is the most common preference, other types of languages can also be used for system specification.

The diagrams and other artifacts that must be created during system development are essential for documenting the FMIS, but they must be chosen carefully, especially because they demand preparation time and have an impact on system costs.

7.4 Data Model

7.4.1 Conceptualization

As previously mentioned, data modeling is an instrument by which the data used in FMIS processes can be collected, analyzed, represented, and communicated precisely,

Creating a data model for an FMIS is important, irrespective of whether a commercial off-the-shelf (COTS) system or a custom system is used.

² See: <https://www.ateomomento.com.br/diagramas-uml/>.

to produce the data model. Data models represent data and enable an organization to understand its data assets.³

The data required by an FMIS can be identified and described based on analysis of public expenditure processes (see Chapter 6). Data models are constructed on the basis of such primary information.

There are three main data model types or perspectives:

1. **The conceptual data model** identifies the relationships at the highest level between the different entities. It also includes the important entities and the relationships between them, but does not specify any attribute or primary key.⁴
2. **The logical data model** describes the data in the greatest detail possible, irrespective of whether the data is physically entered in the database. It also includes all the entities and the relationships between them; the specification of all the attributes of each entity; the primary key of each entity; the foreign keys (FK), which identify relationships between different entities; and normalization (Figure 7.2).⁵
3. **The physical data model** represents how the model is constructed in the database. It also shows all the table structures: column names, type of column data, column restrictions, primary key, foreign keys, and the table relationships. Denormalization may occur.⁶ The physical data model depends on the database management system used.

7.4.2 Representation of the Data Model

There are various methods for representing the diverse aspects of a data model. Among the most commonly used is the one proposed by the Standard UML, with variations according to complementary methodologies adopted for modeling. A simple introduction to data modeling with UML can be found in The Data Administration Newsletter.⁷

Figure 7.2 presents an example of a logical data model prepared using a support tool.

This example presents a logical data model with four tables and their relationships. The primary keys and the FK appear in the top row of each table.

Uruguay's SIIF2 Project proposes a format for presenting the details of the data model that integrates the system's processes and the necessary data (see Annex 7.1).

7.4.3 Tools to Support Data Modeling

There are various tools available in the market that offer support for data analysts. Some examples are:

³Data Management Book of Knowledge (DMBOK). See: (<https://www.dama.org/content/body-knowledge>).

⁴The primary key is a column or a combination of columns that uniquely identifies each row of a table.

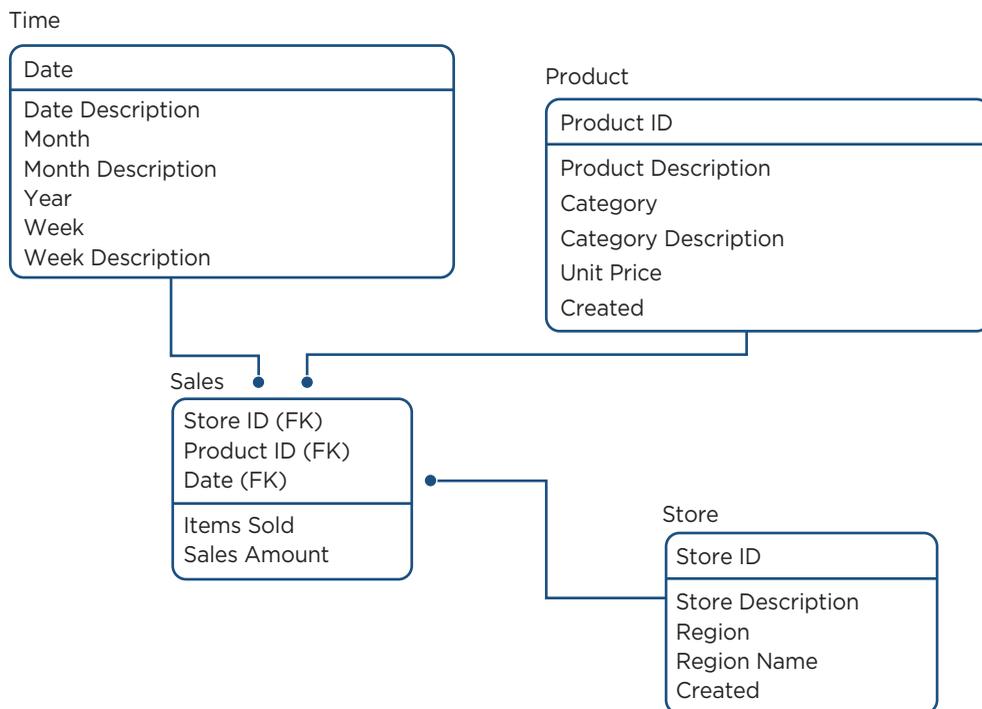
⁵The aim of normalization is to minimize data redundancy.

⁶For the purposes of operations optimization, it increases redundancy in the database.

⁷See: <https://tdan.com/uml-as-a-data-modeling-notation-part-1/8457>.

FIGURE 7.2

Example of a Logical Data Model



Source: Rajkumar Jonnala. Available at: <https://techmsd.com/2014/12/30/logical-data-modeling-toolsexamplesconcepts/>.

- Erwin: <https://erwin.com/products/erwin-data-modeler/>.
- Archi: <https://www.archimatetool.com/>.
- Oracle Data Modeler: <https://www.oracle.com/in/database/technologies/appdev/datamodeler.html>.
- IBM InfoSphere Data Architect: <https://www.ibm.com/in-en/marketplace/infosphere-data-architect>.
- Other indications can be seen at: <https://www.smartdatacollective.com/top-10-powerful-data-modeling-tools/>.

7.5 Data Governance

Data governance involves the specification of decision rights and a framework of responsibility to guarantee appropriate behavior in the evaluation, creation, consumption, and control of data and its analysis (Gartner Glossary).⁸

⁸ See: <https://www.gartner.com/en/glossary>.

The financial administration bears prime responsibility for all the data managed by the FMIS core subsystems: budget, treasury, and accounting. Moreover, the connected subsystems that are part of the FMIS, such as public procurement, human resources, and others, also hold data under their own responsibility. In some countries, certain connected systems are the responsibility of other agencies, other than the FMIS. In these cases, the respective authorities store their own data. Therefore, FMIS managers would only have influence on these agencies to ensure that they adopt appropriate data governance policies.

An FMIS project must envisage the introduction of data governance for its data collection, which thereafter will be assumed by the institution that manages the system. It may start on a small scale, with a data manager that assumes different roles, but the definitive structure must be envisaged from the beginning.

Mature data governance includes the following roles:

- **Data Manager**
The chief data officer (CDO) is the institutional leader in data governance strategy. Appointing a CDO shows commitment to data. Acceptance of a CDO by the institution's senior management indicates legitimization of the data governance program.
- **Data Owners**
Data owners are the persons who have direct responsibility for the data. They are involved in its protection and quality as an institutional asset. A data owner is part of the team that utilizes the data. For example, a member of the treasury team can be an owner of the data related with the FMIS core subsystems.⁹ There are several tools available that help to administer and audit access to the data.
- **Data Administrators**
Data administrators are the champions of the data governance strategy. They meet with the data owners and enforce compliance with the data governance policies and procedures, as well as helping to train new data owners and employees.
- **Data Governance Boards**
The data governance board establishes the data governance policies and procedures. This board works with the CDO to establish the who, what, when, where, and why of data governance.
- **Personal Data Protection Laws**
Many countries (e.g., Argentina, Brazil, Chile, Colombia, and Mexico) have adopted personal data privacy and protection laws which are binding on any public or private institutions that store, in any medium or format, citizens' personal data. These institutions must create their own structures and rules that conform to these laws. In general, the ministries of finance, or their equivalents, establish higher structures to create and operate the mechanisms to enforce compliance with the laws, with which the financial administrations should actively participate.

⁹ A group of two or three technical experts may be designated.

To obtain more information about data governance, access to the Data Management International (DAMA) portal is recommended.¹⁰

7.6 Software Requirements

7.6.1 Conceptualization

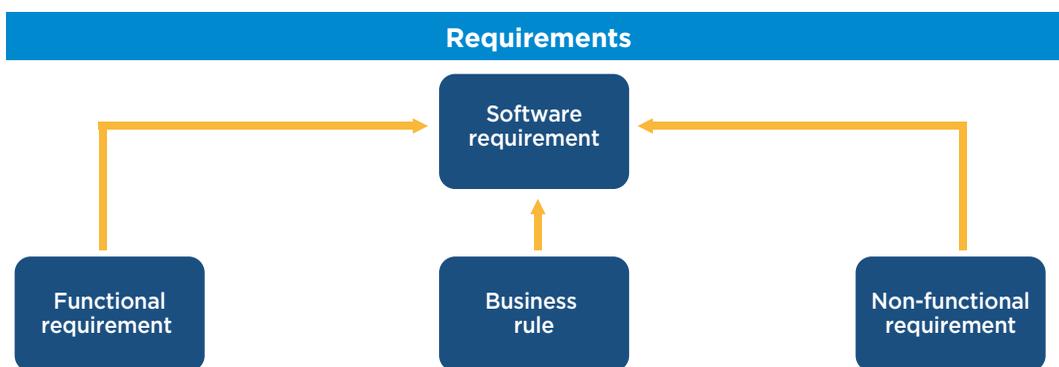
In public financial management systems, software requirements convert the legal arrangements—contained in laws, regulations, and ordinances—and operational arrangements into a set of guidelines with which the computing system must comply.

A requirement is a declaration that translates or expresses a need and its respective limitations and conditions. The engineering of requirements is an interdisciplinary function that mediates between the domains of the user and the provider to establish and maintain the requirements with which the information system must comply. The engineering of requirements is concerned with discovering, obtaining, developing, analyzing, evaluating, communicating, documenting, and managing requirements, as well as determining their methods of verification.

Historically, from the beginning of information systems development, the full and correct specification of software requirements is one of the most problematic areas of ICT deployment. Although many methodologies and techniques have been developed with a view to minimizing these problems, they still persist.

An FMIS is not immune to these problems. However, the shared experiences of developing various versions of these systems in Latin America and the Caribbean (LAC) can help to minimize them.

FIGURE 7.3



Source: Authors' elaboration.

¹⁰ See: <https://www.dama.org/cpages/body-of-knowledge>.

There are many systematic definitions related with software requirements, but here we present the version adapted from the ISO/IEC/IEEE 29148 standard (2011):

The requirements are subdivided into functional requirements (FR), non-functional requirements (NFR), and business rules (BR). The requirement specifications often use initials (FR, NFR, or BR), followed by sequential numbers to identify them (Figure 7.3).

Functional requirements¹¹ define services that the system must provide and the way in which it should react to specific entries and how to behave in specific situations. They must be accurate, full and consistent. Moreover, they can also indicate what the system should not do and represent the transformation of the legal basis for public expenditure into computerized programs, that is, the FMIS.

- Example: “FR-35 – Adjust commitments according to contract stipulations”.

In the case of a FMIS, functional requirements can mainly be identified during analysis of public expenditure business processes (see Chapter 6).

Chapter 5 (Conceptual Model) presents examples of the relationship between modules, processes, and functional requirements in its annexes.

Non-functional requirements refer to the conditions of services or functions offered by the FMIS, such as time limitations, limitations in the development process, standards and security, and others. They are often applied to the system as a whole, rather than to individual characteristics or services. Non-functional requirements can affect the entire system architecture.

- Example: “NFR-06 – the FMIS must be certificated for use in the most up-to-date versions of the Chrome, Safari and Firefox browsers”.

Annex 7.2 addresses the non-functional requirements most commonly used in FMIS definitions.

Business rules: As their name indicates, these are rules used to define or restrict a certain action in the FMIS. A broader definition might be “a rule that comes under the jurisdiction of the business”; that is, which does not involve IT issues. Some of the main characteristics of business rules, according to the Business Rules Manifesto,¹² are the following: they are separate from processes, not contained within them; they are declarative, not procedural; they serve the business, not the technology; they should arise from knowledgeable business people; and they are well-formed expressions, expressed in such a way that they can be validated by business people.

Identifying the business rules is part of the task of the requirements engineer, who must have the ability to find them within a large amount of information. When dealing with business processes, interviews and meetings with stakeholders are a good source

¹¹The concepts of functional requirements and non-functional requirements were adapted from Malavolta (2017).

¹² See: <https://www.businessrulesgroup.org/brmanifesto/BRManifesto.pdf>.

of information, since these are the people who know, define, and support these rules. A further important source are the organisms that govern the FMIS, such as a ministry of finance, economy or treasury, a ministry of planning, or other such entity.

Annex 7.3 presents an example of business rule for a FMIS.

7.6.2 Functionality versus Business Requirement

According to TechTarget,¹³ in information technology (IT), a **functionality** (from the Latin *functio*, which means “to carry out”) is the sum or any aspect of what a product, either as a software application or a computer device, can do for a user. Commercially, the functionality of a product is used to identify its characteristics, which permits the user to enjoy a range of capacities. The functionality can be easy to use, or not.

An FMIS functionality can carry out one or more functional requirements. For example, a user-interactive screen is capable of dealing with one or more functional requirements and business rules. Specifically, a screen for requesting payment can obviously be programmed to handle various functional requirements.

7.6.3 Identification of Functional Requirements and Business Rules

Functional requirements and business rules can be identified and described on the basis of business processes (addressed in Chapter 6). Depending on the depth of the description of the business processes, additional interviews with stakeholders may be necessary. As previously mentioned, the quality of an FMIS depends directly on the quality and comprehensiveness of the requirements raised. This fact justifies the time and effort dedicated to this task.

In addition to analyzing business processes, there are various methods or techniques available to examine, identify, and describe functional requirements, which can be used in combination. These include the following:

- Interviews with stakeholders.
- Joint interviews with focus groups (stakeholders from a specific module or segment).
- This method is similar to the one proposed with regard to “process discovery” (Chapter 6).
- Use cases: this method enables the analyst to navigate the entire system, process by process, as if they were a user. It helps to understand how the system should function.
- Constructing prototypes and making sketches, or models, to allow stakeholders to gain an idea of how the system functions.

Use Cases

The technique of use cases has proved to be very useful for the interaction with future users of the system and for identifying functional requirements, business rules, and

¹³ See: <https://www.businessrulesgroup.org/brmanifesto/BRManifesto.pdf>.

functionalities. A use case is a list of actions or steps that typically define the interactions between a user who plays a role—the “actor”—and a system to achieve an objective. The actor may be either human or another external system. It defines what the system does, but not how it does it, and helps those who have no experience to better understand what the system, the module or the function does.

The UML notation for use cases provides important attributes for understanding functional requirements, and is one of the most commonly used. A basic tutorial on use cases with UML can be found at Tutorials Point.¹⁴

Each use case must describe the details in a separate explanatory text, which contains details of the “normal pathway” of the actions and all the identified exceptions, with the figure remaining as visual support. It is essential that the use cases cover all of the exceptions that may exist in an interaction. For example:

“When recording an invoice to make a payment, verify the date of issue. If the date is later than the current date, emit error message ‘xxxxxxx’; verify whether the submitter of the invoice is registered as a “Beneficiary”. In a negative case, emit error message ‘yyyyyyy”.

The messages must be sufficiently clear to enable the user to take a corrective action.

Annex 7.4 presents examples of use cases taken from an FMIS.

7.6.4 Essential Functional Requirements of an FMIS

The functional requirements—or functional prerequisites—make up the “heart” of the FMIS and define the entire environment of the system. Depending on the depth of the description, the detailed requirements can fill up a hundred pages and are obtained from the business processes, or jointly with them, and are subsequently refined. Annex 7.5 presents a set of functional requirements that are considered essential in a modern FMIS, to be evaluated in terms of feasibility in the context of new FMIS projects.

7.6.5 Agile Development Methods

With respect to agile development methods, when the information to be developed is gathered, both the process model and the domain model are generally used.

The process model helps to identify the flow of data, the actors, and the life cycle of the main entities, whereas the domain model¹⁵ replaces the data model. In the domain model, the main entities,

Adequate definition of the process, requirements—functional, non-functional, and business rules—and the data model make up a critical stage for FMIS success. Its complexity and accuracy will determine the accurate estimate of procurement values and system quality, user acceptance, the amount of rework, and cost increases.

¹⁴ See: https://www.tutorialspoint.com/uml/uml_use_case_diagram.htm.

¹⁵ A domain model is a representation of real-world conceptual classes, in general as a set of diagrams, rather than software components.

the relationships between them, and their most significant attributes are identified. This is often sufficient to begin with.

7.7 Final Comments

Consequently, any time spent preparing these models will be worthwhile. To support the definition of these models, it is important to be able to count on the collaboration of specialized external consultants and, where possible, with experiences from other FMISs. The publication by Chung, Nixon, Yu and Mylopoulos (2000) is an excellent resource for delving more deeply into the concepts of non-functional software requirement engineering.

ANNEX 7.1

DATA MODELING WITH INTEGRATED DATA AND PROCESSES: URUGUAY'S SIIF2

The data from a process instance consist of all the information that is displayed or entered during execution of the process instance. This information is specified through a list of fields associated with each activity of the process. For each field, a series of attributes are determined such as the type of data, content validation, content visualization, and others. A file containing the data model in an electronic spreadsheet format is annexed to all processes that incorporate user tasks. It includes a sheet for each existing user task in the process (Figure A7.1).

Figure A7.1 presents the data model for the “Movements between SIR Codes”¹⁶ process, with the sheets corresponding to the tasks: “Enter Movements,” “Authorize Request,” “Identify SIR Code,” and the table linked to the latter, “Identify SIR Code Balances.”

FIGURE A7.1.1

Example of a Process/Data/Task Sheet

Process Tab Task name	Movement between SIR codes Automatic movement between SIR codes Identify SIR code balances		
Column/Table	Section	Description	Type of Data
Table: Identify SIR code balances			
SIR recipient code movements		Sum of the (amounts) of the SIR recipient code movements of the sum of the (amounts) of the SIR sender code in the current period (Associated with the Table: Balance at the start of the current period) + (SIR recipient code movements)	Numerical
SIR sender code movements			Numerical
Final balance of current period			Numerical
Add to General Revenues		Amount deposited if applicable. If not, final balance of 31/12 is added to General Revenues	Boolean

Source: SIIF2, Uruguay.

¹⁶ The Registers Interconnection System (Sistema de Interconexión de Registros, or SIR) code denotes financial availability.

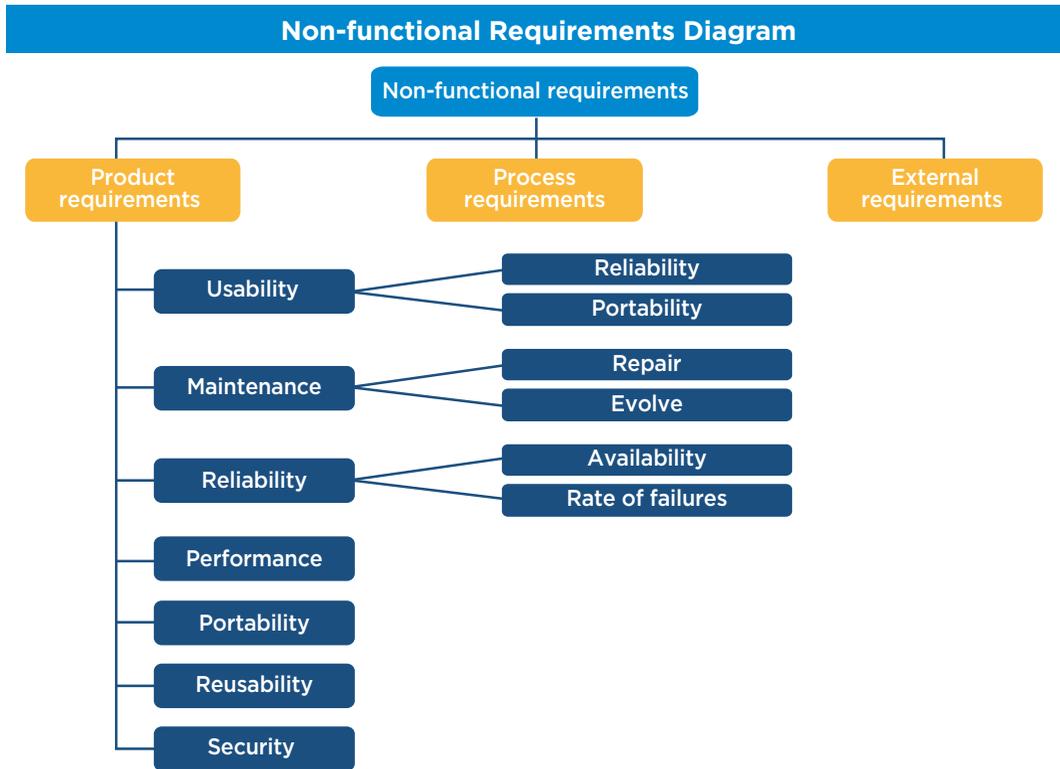
ANNEX 7.2

IMPORTANT NON-FUNCTIONAL REQUIREMENTS FOR AN FMIS

Non-functional requirements also directly affect decisions about the FMIS architecture. For example, a layered architecture is better at separating the functionalities of a system, making it more modular and facilitating maintenance. A system’s complexity is based on both its functional requirements (what it does) and its non-functional requirements (how it does it) (Figure A7.2).

The identification of non-functional requirements is based on the system characteristics, meetings with stakeholders, analysis of the processes, and the experience of the non-functional requirement architect or analyst. The following section summarizes some of the main non-functional product requirements that are applied to an FMIS:¹⁷

FIGURE A7.2.1



Source: Devmedia and Sommerville. See: <https://www.devmedia.com.br/artigo-engenharia-de-software-3-requirements-nao-funcionais/9525>.

¹⁷ Adapted from the following sources: <https://www.devmedia.com.br/artigo-engenharia-de-software-3-requisitos-nao-funcionais/9525>; Standard IEEE 830-1993 “Recommended Practice for Software Requirements Specifications.”

Usability: As this is a system that is generally used throughout public administration by civil servants with varying degrees of knowledge of public financial management and who, moreover, can be frequently removed from their functions, an FMIS must be easy to learn and to use. Some criteria for the measurement of usability are (i) time taken to perform a task, (ii) number of commands used to complete a task, (iii) number of unused available commands, (iv) frequency of use of the help or documentation features, and (v) percentage of errors.

Maintenance, ease of: This refers to the facilities for corrective maintenance—caused by system errors—and evolution—caused by expanding the scope of the system. Using modular systems facilitates software maintenance.

Reliability: This is the probability that the software does not cause failures in the system during a certain time period and under specific conditions. Generally, the critical factor is time. The metrics that can be evaluated for this item are: availability, or the percentage of time that the system has available for use; rate of occurrence of failures, or the number of failures that occurred in a certain space of time; and the mean time to failure (MTTF).

Performance: This refers to time, that is, response time and performance or throughput, and space, that is, use of resources such as memory. Failures in this requirement can also impact others, such as performance. Long response times also affect performance.

Portability: This defines the way in which the software can be transported from one operational environment to another. The portability of a system is proportional to the quantity of work needed to transport it to another environment. Portability can be separated into several parts: hardware, operating system, and entry/exit.

Reusability: This refers to componentization of the system, that is, the capacity to project and develop reusable components. Other aspects of reusability include specific domain processes and knowledge. Applications, subsystems, objects or modules, and functions all have potential for reuse.

Security: Security is a critical requirement for an FMIS. It can be classified into availability, integrity, confidentiality, and operational security. The important aspects of this requirement are: identification of the user; authentication, which confirms that the user is who they say they are; access time, which limits the time to access the system to reduce threats; security auditing, or event monitoring and tracking; and alarms that notify potentially suspicious entries. Security requirements may include the following:

- All users must be identified and authenticated before accessing the system.
- Access to transactions and data must be controlled through specific permissions.
- Only the system administrator can change permission to access the system.

- Back-up copies of all the system data should be made every 24 hours and stored in a safe place, different from the place in which the system is located.
- All system entries and finished tasks must be stored with their respective date and time, for a period of five years.
- No information must be physically erased from the system.
- All external communications between the system data server and the clients must be encoded.

Connectivity:

- Establish a technological connectivity model to be followed by the FMIS (API,¹⁸ Web services, ESB,¹⁹ etc.).
- Establish connectivity with the tax information system (TIS) to validate the tax identification number (TIN) and the invoice value (electronic invoice where available).

Exchange data with other government financial management systems:

- Identify the government information systems that will need to exchange information with the FMIS.
- Describe each system and define points of contact, with the information to be exchanged and periodicity.

ICT platform:

- Define through a reference architecture the ICT platform that will be transformed into a technological solution based on proposals by providers (optional).
- Establish a data network with adequate performance for all users.
- Define levels of redundancy and contingency plans.
- Introduce a security policy.
- Establish a management model to guide the FMIS during its production stage.
- Evaluate the use of cloud computing for total or partial use in the FMIS—central subsystems, connected systems, back-up, and others.

¹⁸ Application programming interface (API).

¹⁹ Enterprise Service Bus (ESB).

ANNEX 7.3

BUSINESS RULE: EXAMPLE OF AN FMIS

T A B L E A 7.3.1

Complementary Information for the Rule	
Table:	DGII_INVOICE_ITEM
Type of rule:	Action
Class:	RuleActionDGIIFFInsertInvoiceItems
Description:	<p>This rule inserts the following items associated with the invoice into the system:</p> <ol style="list-style-type: none"> 1. Calculate the sum of the budget amount and the non-budget amount of all items inserted on screen by the user. 2. If the budget amount and the non-budget amount are both greater than zero, then the system issues an error message "You cannot have both budget and non-budget items." 3. The system deletes from the system all items previously recorded on the invoice. 4. The system inserts the items defined and/or modified on screen by the user.
Before or after update (B/A):	A
Insert, update, or delete (I,U,D):	I, U
When execute:	
Message:	

Source: Authors' elaboration based on SIGEF (Dominican Republic).

ANNEX 7.4

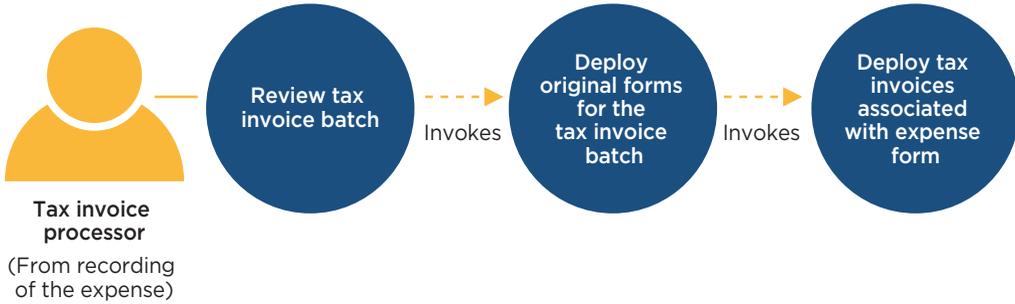
USE CASE: EXAMPLE OF AN FMIS

FIGURE A 7.4.1

Use Case Model: Tax Invoice

Tax invoice

Use case model



Detail:

Name of the use case:	Find Expenditure Commitment stage document		
State:		Version: 1.0	Phase: 1.0
Author:	Xxxxxxxx		
Date created:	10/30/2017	Date modified:	10/30/2017
Notes:			

Restrictions:

Scenarios:

- Basic Path*
1. The system will display the initial form search screen (Original).
 2. The user sets the search parameters on this screen.
 3. The system will display a list of expense documents that comply with the parameters set by the user. The list must only display the expense documents at the commitment stage that are not related to a tax invoice.
 4. The user will select an expense document.
 5. The system will return to the point at which the request was made, providing the ID of the selected expense document as a result. If no expense document is selected, then the return value will be NULL.

Source: SIGEF (Dominican Republic).

ANNEX 7.5

EXAMPLES OF ESSENTIAL FUNCTIONAL REQUIREMENTS IN AN FMIS

Certain functional requirements are crucial for the completeness and success of an FMIS. Table A7.5.1 summarizes the functional requirements that are considered most important and that deserve special attention from project managers.

T A B L E A 7 . 5 . 1

Most Important Functional Requirements	
Theme	Requirement / Description
1. Accounting and fiscal reports	<p>Produce timely and accurate fiscal reports</p> <ul style="list-style-type: none"> • Produce financial statements on cash basis: state of cash receipts and payments, accounting policies and explanatory notes, and a comparison of original and current budgets. • Issue annual financial statements within six months of the end of the fiscal year. • Issue budget reports throughout the year (e.g., monthly, quarterly, semi-annually) and at the end of the year, according to criteria established by international standards. • Ensure that accounting entries are accurate and automated. • Certify that all data and budget accounts are appropriately and consistently classified according to administrative units, economic categories, functions, etc., in line with international standards. <p>Failure to integrate the plan of accounts with the budget classification</p> <ul style="list-style-type: none"> • Ensure coherence between the plan of accounts and the budget classification. • Guarantee timely and reliable accounts and budget records of all financial transactions. • Establish data storage with drill-down capacity for detailed accounting and budget information. • Guarantee the production of reports that adapt to specific user needs, with appropriate tools.
2. Tracking cash flows and bank reconciliation	<p>Electronic payments and bank reconciliation</p> <ul style="list-style-type: none"> • Ensure the integrity and consistency of deposits and payments data shared between the FMIS and government bank accounts.
3. Budget execution and internal control	<p>Budget management and control</p> <ul style="list-style-type: none"> • All expenditures, loans, debts, donations and grants must be administered through the FMIS. • Capture all the relevant data to guarantee control of expenditure by tracking all the payment of commitments, budget allocations, and budget releases. • Enable tracking of multi-annual expenditure on individual public investment projects, identifying delays in implementation and overspending. • Create a data cube for budget, treasury, and accounting.
4. Treasury and cash management	<p>Support government banking functions</p> <ul style="list-style-type: none"> • Support efficient operation of the single treasury account (STA), under a single bank account or a unified bank accounts structure. • Establish electronic payment mechanisms that avoid manual payments for central government, entities and extra-budgetary accounts, and social security funds.

(continued on next page)

T A B L E A 7 . 5 . 1 (continued)

Most Important Functional Requirements	
Theme	Requirement / Description
	<p>Produce reliable and timely information for cash administration purposes</p> <ul style="list-style-type: none"> Record the cash flow on the days the payments are made and deposits received. Record accurate and timely information of the date of recognition of outstanding accounts. Ensure that payments are made on or before the expiry date. Provide timely information about the stock of arrears and the accumulation of new arrears. Create a data cube for treasury and financial programming.
5. Debt management ^a	<ul style="list-style-type: none"> Establish a debt management and analysis module or subsystem, adaptable or custom software based on a commercial system. Commercial autonomous debt management systems are available with interface for integrating debt management with the FMIS (e.g., DMFAS 6, created by UNCTAD).^b
6. Public procurement	<ul style="list-style-type: none"> Establish a public procurement management module or subsystem, adaptable or custom software based on a generic commercial system. Commercial systems must be integrated with the FMIS, preferably carrying out the stages of expenditure in real time.^c
7. Human resource management	<ul style="list-style-type: none"> Establish a human resource management module or subsystem, adaptable or custom based on a generic commercial system. Commercial systems must be integrated with the FMIS, preferably carrying out the stages of expenditure in real time.^c
8. Transparency	<p>Provide society with exhaustive public expenditure information</p> <ul style="list-style-type: none"> Ensure that timely, accurate, and exhaustive public expenditure information is collected in a database. Ensure the availability of basic reports and advanced search tools to enable the delivery of reports from various perspectives. See, for example: http://www.usaspending.gov/. Establish technological capacities for online access to reports by civil society institutions (API and Web services).
9. General	<ul style="list-style-type: none"> Evaluate the need to manage multiple currencies or monetary units. Evaluate the need to disclose future budget exercises—multi-annual budget.
10. Institutional coverage	<ul style="list-style-type: none"> Institutional coverage must include, at the very least, central government, budget entities, extra-budgetary accounts and social security funds. This may be implemented in phases.

Source: Authors' elaboration, with contributions from Uña, Allen, and Botton (2019).

Notes:

^a Desirable functionalities in a debt management module:

- Record all information relating to loans, donations, and debt securities, including their possible relationship to projects and national budget accounts.
- Create and automatically update the estimated disbursements.
- Automatically calculate all amortization tables automatically.
- Record actual money orders, actual placements, and debt service operations.
- Identify the loans with debt servicing arrears and calculate the interests for late payment.
- Elaborate a wide range of standard and personalized reports, including reports for statistical bulletins and reports for evaluation and control purposes.
- Analyze the debt portfolio and formulate debt management strategies.

* Source: https://unctad.org/dmfas/system/files/client_area/UNCTAD_GDS_DMFAFAS_MISC_2011_1_spa.pdf.

^b DMFAS is the Debt Management and Financial Analysis System; UNCTAD is the United Nations Conference on Trade and Development.

^c Due to the size of the project, this is generally developed in a specific project.



In this chapter:

- 8.1** Introduction
- 8.2** Route Map for FMIS Modernization
- 8.3** Functional Assessment of the Current FMIS
- 8.4** Assessment of the Information and Communication Technologies of the Current FMIS
- 8.5** The Decision to Replace Modules or Develop an Entirely New FMIS
- 8.6** Development of a New FMIS: Alternatives
- 8.7** Modular Approach: Basic Concepts
- 8.8** Modular FMIS Modernization
- 8.9** Using the Cloud
- 8.10** The Subnational FMIS: Alternatives

Modernizing an FMIS: Implement a New One or Reform the Existing One?

8.1 Introduction

In Latin America and the Caribbean (LAC), nearly all countries have implemented a financial management information system (FMIS). However, once an integrated financial management system (IFMS) has been proven to be ineffective, actions should be taken to modernize it, through a specific project.

Two major alternatives are presented here: either developing a new FMIS or renewing the current one. Making this decision is the first challenge that arises during project preparation.

Developing an FMIS is a complex task, from both the functional and the technological point of view, and implies a high cost for the institution. Its cost goes beyond the budget allocated to it, after the number of internal man-hours that will go into the design and the specifications—particularly functional ones—testing and commissioning are taken into account.

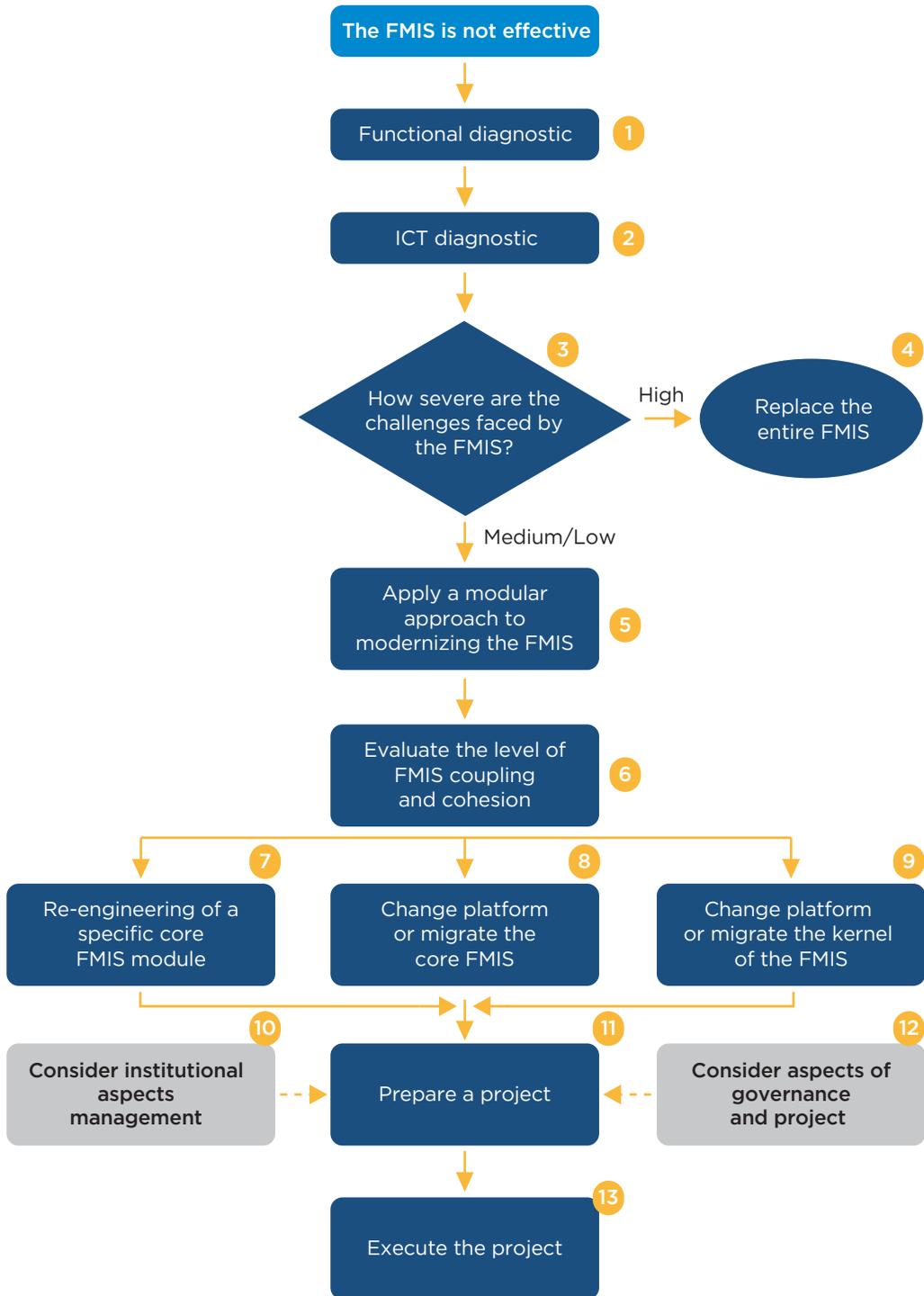
The substitution of information technology (IT) modules, which prolongs the life of the system at a lower cost and with less complexity, is, however, not recommended in all cases. It will depend on certain characteristics of the construction of the existing FMIS and of the quantity/impact of the functional and technological aspects that need to be modernized.

8.2 Route Map for FMIS Modernization

The initial idea of FMIS modernization is generally based on empirical observations and complaints from users and stakeholders—lead agencies, ministries, entities, citizens, and others—which must thereafter be demonstrated by a formal evaluation. To help make this critical decision, a route map is used (Figure 8.1).

FIGURE 8.1

Route Map for FMIS Modernization



Source: Authors' elaboration with contributions from Uña, Allen, and Botton (2019).

The actions defined in this route map will be presented below, with the proposals, tools, and guidance needed to follow it.

8.3 Functional Assessment of the Current FMIS

The functional assessment must be based on the existence and optimal operation of certain functionalities, some of which are essential in a modern FMIS, while others are specific to a particular financial administration.

Annex 5.2 (Chapter 5, FMIS Conceptual Model) sets out the requirements for the core subsystems of a modern FMIS. Based on these requirements, a list can be made of functionalities that must be evaluated for diagnostic purposes, and which must be complemented and adjusted according to the specific environment of each financial administration.

Although essential, the problems of the system reported at a user help desk or similar user support structure are not considered here to be the sole factor that justifies making functional or technological changes to the FMIS. This is a management decision, which can be implemented at any time. Moreover, the questions and problems reported to the user help desk can also support decisions that relate to changes in processes or forms in different areas of the FMIS.

The proposal is to award a severity rating to the problem of implementing each FMIS functionality. This rating can be a number—for example, from zero to five—where zero signifies good quality implementation—negligible severity of problems—and five indicates absence or very poor quality of functionality implementation—maximum severity of problems. Some functionalities are more critical than others when it comes to good FMIS operation. In this case, an importance or weighting can be assigned to each functionality in relation to the others.

Finally, using a weighted average, a general severity rating can be arrived at for the functional problems. This rating can provide an executive view of the existing functional problems and be useful for the decision-making process that will be discussed below.

It is possible to adopt a general functional rating scale for the FMIS, based on the final scores obtained. One option would be as follows:

Degree of severity of functional problems between 0 and 1.5:
FMIS in good functional state

Degree of severity of functional problems between 1.5 and 3.5:
FMIS needs functional improvements

Degree of severity of functional problems between 3.5 and 5:
FMIS with critical functional problems

Table 8.1 presents an example that helps identify and rate the severity of the functional problems of an FMIS, which must be adjusted in each case. This type of exercise

must include the participation of the functional and technological experts related with these processes and may be carried out with the support of external consultants.

T A B L E 8.1

Severity Rating of the Problems of an FMIS According to Functional Assessment				
Assessment of severity of functional problems		Severity rating	Weighting	Value
		0-5		
1	Accounting and fiscal reports: produce timely and accurate fiscal reports			
1.1	Produce financial statements on cash basis: state of cash receipts and payments, accounting policies and explanatory notes, and a comparison of original and current budgets.			
1.2	Issue annual financial statements within six months of the end of the fiscal year.			
1.3	Issue budget reports throughout the year (monthly, quarterly, semi-annually) and at the end of the year, according to criteria established by international standards.			
1.4	Ensure that accounting entries are accurate and automated.			
1.5	Certify that all data and budget accounts are appropriately and consistently classified according to administrative units, economic categories, functions, etc., in line with international standards.			
2	Failure to integrate the plan of accounts with the budget classification			
2.1	Ensure coherence between the plan of accounts and the budget classification.			
2.2	Guarantee timely and reliable accounts and budget records of all financial transactions.			
2.3	Establish data storage with drill-down capacity for detailed accounting and budget information.			
2.4	Guarantee the production of reports that adapt to specific user needs, with appropriate tools.			
3	Tracking cash flows and bank reconciliation: electronic payments and bank reconciliation			
3.1	Ensure the integrity and consistency of deposits and payments data shared between the FMIS and government bank accounts.			
4	Budget execution and internal control: budget management and control			
4.1	All expenditures, loans, debts, donations, and grants must be administered through the FMIS.			
4.2	Capture all the relevant data to guarantee control of expenditures by tracking all the payment of commitments, budget allocations, and budget releases.			

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T A B L E 8.1 (continued)

Severity Rating of the Problems of an FMIS According to Functional Assessment			
Assessment of severity of functional problems	Severity rating	Weighting	Value
	0-5		
4.3 Enable monitoring of expenditure at all its stages: pre-commitment, commitment, accruals and payment.			
4.4 Enable tracking of multi-annual expenditure on individual public investment projects, identifying delays in implementation and overspending.			
5 Treasury and cash management: support government banking functions			
5.1 Support efficient operation of the single treasury account (STA) under a single bank account or a unified bank accounts structure.			
5.2 Establish electronic payment mechanisms that avoid manual payments for central government, entities, and extra-budgetary accounts and social security funds.			
6 Ensure reliable and timely information for cash administration purposes			
6.1 Record the cash flow on the days the payments are made and deposits received.			
6.2 Record accurate and timely information of the date of recognition of outstanding accounts.			
6.3 Ensure that payments are made on or before the expiry date.			
6.4 Provide timely information about the stock of arrears and the accumulation of new arrears.			
7 Transparency: provide society with exhaustive public expenditure information			
7.1 Ensure that timely, accurate, and exhaustive public expenditure information is collected in a database.			
7.2 Ensure the availability of basic reports and advanced search tools to enable the delivery of reports from various perspectives. (See, for example: http://www.usaspending.gov/.)			
7.3 Establish technological capacities for online access to reports by civil society institutions (API and Web services).			
8 General:			
8.1 Evaluate the need to manage multiple currencies or monetary units.			
8.2 Evaluate the need to disclose future budget exercises (multi-annual budget).			
Total:			
Functional diagnostic rating:			

Source: Authors' elaboration.

8.4 Assessment of the Information and Communication Technologies of the Current FMIS

The assessment of the ICTs in an FMIS can be carried out in a similar way as for the functional aspects, considering different perspectives that are identified in Annex 5.2 (Chapter 5, Conceptual Model) and other operational aspects. Table 8.2 presents these perspectives, which should be adjusted to the needs of the specific country.

T A B L E 8 . 2

Severity Rating of the Problems of an FMIS by IT Assessment			
Assessment of the severity of technological problems (ICT)	Severity rating	Weighting	Value
1 Hardware and software infrastructure			
1.1 The software packages used by the FMIS are adjusted to the system's ongoing modernization needs.			
1.2 The infrastructure (on-premise or in the cloud) ^a is compatible with technologies that can offer services to taxpayers via the internet.			
1.3 The FMIS platform is web-based.			
1.4 There is software support for the use of electronic signatures.			
1.5 There is software support for the introduction of data cubes. ^b			
1.6 The IT platform of the FMIS permits timely ongoing maintenance.			
1.7 The IT platform is stable.			
1.8 The IT platform permits online information exchange between institutions.			
1.9 There is connectivity with the tax information system for validating the tax identification number (TIN) and the invoice value (electronic invoice where available).			
1.10 Maintenance is timely and sufficient and conforms to standards such as COBIT or ITIL.			
1.11 The costs of maintaining and updating the IT platform are acceptable. ^c			
1.12 Documentation of the system is adequate and sufficient to guarantee its maintenance.			
1.13 The FMIS data center is world class (e.g., TIER 3) or a similar service is used in the cloud.			
1.14 All the executive organs are connected to the system.			
1.15 The servers and storage equipment (on-premise or in the cloud) respond to short- and medium-term financial management needs.			
1.16 The software licenses used in the FMIS are adequate and legalized.			

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T A B L E 8 . 2 (continued)

Severity Rating of the Problems of an FMIS by IT Assessment			
Assessment of the severity of technological problems (ICT)		Severity rating	Weighting Value
		0-5	
2 Security			
2.1	There is redundancy at the main data center.		
2.2	There is an active information security plan.		
2.3	There is an active business continuity plan.		
2.4	There is a database and data network cryptography.		
3 Processes (ICT)			
3.1	FMIS life cycle management processes are implemented.		
3.2	Agile system development methodologies are used, or an efficient management methodology of adaptable and parameterizable COTS software solutions.		
3.3	There are data management processes.		
3.4	A process is underway for the preparation, approval, and monitoring of an information technology strategic plan (ITSP) or similar.		
3.5	There is a service outsourcing strategy.		
4 ICT human resources			
4.1	The ICT human resources are sufficient.		
4.2	There are ICT human resource training and updating programs.		
4.3	Strategies are in place to attract, retain, and evaluate ICT human resources.		
Total:			
IT diagnostic rating:			

Source: Authors' elaboration.

^a If contracted in the cloud, there is more flexibility for making changes.

^b A data cube is a multidimensional data matrix.

^c Generally speaking, between 10 and 20 percent of the value of the platform.

The proposal is to award a severity rating to the problems detected in relation to the technological aspects of the FMIS. This rating can be a number—for example, from zero to five—where zero signifies good quality implementation—negligible severity of problems—and five indicates absence or very poor quality of functionality implementation—maximum severity of problems.

Some technological aspects are more critical than others when it comes to optimal FMIS operation. In this case, an importance or weighting can be assigned to each aspect in relation to the others.

Finally, using a weighted average, a general severity rating can be arrived at for the technological problems. This rating can provide an executive view of the existing functional problems and be useful for the decision-making process that will be discussed below.

Similar to the functional evaluation, a general IT rating scale can be created for the FMIS, based on the final scores obtained. A possible option would be the following:

Degree of severity of IT problems between 0 and 1.5:
FMIS in a good IT situation

Degree of severity of IT problems between 1.5 and 3.5:
FMIS needs IT improvements

Degree of severity of IT problems between 3.5 and 5:
FMIS with critical IT problems

Table 8.2 presents an example that helps identify and rate the severity of the functional problems of an FMIS, which must be adjusted in each case. This type of exercise must include the participation of the functional and technological experts who are associated with these processes, and may be carried out with the support of external consultants.

Measuring the level of severity of the functional and technological problems is not a mathematical procedure; it depends on the context of each institution. The intrinsic deficiency of a specific technological or functional element should be separated from the institution's own shortcomings in using it, for which there may be other causes. It is important to take complexity into account when making a reasonable and impartial measurement of these factors. If possible, these should be evaluated with the support of outside experts.

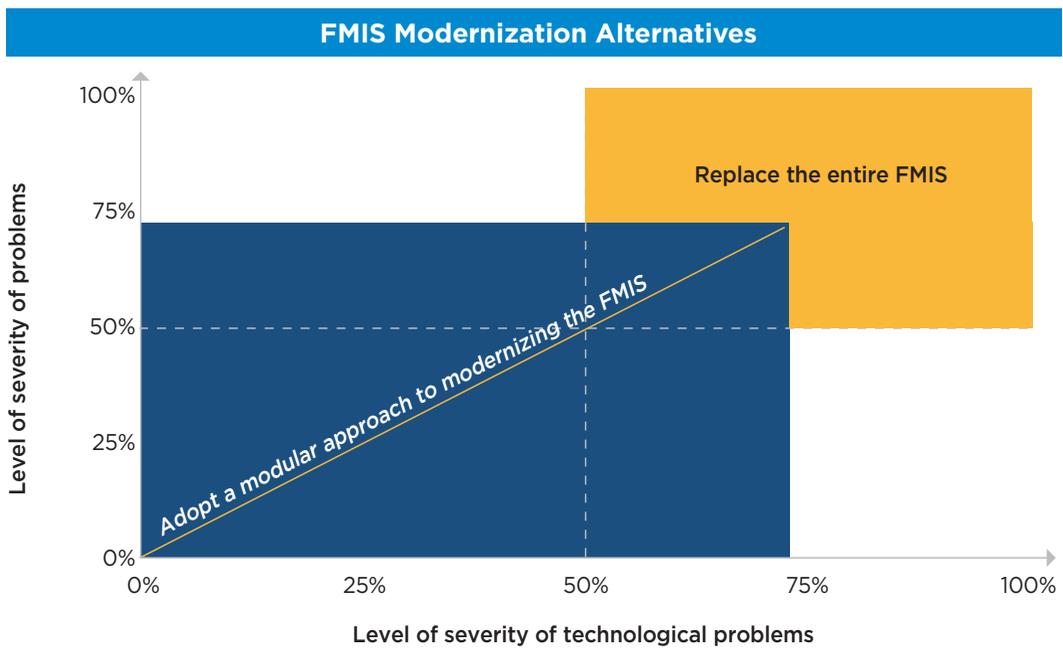
8.5 The Decision to Replace Modules or Develop an Entirely New FMIS

As already indicated, there are two options for modernizing an FMIS: replace modules or remake the system completely. The functional and IT assessments shown above can provide a clue as to the direction to follow, transforming the final result of the two evaluations—functional and IT—into a percentage with respect to the maximum possible result.

Uña, Allen, and Botton (2019) put forward an empirical method by which the severity of the functional and technical problems determines the response to the question (Figure 8.2).

Empirically, this model applies the 80/20 rule—the Pareto principle—which establishes that in many situations, 20 percent of the causes produce approximately 80 percent of the effects. It considers that, on average, the core FMIS functionalities represent 20 percent of all the system functionalities. Therefore, it should be possible to evaluate whether the severity of the functional challenges and the technological problems are related to more than 80 percent of all the FMIS functionalities. In this figure, the conditions show that if the FMIS displays severe weaknesses or failures that

FIGURE 8.2



Source: Uña, Allen, and Botton (2019).

reach, approximately, more than 75 percent of its core functionalities and technologies—part of the right upper quadrant—there is strong evidence for substituting the system. Otherwise, other solutions may be feasible, such as changing some of the system modules.

There are conditions in which a decision may be made to completely substitute an FMIS in the expectation of one or two potentially extremely serious problems. An example is anticipated obsolescence of the ICT platform that serves as a base for the FMIS and would give rise to serious problems over the medium and the long term with respect to the evolution, sustainability, and maintenance of the operation. In this case, the most appropriate method is for these discussions to be carried out by a high-level team that can confirm the veracity of the premises.

8.6 Development of a New FMIS: Alternatives

8.6.1 Development Models

The development of a new FMIS can adopt three main models:

- Custom software internal development, with in-house resources or individual consultants.

- Custom software development via a software firm or manufacturer.
- Acquiring a COTS solution.

Adopting an IT solution for the FMIS has advantages and disadvantages (Table 8.3). In Latin America, the most common solution is custom software development. In the Caribbean, the COTS type of solution prevails. Chapter 1 presents more details.

Furthermore, several recommendations made by the German Development Bank (ITC KfW, 2015) may be considered when implementing a tax information system in developing countries, since they are also feasible in the case of an FMIS. The German Development Bank proposes developing a business case to compare the available alternatives since, in general, ministerial ICT departments overestimate their capacities to develop a complex product such as an FMIS. On the other hand, the providers of COTS often lack a deep understanding of the requirements of public financial administrations in general and of the specific conditions of a country. The aforementioned reference, moreover, enumerates aspects that must be taken into account when making the decision to either create or purchase an FMIS, according to the adaptations and extensions indicated below:

- A complete general description of the costs and benefits of each scenario—internal/LDSW or COTS—must be considered in detail.
- If a COTS solution is chosen, the following factors must be considered:
 - The scope and available functionalities of the system evaluated compared to the required functionalities. This will indicate the volume of personalization/adaptability necessary.
 - The full cost of purchasing the system licenses and the subsequent support and maintenance contracts, known as the total cost of ownership (TCO), and their respective updates.¹
 - Facilities for inserting additional programming code into the system.
 - Impacts on software maintenance/update costs of introducing additional code into the system.
 - Clarity with respect to the version maintenance/update costs and the rules for price readjustments.
 - The training courses required for software management, parameterization, and programming of additional code, with the associated costs.
 - Flexibility in the use in the cloud and migration to the data center, and vice versa.
 - Availability of similar facilities in the world, especially in Latin America.
 - Technical support facilities—local and via a help center.
 - IT infrastructure requirements—technical characteristics and costs.

¹ Most COTS systems establish their costs—total and maintenance—based on the number of users that access the system. In this case, any expected expansion in the number of users over the medium or the long term must be clear from the start. The annual cost of maintaining an FMIS using the COTS model can be estimated at around 20 percent of the value of the licenses acquired.

T A B L E 8 . 3

Advantages and Disadvantages of FMIS IT Solutions		
Type of IT Solution	Main Advantages	Main Disadvantages
Custom software solutions, with in-house human resources, or individual consultants	<ul style="list-style-type: none"> • The state retains ownership of the software source code. • Possibility of rapidly applying changes to the system. • Low cost of maintenance over the short and medium term. • State responsibility and development totally under control. • The system can perfectly reflect the functional processes established, which can be adjusted rapidly should the processes change. 	<ul style="list-style-type: none"> • Often implies hiring new staff and setting up large ICT areas to develop and maintain the system. • The state assumes all the risks of the project. • Institutional inertia is often produced, with large technology units that never completely finish the project.
Custom software solutions, with external resources (LDSW)^a	<ul style="list-style-type: none"> • The state retains ownership of the software source code. • The risks are shared between the state and the provider. • Less need to hire more employees or individual consultants or to create large ICT areas. 	<ul style="list-style-type: none"> • Often requires contracting maintenance services. • May lead to dependence on the provider for maintenance. • It is often more expensive than custom software development with in-house human resources or individual consultants.
Commercial adaptable or parameterizable solutions (COTS)	<ul style="list-style-type: none"> • Facilitates implementation of good business practices. • The risks are shared between the state and the provider. • The implementation times can be shorter; however, possible conflicts in making the functional areas accept the system processes may prolong implementation time. 	<ul style="list-style-type: none"> • The state does not own the software source code. • Greater commitment is required from the state to adapt its business processes to the IT solutions. • The state is liable for the licensing, support and maintenance costs, which can be high over the long term if vendor lock-in occurs (dependence on a single provider that owns the technologies).

Source: Authors' elaboration based on Seco et al. (Eds.) (2020).

^a Locally developed software.

- Underlying technological platform (required), compared to what is already available within the existing public financial administration and its interfaces.
 - The capacities that exist within the financial administration’s IT department to be able to maintain the system after this phase of the project.
- If an internal/LDSW solution is chosen, the following factors must be considered:
 - Level of knowledge and understanding of cutting-edge practices within the financial administration.
 - Level of experience to translate such cutting-edge practices into an integrated set of business process models, which must be computerized.
 - Total cost of ownership: cost of designing, building and maintaining the system, including external consultancy in all phases of the project.
 - Underlying technology platform within the financial administration and how this relates to the new desired situation.
 - Capacities existing within the financial administration’s IT department to build and maintain such a system, or to cooperate with an external IT company to create one.
 - In the case of LDSW, the existence of an IT company with the abilities and the presence in the market and in the country, to build and maintain a system, or to cooperate with the financial administration to create one.
 - The development methodology to be used.
 - The artifacts that will be produced.
 - Costs of maintaining the team of technical experts for maintenance and improvement activities.

8.6.2 Open-source Software

An alternative that has yet to be fully explored in LAC is open-source software. The term “open source” refers to software that people can modify and share because its design is publicly available. The term originated in the context of developing software to design a specific approach to the creation of computer programs. Today, however, “open source” designates a wider set of values called the “open-source way.” Open-source projects, products, or initiatives adopt and celebrate the principles of open exchange, collaborative participation, rapid prototype creation, transparency, meritocracy, and community-oriented development.² Open source, however, does not necessarily mean without cost. Although no licensing fee is charged in open source, or only a relatively low fee is charged in the commercial version, the costs of implementation, configuration, personalization, integration, security, and training must also be considered.

In Uruguay, the budget management component of the SIIF2 system uses open software (OdoO).³

² See: <https://opensource.com/resources/what-open-source>.

³ See: https://www.odoo.com/es_ES/.

8.6.3 Comments on COTS Solutions for an FMIS

The most well-known risk of using COTS solutions occurs when an institution frequently changes its business processes, adopting its own processes, which do not follow best international practices. In this case, the system requires additional code, or programming, which has a double cost: coding the specific solution and its maintenance in later versions of the software. The original costs, thereby, increase until they reach levels that the lead institution often finds it difficult to assume.

The adoption of a COTS solution is a long-term commitment between the lead institution of the FMIS and the software provider. Therefore, a permanent close relationship should be sought which always seeks consensual solutions to tackle day-to-day problems.

In general, an FMIS lasts longer than the terms of the governments or managers who made the initial decision to implement it. It is therefore possible that new managers may change the originally accepted premises—for example, the commitment to use only processes that adhere to best international practices—and that this may impact the estimated maintenance costs. However, such decisions should not invalidate a COTS-based FMIS, if they are considered during the decision-making process.

A golden rule is often applied when assessing the suitability of a particular COTS solution for a specific FMIS: the package must support at least 80 percent of the FMIS functionalities and must be parameterizable. Based on this rule, the need for a full survey of the functional requirements of an FMIS is accentuated, even when COTS solutions are used.

8.6.4 A COTS-based FMIS in the Cloud or in a Data Center

It may be necessary to decide whether the COTS solution will be cloud-based or installed in the purchaser's on-premise data center. Although this decision is mainly strategic and financial, the technical aspects related to the software performance must also be evaluated beforehand, especially with regard to the latency of services in the cloud and the possible adjustments needed in the data network used by the financial administration.

In the event that the COTS solution is installed in the on-premise data center, the firm should offer support in sizing the IT equipment. Likewise, it will also be necessary to evaluate hardware structures that must be scalable and support virtualization.

As part of the selection process, visits to organizations that have installed similar systems are recommended, preferably in the public sector. It is also useful to meet private sector users, even if they are not functionally compatible, to verify performance-related situations, the structures of the parameterization and technical support teams, and the technical support offered by the software provider.

8.6.5 Custom Software Solutions for an FMIS: An Estimate of the Development Costs

One of the problems that most affects the construction of a custom software FMIS is the estimate of development and implementation costs. When developed internally, this estimate can be used for sizing the equipment *vis-à-vis* the proposed time available for the project. When carried out by an outside firm, this estimate becomes even more critical, as it determines parameters for procurement, especially regarding the cost to be paid. Due to unrealistic estimates—generally underestimated—many contracts require readjustment throughout their development to avoid improvised endings or reductions in contract scope.

To achieve a reasonably correct estimate, the following three key factors must be taken into account:

1. Detailed and exhaustive functional specifications
2. Data model availability
3. Use of a recognized estimation method

The comprehensiveness of the functional specification and the data model will impact positively on the accuracy of the estimate.

There are various acceptable estimation methods, depending on the experience available in the country. One of the most commonly used is the function points (FP) metric and its variants, such as, for example, NESMA,⁴ which is often adopted for its relative simplicity and accuracy within acceptable limits. NESMA recognizes three methods of analysis per FP: (i) detailed, (ii) high level, and (iii) indicative. The latter two do not demand detailed requirements and yield adequate results.

The result of applying this method will be the “functional size” of the FMIS, expressed in function points. An estimate of the cost can be made based on the functional size. The cost of the FP will vary according to the work required to deliver the specified characteristics of the FMIS, according to the technical standard and quality and the number of deliverables—artifacts, documents, models, and others—requested by the customer. The technology to be used will also influence the value of the FP.

In summary, everything that significantly affects the cost but does not have a direct relationship with the size of the system measured in FPs will be included in the calculation of the price of the FP.

In Brazil, in 2017, the average price of a function point when acquiring an information system in the public sector was BRL 985.67 (~ US\$307, at then-current

The support of an external consultant who specializes in function points is recommended in order to calculate the functional size of a FMIS and, subsequently, to establish a reasonable value of the FP, as a reference, based on similar systems in the local market.

⁴Netherlands Software Metrics Users Association.

values), with 80 percent of the tenders with FP values of up to BRL 688.00 (~ US\$215, at then-current values).⁵

8.6.6 Custom Software Solutions in an FMIS: Development Methodologies

The current trend is toward the use of agile development methodologies, which can achieve incremental product delivery with higher quality and in shorter periods. Additional results are an improvement in customer satisfaction, whose results are rapidly seen, and in the motivation of the development team where everyone is aware of project situation and the results are negotiated. Various specialists in the area proposed the Agile Software Development Manifesto,⁶ which expresses the philosophy that backs up these methodologies. According to the Manifesto, some of the principles of agile methodologies place more value on software functioning than on extensive documentation, on collaboration with the customer rather than on contractual negotiation, and on responding to change rather than on following a plan.

There are various agile methodologies in the market, and a new one seems to appear every day. These include: Extreme Programming (XP), Scrum, Kanban, and Design Sprint (Google). What matters is to choose one in the event that none are currently being used in the IT area, and to follow its rules. This is where it becomes necessary to rely on experts if there are no in-house personnel who understand the methodology and its application.

In this context, an important aspect to remember with regard to agile methods is that the FMISs are governmental information systems. Therefore, negotiations with the customer are constrained by the requirement to comply with current laws, or business requirements.

Agile methodologies can affect certain modeling approaches consecrated in traditional methods of development. For example, the use of Java Persistent API (JPA) enables the class model that represents the business entities to be mapped directly in the source code. When the system is connected to the database for the first time, database entities are automatically created, based on tables, references, indices, and validations which, to a large extent, reduces the need for data modeling.

It is important to define what constitutes adequate documentation of the system and its artifacts, compared to the maintenance needs and the computerized auditing common in this type of system. It is also worth remembering that the amount of documentation provided impacts the terms of delivery and the system costs.

8.6.7 Custom Software Development Contracted Externally

Under this approach, an external company or software manufacturer is contracted to develop the FMIS, providing analysts and programmers, its own management of the

⁵ Data from Brazil's Tribunal de Contas da União.

⁶ See: <http://agilemanifesto.org/iso/es/manifesto.html>.

development team, and methodologies and production of artifacts. These firms can be in the same country or in a foreign country, such as India.

In this case, an accurate and full functional specification fundamentally contributes to success. Nonetheless, other measures are necessary. The price estimate based on verifiable metrics, as mentioned previously, is essential for avoiding contractual problems during development. The documents that the external firm must produce and deliver, known as artifacts, must be clearly specified. The choice of these artifacts is important because it affects the clarity of the documentation and the costs of the product.

The product testing and acceptance mechanisms must be clear and based on the functional requirements/specifications. The technique of use cases is worth highlighting here, which is particularly suitable for acceptance tests.

8.6.8 Custom Software Development: Preparing the Future

A custom software solution can be developed internally with in-house resources backed by externally contracted consultants, or can be acquired from a software provider or manufacturer. In both cases, the corrective maintenance and evolution of the future FMIS must be planned ahead of time: will this be done by the internal IT team?; are there enough technical experts with the right skills?; will it be outsourced to the provider?; have real cost estimates been made?; are the managers aware of the cost variables involved? The answers to these questions will guide the actions aimed at supporting the project, such as allocating budget resources, hiring additional technical personnel, and training oriented to achieving the desired goals.

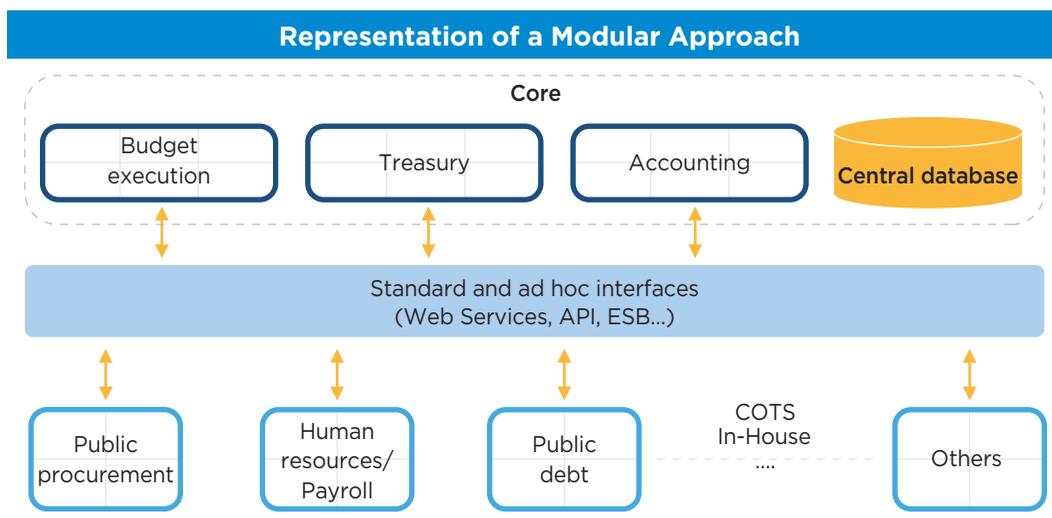
8.7 Modular Approach: Basic Concepts

The modular approach can be used either for replacing modules, modernizing an existing FMIS, or for constructing a new FMIS. An FMIS developed using a modular approach can modernize subsystems or individual modules without having to remake the entire system from time to time. A modular architecture uses standard components and interfaces, offering a wide range of architecture options for the core FMIS and the connected systems (Figure 8.3).

In the case of internally developed modules, a variety of programming environments can also be used, ranging from those based on container software⁷ to those programmed directly in languages such as Java, Pearl, Python, and others. The organization of these modules into microservices also provides flexibility, with less coupling and more cohesion.

⁷ A container is a standard unit of software that packages up code and all its dependencies so the application runs quickly and reliably from one computing environment to another.

FIGURE 8.3



Source: Authors' elaboration based on Pimenta and Seco (2019).

Coupling is the measurement of the level of interdependence between modules. Software is considered good when there is a low level of coupling.

Likewise, there are various models of coupling. The most effective is data coupling, that is, when the interdependence between modules is based exclusively on data sharing.

Cohesion is the measurement of the level of functional relationship between the elements of a module, that is, the level by which all the elements of a component are directed toward a single task. Good software has a high degree of cohesion.

8.8 Modular FMIS Modernization

The replacement of modules in an FMIS can be carried out by three methods: (i) re-engineering core modules, (ii) developing a data exchange layer, and (iii) changing the platform or migration of the core FMIS. Figure 8.3 depicts the FMIS design alternatives using the modular approach.

In each method there are preconditions with respect to the problems identified, and these must be evaluated. The three alternatives described below were adapted from Uña, Allen, and Botton (2019).

8.8.1 Re-engineering a Specific Module of the FMIS Core

The optimal case in which the modular approach may be applied occurs when the following situations arise: there is low coupling; there are low or medium functional problems in

the core accounting and fiscal report modules, budget execution, or treasury and cash management; and there are no severe technological problems. This approach resolves non-critical functional problems and improves performance and interoperability. It may require the development of a middleware layer or changes in the database structure.

For the substitution of a module, a specific module can be developed that covers local needs or a software alternative provided by the same or a different provider. The current availability of agile development methodologies means that this strategy is faster to implement and more economical than it used to be.

Another alternative is to use one specific COTS segment, such as a budget formulation module. However, the flexibility of acquiring the COTS software in installments and the costs involved must first be evaluated.

8.8.2 Development of a Data Exchange Layer for the FMIS

This approach is more appropriate for an FMIS in which the following situations are present: the system is developed as custom software, the level of coupling is medium, the functional problems are low or medium, and the technological problems are not severe.

This approach maintains the existing modules, which can be communicated via an Application Programming Interface (API), using an Enterprise Service Bus (ESB) interconnection. It can also support communication with interconnected systems, such as public procurement, human resources and payroll and others, via an API, Web services, and others.

8.8.3 Changing the Platform or Migrating the FMIS Core to the Cloud

This alternative is preferred when the functional problems are few but the technological problems are of medium or high impact and are related to software licenses, database problems, or hardware and connectivity deficiencies. The proposal is to migrate from high-cost hardware or obsolete platforms to platforms that are fit for use in the cloud, using techniques known as “lift and shift.” These include moving the application or operation from one environment to another without having to redesign the application or the operations work flow. For example, Argentina is currently trialling moving its FMIS (eSIDIF) directly to the cloud, using the container software technique, based on Kubernetes technology.

This alternative aims to simplify the IT environment, reducing the responsibilities (and costs) of managing the operational environment, while at the same time improving flexibility by using a reliable hardware and software platform.

8.9 Using the Cloud

The use of cloud computing offers a new opportunity for modernizing FMIS implementation and operation, including interconnected systems, at the national and especially the subnational level. Due to its importance, this new model of cloud computing for an FMIS is examined in more detail in Chapter 13 (Use of New Emerging Technologies FMIS Projects).

8.10 The Subnational FMIS: Alternatives

A subnational FMIS can serve states, provinces, or municipalities. Because of geographical, economic, and population dimensions and degrees of autonomy, some subnational entities may have an FMIS similar to the national one. Examples include the states of Sao Paulo and Rio de Janeiro in Brazil, the Mexican states of Jalisco and Mexico, Buenos Aires in Argentina, and some others. In federal countries, the functionalities of a subnational FMIS, as well as its IT infrastructure, can be equally complex as those at the national FMIS level.

8.10.1 Strategies

Depending on a country's political, geographic, and infrastructure characteristics, different strategies may be adopted to implement and operate a subnational FMIS. Some alternatives are presented below:

- **Centralized system with access via internet for subnational entities**
The central government provides a single system that serves all subnational entities. It is implemented centrally and its preferred access mode is via the internet—on demand. It is most common for an FMIS to be offered to municipalities. This avoids the proliferation of similar systems and incomplete and underused data centers. For this alternative to be viable, the system functionalities must be the same or similar for all participants. Central support will have to be provided with projections in defined spaces. Moreover, the central system must possess adequate computing capacity and an internet service of acceptable quality must be available at the national level. Bolivia and Honduras have both implemented a subnational FMIS with these characteristics.
- **Consortia for the development or parameterization of a shared system**
In this case, a group of subnational entities joins together to develop or acquire licenses and parameterize a shared FMIS. Various Brazilian municipalities use this method, especially in the southern region.⁸ This model can also be seen in the solution adopted by some of the island countries of the Caribbean, as described in Chapter 1.
- **Sharing information systems**
Some Brazilian states have adopted a form of this strategy: an FMIS developed by a private firm for a state then becomes the property of the latter. Likewise, another state can receive the same system and contract the software developer to adapt it to the local conditions and to perform the maintenance. The advantages are agility of implementation and exemption from licensing fees. In the case of Brazil, the individual states collaborated to reduce the price of the FMIS.

As mentioned in Chapter 13, for many municipalities and provinces/states, it is very difficult, in terms of scale, budget and availability of qualified human resources, to assemble data centers with physical facilities and adequate management processes. In general,

⁸ Brazil has more than 5,000 municipalities, each with constitutional autonomy.

they use “server rooms,” which are subject to the operational, availability, and security problems inherent in this type of infrastructure. The option of services in the cloud can be a solution for reducing investment costs, improving operability, and obtaining the best services for both managers and citizens.

The same comments apply to smaller-scale national financial administrations. In organizational and functional terms, institution strengthening is very important, when considering the weaknesses inherent in the subnational administrations, especially the minor ones, the establishment of municipal consortia for mutual strengthening and the adoption of the concepts of the single treasury account (STA).

8.10.2 More Information concerning Subnational FMIS

A study financed by the IDB seeks to reveal the characteristics of the subnational FMIS in certain Latin America countries and to propose guidelines for the development of these systems in the Software as a Service (SaaS) model (Alarcón and Grafe, 2021). One of the authors' key findings is the need to insert the subnational FMIS into the existing institutional arrangements, which vary considerably by country, especially with respect to transferring political power and responsibilities to the territory. However, in some countries the intermediate levels assume responsibility through the legal route for a wide range of public services, such as health and education, which are not transferred to their ownership.

To collect more information, 26 questions were put to a group of seven countries: Bolivia, Brazil, Chile, Honduras, Paraguay, Peru, and Uruguay. The responses provided the authors with a snapshot of the subnational FMISs. Among these findings were:

- Technological changes perform an essential role in the system architecture and in the type of technological solutions. In most cases, a three-layered architecture is generally used, which runs on a web platform and, in some cases, in the cloud (e.g., Uruguay) or in a data center that depends on the lead institution (e.g., Peru).
- Although decentralization and autonomy can explain the guidelines for adopting the different FMIS models, the determining element of the degree of freedom that a local subnational entity can have with respect to using a conceptual model and a particular technological solution for its own FMIS lies in the financing model of the municipalities. It could be argued that the more that municipal revenues are dependent on central government transfers, the smaller the margin of freedom they will have to choose the FMIS solution they adopt.
- In the vast majority of cases, the FMIS in operation at the subnational level in LAC is based on a conceptual model in which the functional requirements are defined by national rules in force for the management of public resources. In the most centralized countries, the ministries of finance or treasury identify these requirements, in some cases following consultations with local entities.
- The option to locate the FMIS in the cloud depends on the regulations in each country. For example, in Bolivia a law has been in place since 2011 that prohibits systems or databases from being located in the cloud—whether public or private. In Uruguay,

the only restriction is that the data center must be located in the country. However, there are other countries where it is possible to locate applications and databases in the cloud without any impediment, such as Chile, Honduras, and Peru (Schijman et al., 2020).

- In nearly all the countries consulted, the central governments supervise subnational finances via public accountability mechanisms, or through regular disclosure of financial statement information. In this case, their capacity to sanction is limited, except when managing incentives, basically via the control of national transfers to subnational entities. Supporting such supervision must be part of the technological and functional specifications of a subnational FMIS.

Considering that one of the authors' most important findings is the need to align a strategy to insert the subnational FMIS within existing institutional arrangements, which are highly variable between countries in terms of responsibilities, autonomy, local capacity, and transfers received from the central government, one possibility would be to use the transfers to adopt and use an FMIS that is offered by the central government via the internet (such as a SaaS), with the argument that their transfer resources would then be automatically available online. In this alternative, the theme of the STA must be analyzed in greater depth, with the possibility that transfer resources appear as available in the subnational FMIS but continue to be deposited in the national STA unless they are executed with online payment orders. The National Treasury would act as a bank holding the transfer resources for subnational governments. Bolivia has adopted this mechanism.

The study also evaluates strategic, institutional, and technological aspects of introducing an FMIS using the SaaS model in the municipalities of Paraguay. To comply with this objective, certain preconditions were identified that might be applicable in other countries, depending on the technological solution finally adopted for the subnational FMIS. The Paraguayan municipalities should work to improve their institutional weaknesses and undertake a process of modernization in which the financial management model is strengthened and advanced technological solutions are implemented. These solutions should not be limited to the basic financial modules—accounting, budget, treasury, and public debt. They should also serve as tools for better tax collection and revenue management, which is one of their principal concerns. This alternative could include a paradigm shift in the way in which computing resources are used, via a payment for use model, while the municipal management modules would permit access via the internet.



In this chapter:

- 9.1** Introduction
- 9.2** Information Security Management Systems in FMIS and Central Agencies
- 9.3** Roadmap for the Design of an Information Security Management System
- 9.4** Prioritization of Information Security Projects
- 9.5** Access Security in FMIS
- 9.6** Audit Records and Trails
- 9.7** Cloud Security
- 9.8** Outsourcing of Information Security Activities
- 9.9** Additional Considerations

Annex 9.1 Sample Information Security Policy

Information Security in an FMIS

9.1 Introduction

Information security should be an ongoing concern for those responsible for the financial management information system (FMIS). Its databases contain sensitive information, and the continuity of its operations is essential for the effective functioning of the entire government. Accessible by means of communications networks, with users distributed across all government agencies and often external entities, the FMIS is a complex environment that must be protected in terms of privacy, confidentiality, integrity, availability, and traceability.

Government systems suffer all kinds of attacks daily, including fraud, mischief, or simply someone enjoying a challenge. FMIS are attractive targets due to their importance and national coverage. The digitization of society has increased the attraction of carrying out cyber-attacks on information systems worldwide, making the field of information security a strategic concern for companies and governments.

The consulting firm EY revealed surprising figures in this area from a global security survey for the years 2018–2019 (EY, 2019) (Table 9.1).

In the public sector specifically, a 2018 survey of government institutions in the United Kingdom (British Standards Institute, 2018) produced the data laid out in Table 9.2, relating to security violations occurring over a 12-month period.

These data confirm the need to comprehensively strengthen the security of mission-critical government systems such as the FMIS.

Security is a cross-cutting process for organizations, and although it has become increasingly sophisticated and technology-intensive, it is nonetheless true that information security-related issues can only be comprehensively and effectively tackled by establishing clear policies, consistent practices, effective procedures, and the active participation of all stakeholders. This means establishing a complete and effective information security management system (ISMS).

T A B L E 9.1

General Figures on Information Security Problems	
6.4 billion Number of fake emails sent worldwide every day.	1,464 The number of government officials in one U.S. state using “Password123” as their password.
50% Proportion of local authorities in England relying on unsupported server software.	2 million Number of stolen identities used to make fake comments during a U.S. government survey on net neutrality.
1,946,181,599 Total number of records containing personal and other sensitive data compromised between January 2017 and March 2018.	US\$729,000 The amount lost by a businessman in a scam involving two types of phishing. ^a
550 million Number of phishing emails sent out by a single campaign during the first quarter of 2018.	US\$3.62 million Average cost of a data breach in 2018 (United States).

Source: EY (2019).

Note:

^a Phishing is a form of identity theft that occurs when a malicious website poses as a legitimate one with the aim of tricking users into entering confidential information such as passwords and/or bank account or credit card data.

T A B L E 9.2

Types of Information Security Breaches: U.K. Government Institutions			
Staff errors	32%	Phishing ^a	30%
Malware ^b	18%	Ransomware ^c	11%
Denial of Service (DoS) ^d	7%	Malice from disgruntled employees	2%
Access from past employees	1%	No security breaches	23%

Source: BSI, 2018.

Notes:

^a Phishing is a form of identity theft that occurs when a malicious website poses as a legitimate one with the aim of tricking users into entering confidential information such as passwords and/or bank account or credit card data.

^b Malware is a generic term used to describe any form of malicious software designed to infiltrate a user’s device without being detected.

^c Ransomware is a type of software that installs itself on the user’s computer without consent. It locks parts of the system or individual folders, encrypts the data, and hides the key so that the user cannot decrypt it, or alternatively locks the screen with a pop-up window. A ransom is usually demanded in return for the decryption key.

^d A Denial-of-Service attack attempts to deny user access to a system’s resources. Web servers are standard targets.

The ISO/IEC 27000 series of standards—particularly standards 27001 and 27002—provide a framework for the steps that must be taken to create an ISMS. Adopting these standards serves as a guide for information security actions, facilitating planning and ensuring the coherence and integrity of plans.

9.2 Information Security Management Systems in FMIS and Central Agencies

Given that implementation of an ISMS is a modernization project, in the case of an FMIS it is frequently addressed for the first time by the system's central agency. It is advisable for the central agency to introduce the ISMS. Although a joint approach is recommended, this expansion in institutional coverage should not represent an obstacle to the FMIS project moving forward. Instead, the central agency may adapt to the FMIS's system at a later stage, either independently or through a joint effort.

Where the central agency for the FMIS already has an ISMS, the FMIS project should assess its completeness and effectiveness before deciding whether to adopt it, help to expand it, or develop its own system.

9.3 Roadmap for the Design of an Information Security Management System¹

The aforementioned ISO/IEC 27000 series of standards provides a roadmap for this design.

Once completed, these projects should meet the institution's information security needs. The information security approach provided by a coherent ISP also allows weaknesses to be identified where isolated information security initiatives already exist in the institution.

One way of transforming the standards into practical actions is by creating an **information security program (ISP)** consisting initially of projects. The latter should be assigned different levels of priority depending on the institutional context.

9.3.1 Projects Associated with Information Security Programs

The following is a list of projects associated with information security programs, aligned with the ISO standards:

a. Information security management model

Design and approval of a management model that allows requirements to be identified and actions implemented that make up the lifecycle of information security management strategies, thus ensuring an institutionally sustainable process. The model identifies the institutions involved and their responsibilities. A structure should be proposed for the information security management unit, together with its position in the institutional hierarchy.

¹ This section draws on Martins et al. (2020).

The documents that make up the regulatory framework for information security management are divided into three categories:

1. Policy (strategic level): This sets high-level rules that represent the basic principles the FMIS has decided to incorporate into its information security management system, based on the strategic approach chosen by senior management. Policies provide a foundation for the introduction of rules and procedures.
2. Standards or rules (tactical level): These specify the tactical plan, technological options, and controls that must be implemented to achieve the outcome proposed in the policy.
3. Procedures (operational level): These are used to implement what is written in the standards and policies, allowing them to be directly applied to FMIS activities.

b. Information security policies

Definition of the set of rules, methods, and procedures used to keep information secure. These should be set out in a document, and all information users should be aware of the contents of this document. They entail the preparation and approval of a document with strategic guidelines for the secure use and handling of data either belonging to the FMIS or under its control.

The main objectives are as follows:

- Coordinating roles and responsibilities in the field of information security.
- Ensuring alignment with legal and regulatory requirements, including privacy and civil liberties issues in information security.
- Establishing governance arrangements for the information security system.

c. Information security rules and best practices

Preparation of regulatory documents with tactical-level rules regarding the secure use and handling of institutional information by users, such as the appropriate use of available computer resources. As a complement to this, recommendations of good practices for using IT resources may accompany security standards.

Priority is generally placed on rules governing the following areas:

- Password management and other means of identification
- Access to project computer resources
- FMIS access
- Criteria for providing, changing, and rescinding passwords or digital identity certificates (possibly the most important rule)
- Shared folders
- Use of email

- Workstations
- Internet and intranet access
- Use of computer programs
- Use of office productivity programs, such as Office (special rule)
- Protection technologies (routers, firewalls, etc.)

d. Physical security of data center

Identification of vulnerabilities in the physical environment of all data centers under the control of the FMIS, together with recommendations for security controls to minimize the risks identified. The recommendations should be implemented through a specific project.

e. Information security dissemination campaign

Design of specific campaigns to build awareness among staff working with the FMIS (central agencies and management and executing units) regarding the importance of information security in their institution. Internal campaigns should address the information security program, standards, and good practices.

f. Information security risk management methodology

Development of an institutional risk management methodology aimed at identifying and managing the information security risks to which the organization is subject. The corporate risk analysis should focus on the following aspects:

- Risk assessment
- Identification and documentation of the vulnerabilities of organizational assets
- Identification and documentation of internal and external threats
- Identification of the business impact and the likelihood it will occur
- Risk determination based on threats, vulnerabilities, probabilities, and impact
- Determination of the response to the risk based on its priority
- Risk assessment strategy
- Support for determining risk tolerance

g. Training in information security management

Training of security professionals to perform or support information security management. The first phase of this project should involve internal training in basic concepts and information security management for staff in the FMIS IT department.

A second phase should target staff that will be assigned to the area of information security for the FMIS, in which case advanced information security courses are

recommended, such as the following: COBIT 5 for Information Security, COBIT 5 for Risk, Certified Information Systems Security Professional (CISSP), Certified in Risk and Information Systems Control (CRISC), and Certified Ethical Hacker (CEH).

h. Information classification

Determination of criteria, rules, and procedures for the accurate classification and proper management of information throughout its life cycle (creation, use, storage, transportation, and purging).

i. Asset management

Inventory of all devices and physical systems present in the FMIS, together with the classification of hardware and software based on its critical importance and value for the business. Where the resource used to access the FMIS (computer, printer, or other) is provided by the management or executing units themselves, there should be a standard establishing the minimum technical specifications of the equipment, and the supplying unit must comply with this.

j. Continuity management

Definition of the structure, roles and responsibilities, and management methodology for business continuity. The business continuity management methodology describes how a continuity plan will be prepared for each critical service to prepare institutional structures based on the following criteria:

- Response to anomalies
- Response plan
 - Monitoring implementation of the response plan
- Communication
 - Ensuring information flows during execution of the plan
 - Creating an event report
 - Coordinating the exchange of information regarding the response plan
- Analysis
 - Investigating notifications
 - Analyzing incident impact
 - Categorizing incidents based on the response plan
- Mitigation
 - Establishing parameters
 - Mitigating risks
 - Transferring risks
 - Risk acceptance

- Improvements
 - Proposing improvements to the response plan as necessary
 - Recovering from anomalies
- Recovery plan
 - Monitoring implementation of the recovery plan
- Improvements
 - Updating the recovery strategy
- Communication
 - Ensuring communication flows regard recovery status

k. Digital certification²

Use of digital identity certificates for FMIS applications and their users. In the current context of financial management information systems, the use of digital certification is essential for identifying parties, improving control, and expanding the services offered. This applies both at the level of user/system interaction and when exchanging documents with digital signatures. In addition, the use of identities in FMIS help to avoid phishing attacks.

The authorities must decide on one of the following alternatives:

- Use of digital certificates from the local market (where public key infrastructure is available)
- Use of digital certificates from the international market (encourage certificate authorities or their representatives to establish themselves in the country)
- Creation of their own certificate authority, the scope of which is limited to the institution concerned

l. Threat control

A network-focused security solution aimed at preventing attacks and implementing access rules for the entire FMIS environment. The following criteria need to be fulfilled:

- Events and anomalies
 - Analyzing attacks
 - Determining the impact of detected events
 - Calibrating incident sensitivity
- Continuous security monitoring
 - Participating in network monitoring
 - Participating in monitoring of the physical environment
 - Participating in user activity monitoring

²In addition to digital identity certificates, many companies use biometric data to identify users. According to Price Waterhouse Coopers, 57 percent of companies worldwide use some type of biometric data for this purpose.

- Detection process
 - Determining detection parameters
 - Improving the monitoring process

m. Access control

Determine the following: (i) identity and credential controls for the institution, (ii) physical access controls for protected assets, (iii) remote access controls, and (iv) logical access controls (based on privileges and the separation of duties).

9.3.2 Planning and Implementation

The support of a specialized external consultancy is recommended when planning an information security program. Several isolated information security actions may already have been implemented for an existing FMIS, such as firewalls, some access controls, and/or rules governing the use of particular devices on the institution's network (e.g., Bring Your Own Device, or BYOD). An ISP should take these initiatives into account, incorporating them into the program so that they can be integrated with other solutions and potentially improved.

Information security comes at a cost: budgets will need to be developed for the projects to be undertaken, and these will need to be evaluated and approved by senior management.

There are examples of information security policies on the internet—both general and for specific types of companies—that can be used as a guide. These policies offer different degrees of specificity (high-level, specific areas, general recommendations, etc.) and can be selected according to institutional needs (Annex 9.1 provides an example).

In theory, information security policies should encompass a definition of the technologies (hardware, software, and their parameters) that will make up the information security context in the institution. In reality, however, there is a feedback loop between policies and technology. A given security policy may be technically impossible or excessively costly to implement in full. At the same time, a new technology may allow the introduction of new policies. The dialogue between policies and technology helps to refine the information security system.

9.4 Prioritization of Information Security Projects

Of the many information security-related projects that may be developed as part of an ISP, some must be prioritized for implementation during the initial years of an FMIS project. In working to ensure the internal security of the software being produced—particularly that of stored data—the FMIS development team will have the support of a security consultancy. In principle, the FMIS project security group should be able to implement the projects indicated.

The projects below have been selected and ranked based on the situation encountered in several earlier projects, where some IT infrastructure was already in place. This approach is not mandatory and should be reviewed based on the local context.

In order of priority (the first two being the most critical):

- Information Security Management Model and Structure
- This project organizes the design or modernization of the formal security management entity in the central FMIS agency, including its adjuncts in other units.
- Information Security Policy
- This project determines the strategic rules governing information security. Annex 9.1 provides an example of an information security policy.
- Physical Security Analysis of the Data Center
- This project should be treated as a priority where the FMIS will be operated using an existing data center.
- Improving Management of the Communications Network
- The communications network to be expanded or installed is a critical security point for the FMIS, and its security should be addressed as a priority.
- Business Continuity Management Model
- It is important to address this issue from the very beginning of the FMIS project. Among other things, it involves ensuring the availability of an alternate data center or use of the cloud.
- Information Security Rules
- Paragraph 9.3.1 (c) offers a proposed ranking for security rules.
- Information Security Training
- A local team should be created at the outset of the project to provide training in information security techniques and methods. The security consultant will provide support to determine the number of staff and the most appropriate courses.

9.5 Access Security in FMIS

FMIS contain information that needs to remain confidential, with access restricted to those with a specific level of authorization. Accordingly, access to an FMIS should be governed by different security levels and mechanisms.

9.5.1 Role-based Security

In the case of FMIS, access permissions are partly associated with a user's role upon entering the system. The system must link users with the functions that they perform, taking care to verify whether they are on holiday or leave, have changed departments or institution, or have retired from public service. User permission is generally granted for a determined period and may therefore need to be renewed periodically so that the system can reflect any changes in user functions.

For the purposes of a security audit, each user's permission history should be stored for the duration of their existence in the system.

9.5.2 Levels of Security

Three levels of security are advised in the case of an FMIS:

- Functional level:
 - This allows access to a given functionality depending on the role of the user (e.g., "view payments made").
- Object level:
 - This allows a user to access objects such as payment documents, but only those relating to their role (e.g., only payments made by the executing unit to which the user belongs).
- Field level:
 - Access is limited to parts (fields) of specific documents, also depending on the user's function. This is a more restrictive level of access.

9.6 Audit Records and Trails

All changes to the information contained in an FMIS should be recorded. These records should include all key information relating to the operation, such as the identity and active roles of the user, the program, the application, the screen or page used to perform the operation, the IP address, and all other relevant information needed to identify the machine or software used, including the MAC address, the mobile identification number or other series numbers, the time stamp for the start of the operation, and the prior values that have been updated or deleted. Records should also be kept for non-update queries (Martins et al., 2020).

Extract, transform, and load (ETL) processes may be used to replicate data for the purpose of preparing operational data to be used for analytical purposes in different environments (usually with the support of business intelligence tools). In these cases, the replicated data should be governed by well-defined security policies. In general, this type of data is not subject to strict control.

9.7 Cloud Security

The increasingly frequent use of cloud computing poses information security challenges, an issue that is one of the most important for executives considering the use of cloud computing in their organizations. According to EY (2019), 52 percent of companies plan to prioritize security investment in cloud computing, while 57 percent plan to invest more than last year.

According to Jay Heiser, Vice President at Gartner, concerns about the security of cloud service providers have become counterproductive and are distracting

CIOs³ and CISOs⁴ from establishing organizational security and governance processes to prevent compliance and cloud security failures. Those responsible must change their line of questioning from “Is the cloud secure?” to “Am I using the cloud securely?”⁵

Cloud service providers are NOT responsible for all aspects of information security. Issues relating to staff behavior are primarily the responsibility of the service client.

Indeed, Gartner predicts that through 2025, 99 percent of cloud security failures will be the fault of the user.

Also, according to Gartner, virtually all public cloud use is within services that are highly resistant to attack and, in most circumstances, represents a more secure starting point than traditional in-house implementations. The company also indicates that cloud service providers can afford to hire experienced system and vulnerability managers, and their economies of scale make it practical to provide 24-hour security monitoring and response services. Only a small percentage of security incidents that have affected companies using the cloud have been due to vulnerabilities on the part of the provider.

Organizations should not assume that using a cloud service means that whatever they do within the cloud will be secure. Clients must have policies governing the use of the cloud, with clear rules on responsibility and risk assessment. They must determine and negotiate the policies they expect the cloud service provider to fulfill, including those areas in which it may be desirable to extend or supplement the security provided by the cloud, and they should also determine how implementation of the agreement will be monitored.

9.8 Outsourcing of Information Security Activities

Information security management units are responsible for determining security policies and—either directly or through the specific operational unit—operating or monitoring the resulting procedures, equipment, and software. Seventy-two percent of larger organizations have a security operations center that is responsible for this operational aspect. Nonetheless, increasing complexity, sophistication, and cost has led many to seek specialized third parties to perform certain tasks. The EY global survey reveals the security functions that enterprises have chosen to outsource (Figure 9.1).

In Brazil, the institutions operating fiscal systems at the federal and subnational levels have contracts with specialized private firms that have allowed them to outsource several security functions.

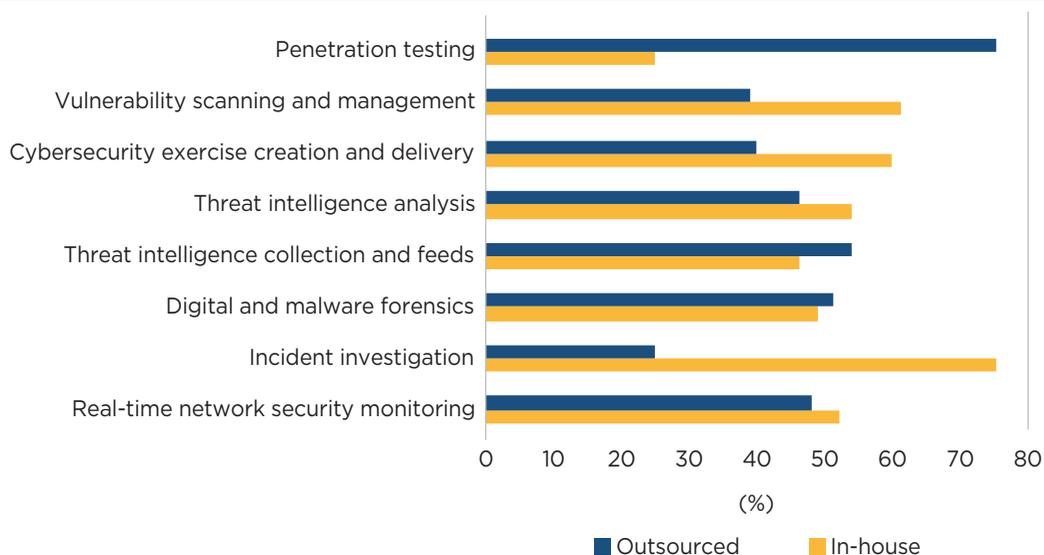
³ Chief Information Officer.

⁴ Chief Information Security Officer.

⁵ See <https://www.gartner.com/smarterwithgartner/is-the-cloud-secure/>.

FIGURE 9.1

Corporate Security Operations Centers, Outsourced Functions



Source: EY Global Survey (EY, 2019).

9.9 Additional Considerations

Establishing an effective information security system is costly. The system and its development need to be planned, costs estimated, and senior managers kept up to date regarding the required investments and their benefits.

Once a communications network has been implemented and is in operation, network security requires constant monitoring and immediate actions to be taken in the event of a possible security breach. These actions should be decided *ex ante*, including which officials should intervene depending on the level of the breach.

Instead of one-off security actions, such as purchasing hardware/software or installing isolated firewalls, tackling the issue of information security requires an INFORMATION SECURITY PROGRAM that provides a comprehensive vision and unites the actions to be taken within that vision.

Most information security actions are the responsibility of the information and communication technologies (ICT) area, and many organizations therefore assign management of all information security issues to a department or division within that area. In large organizations, there is generally a high-level unit responsible for the overall management of security issues, with staff assigned to departments or divisions. This is particularly the case with respect to information technology, where the objective is to maintain consistency in security policies and practices.

ANNEX 9.1

SAMPLE INFORMATION SECURITY POLICY

Information Security Policy⁶

1. **Policy summary:** Information must always be protected, regardless of how it is shared, communicated, or stored.
2. **Introduction:**
 - Information can exist in a variety of forms: printed or written on paper, stored electronically, transmitted by email or other electronic mediums, projected, or communicated orally through conversation.
 - Information security involves protecting information against a wide range of threats, with the aim of ensuring business continuity, minimizing business risks, and maximizing business opportunities and return on investment.
3. **Scope:**
 - This policy supports the general policy governing the organization's information security management system (ISMS).
 - The policy applies to all members of the organization.
4. **Information security objectives:**
 - Understand and address operational and strategic information security risks to ensure these remain at levels that are acceptable to the organization.
 - Protect the confidentiality of client data and development plans.
 - Preserve the integrity of accounting records.
 - Ensure that publicly accessible web services and internal networks meet required availability specifications.
 - Understand and meet the needs of all stakeholders.
5. **Information security principles:**
 - This organization accepts the need to take risks, tolerating those risks that, based on the available information, are comprehensible, controlled, and addressed where necessary. Details of the methodology used to assess and address risk are described in the ISMS.⁷
 - All staff will be informed about and will be responsible for information security as relevant for performing their work.
 - Funding will be provided for the operational management of controls in information security and management processes for their implementation and maintenance.
 - The potential for fraud relating to the abusive use of information systems will be considered within overall information systems management.
 - Regular security status reports will be made available.

⁶ Adapted from the Centro Europeo de Postgrado blog (www.ceupe.com).

⁷ The ISMS is a broader policy that deals with the security of all the organization's information.

- Information security risks will be monitored, and the relevant measures adopted in the event of changes associated with an acceptable level of risk.
 - The criteria for risk classification and acceptance are laid out in the ISMS policy.
 - Situations that may expose the organization to legal and regulatory violations will not be tolerated.
6. **Responsibilities:**
- The management team is responsible for ensuring that information security is handled appropriately throughout the organization.
 - Each manager is responsible for ensuring that their staff protect information in accordance with the rules established by the organization.
 - The head of security advises the management team, provides specialized support to the staff of the organization, and ensures that security status reports are available.
 - Each staff member is responsible for maintaining information security in activities relating to their work.
7. **Key indicators:**
- Information security incidents will not lead to serious, unexpected costs and will not cause serious disturbance to commercial services and activities.
 - Fraud-related losses will be detected and will remain within acceptable levels.
 - Information security issues will not adversely affect client acceptance of products and services.
8. **Related policies:** The following policies provide principles and guidelines in specific aspects of information security:
- Information security management system policy
 - Physical access control policy
 - Clean desk policy
 - Unauthorized software policy
 - File download policy
 - Data backup policy
 - Policy governing the exchange of information with other organizations
 - Courier service policy
 - Data retention policy
 - Network services policy
 - IT and mobile communications policy
 - Teleworking policy
 - Encryption policy
 - Legal compliance policy
 - Software license policy
 - Data protection and privacy policy

The information security policy should be supported at a lower level by other rules or procedures governing specific issues that necessitate the use of information security controls to an even greater extent, such as meeting the needs of certain groups within the organization or addressing specific topics.

Examples of These Policy Issues Include The Following:

- Access control
- Information classification
- Physical and environmental security

Directed More Specifically at Users:

- Acceptable use of assets
- Clean desk and clear screen
- Information transfer
- Mobile devices and telework
- Restrictions on the installation and use of software
- Data backup
- Information transfer
- Malware protection
- Management of technical vulnerabilities
- Encryption controls
- Security communications
- Privacy and protection of personally identifiable information

These policies/rules/procedures should be communicated to employees and external stakeholders. The need for internal information security rules varies depending on the nature of the organization.

Where any of the information security rules or policies are distributed outside the organization, care should be taken to avoid revealing confidential information. Some organizations use other terms for these policy documents, such as standards, directives, or rules.

These policies should all help to support risk identification and risk treatment—the former by establishing controls with respect to a baseline that can be used to identify deficiencies in system design and implementation, and the latter through the potential identification of appropriate treatments for the threats and vulnerabilities detected.

Risk identification and treatment belong to the processes listed in the “Principles” section of the security policy or may alternatively be included in the ICMS policy itself, as discussed below and referred to in the sample policy.

Information Security Management System Policy

Given the importance of information systems for effective business processes, these systems must be properly protected. Reliable protection gives an organization a better understanding of its interests and allows it to perform its information security obligations efficiently. Inadequate protection affects the company’s general performance and can adversely affect its image, reputation, and perceived trustworthiness among both clients and investors who place their trust in the strategic growth of our activities at an international level.

The purpose of information security is to protect business continuity in an organization and minimize the risk of damage by preventing security incidents and—where these are inevitable—reducing their potential impact. To this end, the organization has developed a risk management methodology that allows us to regularly assess the degree to which our important assets are exposed to threats that can exploit certain vulnerabilities, adversely affecting the activities of our staff and the important processes in our organization.

Successful use of this methodology rests on the experience and contributions of all our staff in security and on their communication of any relevant issue to their line managers in the weekly meetings arranged by management. The aim should be to identify potential changes in levels of protection and to assess the most effective risk management options on a cost-benefit basis at any given moment, depending on circumstances.

The security information management group developed the principles laid out in the security policy accompanying this policy, with the aim of ensuring that future decisions are based on the need to preserve the confidentiality, integrity, and availability of important information belonging to the organization. The organization has the support of all its staff in implementing the proposed security policies and directives.

Compliance with these principles will be determined by the staff's daily use of computers, as well as an inspection process aimed at verifying that the principles are being observed across the entire organization. In addition to this policy and the organization's security policy, there are specific policies for the different activities.

All current security policies will be posted on the organization's intranet site and will be updated regularly. They may be accessed directly from all workstations connected to the company network by clicking on the "Information Security" link on the main webpage. The objective of the policy is to protect the organization's information assets from all internal and external threats and vulnerabilities, whether deliberate or accidental.

The Company's Executive Leadership is Responsible for Approving an Information Security Policy that Ensures the Following:

- Information is protected from unauthorized access.
- Information confidentiality is preserved, particularly as regards employee and client data of a personal nature.
- The integrity of information is maintained in relation to information classification (particularly information for internal use).
- Information availability is consistent with the time frames required for developing critical business processes.
- Legal and regulatory requirements are complied with, particularly the Data Protection and Electronic Signature Act.
- Business continuity plans are maintained, tested, and updated at least once per year.
- All employees receive updated training in security issues.
- All information security events, both real and suspected, are communicated to the head of security, and investigated.

Support procedures are available that include the specific means by which those responsible must implement the general guidelines set out in the policies.

This policy is mandatory for all staff in the organization, together with the information security policy and any procedure or document included in the ISMS document repository. Visitors and external staff who access our facilities are bound by the obligations set out in the ISMS documentation, and the company's staff will ensure compliance in these cases.

Any questions regarding the use of this policy and the applicability of its content should be directed by telephone or email to the staff member with formal responsibility for the ISMS, as indicated in the company's organizational chart.



In this chapter:

- 10.1** Introduction
 - 10.2** Structuring a Procurement and Quality Management Consultancy for the FMIS Project
 - 10.3** Procurement Method Considerations
 - 10.4** Using Requests for Information, Requests for Bids, and Requests for Proposals
 - 10.5** Preparing Implementation of the IT System
 - 10.6** FMIS Systems Developed In-House by the Organization's Technical Team
 - 10.7** FMIS Systems Custom Built by an External Team
 - 10.8** COTS Systems
 - 10.9** Final Observations
- Annex 10.1 Summary of IDB Procurement Methods (October 2020)
- Annex 10.2 Sample Table of Contents from the International Competitive Bidding Documents for a Custom FMIS Built by an External Firm
- Annex 10.3 Sample Request for Information for an FMIS
- Annex 10.4 Sample International Competitive Bidding Documents for a COTS FMIS

Procurement of Hardware, Software, and Services

10.1 Introduction

The nature of procurement processes for hardware, software, and services means that they are vulnerable to administrative and judicial problems that may unexpectedly delay completion. As a result, the time required for the different procurement phases may be a critical factor for the effective and timely execution of an FMIS project.

A key principle in procurement is value for money (VfM),¹ which seeks to ensure the effective, efficient, and economic use of resources. This requires an assessment of the relevant costs and benefits, as well as risks and other non-price aspects, including lifecycle costs where appropriate.

VfM is not an evaluation criterion, but rather a concept that serves as a basis for comparing bids and selecting the most advantageous one. Price alone can occasionally be an inadequate indicator, particularly for complex procurement processes in which quality, sustainability, innovation, and lifecycle costs are important factors for the success of a project.

The principles listed below are critical for the procurement of hardware, software, and services in an FMIS project:

- Integrity throughout the entire procurement process.
- Clear definition of procurement needs and objectives.
- Proportionality between the approach used for procurement and the risks, amounts, context, and complexity involved.

¹VfM concepts and definitions are taken from the IDB presentation “Procurement Compass,” which is summarized in Annex 10.1.

- Specification of the conditions and technical and functional requirements of the hardware, software, and services to be acquired.
- Selection of contractual arrangements, the contracting method, and relevant evaluation criteria.

Given that significant delays are common, procurement processes should begin as soon as possible. However, this also depends on the phase of the project, as purchasing too early can also increase the risk of obsolescence. This rule means that the main project technical decisions and specifications are determined during development of the conceptual model or design of the funding project, thus minimizing risks and the need for significant adjustments thereafter. Although external factors mean that full compliance with the rule is often not possible, it should continue to guide management of the project at all times.

The main documents governing procurement transactions financed by the Inter-American Development Bank are GN-2349-15 and GN-2350-15 (2019). These documents are included in the References at the end of this chapter.

10.2 Structuring a Procurement and Quality Management Consultancy for the FMIS Project

Several specific consultancies are proposed to support the project leader in structuring the management of an FMIS project (Chapter 2). Due to the impact and complexity of procurement-related processes, a specific consultancy is required to guide them. Inclusion of a quality management consultancy is also proposed. The procurement consultancy may be divided into two parts: the first to determine the strategy and the configuration of the systems, and the second to ensure the quality of the software purchased or developed, either internally or by an external contractor. The profiles of the firms or consultants for each part will be different.

Even where skills of the technical team in the institution managing the FMIS project are acknowledged, the value of the investment to be undertaken and its importance for the future of the institution warrant additional assurances that the procured solutions will support system success in terms of quality, sustainability, innovation, and life-cycle costs.

In addition to contracting and selection processes, the consultancy may also cover quality control during implementation of the purchased software and devices, or the proper execution of services. This not only directly benefits the project but may also be used to provide on-the-job training to managers and technical staff in the contracting institution, including processes and methods for identifying, preparing, and managing external contracts.

This type of decision should be taken at the start of the project, so that the consultant or firm concerned can participate in and benefit from all the stipulated activities. Chapter 2 provides additional analysis of this topic.

In light of the complexity and wide range of alternatives currently available, as well as the importance of these products and services for the success of the FMIS project, Chapter 2 proposes that projects involving innovative or complex solutions make use of specialized advisory services to support the procurement and implementation of these products and services. These types of services were previously limited to formal aspects of the procurement process but have now been extended to support market scouting (local and international) aimed at identifying products and suppliers, proposing procurement strategies, highlighting important contractual issues, suggesting appropriate procurement methods, and monitoring the implementation of contracts and other activities in this area. Project managers may choose to hire either a well-regarded firm in the market or specialized individual consultants. Firms offer a wider range of specializations and are well suited to complex, innovative projects. The second option is less expensive and may be suitable for traditional projects in which the institution's technical teams have extensive knowledge of the items to be procured, contracting processes, and the market. Another alternative is for the software project to include the costs of sizing and procurement of the hardware and software necessary for the solution to operate. This avoids potential incompatibilities with respect to the equipment or software that the institution purchases or already has.

10.3 Procurement Method Considerations

The following summary covers the main procurement methods, as described in the document “Procurement Compass” (IDB, 2020).

International competitive bidding (ICB): The objective of ICB is to provide all eligible prospective bidders with timely and adequate notification of a borrower's requirements in a project and an equal opportunity to bid for the goods and works concerned. ICB may be performed using an RFB (where the borrower can provide a detailed list of requirements) or an RFP (in the case of complex, innovative procurement transactions).

It is used to procure works, goods, or services in large amounts or of a complex nature, where the scope, purpose, or function may be clearly described in plans or technical specifications. Delays may be experienced in this type of process.

National competitive bidding (NCB): NCB is the competitive bidding procedure normally used for public procurement in the country of the borrower and may be the most appropriate way of procuring goods or works which, by their nature or scope, are unlikely to attract foreign competition. To be acceptable for use in IDB-financed procurement, these procedures shall be reviewed and modified as necessary to ensure their coherence with

Core Procurement Principles, as well as broad consistency with the provisions included in Section I of these Policies.

NCB is used for the procurement of works, goods, and services in amounts below the threshold for ICB, or where the scope or nature of the items to be procured means that foreign bidders unlikely to be interested (based on four criteria set out in the Bank's policies).

Limited bidding: Limited bidding is a competitive method by invitation without open advertisement. Borrowers seek bids from a list of potential suppliers broad enough to assure competitive prices. Where there are only a limited number of suppliers, the list should include all of them.

This method is used to procure works, goods, or services where there is only a limited number of suppliers in the market, or where other exceptional reasons justify departure from ICB procedures. Time frames for limited bidding are shorter than in the case of NCB, and no open advertisement is required (only invitation).

Shopping: This procurement method involves comparing price quotations obtained from several suppliers (in the case of goods) or from several contractors (in the case of civil works), with a minimum of three to ensure competitive prices. It is used to procure readily available goods or simple civil works of small value, and at least three valid quotations are required. The process is simple, swift, and informal, and is formalized through a purchase or service order or simplified contract. Competition is limited.

Direct contracting: This is used for the direct procurement of works, goods, and services without competition or advertising. The main characteristics are the absence of competition and the need to justify use of this method based on the evaluation report.

Competitive dialogue: This method allows borrowers to engage dynamically with proposers, and it is recommended for use in the case of complex or innovative procurement transactions.

Under this method, the borrower enters into dialogue with the companies, joint ventures, consortia, or associations selected initially, with the aim of identifying and determining alternative solutions that are best suited to satisfy the borrower's needs. Firms are then invited to submit their final proposals. The approach requires the involvement of an independent probity auditor.

Electronic reverse auction (eRA): This involves a scheduled online event in which prequalified or registered firms meeting minimum qualification criteria bid against each other on price.

There are several conditions associated with performing an eRA, as follows: (i) the procedure should be strictly electronic; (ii) no in-person proposals or bids may be accepted; (iii) there must be a competitive market for suppliers or contractors, with firms of any size participating; (iv) there must be a detailed, unambiguous description of the subject of contract; and (v) criteria for selecting the winning bid must be quantifiable and expressible in monetary terms.

Depending on the characteristics of the market and the subject of the contract, reverse auctions, Dutch auctions, or any other auction method can be used to fulfill the conditions.² To the extent possible, the authorities should avoid revealing their reference price and they should also avoid generalized, systematic use of this mechanism that could lead to coordination between auction participants.

Innovation partnership: Through a single selection and contracting process consisting of multiple stages, an innovation partnership is established for a sufficient period to cover the research and development (R&D) and subsequent purchase of a new or innovative good, service, or work that is not available in the international market (the purchase being subject to the attainment of agreed levels of performance and cost).

This is different to both pre-commercial procurement, which is aimed at procuring R&D activities, and innovation procurement, which is limited to the procurement of a pre-existing solution, either as a prototype or because it is not yet available at commercial scale and requires the development of new or improved technology without R&D (Figure 10.1).

Characteristics:

- The competitive phase takes place at the start of the procedure, when the most suitable partners are selected based on skills and experience.
- In the development phase, the partners develop the solution in collaboration with the borrower. R&D may be divided into several stages.
- In the commercial stage, the agreed products are delivered.

This approach may be suited to the use of a number of the emerging technologies analyzed in Chapter 13 (“The use of emerging technologies in FMIS projects”).

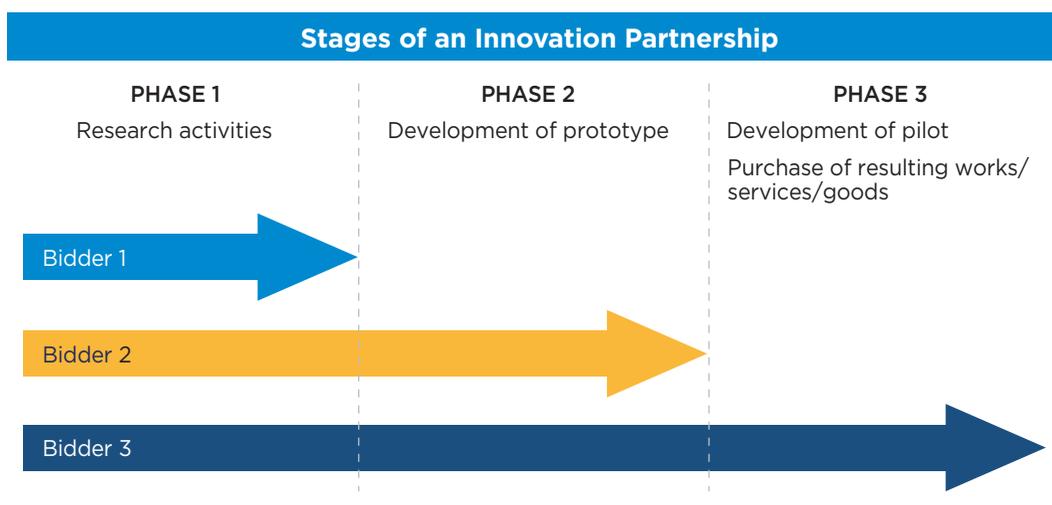
Other methods: Force account, procurement from specialized agencies, procurement in loans to financial intermediaries, procurement under loans guaranteed by the Bank, community participation in procurement, and modified international competitive bidding.

10.4 Using Requests for Information, Requests for Bids, and Requests for Proposals

The request for information (RFI) is a solicitation document used to obtain general information about products, services, or suppliers. It is an information request, not binding on either the supplier or the purchaser, and is often used prior to specific requisitions for items.³ The purpose of an RFI is to gain familiarity with the current market for a particular supply or service and to gather information in a formal, structured, and comparable way.

² These go by several names, such as the English auction, Dutch auction, Japanese reverse auction, etc.

³ Source: <https://www.iup.edu/procurement/howto/request-for-information-rfi.html>.

FIGURE 10.1

Source: Procurement Compass (IDB, 2020).

The RFI process may help in the decision-making process by developing a well-conceived solicitation document and clarifying the competitive requirements. It may be used in FMIS projects to gather market information on innovative solutions or the availability of suppliers for specific solutions.

Annex 10.3 provides a sample RFI issued by Ecuador’s financial management authorities for the purposes of gathering information from the national and international markets on the best solutions for the new Integrated Financial Management System (eSIGEF).

A request for bid (RFB) is a bidding document that should be used when the borrower is able to specify in detail the full range of requirements, allowing firms to present price offers that meet the requirements established in the bidding document. Evaluation criteria are normally expressed in monetary terms.

Requests for proposals (RFP) are bidding documents that should be used when the borrower is unable to clearly specify requirements (generally in the case of complex, innovative procurement transactions), allowing firms to present proposals that vary in their degree of responsiveness to the requirements in the bidding documents. Evaluation criteria normally include a scoring system.

10.5 Preparing Implementation of the IT System

Chapter 5 and particularly Chapter 8 address implementation models for an FMIS, including the issues that must be considered in relation to each one and their respective advantages and disadvantages.

This chapter assumes that the decision has already been made, and it lists the main issues that must be addressed when either developing a system in-house or selecting and contracting firms to implement the chosen FMIS modality.

10.5.1 General Prerequisites

The most important technical documents for developing an FMIS—whether in-house development, procurement of a custom-made solution, or licensing of a COTS⁴ system—are as follows:

- Process model
- Functional and nonfunctional requirements (including interoperability with other systems)
- Data model (for information purposes, for COTS systems)
- Reference architecture (for information purposes, for COTS systems)
- Sizing issues, such as data volumes, numbers of users and simultaneous transactions, etc.

Both the data model and the reference architecture for COTS systems should be included for information purposes only, as in some countries these have become a rigid constraint forcing the authorities to void processes that have attracted no bids. Based on these documents, estimates of the timelines and necessary resources for system development can be prepared in the most effective manner.

10.5.2 Preparing the Technical Documents

Depending on strategy adopted, the functional and technical specifications of an FMIS may be included in the conceptual model (Chapter 5) or prepared at a later stage. Where the specifications are prepared at an earlier stage, however, revisions, updates, or supplementary information will be required before the bidding documents can be used or officially published, due to the dynamic nature of this field.

In either case, a specialized consultancy is recommended to support the preparation of detailed functional and technical specifications for development or customization of the IT system. The consultant(s) will interact with local managers and technical staff, providing technological knowledge of updated, modern methods and processes that can elevate financial management to new levels of productivity and efficiency in subsequent years. This consultancy may be performed using

It is strongly recommended that Chapter 8 be read beforehand, so that key points in the implementation of the great variety of IT models for an FMIS may be considered.

Market scouting/RFIs may be used to find such a company, either directly or with the support of the procurement and quality management consultancy described above. Where individual consultants are concerned, prior experience in FMIS projects is an important factor to be considered.

⁴ Commercial off-the-shelf: software and hardware that already exist and are available from commercial sources.

individual consultants or a specialized firm. The option of hiring a firm may be recommendable in the case of complex, innovative systems, as discussed in Chapter 2.

This consultancy can assist in producing the additional documents needed for the contracting approach to be used for outsourced development or COTS systems, consistent with the procurement models to be adopted.

Preparation of the technical documents, including specifications and other components, should begin as early as possible given that bidding processes may take a year or more. In Uruguay, for example, the initial bidding process for the system took almost a year and attracted just one qualified proposal. The authorities opted to cancel this and conduct another bidding process which took another year. In Paraguay, the government attempted to conduct a bidding process with competing COTS systems and custom software factories, but the process was challenged several times and was declared void. Another bidding process was designed and was won by an international consortium that will program the system. It should be noted that there are also opportunities to contract and develop technical specifications before the main FMIS project loan has been formalized.

10.6 FMIS Systems Developed In-House by the Organization's Technical Team

In this type of project, technological solutions are generally aligned with the prevailing technology model in the institution into which the FMIS will be inserted. Existing technology platforms may potentially be expanded and modernized within the current environment.

The issue here is whether IT and functional technical staff in the central FMIS agency—generally, the Ministry of Finance or the Economy—will have the updated skills needed to incorporate modern and updated technologies, methods, and processes into the FMIS that will elevate financial management to new levels of productivity and efficiency in subsequent years. To that end, a specialized consultancy is recommended to provide advice on modernization of the IT architecture and the preparation of system requirements (i.e., processes, data model, functional and nonfunctional specifications), with a view to ensuring innovation and sustainability in the development of the system. This may be an individual consultancy or a specialized firm.

The procurement consultant should assist with the search for local or international consulting firms or individual consultants with the appropriate profile for this objective, as well as preparation of the terms of reference and the procurement process. The project technical unit will be responsible for managing and evaluating consultancy work, with support of the quality control consultant(s).

10.7 FMIS Systems Custom Built by an External Team

This type of project involves hiring a software firm or factory to develop an FMIS based on specifications provided by the financial management authorities.

This model initially faces a similar challenge to the one above—aligning technological solutions with the prevailing technology model in the institution given that existing platforms may potentially be expanded and modernized within a known context. System specifications (i.e., process model, data model, functional and nonfunctional requirements, etc.) will also need to be prepared and should be sufficiently detailed for use by the software factory to be contracted.

There are, however, two further important challenges:

- Seeking companies in the national and international markets with the ability to develop an FMIS. This can be achieved by means of direct consultations or an RFI, based on the technical specifications that have been prepared.
- Estimating system dimensions with a view to gauging procurement timelines and costs. Chapter 8 suggests using one of the function point sizing models proposed by NESMA⁵ to obtain a reasonable estimate of the functional size of the software and, accordingly, its cost.⁶ A specialized consultant can perform this work.

Annex 10.2 includes a sample Table of Contents from the international competitive bidding documents for a custom FMIS built by an external firm. The main technical documents that should be provided to interested companies are highlighted in yellow in the text of Annex 10.2.

ICB is generally used for this type of contract, although the suitability of this must be evaluated. The procurement team are responsible for the following tasks: (i) developing the bidding documents, including the terms of reference; (ii) supporting the evaluation of proposals; and (iii) selecting and contracting the winner. The project technical unit will be responsible for managing and evaluating consultancy work, with support of the quality control consultant.

10.8 COTS Systems

COTS systems in the area of public finances are based, in theory, on a library of best practices and must be adapted and customized for use in a country. The decision to procure a COTS system has already been made following strategic assessments both within the institution and of the solutions available on the market, based on the functional and technical specifications developed previously.

Chapter 8 provides a detailed discussion of the selection and implementation of COTS systems and should be reviewed as an input into the decision-making process.

In this stage, the team will seek to identify the product that is best suited to the institution's technical/functional needs and the technical/financial conditions of supply. A specialized consultancy is recommended, involving either a consulting firm or individual

⁵ Netherlands Software Metrics Users Association.

⁶ As mentioned in Chapter 8, the cost of the software will also depend on the technology to be used and the devices to be produced during system development, among other factors.

consultant(s). The process of selecting a COTS system is different from that of a custom-made system, and the market availability of specialists is more limited.

To assess whether a COTS system is consistent with the functional requirements of an FMIS, bidders should be asked to perform a self-evaluation: based on the list of functional and nonfunctional requirements determined for the system, each bidder should specify which requirements will be supported by customization and which will need additional coding (programming).

The bidding documents may require suppliers to customize and test some of the functionalities considered critical for the system's structure. To that end, the testing environment and data must be organized.

The following aspects also need to be evaluated:

- The total cost of ownership.
- Annual maintenance costs, the cost of maintaining functionalities supported by additional coding, the cost of support for the development of new functionalities through additional coding, technical support costs, and price adjustment rules.⁷
- Most COTS systems base their costs (maintenance and total) on the number of users accessing the system. Where this is the case, any planned long-term expansion in the number of users must be considered.
- Ease of programming for the insertion of unsupported functionalities through customization.
- Programming methods for new functionalities, languages supported, application programming interface (API), and technology requirements.
- Training:
- A comprehensive training program for FMIS technical staff, with the number of students, cost, and proposed calendar.

The technical and financial sections of the bidding documents should reflect these concerns.

Experiences in the Use of COTS Systems in Latin America and the Caribbean

The adoption of market solutions is a recent phenomenon in Latin America and the Caribbean (LAC). Of the 19 countries that participated in the 2019 LAC FMIS Survey spearheaded by the IDB and the International Monetary Fund, 5 used COTS FMIS, of which 60 percent have been implemented in the last three years.

The following countries in Latin America use COTS systems: (i) Nicaragua (FreeBalance, in operation), (ii) Panama (SAP, in operation), (iii) Ecuador (SAP, in implementation), and

⁷ In Guatemala City Hall, total maintenance and updating costs for a Systems Applications and Products in Data Processing (SAP) system were not sufficiently considered. As a result, resources have been insufficient to pay for these needs, and the system has continued to function using outdated versions.

(iv) Costa Rica (SAP, in operation). Thus, of the 18 Spanish-speaking countries in the region plus Brazil, 4 use COTS systems. In contrast, the use of COTS solutions is more common in the Caribbean. An example is FreeBalance, which is being implemented in Trinidad and Tobago.

The greatest functional challenge in procuring, implementing, and operating a COTS system is the recommendation of a certain degree of flexibility/adaptation in the country's public financial management processes, given that adjustments and customization can be costly and can sometimes create conflict with the functional areas. In Latin American countries, functional regulations in public financial management are usually part of public administrative law, with many laws and other regulations constantly being updated. Adapting to a COTS system is therefore complex, but not impossible. Anglophone countries, such as some of those in the Caribbean, have broader, more flexible regulations, making COTS adaptation less complex.

The following are some of the lessons learned during this short period of use in LAC countries:

- The functionalities to be supported by programming need to be considered, as these will be important factors in the cost of software maintenance. A higher score or weight should be allocated to functionalities supported by customization.
- Where there is an excessive need to program functionalities not supported by customization, software maintenance costs may be higher than initially estimated.
- Where the financial management authorities are responsible for software maintenance, including customization and programming, technical staff should be able to work independently with less dependence on the supplier.
- Software performance has fallen short of expectations in many cases, but this situation is likely to improve in the future.
- Contracts with suppliers should have clearer clauses governing breaches of contract by the parties, as well as more agile mechanisms for resolving disputes.

With respect to the first point, verification is recommended of the means by which each functional requirement will be implemented: by customization, coding, or both. This aspect may be for information purposes or, preferably, it may be assigned a score, as it will affect future maintenance costs and time frames for the FMIS.⁸ Where possible, a “golden rule” should be followed to the effect that if more than 20 percent of the planned functionalities are supported by additional coding, the proposed software will be eliminated from consideration or its score will be heavily penalized, on the basis that adjustments of more than 20 percent can lead to structural changes that do not justify the additional effort and possible instability of the resulting product.

Table 10.1 shows how these conditions were evaluated in bidding documents for Nicaragua's SIGAF-GRP⁹ in 2013.

⁸ Current costs and time frames may already be included in the proposal.

⁹ GRP: Government Resource Planning, which may be regarded as a government COTS system.

T A B L E 1 0 . 1

Sample Means of Compliance for Functional Requirements			
Ref.	Type	Means of Compliance	
		DEV	NAT
General functional requirements			
GFR 001	○		
GFR 002	○		
GFR 003	○		
GFR 004	○		
GFR 005	○		
GFR 006	○		
GFR 007	○		
GFR 008	○		
GFR 009	○		
GFR 010	○		
GFR 011	○		
GFR 012	○		
GFR 013	○		
GFR 018	○		
GFR 019	○		
Budget subsystem (BSS)			
General requirements and budget classifications			
BSS 001	○		
BSS 002	○		
BSS 003	○		
.....		

Source: Authors’ elaboration based on the bidding documents for Nicaragua’s SIGAF-GRP.

Notes: “Ref” indicates the functional requirement; “Type,” whether it is obligatory; and “Means of compliance,” whether the functionality is custom developed (DES) or native (NAT).

Table 10.2 shows the codes for the means of compliance that should be entered in Table 10.1.

In terms of the responsiveness to requirements, a weighted evaluation is performed. Table 10.3 presents an example of this, linked to the two above (Tables 10.1 and 10.2). It is important to emphasize where requirements are met through **customization**.

The same type of evaluation may be used in the case of nonfunctional requirements.

Annex 10.4 provides a summary example of bidding documents for an FMIS using the COTS modality.

T A B L E 10.2

Example of Codes for Compliance with Requirements				
Value	Generic Meaning	Specific Meaning	Abbreviation	Description
0	Feature absent	Not offered or not supported	NONS	Not offered or supported in the proposal.
1	Feature present but with deficiencies	To be developed or third-party product (deficiencies)	DEV/3P	<p>Responds to the requirement but with deficiencies:</p> <p>Development (DEV): The source code must be modified to adapt the GRP. Source code modification involves costs for the bidder and risks for the purchaser (as with all system development, this will require design, development, and testing phases, with the latter representing an additional workload for the purchaser).</p> <p>Third-party (3P): Consideration must be given to the interaction of GRP with third-party products that are not 100% incorporated into the platform in terms of licensing and maintenance and do not make up part of a stable functionality in the GRP version offered.</p>
2	Meets requirements	Native (Satisfactory)	NAT	Responds to the requirement through configuration of the proposed platform (i.e., not only does it respond to the requirement, but this is achieved using the GRP's native features). Where a third-party product is involved, this must be incorporated into the platform and have been listed among the features offered in at least the last two GRP versions.
3	Exceeds requirements	Exceeds requirements	EX	Responds to the requirement through configuration of the proposed platform and includes additional native GRP functionalities that are not specified in the requirement but that, in the opinion of the purchaser, constitute a clear benefit or value added with respect to the requirement.

Source: Authors' elaboration based on the bidding documents for Nicaragua's SIGAF-GRP.

T A B L E 1 0 . 3

Example of Weighted Technical/Functional Verification													
Ref.	Type	Weight	Means of Compliance						References to the Technical Bid Documents	Name of the Manufacturer's Product Linked to Requirement	Features Cited by the Bidder to Demonstrate Responsiveness to the Requirement		
			0		1		2					3	
			NONS	DEV	3P	NAT	EX						
General Functional Requirements (GFR)													
GFR 014	D	0.0250											
GFR 015	D	0.0250											
GFR 016	D	0.0250											
GFR 017	D	0.0300											
GFR 019	O	0.0250											
Budget Subsystem (BSS)													
Preparation of Draft MGIMP													
BSS 015	O	0.0250											
BSS 017	O	0.0250											
Editing, Drafting, and Budget Law and MPMP													
BSS 027	D	0.0250											
BSS 028	O	0.0250											
Implementation of GRP for Execution													
BSS 029	O	0.0250											
Budget Execution Program													
....				

Source: Authors' elaboration based on the bidding documents for Nicaragua's SIGAF-GRP.

10.9 Final Observations

This chapter does not purport to cover all aspects of the procurement processes for an FMIS; rather, it attempts to provide a general overview of important considerations in the successful management of procurement processes in an FMIS project. It highlights the need for external consultancies—using either individual consultants or specialized firms—with the core objective of bringing new organizational and technological knowledge and experience to the project. With respect to services, it also demonstrates the importance of quality control during the contracting and execution processes. Complex projects with innovative solutions benefit to the greatest extent from these consultancies.

In the case of FMIS, the procurement of COTS systems or custom-made systems from software factories poses particular challenges that are addressed here with a view to providing guidance to project managers. The principle of value for money, which refers to the effective, efficient, and economic use of resources, should always be present in procurement processes.

ANNEX 10.1

SUMMARY OF IDB PROCUREMENT METHODS (OCTOBER 2020)

MÉTODOS DE ADQUISICIÓN	ATRIBUTOS DEL PROCESO										ENFOQUE DE MERCADO					ATRIBUTOS PARA EVALUACIÓN					MECANISMOS APLICABLES		
	Intor	Nbc	Procz	1 Etapa	1 Sube	2 Sube	2 Sube	Multi Etapa	Comp. Abierta	Comp. Limitada	RFI	RFP	Bajo	Bajo	Invoc	Preco	SociaRb.	Inova.	Otro	Piso	ACA	Autoridad	OIB
Licitación Pública Internacional (LPI)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Diálogo Competitivo (DC)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Asociación para la Inversión (AI)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Licitación Limitada (LL)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Licitación Pública Nacional (LPN)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Comparación de Precios (CP)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Contratación Directa (CD)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Subasta Inversa Electrónica (SIE)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Source: Procurement Compass (IDB, 2020).

ANNEX 10.2

SAMPLE TABLE OF CONTENTS FROM THE INTERNATIONAL COMPETITIVE BIDDING DOCUMENTS FOR A CUSTOM FMIS BUILT BY AN EXTERNAL FIRM¹⁰

(THE FULL DOCUMENT MAY BE OBTAINED FROM THE PROJECT OFFICIAL IN THE IDB REPRESENTATION)

ICB No. *[indicate number]*

[International Competitive Bidding Process: Implementation of the Integrated Financial Management System (SIAF)]

[May 2017]

[Ministry of Economy and Finance – Public Financial Management Modernization Program, IDB Loan No. XXXX/OC-XX]

¹⁰ Source: SIIF2, Uruguay.

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15. Contract Price
16. Terms of Payment
17. Taxes and Duties
18. Performance Security
19. Copyright
20. Confidential Information
21. Subcontracting
22. Specifications and Standards
23. Packing and Documents

24. Insurance
25. Transportation
26. Inspections and Tests
27. Liquidated Damages
28. Warranty
29. Patent Indemnity
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SAMPLE FORMAT: Call for Tenders

ANNEX 10.3

SAMPLE REQUEST FOR INFORMATION FOR AN FMIS¹¹



Request for Information

The Ministry of Finance of Ecuador is undertaking structural reforms to the organization, processes, technology, and services of the National Public Finance System (SINFIP). As part of this, it has identified the need to modernize the technology platform of the Integrated Financial Management System for public institutions, as well as to incorporate new functionalities based on the latest technological advances in the platform known as eSIGEF. Said modernization process must be consistent with the new regulatory framework provided by the Public Finance Planning Code.

Accordingly, the Ministry of Finance of Ecuador requests that the national and international technology firms participate in a Request for Information (RFI) to examine the potential solutions that exist.

To that end, interested parties are invited to an informational meeting to be held on Wednesday, 13 November 2013 at 10 AM, at the following address: City of Quito, Av. Colón OE1-93 and 10 de Agosto, La Circasiana Building, Escudos Room in the National Cultural Heritage Institute (INPC). Further details will be provided at this meeting.

Bidders interested in this event should confirm their attendance by registering using the following form.

Any further queries may be sent to the following email: sinfip@finanzas.gob.ec

▪ **Share this publication:**

¹¹ eSIGEF (Ecuador, 2013).

ANNEX 10.4

SAMPLE INTERNATIONAL COMPETITIVE BIDDING DOCUMENTS FOR A COTS FMIS

**(THE FULL DOCUMENT MAY BE OBTAINED FROM
THE PROJECT OFFICIAL IN THE IDB REPRESENTATION)**

BIDDING DOCUMENTS

Procurement of SIGAF-GRP Financial Management Software

Two-stage tendering process

Inter-American Development Bank

Two-Stage Tendering Process, Sequencing

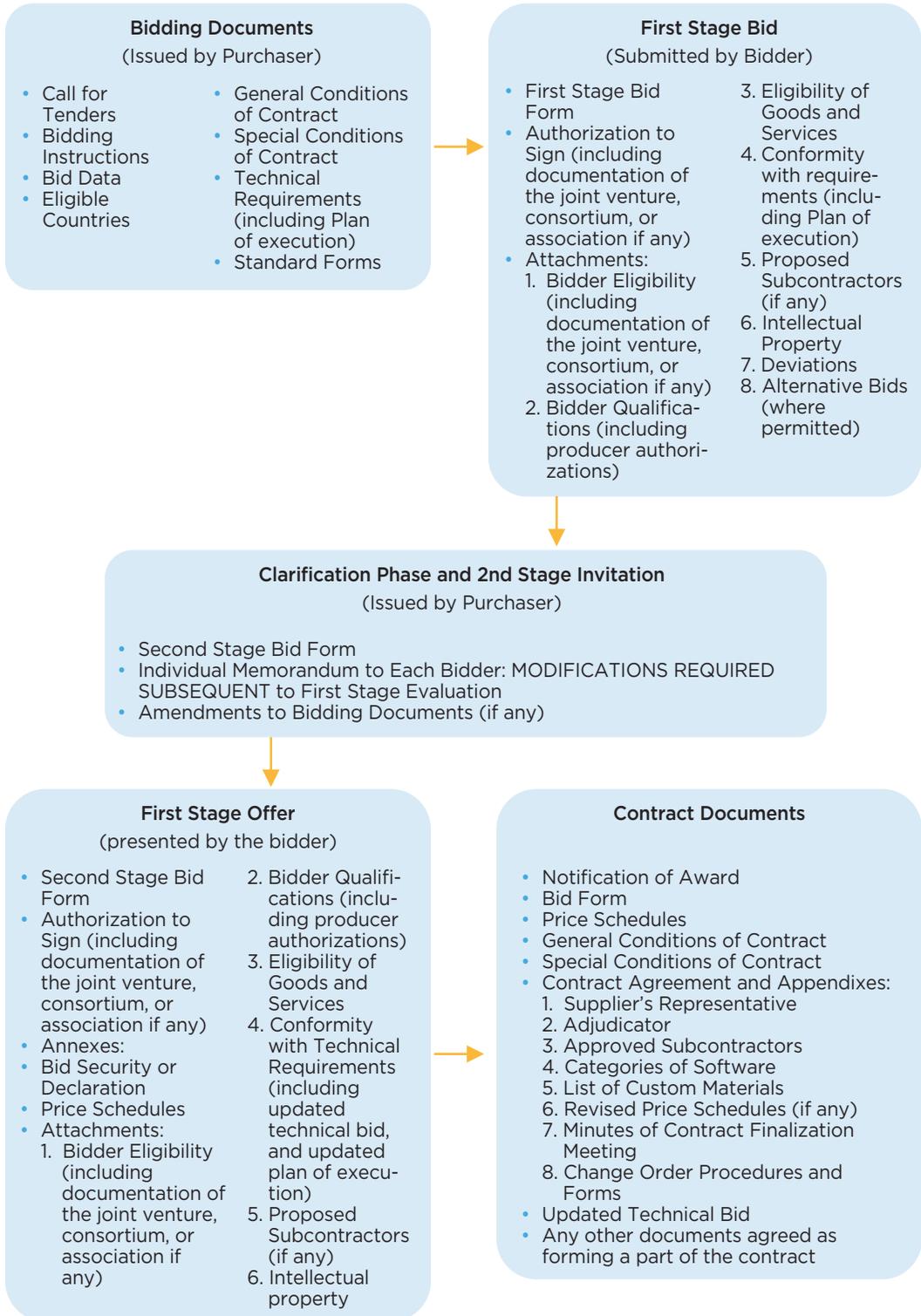


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- 11.2 Migration to the New System
- 11.3 Final testing
- 11.4 Planning, Institutional Arrangements, and Dissemination of Information
- 11.5 Preparing the Physical Environment and IT Equipment
- 11.6 User Training and Manuals
- 11.7 Supporting Teams
- 11.8 Administrative Arrangements
- 11.9 War Room
- 11.10 User Help Desk
- 11.11 Observations

Annex 11.1 Key Activities in FMIS Deployment

Deployment of the FMIS

11.1 Introduction

Deployment of the financial management information system (FMIS) is the culmination of years of effort. Detailed planning of all the different phases of deployment and the timely allocation of resources are essential for success. The biggest challenge is that the system will be exposed for the first time to the demands of the real world: the moment when it will be seen whether the processes, data collection, solutions, and specifications really work outside the walls of the Ministry of Finance/Economy.

In reality, tests and simulations, adjustments, and planning processes will already have been carried out in the run-up to that moment. This chapter provides a checklist of the most important steps to be taken to successfully deploy an FMIS.

11.2 Migration to the New System¹

In Latin America and the Caribbean, it is more common that a new FMIS replaces an existing one. In such cases, a migration plan needs to be developed based on one of the following alternatives:

- Big Bang implementation:² This is high risk, but deployment is swift and costs are low. The cost of returning to the previous system, if necessary, is high.

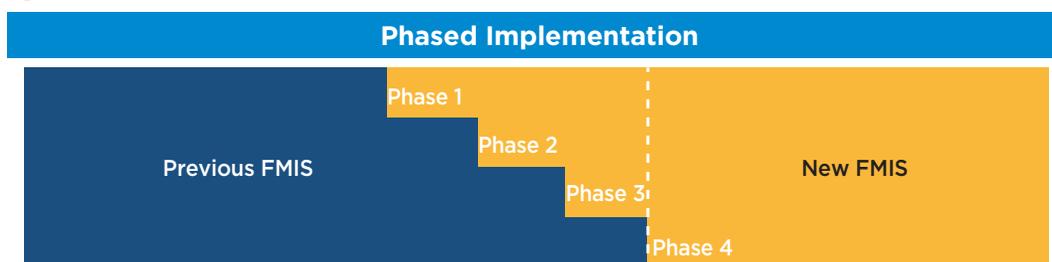
¹The plan for migrating from an existing FMIS to a new one is addressed in Chapter 5.

²Big Bang is a hardware or software migration method that involves abandoning the existing system and transferring all users to the new system simultaneously.

- Phased implementation:³ This is associated with a medium level of risk. Deployment is iterative and incremental, and the costs are medium.
- Parallel implementation:⁴ This is low risk. Implementation is slow and costs are high.

The most commonly used approach is the phased one. Figure 11.1 shows a simplified structure for this approach.

FIGURE 11.1



Source: Authors' elaboration.

One of the main characteristics of phased implementation is the need to create temporary interfaces between the new system and the remaining parts of the legacy system. These interfaces can be complex and have no long-term value, as they are abandoned as soon as the new system is complete. The IT architecture should allow for these interfaces.

The migration stage is key for overall success and should be planned in detail and agreed to with all stakeholders. It should ideally occur early in the process, allowing the new system to be tested with migrated data and users.

Some countries may propose FMIS deployment midyear, preparing the budget in both systems (new and legacy) and designing backup plans and procedures in case of failure or poor performance of the new system.

In the big bang implementation strategy, the new FMIS is typically introduced on January 1, which is the start of the fiscal year for most countries in Latin America (though not for the Caribbean). In some cases, only data for pending payments are migrated to the new system, with past (historical) data provisionally remaining in the previous system in order to reduce the complexity of implementation.

11.3 Final Testing

Before migration occurs, final testing should extend to all functionalities to be operated, including those with crosscutting coverage of all system processes (e.g., budget

³ Phased refers to the fact that components of the old system are progressively replaced until the new system is completed.

⁴ Parallel refers a situation in which the two systems (old and new) continue to operate simultaneously until the authorities are sufficiently confident to eliminate the old system.

modifications followed by commitments, accruals, and payments). This should include the participation of users that will be involved in the initial phase. These tests are important for making final adjustments to the system and for reassuring managers and leaders about operation of the new FMIS.

11.4 Planning, Institutional Arrangements, and Dissemination of Information

Deployment of the FMIS should be planned in detail, including a contingency plan for rollback⁵ should this be necessary. Senior management in the institutions involved should approve the system deployment plan.

Depending on the strategy adopted, implementation is generally carried out in two phases:

1. Deploying the system in the central management units of the institutions concerned
2. Extending this to the main executing units—i.e., those responsible for executing most of the budget.

It is important to determine and publish the names of the institutions that will participate in the deployment phases and negotiate the process with each of them. To that end, a list of needs should be prepared indicating the resources that each institution must provide to support deployment (e.g., financial and administrative resources and points of contact). The availability of these resources should be verified before the operating process begins. The official responsible for general coordination of the deployment process should be clearly identified, with support provided by technical staff.

Up-to-date information on the process—either printed or electronic—should be provided on an ongoing basis to institutions participating in the deployment. A hotline should also be established to facilitate communication between the general coordinator and the managers responsible for deployment in each participating entity.

11.5 Preparing the Physical Environment and IT Equipment

The physical facilities of the institutions participating in deployment of the FMIS should be assessed beforehand and approved by the project coordinator. The evaluation should encompass electrical installations (wiring, power protection, outlets, and stabilization), air conditioning, network cables, a network equipment room or equivalent, controlled access to operating rooms, installed and operational IT equipment, network equipment, and others. This verification should take place at least three months in advance.

⁵ Rollback involves restoring a database or system to an earlier state, generally to recover from an error.

One of the most difficult and complex issues to resolve is providing IT equipment and adjusting physical installations in each FMIS operating unit. The administrative units of public institutions using the FMIS are in a better position now than in the past, when the use of IT in the public sector was more limited. Nonetheless, this activity remains the most critical for the success of an FMIS.

Various institutional arrangements may be considered when adapting physical installations and providing the equipment needed to operate the FMIS. At a minimum, however, the FMIS project should provide technical specifications for the following:

- IT equipment (computers, printers, and network equipment)
- Local network
- Electrical network
- Air conditioning
- Equipment room
- Supplies

It is common for the FMIS project to provide the necessary network equipment and connections, while the management/executing units provide the remaining equipment and supplies. Before the system is deployed, the FMIS project should also conduct an audit of all installations and compare them to the specifications provided.

Some officials responsible for FMIS projects believe that it is more effective, in terms of availability and timeliness, for the project to assume responsibility for providing equipment and adjusting workspaces, even though costs will be higher. Such decisions will have a marked impact on the budget for the project and should be assessed on a case-by-case basis.

In practical terms, the main rule ensuring that all management and executing units will work to adopt the system in a timely manner is the stipulation that no expenditure may occur outside the FMIS.

Given their critical importance to FMIS deployment, users' physical installations should be taken into account from project's inception, including an assessment of critical locations to gain an idea of the situation of the main users.

11.6 User Training and Manuals

Experience shows that user training is critical to the success of an FMIS. Moreover, it is not sufficient to instruct users in system operations; the basics of public finances also need to be covered, including the mechanisms, functionalities, and stages of public expenditure. Even where the staff complement of a given public administration is stable, a minimum level of ongoing training needs to be provided.

Another important aspect of training is the need for it to be formalized. All courses should include participant evaluation and require a minimum passing score a precondition for using the system.

Experience shows that poorly trained users can overload the system and require processes to be repeated, creating inefficiency and delays.

No user should receive a password for accessing the system without having passed certain basic courses. Financial management authorities currently use permanent online courses to ensure that officials participating in the FMIS remain up to date.

Other important resources that can be used are quick guides covering specific topics, such as how to settle a payment. These guides can be offered on mobile devices and can help to quickly resolve users' operating needs.

Printed operating manuals are expensive and difficult to keep current. It is important, therefore, that digital versions be made available to all users, mainly for consultation regarding more complex operations. Another common practice is to record short videos explaining how to perform basic system operations; these videos can be uploaded to mass-use platforms such as YouTube.

11.7 Support Teams

The FMIS project is responsible for providing two basic types of support: (i) functional, relating to use of the FMIS; and (ii) IT, relating to the use of IT equipment and physical installations. A strategy for rapid, flexible support needs to be developed for deployment of the FMIS. The following are the three main scenarios for the support offered by the FMIS project:

1. Direct, in-person support to all executing and management units
2. Direct support to a number of predetermined executing and management units, and remote support to the rest
3. Remote support to all executing and management units

The alternative selected will influence the way the support is organized.

In the first deployment stage, during which system use is restricted to management units, functional and IT staff are usually assigned to provide direct, in-person support to these units. This expedites support and creates knowledge hubs for the subsequent stages. Large management units such as education and health require special attention and additional support resources.

The support teams also need to be planned relatively far in advance, conducting training and obtaining the necessary resources. Temporary IT support staff are relatively

easy to obtain in the market, or a specialized firm may even be hired. Functional support, however, requires experience and specialized public finance training, and it is easier to obtain this from the oversight bodies in particular.

IT technical support teams should have a set of common tools available for measuring and installing electrical/network cables and meters, as well as standard support tools.⁶ This equipment should be planned in advance and should be stored in appropriate cases. A further means of providing support is to implement remote support requests through the system, allowing users to monitor the status of their requests.

The FMIS project should leverage technical staff already working in the public sector, supported by external staff. One option—particularly in the case of IT support—is to hire a private firm for this stage, although such an approach is more complicated in the case of functional support.

In larger countries, consideration may be given to hiring regional IT firms to provide local support. In this case, it is important to list the exact responsibilities of the firm in the contract—particularly in terms of the IT inputs they will be providing.

During deployment of Brazil's Integrated Financial Management System (SIAFI), the state-owned company responsible for IT in the federal government prepared mobile technical support units in the main cities. Each vehicle had replacement parts, such as a complete microcomputer, keyboards, monitors, cables, electrical and local network parts, and other key inputs. Maximum call response times were set for each city. The strategy was to minimize the impact of local technical problems on system acceptance.

11.8 Administrative Arrangements

Mobility of the support team depends on the timely allocation of technical staff to the respective work units, as well as means of communication (cell phones), the availability of vehicles, per diems, and work equipment and materials.

With respect to the transportation of technical staff, service agreements might be arranged with taxi companies or transportation service apps to allow signed receipts to be charged to the financial management authorities. This model would be more agile and efficient than building an in-house fleet or reimbursing expenses.

11.9 War Room

Creating a war room for those responsible for deployment can be good idea. It gives participants a consistent view of the implementation process, provides them with access to the data, and allows certain more complex issues to be dealt with immediately.

⁶ FMIS deployment is a critical stage of the project. With the use of new technologies, executing units may not be able to solve complex problems, and the project manager should be prepared to provide local support where necessary. Outsourcing this support to specialized firms may also be a solution.

In addition to adequate microcomputers and communications, a large television is also useful for projecting computer screens, with a projector and access to system documents. It should also be determined which statistical tables will be provided to the managers of the different executing, management, and response units (twice a day, for example).

11.10 User Help Desk

Establishing a user help desk for FMIS deployment is an important activity. While there is no need for a fully developed center with the entire range of tools and channels of communication, the help desk should at least provide a single point of contact for users and should accept phone and email requests at a minimum. Chapter 12 provides a proposal for a modern, multichannel user help desk supported by chat bots or virtual assistants.

11.11 Observations

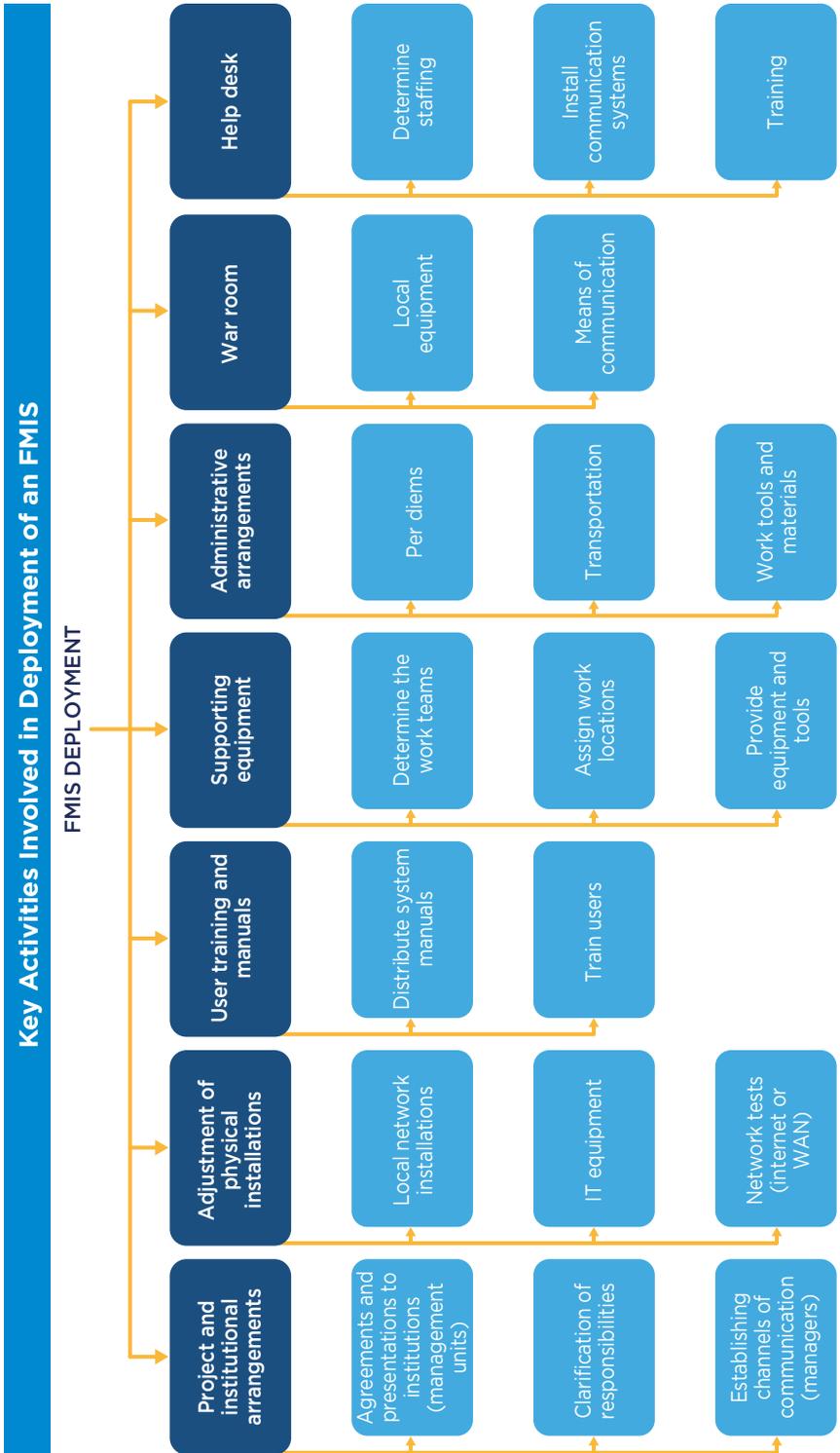
The effective organization of FMIS deployment is one of the critical factors in system success. Previous experiences should be taken into account, and the authorities should attempt to plan the full set of activities in advance, with the participation of the managers of institutions that will be involved in the process. Comprehensive support should be provided, encompassing not just IT but also functional support, including the rules and processes in each area (budget, treasury, accounting etc.).

It is recommended that preparation for deployment begin at least one year in advance of the planned date, as strategic decisions—often with a major financial impact—will need to be taken and institutional arrangements developed, requiring a range of multidisciplinary activities. The official responsible for coordinating deployment should report periodically to the project manager and warn of any delays in the calendar for implementation.

ANNEX 11.1

KEY ACTIVITIES IN FMIS DEPLOYMENT

FIGURE A 11.1.1.1



Source: Authors' elaboration.



In this chapter:

- 12.1 Introduction
- 12.2 Basic ITIL concepts
- 12.3 FMIS Maintenance: Considerations
- 12.4 Final Comments

Annex 12.1 ITIL Processes v3

Annex 12.2 ITIL Practices 4

Management Model for an FMIS in Operation

12.1 Introduction

Information and communication technologies (ICTs) comprise one of the foundations that underpin a financial management information system (FMIS). Successful implementation of the system means that a set of complex technological, functional, and organizational actions have been finalized. However, maintaining the system in operation in a stable and effective way is of fundamental importance for public financial management. This refers to Stages 3 and 4 of the information system life cycle, as can be observed in Figure 12.1.

Managing an FMIS already in operation or in production has two components: the system and the IT infrastructure. Fortunately, it is not necessary to reinvent the wheel: the accumulated experience at the global level in exploiting and maintaining information systems provides the foundations to enable an FMIS project to create the basis for such management.

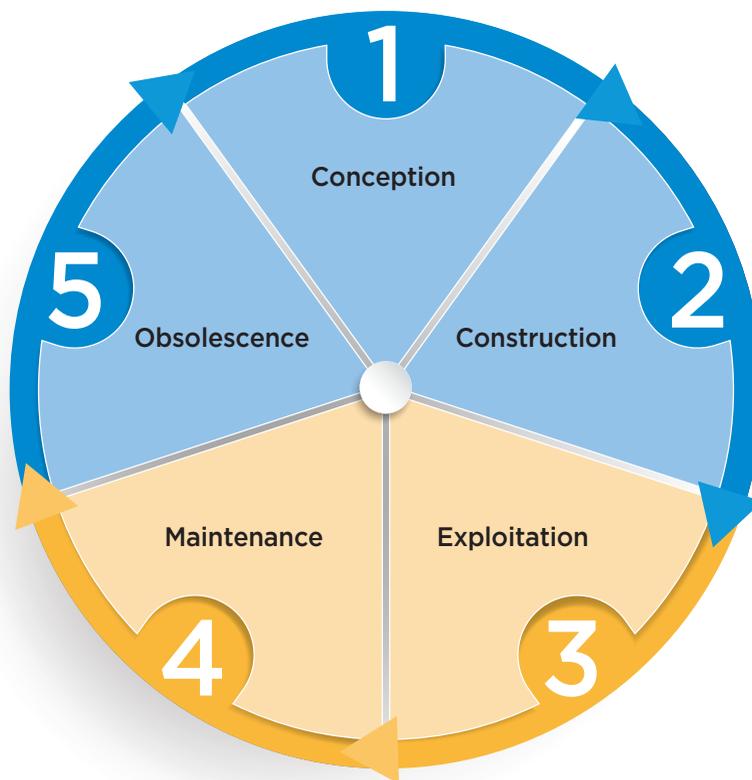
There are various frameworks of international best practices for information technology services management (ITSM), which organize and guide the structuring of these actions. The best known are the Information Technology Infrastructure Library (ITIL); Control Objectives for Information and Related Technologies (COBIT), and the Microsoft Operations Framework (MOF). The most widely-used in LAC is the ITIL, which is used as the framework for this chapter.

Not all the practices of a framework need be implemented immediately. This would be impossible. However, after establishing a reference point, certain practices could be prioritized while the framework was being implemented in stages, as the organization becomes more mature.

In the survey carried out by the IDB in the first half of 2020, which was administered to LAC countries that use an FMIS, they were asked about the use of management frameworks for the system. Forty percent responded that they use the ITIL; 40 percent

FIGURE 12.1

Life Cycle of an Information System



Source: Authors' elaboration.

that they do not use a framework, and 20 percent that they use their own frameworks. However, “use” does not mean that they are using it correctly. It is noteworthy that many of the countries still fail to appropriately maintain their FMIS.

This chapter provides guidance on structuring adequate management of the system not only for new FMIS, but also for those already established.

The ITIL framework, used here as a reference, covers the two aspects of interest for this chapter: system management and infrastructure management. However, its scope is wider and can be used as a guide if needed in other areas, such as financial management, service portfolio management (SPM), management of service providers, and others.

The main idea presented here is the importance of ensuring that an IFMS management model is set up from the beginning of its implementation as an inherent task in the IFMS project. When this is left “for later,” it is difficult to achieve anything with the level of quality required.

12.2 Basic ITIL Concepts

ITIL offers best practices that are applicable to any kind of organization and technology. The use of ITIL does not require any type of license or compensation for the use of licenses. However, support tools may be available either as free software or by acquiring commercial licenses.

The current version, ITIL 4, is divided into 34 practices (see Annex 12.2) that are governed by the usefulness and availability of information and communication technology (ICT). These practices are supported by four dimensions:

- Organizations and people: An organization needs a culture that backs its objectives and an appropriate level of skills and competencies among its workforce.
- Information and technology: This includes information and knowledge, as well as the technologies necessary for service management.
- Associates and providers: This refers to the relationships between an organization and the other firms involved in the design, implementation, delivery, support, and continuous improvement of services.
- Value flows and chains: As the different parts of the organization work in an integrated and coordinated fashion, it is important to create value through products and services.

Adoption of ITIL practices must observe the following guiding principles:¹

- Focus on value.
- Start where you are.
- Progress iteratively with feedback.
- Collaborate and promote visibility.
- Think and work holistically.
- Keep it simple and practical.
- Optimize and automate.

Published in 2019, ITIL 4 has yet to be incorporated into the day-to-day running of organizations. Thus, for practical purposes, the principles of ITIL v3 are still in force.

The following sections briefly describe some of the ITIL practices that are most important for FMIS.²

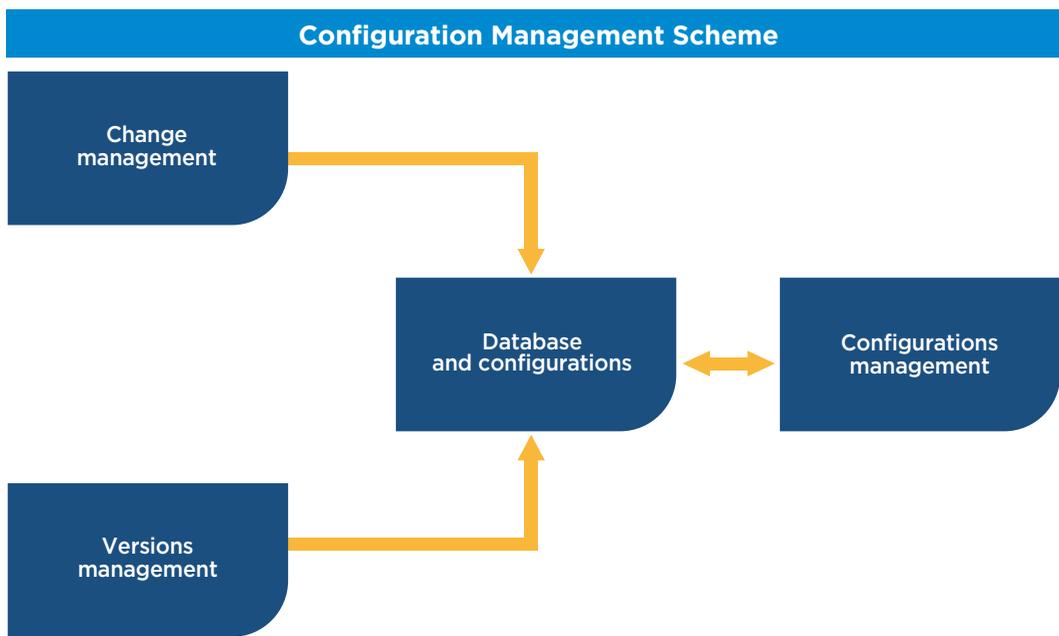
12.2.1 Configuration Management

It is necessary to maintain detailed control of all the components of the IT infrastructure and the information systems it supports, storing this information in a configuration

¹According to the freshservice.com website.

²The practices addressed are based on: <https://bit.ly/2PK5HWM> and follow the guiding principles of ITIL v3.

FIGURE 12.2



Source: <https://bit.ly/2PK5HWM>.

management (CMDB)³ database and delivering it to the different IT management processes. The task of configuration management and its interactions is represented in Figure 12.2.

The programs acquired and their licenses are also stored in the CMDB, thereby helping to control the proliferation of illegal copies. Configurations are defined by configuration items (CI), which define all the components of the IT services.

12.2.2 Change Management

Change management is responsible for supervising and approving the modification or creation of services, guaranteeing that the entire process has been appropriately planned, evaluated, tested, implemented, and documented, in such a way that existing services are not affected. Change management is present in nearly all aspects of service management.

This type of management must ensure that the changes:

- Are justified and duly supported.
- Are appropriately registered, classified, and documented.
- Have been carefully tested in a test environment.

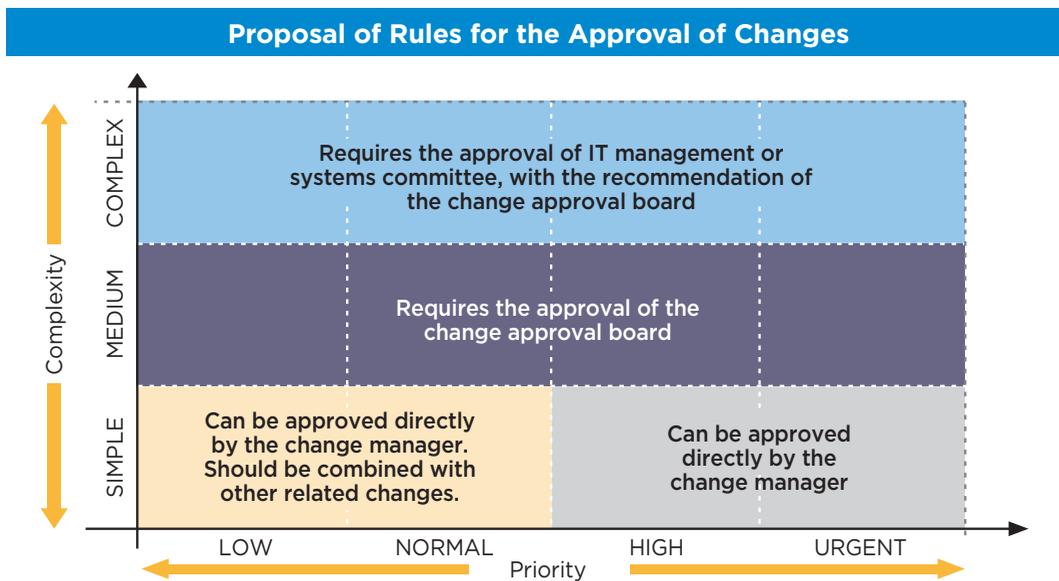
³ A CMDB is a data repository related to all the components of an information system. It contains details of the configuration items of the IT infrastructure. Despite the fact that IT departments have employed data repositories similar to the CMDB for many years, the term CMDB itself comes from ITIL.

- Have been carried out without jeopardizing the quality of the IT service.
- Are reflected in the CMDB.
- Are accompanied by a backout plan in the event that the change creates problems in the service, or due to any failure that might occur.

Change management uses standardized methods and procedures for fast and effective manipulation of all changes, while maximizing the value of the service and minimizing incidents and interruptions. This reduces business risk.

Change requests are made formally, via a document, a form, or a call to the service desk. The person requesting the changes classifies them according to their complexity—simple, medium, or complex—and their priority—low, normal, high, or urgent. In the change management structure, preferably in the IT area, there must be a change manager or administrator responsible for the analysis of the justifications and the final approval of their implementation. Establishing a change approval board (CAB) is often justified. A CAB consists of the change manager and at least one representative from the business area and another from IT management. It analyzes and approves any changes that have a high impact on FMIS operation. Figure 12.3 proposes a method for approving changes in accordance with their complexity and priority.

FIGURE 12.3

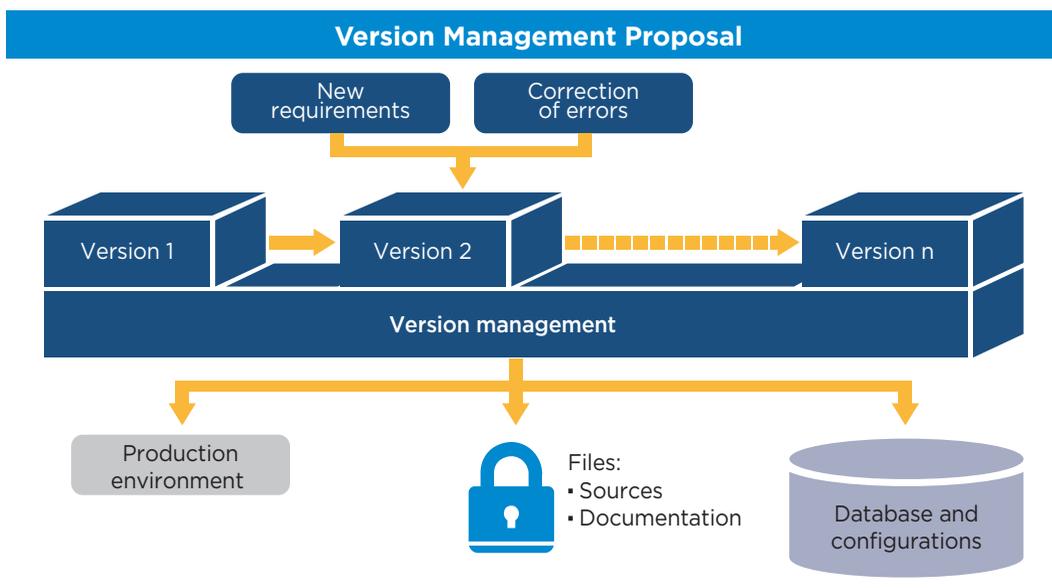


Source: <https://bit.ly/3wDNY44>.

12.2.3 Version Management

These are practices related to coordinating and controlling the process of implementing all of the software, whether already installed or in production (Figure 12.4). The process

FIGURE 12.4



Source: <https://bit.ly/3tONKSn>.

must be coordinated with both change management and configuration management so that all information is updated in the CMDB. This discipline can also be applied to hardware; however, for practical reasons it is preferable to deal with software and hardware separately. Version management can be included in change management.

The main objectives of this type of management are the following:

- Implement new versions of the software in the production environment once the appropriate tests have been carried out.
- Ensure that the changes comply with established specifications.
- Certify that information on the changes is recorded or updated in the CMDB.
- File and safeguard both the source programs and the copy of the executables in production, as well as all associated documentation in the agreed database.
- Maintain custody of previous versions within defined policies.

Some of the challenges that need to be tackled are resistance to centralizing the change process and, particularly, possible reluctance of the IT area to recognize the authority of the versions manager. Some conflicts may arise from insufficient

As they are related, many small and medium-sized institutions decide to combine the three practices—configuration management, change management, and version management—under a single management in the interest of simplification. Despite their being combined, the individual practices of each discipline are maintained.

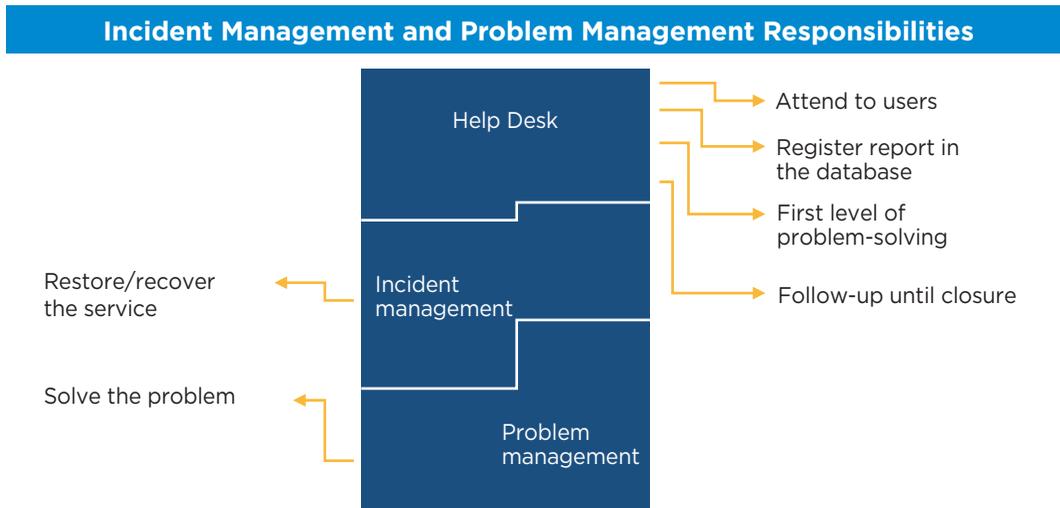
software tests, which will result in the implementation of new, poor quality versions that will soon require urgent repairs.

12.2.4 Incident Management and Problem Management

An incident is any unplanned interruption in IT services. Incident management seeks to restore the service as quickly and efficiently as possible.

Problem management is concerned with analyzing and identifying the factors that may have caused a certain incident, whereas incident management seeks to restore the service as much as possible. Although the two types of management are interrelated, they are different. Figure 12.5 shows the responsibilities pertaining to each one.

FIGURE 12.5



Source: Adapted from <https://bit.ly/3t3tUFT>.

Appropriate incident management can help to achieve higher user satisfaction and increase productivity. If the reverse is true, it can jeopardize the agreed levels of service, and there may be a proliferation of users who are dissatisfied with the services received.

12.2.5 Help Desk

The main objective of a help desk is to serve as a point of contact between users and managers of IT services. It is also the linkage point for all processes aimed at providing support to the final user.

The help desk:

- Records user requests and follows up on them.
- Applies temporary solutions to known problems.

- Processes the changes requested by users through service requests integrated with the other disciplines.

Considering the various communications media available to the help desk, a social media officer should be appointed for platforms such as WhatsApp, Facebook, and others and integrated with the full-support environment.

Presently, an AI/ML-based chatbot⁴ can be developed to meet the needs of users. Chapter 13 contains more details on this area.

The help desk should be evaluated to measure its performance. The following metrics may be used:

- Average time taken to process requests received via the different communications media
- Percentage of incidents that are resolved in the first line of support
- Percentage of queries answered after the first contact
- Statistical analysis of the amount of time taken to resolve incidents, organized by their urgency and impact
- Percentage of calls passed on to higher support departments
- Degree of user satisfaction, ascertained via regular surveys

A help desk may be outsourced, thus preserving the financial area's own resources. In general, the first level of customer care—dealing with basic questions about use of the system, connectivity and microcomputing—can be outsourced completely. The second level, which deals with specific questions about the use of FMIS functionalities, should receive the support of specialized staff from the financial area.

12.2.6 Support Tools

Application of the ITIL disciplines requires the use of support tools. There are several available in the market, and the choice will depend on factors such as the option of choosing between a commercial product or an open-source code, the number of users, compatibility with other technologies available in the organization, availability of trained professionals, the solution installed in the on-premise data center or in the cloud, and so on.

There are many open-source code tools that partially deal with ITIL practices (or ITIL processes, according to Version 3 terminology), which are available at *sourceforge.net*. Furthermore, in the area of commercial solutions, services are offered in the cloud and on-premises for the client's own facilities, with the possibility that the client can choose one of the options.

Table 12.1 presents some alternatives.

⁴ A chatbot is a computer program that simulates a human conversation (by voice or text) with the user, to answer questions. It is generally based on artificial intelligence (AI) and machine learning (ML).

T A B L E 1 2 . 1

Alternative ITIL Tools		
Solution	Site	Supply
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 code
EasyVista Service Management	www.easyvista.com	Commercial
FreshService	www.freshservice.com	Commercial
GLPI	glpi-project.org	Open source code
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: Martins and Seco (2020).

12.2.7 Priority Practices and Recommendations

During the commissioning of the FMIS, a minimum of service management practices should be implemented. Table 12.2 lists these practices.

T A B L E 1 2 . 2

Service Management Practices
Configuration management
Management of ICT assets
Change management ^a
Incident management
Problem management
Help desk management
Availability management

Source: Authors' elaboration.

^a Known as "Change Control" in ITIL 4.

12.3 FMIS Maintenance: Considerations

An FMIS is constantly updated throughout its working life, since public financial management is dynamic and is subject to constant legal or regulatory changes. Moreover, there are visual adjustments, improvements in usability, and technological improvements. In general, the processes initiate the changes and must be updated and optimized before being automated.

The following section addresses the corrective maintenance or evolution of the IT system, which can be affected in its software requirements. In addition to managing a methodology for FMIS development, a similar methodology must also be managed with

respect to system maintenance. The artifacts produced during development that are affected by maintenance must be renewed and remain in the same status as the updated code.

These considerations require the establishment of organizational support structures which adhere to best international practices. While the FMIS Project continues to be responsible for the operation of the FMIS, the structures should remain internalized. When the operation is transferred to the lead agency, that agency should replicate or adapt the organizational structures so that the FMIS can continue to be operational and effective.

12.3.1 Process Management

Processes are cross-cutting throughout the organization and, depending on the structure of public financial management, can also cut across various ministries. In this case, institutional arrangements are essential.

Given this reality, a process management office, as analyzed in Chapter 6, can have projections (replicas) in other agencies, even when it is structured within the lead agency.

12.3.2 Maintenance Management

Adequate maintenance of the FMIS is necessary to enable it to function efficiently and to ensure that its useful life is long and commensurate with the investment made. According to Pimenta and Seco (2019), any changes that are not made in a timely fashion and guided by procedures and documentation well defined in best international practices can have the following major consequences: (i) the useful life of the system could be drastically reduced; (ii) FMIS performance can suffer; (iii) the mean time between failures (MTBF) would tend to be reduced, and (iv) the mean time required for a corrective maintenance intervention would also be reduced.

Moreover, as a natural consequence, the system will gradually lose its modularity and be difficult and expensive to maintain, improve, and expand, since nobody or only a few people will understand its internal logic and dare to touch its programming codes. In these cases, it is common to opt for writing another routine for each new case and abandon the previous one, because nobody knows if the existing routine is used by others or includes any special unknown condition. The system would be filled with fragments of code and data, whose purpose would be unknown. This would make the system cumbersome and slow. Each maintenance action in the system or the databases will mean an increased risk of interruptions in the operation, as well as the introduction of errors, which often will only be noticed hours or days later.

In many cases, senior management presses for a particular change deemed to be an “emergency” to be rapidly implemented, bypassing methodological stages. In ITIL processes or practices, there is room for emergency changes. Such extreme cases must undergo analysis by the change manager and, when authorized, must be immediately documented in accordance with the current rules. Situations considered to be emergencies, however, should not become commonplace.

12.4 Final Comments

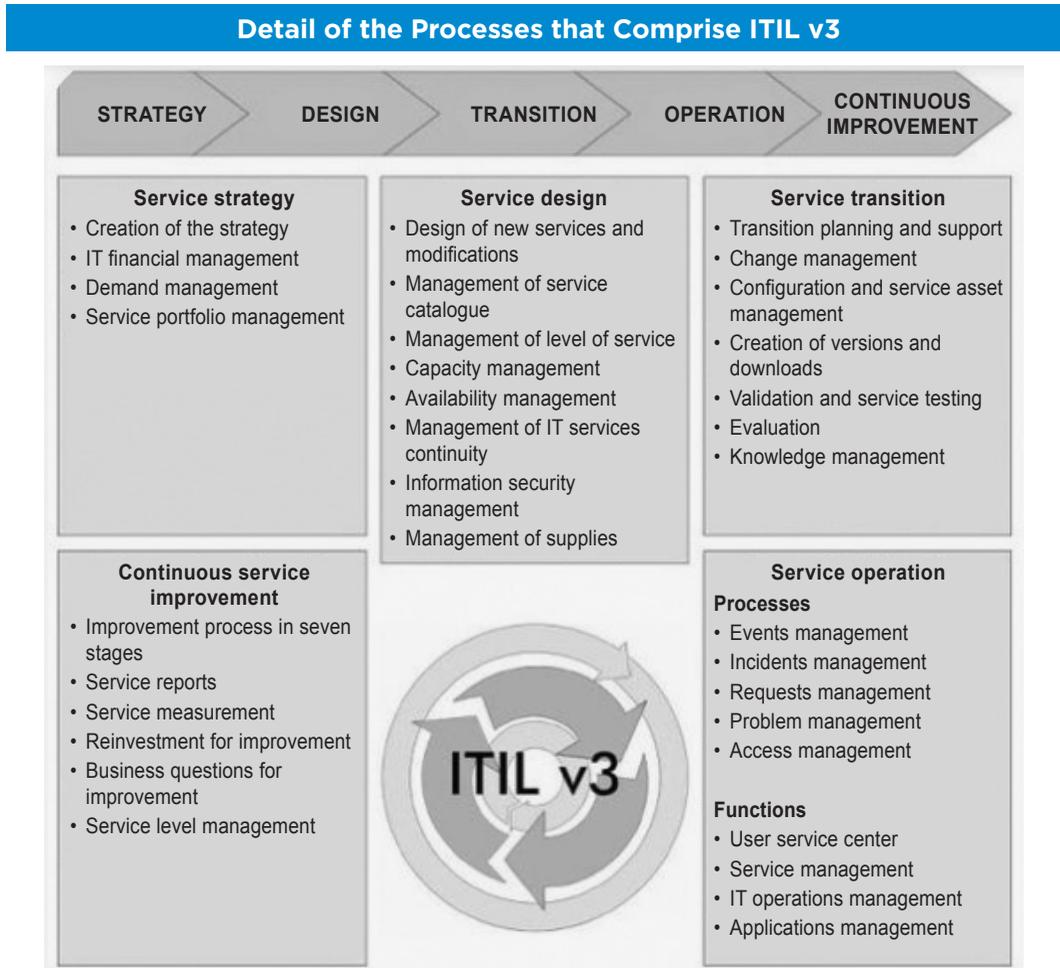
Applying ITIL processes/practices helps to establish an efficient IT management environment. This requires specialized software and hardware and trained personnel. Therefore, it bears a cost that must be assumed by the lead agency at the end of the FMIS Project. It is important to clearly define these costs to convince senior financial management executives of the need to include them in annual budgets.

Broadening the concept presented in Martins and Seco (2020), given the importance of ICT in fiscal administration, it is extremely risky to work with an ICT area that lacks systematized management. Positive results must be incorporated into organizational practices, while errors cannot be repeated. Therefore, there are many ways of systematically managing ICT, and ITIL is only one of them. The organization does not need to developing its own ICT management methodology.

A significant proportion of IT management processes or practices may be outsourced, thereby reducing the complexity of internal management and the need to invest in developing them. As described in other chapters of this publication, particularly Chapter 13, cloud computing is an alternative for financial administrations wishing to move from a capital expenditures model to an operational expenditure model, while maintaining or even improving the quality of the services.

ANNEX 12.1 ITIL PROCESSES V3

FIGURE A12.1.1



Source: ITIL v3 Books, published by the UK Office of Government Commerce (OGC).

ANNEX 12.2

ITIL 4 PRACTICES

FIGURE A12.2.1

Detail of the Practices that Comprise ITIL 4

GENERAL MANAGEMENT PRACTICES	SERVICE MANAGEMENT PRACTICES	TECHNICAL MANAGEMENT PRACTICES
1. Architecture management	1. Availability management	1. Implementation management
2. Continuous improvement	2. Business analysis	2. Infrastructure and platform management
3. Security and information management	3. Capacity and performance management	3. Software development and management
4. Knowledge management	4. Change management	
5. Measurement and notification	5. Incident management	
6. Organizational change management	6. IT asset management	
7. Portfolio management	7. Event monitoring and management	
8. Project management	8. Problem management	
9. Relationships management	9. Version management	
10. Risk management	10. Service catalogue management	
11. Financial service management	11. Service configuration management	
12. Strategy management	12. Service continuity management	
13. Supply management	13. Service design	
14. Workforce and talent management	14. Customer attention service	
	15. Service level management	
	16. Service request management	
	17. Service validation and testing	



Source: <https://proagilist.es/gestion-servicios-itol-4/>.



13

In this chapter:

- 13.1 Introduction
- 13.2 Use of Cloud Services
- 13.3 Distributed Ledger Technologies / Blockchain
- 13.4 Artificial Intelligence, Machine Learning, Data Analytics, and Robotic Process Automation
- 13.5 Data Visualization
- 13.6 Open Fiscal Data
- 13.7 Mobile Money and the Targeting of Social Subsidies
- 13.8 Open Source and Free Software and Means of Sharing Code
- 13.9 Final Considerations

Annex 13.1 Examples of Fiscal Data Visualization

Use of Emerging Technologies in FMIS Projects

13.1 Introduction

The emergence of new digital technologies and services, particularly in recent decades, has created new opportunities for improving organizations and services in both the public and private sectors. While the private sector moves quickly to evaluate and use anything suitable for its needs, the public sector reacts more slowly, missing out on opportunities that could support greater efficiency and effectiveness. This chapter presents a number of the emerging technologies and digital services that are already supporting the modernization of public financial management, or that have strong disruptive potential in this area.

13.2 Use of Cloud Services¹

13.2.1 A Brief Introduction to Cloud Computing

The United States National Institute of Standards and Technology (NIST) defines cloud computing as a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction. Its essential property is scalability, while in financial terms it can represent a shift from a CAPEX² model to an OPEX one.³

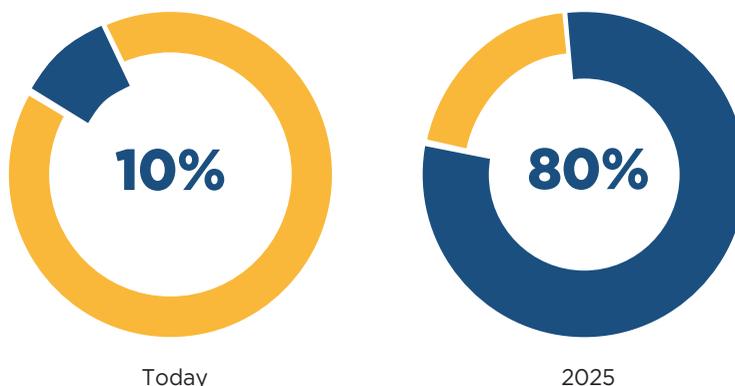
¹This section is based primarily on Corvalán et al. (2020), Pimenta and Seco (2019), and Schijman et al. (2020).

²Capital expenditures, including investments in IT.

³Operational expenditures, including payments for IT services.

FIGURE 13.1

Projected Closure of Data Centers



Percentage of enterprises that will close their traditional datacenters in 2019, and in 2025.

Source: Gartner Group (2019).

There are a number of service delivery models, such as infrastructure as a service (IaaS), platform as a service (PaaS), and software as a service (SaaS).⁴ SaaS can offer options for a number of other services necessary for financial management, such as Backend as a Service (BaaS), Database as a Service (DBaaS), Machine Learning as a Service (MLaaS), Disaster Recovery as a Service (DRaaS), and Block Chain as a Service (BaaS). DRaaS services are of particular interest as a potential way of avoiding having to maintain additional infrastructure for this purpose.

The models of cloud computing are as follows: (i) public clouds (available to general users), (ii) private clouds (available to individual organizations, including government organizations), (iii) community clouds (available to groups of associated organizations), and (iv) hybrid clouds (consisting of several models of cloud, connected by internal or proprietary technology).

Cloud computing has spread quickly in the private sector but more slowly in the public sector. By 2025, the Gartner Group expects companies to close 80 percent of the data centers that existed in 2019, turning to cloud services instead.

Several international cloud services are available in the Latin American and Caribbean (LAC) countries, including Azure (Microsoft), AWS (Amazon), and Google Cloud (Google). Azure has data centers in Mexico and São Paulo (Brazil), while AWS has its data center in São Paulo.⁵

⁴For additional details, see <https://www.gartner.com/en/information-technology/glossary>.

⁵The availability of a local data center is not a requirement for providing cloud services, but it is an advantage when there are legal restrictions relating to the geographic location of the data. Latency may also be lower.

With respect to the public sector, several countries have developed digitalization strategies in which cloud computing plays a core role, including the following examples:

- The United States has a cloud computing strategy known as Cloud Smart, which encourages government agencies to use cloud services. Companies such as Azure and AWS have created specific clouds for the U.S. government that comply with previously established security rules.
- The United Kingdom has established the Cloud First policy, which obliges government agencies to consider cloud solutions in preference to others, in addition to recommending that agencies first assess the use of public clouds.
- Mexico has a National Digital Strategy and has partnered initially with Microsoft to provide cloud services to the entire government. The tax administration service uses a hybrid cloud model. The country is currently reviewing this model.
- Guatemala is adopting cloud strategies for the main government institutions, including the use of Azure and AWS cloud services to provide support to the electronic invoicing system.
- Colombia also uses cloud services for the electronic invoicing system.

13.2.2 Advantages of Cloud Computing

The following are the most significant advantages and opportunities that cloud computing offers for the financial management authorities:

- *Cost reduction*
Includes the human resources necessary to maintain operational infrastructure, electricity, and investments to maintain and implement cooling systems and data centers, access controls to strengthen the protection of IT infrastructure, and an administrative team for managing software contracts and licenses.
- *Flexibility*
Accelerates the response to change, with rapid access to an increase or reduction in storage resources and computing power.
- *Contribution to green computing*
Reduces the number of data centers, meaning less need for cooling and power supply systems, thus helping to protect the ozone layer and reduce pollution.
- *Greater ease of integrating services and better information security*
With the use of more standards, the informal strength of organizational silos is reduced and greater process integration can occur, with fewer duplicate records and less work. The coverage of information security tools is also increased.
- *Immediate availability of new services*
New service platforms such as artificial intelligence, data mining, and the Internet of Things use the cloud as their first option (e.g., IBM Watson).
- *From CAPEX to OPEX*

Reduces investment and maintenance costs for IT resources (CAPEX), with a shift to periodic payments for third-party services (cloud service providers) based on consumption of those services (OPEX). This may represent an advantage or a threat depending on the characteristics of budget management by the financial management authorities, as discussed below.

13.2.3 Challenges in Adopting Cloud Computing

- *Geographical location*

Some countries have laws that require government data to be located within national territory. In such cases, government information should be categorized, with low-sensitivity data stored in the public cloud while the authorities decide what to do with highly sensitive information.

In countries where cloud service providers have data centers, the authorities can request that government data be stored in these locations. The use of private or community government clouds may also be considered, where available. This type of project can be found in Argentina and Brazil. Where hybrid clouds are adopted as a solution, confidential data are stored in the private part of the cloud.

- *The problem of the OPEX model*

To ensure the continuity of cloud services, financial administrations without financial autonomy need to protect these contracts against potential budget cuts, which generally focus on the operational budget. Although this is not an obstacle, cloud service contracts must be determined, understood, and guaranteed by an institution's top-level management before signing.

- *Cost and availability of reliable cloud services*

The availability of sufficiently reliable cloud providers for use by the financial management authorities may be problematic in some countries, and the cost of the services must be assessed.

- *Financing of FMIS modernization programs*

In the past, many of the financial management modernization programs financed by international organizations had an IT component involving significant spending (at least 30 percent of the total) on investment in IT equipment and infrastructure. This

Subnational or smaller national financial administrations

Issues of scale, budget, and the availability of qualified human resources mean that it is very difficult for many municipalities and provinces/states to build data centers with adequate physical facilities and management processes. These generally use server rooms that are plagued with the kinds of operational, availability, and security problems inherent to this type of infrastructure. Cloud services may be an alternative solution for reducing investment costs, improving operability, and obtaining better services for managers and citizens. The same applies to smaller national financial administrations.

represented an opportunity for project managers to provide the institution with its own modern equipment and software, but without full consideration of long-term costs such as equipment maintenance, depreciation, and obsolescence.

- *The fact that some financial administrations are traditionally conservative and shy away from external IT environments*

Change management processes are essential for mitigating this perception.

- *The technical team in the financial administration will require new skills*

Of greatest importance will be skills and rules for the hiring and management of external IT services, requiring retraining or the contracting of new resources.

Attorneys specializing in large-scale technology service contracts will be needed.

- *Information security*

Cloud service providers invest substantial resources in security for their clients, keeping their products permanently updated to ensure contract compliance and a positive image among users. Clients should take stock of their needs and verify with providers that this updating is occurring.

The most sensitive areas are user access (i.e., weak passwords, accepting malware,⁶ negligence in saving passwords, etc.) and communication with other applications. It should be noted that these areas are primarily the responsibility of the client (i.e., the financial management authorities). The Gartner Group suggests that 99 percent of cloud security failures are the fault of the customer.⁷

- *Fate of large investments already made in IT infrastructure (data centers, equipment, etc.)*

Some financial management bodies have already made large investments in IT infrastructure, such as data centers, equipment, and others. In such cases, the trend is to create hybrid cloud arrangements. As time passes and the authorities learn to manage cloud services, the tendency will be to reduce in-house infrastructure investments and increase allocations to public cloud services.

- *Vendor lock-in or dependency on a specific provider*

Where cloud services are delivered by just one or a very small number of providers, there is a risk of long-term dependence on the provider(s). This mainly true in the case of proprietary technologies that might allow providers with quasi-monopolistic or oligopolistic status to increase their prices.

13.2.4 Migrating to the Cloud

As mentioned above, private sector companies make the greatest use of cloud computing, and several governments have chosen to base their digital strategies on these services. It is also well known that fiscal management authorities are conservative and mistrustful of external IT environments. Based on these arguments, financial administrations should

⁶ Malware (malicious software) is a generic term for any type of computer software developed with malicious intent. Malware accounts for most online threats.

⁷ <https://www.gartner.com/smarterwithgartner/is-the-cloud-secure/>.

use evaluations, pilot projects, and institutional strategies to prepare themselves for the technological and financial advantages of this mode of computing.

A gradual migration to cloud services is proposed, taking into account the following factors:

- In the initial stage, migrate services or administrative systems that are well known or widely provided by third parties, building on similar experiences. These may include email services, corporate videoconferencing, the backup of administrative documents, customer relationship management (CRM), and others. Practice in contracting and managing these services will allow the financial management authorities to gain the experience and confidence necessary to expand the range of cloud services used. International organizations such as the Inter-American Center of Tax Administrations and the IDB have transferred these and other services to the cloud, with positive results.
- Merge several public sector data centers and offer private cloud services to other public entities. The large number of computing centers in the public sector often represents a barrier to contracting cloud services until such time as their investment costs have been amortized. One possibility is to integrate several of these centers and offer services to other entities, thus enhancing efficiency and avoiding some of them potentially being left idle. Based on this, the number of services contracted from public cloud providers could gradually be increased and a hybrid cloud created.
- Migrate related systems to the cloud. It may be easier to migrate related systems such as human resources, public debt, and others to the cloud. As these are legacy systems, there may be complex technical difficulties that will need to be resolved. A number of alternative approaches are available, such as the experience currently underway in Argentina that involves containerizing the systems and moving them to the cloud without significant changes (i.e., the “lift and shift” approach).⁸
- Contract or develop native systems in the cloud: The development of systems designed specifically for the cloud (“cloud native”), as a service (SaaS), should follow specific rules. One widely used methodology is the Twelve-Factor App,⁹ which establishes 12 technical rules for achieving this objective and is one of the models that may be used as a point of reference.
- Modernization in the cloud: A modernization strategy may involve migrating an entire FMIS or specific subsystems to the cloud. If not developed specifically for the case concerned, one strategy can be to containerize a subsystem or the entire FMIS, as planned in Argentina. It is important to develop performance indicators that allow the consumption of computing resources and the impact on users to be evaluated.

⁸ Lift and shift is a strategy for moving an application or operation from one environment to another without stopping to redesign the app or operations workflow. The complexity of an application or operation is a key factor in deciding whether something should be lifted and shifted or re-architected from scratch as a new native cloud app or operation (<https://whatistechtarget.com/definition/lift-and-shift/>).

⁹ <https://12factor.net/es/>.

T A B L E 13.1

Financial Impact of Migration to the Cloud (Percent Savings)			
Migration to:	Private	Hybrid	Public
SaaS	n/a	n/a	83%
PaaS	57%	58%	60%
IaaS	5%	16%	26%

Source: Schijman et al. (2020).

Note: n/a = not available. Conditions: national coverage, private provider located in the United States, maximum estimated savings.

- Cloud service contracts: This type of cloud contract should be drafted and evaluated by professional specialists—possibly attorneys with training or experience in large technology contracts. The client institution will need this type of advisory support to ensure that it secures the best possible operational and financial terms, in addition to covering all identifiable cases of exceptions in the contract. Similar contracts signed by other public or private organizations are another good source of information.

13.2.5 Cost of Cloud Services

The IDB carried out a modeling exercise for the cost of cloud services in the Southern Cone countries. It is summarized in Table 13.1.

The costs of cloud services depend substantially on the quality and flexibility of the required services. Before taking any decisions, each country should evaluate and negotiate medium- and long-term price policies with the selected providers.

13.3 Distributed Ledger Technologies / Blockchain

Blockchain is a growing list of irrevocable transaction records with encrypted signatures, shared by all participants in a virtual network. Each record contains a time stamp and links to references to previous transactions. With this information, anyone with access permissions can trace a transaction event to a specific participant at a specific point in their transaction history. Blockchain is a computing architecture design of distributed ledgers in the broadest sense and is known as the supporting technology for cryptocurrencies, especially Bitcoin. As integral components of blockchain, decentralized consensus mechanisms (i.e., algorithms that define the transaction to be recorded in the blockchain) and smart contracts (i.e., self-executing computer protocols with strict rules and consequences similar to a legal instrument) enhance the applicability of this technology (Tapscott and Tapscott, 2016).

Ranked on the Gartner Group’s 2019 scale of emerging technologies for digital governance in the “Peak of Inflated Expectations” category, blockchain is considered to

still need 5 to 10 years to reach productivity level.¹⁰ Whenever a disruptive technology with high uncertainty over its use cases appears, it is common to overestimate the benefits and ignore the fact that technological changes take time and require the adaptation of an entire ecosystem.¹¹

The Gartner Group predicts blockchain will create \$3.1 trillion in business value by 2030. Although a significant amount of these returns will result from value generation and efficiency improvements in current operating models and business processes, the real value will come from the way it enables a paradigm shift in how societies, businesses, customers, partners and individuals interact, create, and exchange value.¹² Nonetheless, potential uses for blockchain may be identified in some cases in the area of public expenditure management, including experiences that are currently in the initial stages of development.

13.3.1 Human Resources and Payroll

In the area of human resources management, the construction of public payroll records using blockchain technology would ensure an immutable, sequential record of all events in the functional life of each official. Ainsworth and Viitasaari (2017) consider that payrolls have important features for blockchain application: they are digitized and interact with different agencies, such as social security, tax administration, labor legislation supervisory bodies, unions, and others, that have access to certain data and can perform compliance audits.

Another application suggested by the Gartner Group is the use of smart contracts for temporary contracts or staff. A smart contract creates irrevocable and immutable rights and obligations for all participants. For example, immutable contracts for human resources can automatically release payments held in escrow once workers complete their assigned tasks.

13.3.2 Public Procurement

The FAST Lane system¹³—developed by the Federal Acquisition Service of the United States General Services Administration (GSA/FAS)—is being used in the Multiple Awards Schedules (MAS) procurement program, which covers spending of US\$25 billion on IT services and materials. The system has cut total processing time by about 90 percent and automated all stages except for final negotiation (between the parties' lawyers) and the signing of contracts. It uses a private blockchain based on the hyperledger platform¹⁴ to

¹⁰ https://blogs.gartner.com/smarterwithgartner/files/2019/10/PR_781095_Hype_Cycle_for_Digital_Government_Technology_for_SWG_article_Final.png.

¹¹ For more information, read the interview with Christian Catalini, professor at the Massachusetts Institute of Technology (MIT) available at: <https://sloanreview.mit.edu/article/seeing-beyond-the-blockchain-hype/>.

¹² <https://www.gartner.com/smarterwithgartner/5-ways-blockchain-will-affect-hr/>.

¹³ <https://gcn.com/Articles/2017/09/21/GSA-looks-to-blockchain-forprocurement.aspx?m=1>.

¹⁴ Hyperledger is an open source blockchain platform launched by the Linux Foundation in 2015 to support blockchain-based distributed ledgers.

store the most important documents, messages between participants, and contracts, and its consensus mechanism is based on the “proof of stake” algorithm.¹⁵ The blockchain is built on a group of certified nodes, or servers.

The basic unit of content stored in each block is a JSON data structure that includes contract data such as terms and conditions, metadata, and liabilities. Because vendors are registered through other systems, references to vendors on the blockchain include identity information. At the present time, the program contains only master contract information. In future iterations, it may include specific transactions under each contract.¹⁶ This ensures the security, immutability, transparency, and sequential chaining of information, thus creating consistency, avoiding complaints from participants, and enabling lower prices.

13.3.3 Bond Issuance

The World Bank entered into an agreement with the Commonwealth Bank of Australia to launch the first global bond to be created and managed through blockchain technology throughout its life cycle, using a platform known as bond-i.¹⁷ The two institutions launched the bond in late 2018 after a consultation period with large investors. Blockchain is considered to have the potential to streamline processes in debt markets, intermediaries, and brokers, as well as to simplify fundraising and securities trading and improve operational efficiency and regulatory oversight.

In 2019, secondary market trading recorded on blockchain was enabled. This allows coordination of the negotiation and management of stocks in blockchain, delivering a verified, permanent record and instant reconciliation. The Commonwealth Bank of Australia developed the functionality in conjunction with the World Bank and the investment bank TD Securities.¹⁸ In August 2020, the World Bank issued more than AU\$50 million in bonds using the same platform.

13.3.4 Improving Management Processes

Other operations in the area of public financial management (PFM) may improve in the future as blockchain replaces traditional technologies. The Central Bank of Brazil and other regulatory institutions of the national financial system use a blockchain-based platform for

¹⁵ In the proof of stake algorithm, the probability of beating the competition to record a transaction block is directly proportional to the “stake” one holds. The meaning of “stake” is defined by a certain system and might be a currency, stocks, etc.

¹⁶ https://static1.squarespace.com/static/56534df0e4b0c2babdb6644d/t/5cfaa34d5a82320001639f17/1559929681007/Blockchain_Paper_Final.pdf.

¹⁷ <https://www.worldbank.org/en/news/press-release/2018/08/09/world-bank-mandates-commonwealth-bank-of-australia-for-worlds-first-blockchain-bond>.

¹⁸ <https://www.worldbank.org/en/news/press-release/2019/05/15/world-bank-and-cba-partner-to-enable-secondary-bond-trading-recorded-on-blockchain>.

real-time system control and sharing of operational information, known as “collaboration and information exchange.”

The institutions previously used email messages, faxes, and other means that required validation and authentication, resulting in difficulties with archiving and delays in queries. With the blockchain features of data immutability, chronological order, and the use of electronic signatures, the incidence of errors is lower, tampering is practically impossible, and searches are more effective: each institution has access to all interactions in which it is a participant, and administrative procedures take less time to complete. This is a type of blockchain application for flawless and secure information sharing between public entities.

The Central Bank of Brazil is also in the process of implementing another system based on block chain technology, known as SALT (Alternative Transfer Settlement System), that will process all transfers between financial institutions. Participating entities are still experiencing some difficulties with the system and are in the process of seeking solutions for these (Moura and Oliveira, 2019).

13.3.5 Applicability to FMIS

In LAC countries, national FMIS do much more than merely share information. Built around treasury single accounts and automated accounting, they are centralized systems accessible to participating entities through communication networks. In recent years, technological progress in server equipment, communications networks, and data center physical infrastructure has led to a significant improvement in the security, availability, reliability, and effectiveness of these systems, which are sometimes classified using the TIER standard.¹⁹ Given the centralized architecture of FMIS and treasury single accounts, and the quality of the infrastructure of data centers and supporting networks, investments in radical transformations such as blockchain are less attractive in the short and medium term.

There are still no identified cases of FMIS that use blockchain-type platforms. Nevertheless, the advantages of cloud computing could provide interim distribution opportunities at the subsystem level with respect to ancillary administrative systems (e.g., human resources, payroll, or public procurement), mainly operated through the cloud but integrated into the core of the FMIS.

The use of consensus mechanisms and smart contracts in budget execution and accounting could make established rules more reliable and powerful. Consensus rules and smart contracts are also stored in blockchain; both have technologies that guard against inadvertent or fraudulent tampering and backdoors. In this context, the operational and economic feasibility of a new generation of FMIS with distributed ledgers based on blockchain-type technology is an open-ended issue, which still lacks theoretical assessments and verification through proofs of concept and pilots.

¹⁹ Data center tiers are classification levels used to quickly identify the complexity and redundancy of the data center infrastructure being utilized. They range from TIER 1 (least resilient) to TIER 4 (most robust).

13.3.6 Subnational FMIS

In the medium term, there will be more opportunities to use blockchain-type technologies at the subnational level of government. Cloud-based solutions cannot solve all problems, such as the timely consolidation of provincial and municipal budget execution data for the entire public sector. A blockchain-based subnational FMIS could lead to progress on this issue, as control bodies and other stakeholder institutions would have real-time access to data and could even interact with each other on budget execution based on appropriate consensus mechanisms. Again, there are no theoretical assessments of feasibility or verification through proof of concept; however, achieving feasibility at the subnational level appears more likely in the medium term.

13.3.7 Blockchain and Public Financial Management: Key Points

Replacing existing FMIS with blockchain will only occur when its added value vis-à-vis the current technology can be proven. Theoretically, there are good opportunities for using blockchain in public financial management (PFM) to share data among public entities, as well as for some ancillary administrative systems such as public procurement, bond issuance, human resource management, and administrative processes, and for FMIS at the subnational level—subject to verification. This does not mean that in the future there will be no blockchain-based national FMIS; rather, there seems to be no such trend in the medium term.

13.4 Artificial Intelligence, Machine Learning, Data Analytics, and Robotic Process Automation

13.4.1 Virtual Assistants and Chatbots^{20,21}

Virtual assistants (VAs) help users or enterprises with a set of tasks previously only performed by humans. VAs use semantic and deep learning, such as deep neural networks, natural language processing, prediction models, recommendations and personalization, to assist people or automate tasks. They listen to and observe behaviors, build and maintain data models, and predict and recommend actions. VAs can be deployed in several use cases, including virtual personal assistants, virtual customer assistants and virtual employee assistants.²²

In the case of FMIS, the preferred use case would be a VA that assists system users as the core component of a user help desk. A modern help desk provides support through multiple channels, as selected by the user.

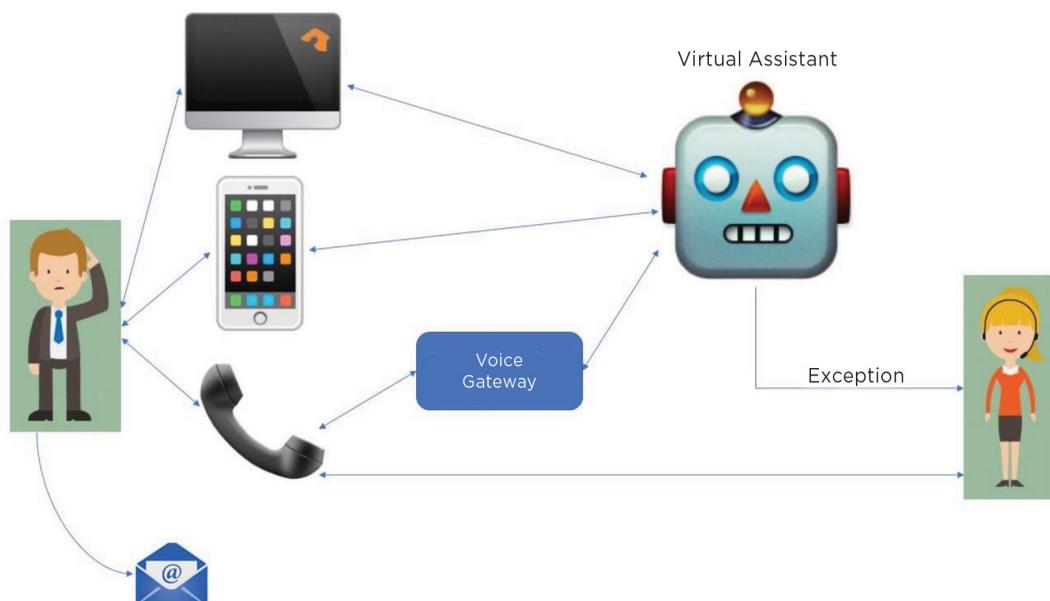
²⁰ This chapter uses the terms virtual assistants and chatbots interchangeably, although chatbots are technologically less advanced.

²¹ For more details of the functions, opportunities, and challenges associated with building and operating a virtual assistant, see Seco and Muñoz (2019).

²² <https://www.gartner.com/en/information-technology/glossary/virtual-assistant-va>.

FIGURE 13.2

Representation of a Modern Help Desk for an FMIS, with a Virtual Assistant and Multichannel Access



Source: Authors' elaboration based on Seco and Muñoz (2019).

VAs represent the use of artificial intelligence technologies, such as machine learning, to strengthen one of the features that is most lacking in FMIS: help desks.

There are several VA initiatives in government institutions.

- In 2016, the Australian Tax Office developed a virtual assistant, Alex, to support its taxpayer help desk. The assistant handled almost 1 million queries in its first year. Alex operates as a front end to the help desk—that is, questions that the VA is unable to answer are transferred to human help desk representatives for handling. They are also stored in a database for subsequent use in teaching the system new skills. The success of Alex led the Australian Digital Transformation Agency to recognize it as the “government helper” in terms of providing user support, with other government agencies also adopting the VA. The patent office was the first to use it.²³
- With the support of the IDB's Program for the Modernization of Fiscal Management in Brazil (PROFISCO), the Department of Finance of the Brazilian State of Piauí implemented a VA to assist taxpayers with issues relating to taxes managed by the state. The assistant, known as “Teresa,”²⁴ was initially developed as a proof of concept to

²³ <https://www.zdnet.com/article/ip-australias-alex-is-more-than-just-a-chatbot/>.

²⁴ In tribute to Teresina, the State capital, which was founded in 1852 and takes its name from



Source: Department of Finance website, State of Piauí (Sefaz-PI).

support the motor vehicle tax area, before being rolled out to other tax areas. The service has become even more important for the population since the emergence of the COVID-19 pandemic and social distancing rules (Figure 13.1).²⁵

This project uses IBM’s cloud-based Watson platform and is supported by a specialized private company.

- In 2017, the Spanish State Tax Agency (AEAT) decided that certain taxpayers would be required to submit invoices within four days of their issuance. To that end, it created the Immediate Supply of Information (SII) system, which is used by more than 54,000 taxpayers (i.e., large companies participating in this monthly value-added tax (VAT) reimbursement scheme). Complying with fiscal obligations—particularly where the rules issued by tax administrations are frequently rectified—can be complex for many professionals in the accounting and financial sectors. Accordingly, the AEAT created its first virtual assistant to support implementation of the SII. This technology project, based on IBM artificial intelligence, has been groundbreaking in Spain’s public administration, and aims to support taxpayers in meeting requirements for the immediate provision of VAT information. Supervised by IBM and experts in the tax agency, the assistant was configured as a chatbot and achieved an 85 percent reduction in the number of transactions handled by agency staff. Users benefited from swifter and more effective assistance, improving compliance with tax obligations. Following implementation and consolidation of the SII, and consistent with a strategy focusing on voluntary taxpayer compliance, the AEAT introduced a second virtual assistant, this time for the VAT in general rather than just issues relating to the SII.²⁶

²⁵ Teresa Cristina, the wife of Pedro II, the Emperor of Brazil from 1831 to 1889.

²⁶ See <https://portal.sefaz.pi.gov.br/atendente-virtual-da-sefaz-e-destaque-na-pagina-do-bid/>

- In the State of São Paulo (Brazil) a chatbot-based virtual assistant supports citizens interested in the public services provided by “Poupatempo (Save Time)” agencies. When communicating with citizens, the system identifies the service or information requested and, in the event that in-person assistance is required, schedules a visit to the relevant service unit. Where the system is unable to identify the appropriate response, a staff member joins the conversation and assists the user.²⁷ This helps the system to learn, and Poupatempo will soon be able to provide responses without external support (machine learning). The virtual assistant supported an average of 5,300 users per day during the first 33 days of project start-up, exchanging more than 2.4 million messages. In 2018, the original proprietary technology was replaced by a cloud solution based on IBM’s Watson. The COVID-19 pandemic and social distancing rules also amplified the importance of this service.

13.4.2 Predictive Analytics

Predictive analytics is a form of advanced analytics that examines data or content to answer the question “What is going to happen?” or more precisely, “What is likely to happen?” It is characterized by techniques such as regression analysis, forecasting, multivariate statistics, pattern matching, predictive modeling, and forecasting.²⁸ A number of applications already exist or are planned to improve macroeconomic policies and other areas of fiscal management, some of which are presented below.

13.4.3 Improvement of the Macroeconomic Supervision System

The analysis of macroeconomic policies is based on information contained in official reports, the publication of which is generally subject to delay. Combined with the swift exchange of information with the banking sector, progress in terms of channeling payments through the banking system—both tax payments to governments and payments in general—has meant that the essential fiscal information needed for macroeconomic supervision systems is available almost in real time.

With the emergence of Big Data and data analytics technologies, information is more rapidly available for use in statistical models. The IMF identifies two main uses for this information (IMF, 2018, pg. 72):

1. improving the quality, precision, and timeliness of revenue trend analyses and end-of-year forecasts; and
2. predicting economic activity in the short term (“nowcasting”).

The same IMF publication warns of the downsides that must be taken into account when using real-time data: they are unaudited and subject to noise and seasonality.

²⁷ <https://a3.wolterskluwer.es/blog/como-utiliza-la-aeat-la-inteligencia-artificial#nuevosistente>.

²⁸ <https://www.facebook.com/poupatemposp/posts/2275668215849969>.

Despite this, they offer important use cases for governments and multilateral institutions. Principles for macroeconomic forecasting using Big Data and data analytics techniques are contained in an article published by Bok, Caratelli, et al. (2018), based on work carried out by the New York Federal Reserve.

13.4.4 Budget Formulation and Financial Analysis

Preparing a national budget is a political act based on the selection of projects and activities that address stipulated national goals. A large amount of work is required to organize information, and this is often hindered by outdated staffing levels, inflexible decision-making processes, antiquated data systems, and modernized systems that magnify data quality problems. Data analytics can expedite the budget formulation process through the automated consolidation, integration, and restructuring of data from different sources, providing those responsible with the knowledge needed to influence the operational planning decisions that determine budget allocations. In addition, the officials responsible can access data-based solutions (with reports and dashboards for project costs), analyze budget performance, and prioritize funding allocations to maximize the operational impact of the budget.

Financial programming is another field in which artificial intelligence and data analytics can be applied. It is currently performed using disconnected tables and graphs, data in Excel spreadsheets, and personal experiences.

Providers of enterprise or government resource planning (ERP and GRP) software—such as Oracle, SAP, or Free Balance—offer modules to support budget preparation and different types of financial analysis based on data analytics. These modules may be part of a complete product or may be purchased separately (e.g., for integration into a custom-made FMIS). The financial management authorities can custom develop these modules themselves but will need to marshal both fiscal and technological expertise for this purpose.

13.4.5 Combating Fraud and Corruption

FMIS should be configured to support segregation of duties and mark changes in the master data. These areas are among the most critical for preventing and detecting fraud and corruption. To help detect specific scenarios, FMIS could send alerts or produce reports on spurious activities to the relevant authorities, as described by Hashim, Farook, and Piatti-Fünfkirchen (2020):

- Vendor: New vendor or dormant vendor with a sudden spike in large payment activity associated with approval by one or very few employees; vendors whose bank accounts or alternate payee field information changed and reverted to the original within a short period; manual payments to vendors outside the FMIS leading to unreconciled payments; direct payment method to pay large amounts to vendors without a purchase order, goods receipts, or invoice.
- Invoice: Duplicate invoice numbers with the same vendor ID, tax ID, or VAT number; invoices from the same vendor having large payments with rounded amounts or

with sequential invoice numbers; invoices without a corresponding purchase order number; split payment of invoices.

Other alerts could include multiple approval steps by the same employee or by different user IDs using the same IP address, unusual quicker payments, and mismatches of invoices, goods receipts, and purchase orders.

13.4.6 Robotic Process Automation

Robotic Process Automation (RPA) is the use of software robots to automate highly repetitive routine tasks normally performed by the staff of an organization.²⁹ These tools act like humans. That is, they log into the FMIS and follow the transaction steps for which they were programmed. For example, RPA can extract information from multiple data sources, such as the financial systems and FMIS of state-owned enterprises, to post it on the government website in a user-friendly format to promote transparency and citizen engagement (Hashim, Farook, and Piatti-Fünfkirchen, 2020). Similarly, RPA tools may be programmed to search electronic invoice databases for invoices relating to specific products, with the aim of creating a price list (application in government procurement).

13.5 Data Visualization

13.5.1 For Citizens (Fiscal Transparency)

The main challenges in providing financial data to citizens relate to the ease of searching for data and the comprehensiveness of available data.

- United States Department of the Treasury
A number of countries already offer this type of information, but one of the most simple and powerful systems for citizens is the one developed by the United States Department of the Treasury to comply with the Digital Accountability and Transparency Act (known as the DATA Act). Its objective was to monitor around US\$4 trillion in annual expenditure on a quarterly basis and to connect data from the budget, accounting, procurement, and financial assistance systems using a common format. This involves gathering, storing, and displaying more than 400 data points provided by more than 100 federal agencies. A DATA Act Information Model Schema was also created for use by agencies providing the data, which are validated by a software broker (the DATA Act Broker) and then certified by senior officials before being transmitted to the Department of the Treasury database. It is worth exploring the USAspending.gov website to assess the product's potential (Figure 13.2).

²⁹ <https://www.gartner.com/en/information-technology/glossary/predictive-analytics-2>.

IMAGE 13.2

Images from the Usaspending.Gov Website

USASPENDING.gov Spending Explorer Award Search Profiles Download Center Glossary

Spending Explorer Share

Explore the spending landscape.

The Spending Explorer makes it easy to understand the big picture of federal spending.

[Learn More](#)

Budget Function

See spending divided by a high level categorization based on purpose.

[Start](#)

Agency

See spending divided by all U.S. government agencies.

[Start](#)

Object Class

See spending grouped by the types of items and services purchased by the federal government.

[Start](#)

Start Over

FY 2020 Q1 Q2 Q3 Q4
1-3 4-6 7 8 9 10 11 12

ALL BUDGET FUNCTIONS
\$8.4 Trillion

You are viewing **FY 2020 spending by Budget Function**.
Choose a budget function below to start your exploration.

FY 2020 OBLIGATED AMOUNT
\$8.4 Trillion
Data as of July 31, 2020

See the breakdown by: **Budget Function**

Budget Function	Percentage
Income Security	15.3%
Social Security	11.6%
Health	10.3%
General Go...	6.3%
Net Interest	5.4%
Medicare	13.8%
National Defense	11.1%
Unreported Data*	7.9%
Commerce an...	7.5%
Educatio...	2.4%
Trans...	1.9%
Veterans...	2.3%
A...	0.8%
N...	0...

FY 2020 Q1 Q2 Q3 Q4
1-3 4-6 7 8 9 10 11 12

ALL AGENCIES
\$8.4 Trillion

AGENCY
Department of Health and Human Services
\$2.0 Trillion

FEDERAL ACCOUNT
Grants to States for Medicaid, Centers for Medicare and Medicaid Services, Health and Human Services
\$502.9 Billion

Grants to States for Medicaid, Centers for Medicare and Medicaid Services, Health and Human Services
A Federal Account of Department of Health and Human Services

\$502.9 Billion
Data as of July 31, 2020

See the breakdown by: **Program Activity**

Program Activity	Total Amount	Percent
MEDICAID VENDOR PAYMENTS	\$475.5 billion	94.5%

Source: USAspending.gov.

- Visualization of fiscal data
Government and third-sector institutions in several countries have invested in consolidating and disseminating fiscal data via the internet using a variety of methods. The specialist Jonathan Gray is compiling these experiences and has published a table with preliminary data from the various portals identified; these can be reviewed for evaluation purposes. See Annex 13.1 for more information.

13.5.2 For Public Expenditure Managers

The Singapore Experience

Singapore's Accountant-General's Department (AGD) developed a data analytics platform called Fi@Gov to support decision making in all areas of public finance. Results are presented primarily in the form of dashboards, as can be seen in Figure 13.3.

The AGD also develops dashboards to support payment audits, as can be seen in Figure 13.4.

The AGD follows the principle that users are the ones that know their business best: they can achieve better results if they are empowered to achieve them.

13.6 Open Fiscal Data

Fiscal reports and data generated by an FMIS should be open, downloadable, and machine readable, and should be published as part of an open government approach. Civil society, the media, the academic world, citizens, and nonprofit organizations can use these data to track expenditure, results, and possible illicit transactions.

The Open Fiscal Data Package (OFDP)³⁰ is a tool built to reduce the friction using public fiscal information, making it easier for citizens to access and analyze the information quickly and reliably. In other words, it is a simple, open specification for publishing data on government spending and budgets. It aims to be easy to use both for those publishing data (governments) and for those using the data (researchers, journalists, and the general public).

The OFDP serves two main purposes:

1. Standardizing the structure and the content of fiscal data so that tools and services can be built over it for visualization, analysis or comparison.

³⁰ <https://bit.ly/2Q1PSul>. The following videos provide general information on these specifications: <https://youtu.be/T0465hShvbK> and <https://youtu.be/9Bf2KGSDKJY>. These links provide technical information on adopting the OFDP: i) "Towards a schema for spending Open Data, Helpdesk included" (http://www.fiscaltransparency.net/blog_open_public.php?IdToOpen=6666); ii) "Publishing Budget and Spending Open Data": (http://www.fiscaltransparency.net/blog_open_public.php?IdToOpen=6681).

FIGURE 13.3

Example of an AGD Dashboard

Historical expenditure trends

What are we spending on?

Who spends and how much?



Source: Authors' elaboration based on Singapore's AGD.

FIGURE 13.4

Support for Payment Audits

Detection of payment anomalies

Automated, in real time, workflow based on risk analysis



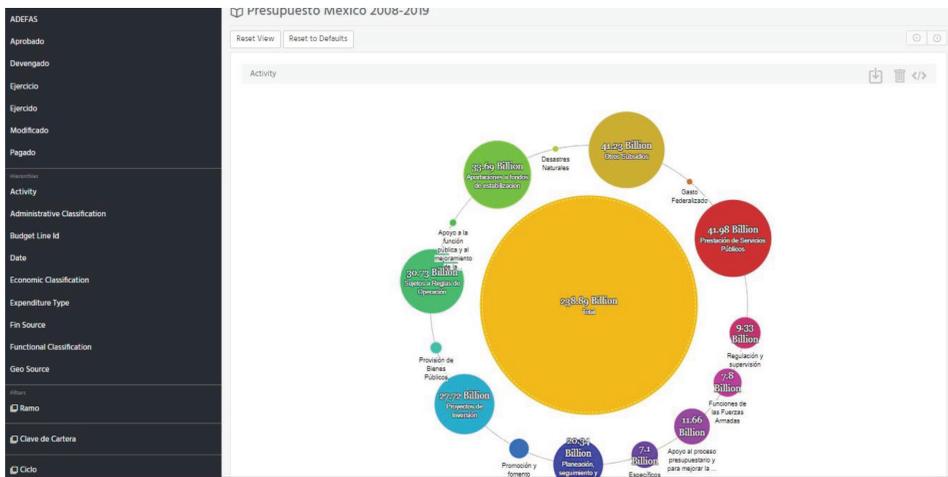
Source: Authors' elaboration based on Singapore's AGD.

2. Driving data quality by providing a solid framework of publication. Accordingly, the OFDP specifies the form for fiscal data and offers a standardized framework for the content.

This initiative is sponsored mainly by the World Bank, Open Knowledge International, and the Global Initiative for Fiscal Transparency.

As of July 2020, seven national governments were using the OFDP to publish their budget and spending data for current and historic expenditures: Costa Rica, Croatia, Mexico, Paraguay, the Dominican Republic, South Africa, and Uruguay (Figure 13.3). The packager

Sample of Mexican Budget Data Published Using the Open Fiscal Data Package



Source: Government of Mexico (<https://tinyurl.com/MexicoOFDP-1>).

is used in different ways to publish the open data, provide standard visualizations or power their own visualization and enable reuse through the Application Programming Interface.³¹

13.7 Mobile Money and the Targeting of Social Subsidies

The COVID-19 pandemic has created enormous challenges for the financial management authorities in LAC, including the need to make social subsidy payments to disadvantaged population groups. A substantial proportion of those receiving assistance had not previously been identified, and many do not have formal records with government assistance programs or bank accounts. Rules aimed at avoiding public gatherings meant that bank branches were closed and campaigns to promote the mass opening of accounts were not feasible. Moreover, most of those interested would probably have experienced difficulties with the minimum required documentation.

At the same time, direct cash payments are associated with higher administrative costs, corruption, and fraud: processing, transportation, and distribution can cost as much as US\$75 and US\$130 annually for each beneficiary. Likewise, a lack of transparency and multiple handling points create opportunities for corruption and fraud. It is estimated that of the US\$21 billion that India spent on food subsidies in 2016, beneficiaries never

³¹ Application Programming Interface (API) is an interface that provides programmatic access to service functionality and data within an application or a database. It can be used as a building block for the development of new interactions with humans, other applications or smart devices (Gartner Glossary).

received 54 percent of wheat subsidies, 48 percent of sugar subsidies, and 15 percent of rice subsidies. (Alpha & Beta, 2018).

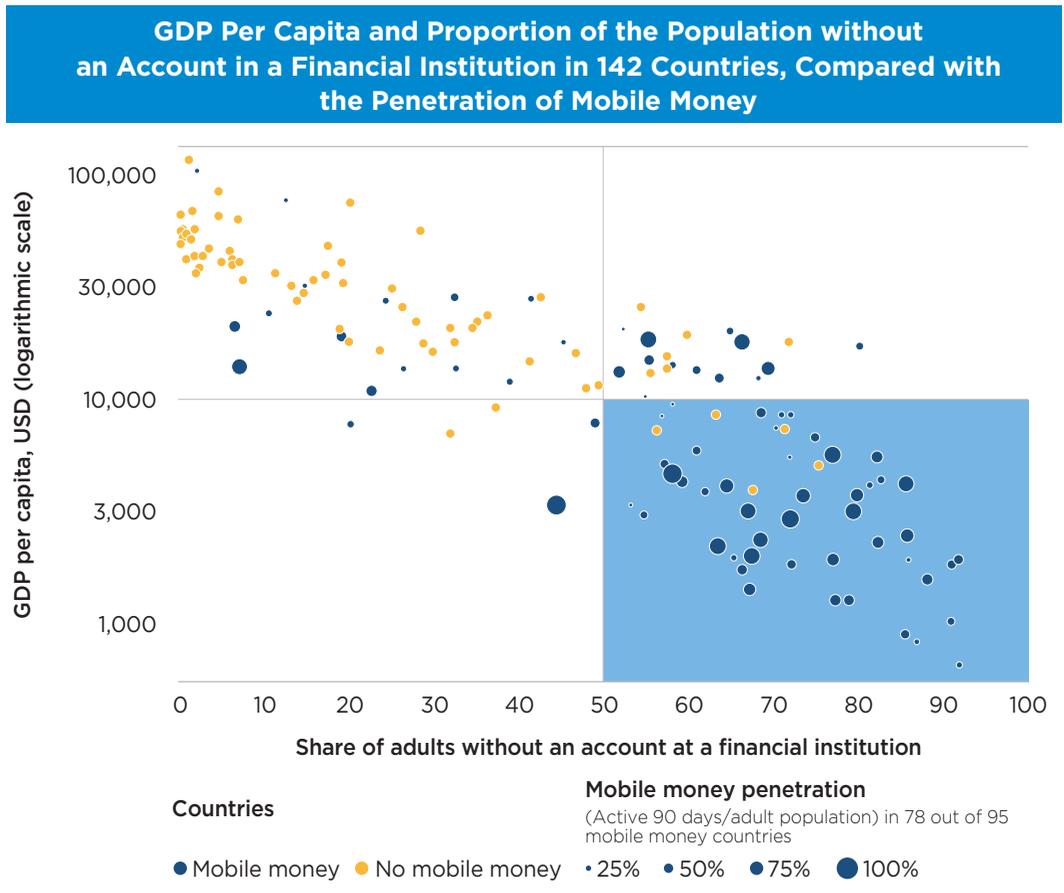
In this context, and due to its coverage of disadvantaged social groups, the “mobile money” network has emerged as an effective, rapid, and secure alternative for direct transfer and subsidies to these population groups. Although this is not a new technology, its potential is considerable in these times of crisis, and it should be reevaluated given the current and future needs of developing countries.

Figure 13.5 shows the penetration of mobile money among low-income adults without accounts in financial institutions.

13.7.1 Banking Access and Mobile Money in Latin America and the Caribbean

Access to bank services has increased among LAC citizens but remains low. Countries such as Brazil, Chile, and Panama have a banking penetration rate of between 71 percent and 78

FIGURE 13.5



Source: GSM Association (2020).

percent, while in Argentina, Colombia, Ecuador, Mexico, the Dominican Republic, Uruguay, and Venezuela, rates range from 64 percent to 71 percent. The lowest rates of banking penetration are in Haiti, Honduras, Nicaragua, and Peru (Zaballos and Rodríguez, 2017).

According to the GSM Association (2020), LAC has 27 mobile money services, with 26 million registered individual accounts (13 million of which are active). In Sub-Saharan Africa, for example—one of the most successful regions in the use of mobile money—there are 144 services with 460 million individual accounts (181 million active) (Figure 13.6).

FIGURE 13.6



Source: Roa, García et al. (2017).

Accordingly, mobile money has arisen as a possible alternative, particularly for targeting payments of social subsidies.³²

13.7.2 Concepts

Mobile money is a service that stores funds in a secure electronic account linked to a mobile phone number. In some cases, the mobile money number will be the same as the phone number, but not always. Mobile money is often provided by the same companies that run the country's mobile phone services and is available to both pre-pay and contract customers.

The service allows users to store, send, and receive money using their mobile phone. They can buy items in stores or online, pay bills, school fees, and top up mobile airtime. They can also withdraw cash at authorized agents. Tax administrations also receive tax payments from small taxpayers (in the informal sector, for example) using mobile money.³³

If the user wants to pay a bill or send money to another person, they simply select the relevant service from their phone's mobile money menu. It is really as simple as sending a text message.

13.7.3 What are the benefits of mobile money?

Almost anyone who has a mobile phone can have a mobile money account. No smart phone is required: simple telephones and 2G networks are generally sufficient. Mobile money is highly accessible, which makes it extremely useful in more remote parts of the world where there are no banks. Other benefits are as follows:

- Multi-faceted: Users can do a wide range of things with a mobile money account, such as receiving, storing, spending, and sending money from the account on their mobile phone.
- Direct: Users can receive money directly to their mobile phones without going through any middlemen.
- Fast: Users can receive, send, and spend money instantly.
- Convenient: Mobile money accounts are always to hand as they sit on users' mobile phones. Mobile money can be used anywhere there is a mobile phone signal.
- Secure: Local financial regulations protect funds held in a mobile money account. Users must verify their identity, making it hard for fraudsters and criminals to use these services illegally.
- Low cost: Fees are low.

13.7.4 Technical Characteristics

Mobile money generally uses the Unstructured Supplementary Service Data (USSD) protocol, also known as "quick codes" or "feature codes." USSD messages are up to 182

³² For an overview of mobile money in LAC, see Roa, García et al. (2017).

³³ Kenya, Mauritius, Rwanda, Tanzania, Uganda (GSM Association).

alphanumeric characters long. Unlike Short Message Service (SMS) messages, they create a real-time connection during a USSD session. The connection remains open, allowing a two-way exchange of a sequence of data.

For example, to send money using the M-Pesa mobile money service provided by Safaricom:³⁴

Select “M-PESA.”
Select “Send Money.”
Enter your recipient’s phone number, the amount you wish to send, and your PIN.
You and the recipient will receive an SMS confirming the transaction.
You will receive a screen with the information you have entered above, (e.g., Send money to 07xx xxxxxx, KSh 2000). Confirm that it is correct then press OK. A pop-up with the name of the recipient will appear on the screen.
Remember to confirm the name of the recipient.
To stop a wrong transaction, press any number or letter and press send within 25 seconds.

13.8 Open Source and Free Software and Means of Sharing Code³⁵

While open-source and free software are based on different concepts, they both refer to computing programs developed individually or by communities that then share their projects, structures, source codes, and documentation with the public, free of charge. These systems are released under proprietary licenses, which define rules that users must follow. These types of licenses underline the fact that while use of the software is free, the author cannot be held responsible for errors or guarantee their absence, and the products resulting from the use of the original software must also be released under the same type of licensing. Accordingly, the use of free/open-source software presupposes evaluating its use in other institutions, as well as a thorough review of published codes and documentation.

The environment for free software in data analytics called R (R Studio)³⁶ may have potential applications in fiscal management. The environment provides an extensive set of statistical techniques (e.g., linear and non-linear modeling, classical statistical testing, time series analysis, classification, grouping, etc.) and graphs. Several OECD countries use R in fiscal management. A survey of these countries revealed that the main reasons for its use, in addition to cost reduction, are flexibility, incorporation of new algorithms, and higher speed compared to commercial packages.

³⁴ A mobile telephone service in Kenya.

³⁵ This subsection is based on section 3.2.2 of Pimenta and Seco (2019).

³⁶ <https://www.rstudio.com/>.

There is great potential to use these types of software solutions in subnational fiscal information systems—including FMIS—mainly within the same country. The central government defines the legal and regulatory framework for the fiscal environment, and municipalities build their information systems around the framework, with few individual differences. A fiscal management system developed on the premises of free/open-source software can be shared among municipalities and can be adapted to the specific conditions of other municipalities, reusing common database structures, concepts, and processes with just a few changes. This strategy does not require the use of an entire system: modules, routines, algorithms, or processes can be shared based on local needs. The cost of adaptation is marginal, which makes it especially easy for small municipalities to use appropriate fiscal information systems at affordable prices.

In addition to the available cloud-based open-source codes, there are other cases in which the codes and systems originally developed for a specific government have been shared. For example, Brazil's 26 states and the Federal District have shared full FMIS under licenses arranged with each other. The State of Alagoas implemented a new FMIS in 2017 based on a system donated by the State of Rio de Janeiro (financed by the IDB). The latter had been developed and implemented by a company based on another system it had in operation in the State of Espírito Santo, the source codes for which were provided to Rio de Janeiro (a legal obligation in that state). In Alagoas, the same company subsequently agreed to implement the FMIS donated by Rio de Janeiro.

Likewise, the State of Mato Grosso donated its FMIS (developed in-house) to the State of Bahia, which adapted and implemented it. There are other, similar cases in Brazil, and all these systems are in operation and have a track record of success. One impact of these practices has been a significant reduction in the costs of new FMIS for the 26 states and the Federal District. Currently, the cost of a new FMIS in Brazil is much lower than in other countries in the region, thanks to these code donation practices and a large market of providers of these types of systems.³⁷

The practice is less frequent in other LAC countries, due mainly to the unique circumstances in each country in terms of both the legal framework and PFM processes. Nevertheless, in 2008, Guatemala donated FMIS codes to Ecuador that the latter successfully adapted and used for many years. Ecuador is now in the process of migrating to a new system procured in the market through a license purchase.

A specialized open access repository needs to be created to facilitate the sharing of information on the availability of open-source or free software resources appropriate for certain areas. The IDB has created an initiative called Code for Development, which allows for exploring and reutilizing open-source digital tools that can be used in the implementation of programs and projects for economic and social development in LAC countries. The website for the initiative (<http://code.iadb.org/es/comparte-tu-codigo>) provides the

³⁷ Since Rio de Janeiro procured, customized, and deployed its new FMIS the first half of the 2010s at a cost of US\$10 million, prices have continued to fall significantly. Alagoas implemented a version of Rio de Janeiro's FMIS at a cost of only US\$1 million. In 2018, the State of São Paulo launched a project to replace its FMIS, with a budget of US\$5 million. New FMIS in other states have cost even less.

available open-source codes, spreadsheets, and algorithms. In addition, the site establishes rules and terms for those who wish to share their digital tools through the platform.

Using open-source or free software is a feasible alternative for public institutions. It is also important to have resources to validate, adapt, and implement systems or routines, or to license a packaged version from a company.

Exchanging open-source or free software solutions between a country's subnational institutions is a highly attractive option in this regard. This exchange can take place formally through agreements or by other means. The probability of success is high, given the similarity of legal and regulatory systems within a country. Once the software and documentation has been delivered, the recipient institution becomes solely responsible for any adaptations and for the system's subsequent maintenance and development. It is important to determine how to carry out these activities: either using the institution's own human resources or by hiring a company.

13.9 Final Considerations

Emerging technologies can play an important role in modernizing FMIS and related systems, and some of the most promising ones have been discussed in this chapter. There is concrete evidence of the effectiveness of some of them, while others are still at the stage of proof of concept. The use by senior financial management officials of artificial intelligence and machine learning technologies has particularly high disruptive potential for improving public financial management. Financial management authorities and international organizations should monitor their development.

ANNEX 13.1

EXAMPLES OF FISCAL DATA VISUALIZATION

Project Name	URL	Geographic		Year	Type
		Scope	Sector	Created	
Africa Spending	http://africanspending.org/	Africa	civil society	2014	
China's African spending spree	http://www.aljazeera.com/indepth/interactive/2014/03/interactive-china-african-spending-spre-2014320121349799136.html	Africa	media	2014	
Subsidies for the Bus Transportation System in Argentina	http://blogs.lanacion.com.ar/projects/data/subsidies-for-the-bus-transportation-system-datajournalism-project-in-argentina-la-nacion/	Argentina	media	2011	
Budget Observatory	http://asap.org.ar/observatorio/#/	Argentina	government	2015	
The Australian Financial Review's Budget Explorer	http://small.mu/work/budget-explorer-australian-financial-review/	Australia	media	2013	
Offener Haushalt Stadt Bern	https://www.offenerhaushalt.at/	Austria	research	2013	Treemap
Nettoausgaben Budget 2012	http://t.preus.se/bernbudget2012/	Austria	civil society	2012	Bubbles
Budzeti.ba	http://budzeti.ba/	Bosnia and Herzegovina	civil society	2013	
Cuidando do Meu Bairro [Caring for my Neighborhood]	https://cuidando.vc/2020/1	Brazil	civil society	2012	Map
Meu Município [My Municipality]	http://www.meumunicipio.org.br/meumunicipio/home	Brazil	company		
Mapa Social [Social Map]	http://appmapasocial.mprs.mp.br/	Brazil	government		
Orçamento ao Seu Alcance [Budget at your Reach]	http://orcamento.inesc.org.br/	Brazil	civil society		Treemap
Programa de Metas [Program of Targets]	http://planejasampa.prefeitura.sp.gov.br/metas/	Brazil	government		

Source: Jonathan Gray (@jwyg). Complete version available at: https://docs.google.com/spreadsheets/d/1xZraa0vR_90DXZlj7lUVK_x19BH0adewZ3xLgb3ygpK/edit#gid=0.

Note: Other links are available in the source document.



Conclusions and Recommendations

The importance of public financial management (PFM) has increased in the context of actions to combat the COVID-19 pandemic. It is estimated that US\$9 trillion of fiscal support has been deployed globally during the COVID-19 crisis. Direct budget support is estimated at US\$4.4 trillion, while public sector loans and equity injections, guarantees, and other quasi-fiscal operations amount to another US\$4.6 trillion.¹ Of the total, US\$1 trillion has been directed toward developing economies. According to Sirois (2020), the most significant problems relate to monitoring and reporting on the use of these funds, which may reveal the weakness of PFM in several countries. She states that the following measures are needed to solve this problem:

- Use of an accrual-based accounting system
- An accounting system based on IPSAS standards²
- Alignment between budget classifications and the accounting classifications in the Chart of Accounts
- The seamless preparation of government estimates, budget execution reports, and financial statements
- Use of a single data source

These proposals are included as part of the requirements for a conceptual model to be implemented in an existing financial management information system (FMIS), with the aim of effectively modernizing PFM.

A number of other key features are needed to ensure that FMIS projects achieve desired improvements in PFM outcomes while also contributing to good governance.

¹IMF blog, May 2020, “Tracking the 9 trillion global fiscal support to fight COVID-19.”

²IPSAS: International Public Sector Accounting Standards.

These issues require a comprehensive diagnostic assessment of the PFM problems that will need to be addressed when implementing an FMIS project. In addition to the issues mentioned above—as well as proper coverage and use of the system and strong adherence to PFM standards—other critical modernizing measures should be considered, evaluated, and adapted to the context of each country, such as:

- Ensuring that timely and reliable accounting and budget records are maintained for financial transactions.
- Maintaining a data warehouse with the capacity to provide detailed accounting and budget information.
- Ensuring that reports are produced that meet the specific needs of users, with appropriate tools.
- Promoting the use of electronic payments that avoid manual payments (particularly with a view to targeting social subsidies), thus ensuring the integrity and consistency of payment and revenue data between the FMIS and the government’s bank accounts.
- Supporting efficient operation of the Treasury Single Account (TSA), using a single bank account or unified structure of bank accounts.
- Recording cash flows on the same day that payment and revenue transactions take place.
- Providing timely information on the stock of arrears and the creation of new arrears.
- Developing a data structure that circumvents the limitations of relational databases and provides rapid, aggregate analyses of data cubes for use in treasury functions and financial programming.

Another important PFM issue is the management and analysis of public debt, which can be adapted using commercial systems such as the Debt Management and Financial Analysis System (DMFAS) developed by the United Nations Conference on Trade and Development (UNCTAD). Connectivity architecture should also be planned to serve as a guide for future, related systems³ that are generally not part of the initial versions of an FMIS.

These critical functional requirements for an FMIS can only be achieved where the project and its managers take into account certain **strategic, organizational, and political economy factors** that have a major impact on the success of an FMIS project. These include:

- Securing institutional and political support from the public finance authorities, taking care to ensure that the main project sponsor or other relevant senior finance official oversees the FMIS project unit.
- Institutionalizing the new system through specific laws or regulations.
- Creating institutional coordination mechanisms to facilitate consensus building.
- Supporting genuine change initiatives encompassing not only the Ministry of Finance or equivalent, but also other participating ministries (e.g., creating user committees is a good practice in this respect).

³These include public procurement, human resource management, and public investment systems.

- Strengthening the role of FMIS users, providing ways for them to participate in online training and refresher courses on public finances and FMIS operations, as well as formalizing and enforcing the minimum requirements for a user to obtain a system access password.

Institutional arrangements for creating a comprehensive TSA are another important issue, particularly agreements with the banking/financial system. These are generally secured as part of a joint initiative with the tax administration, which also uses the services of the banking sector.

New institutional solutions are proposed to ensure adequate maintenance and functional and technological development of the system, such as creating PFM agencies with the financial autonomy needed to provide a sufficient flow of resources to maintain sustainability over the long term. There are examples of this approach in the financial sphere in Brazil, France, Italy, and South Korea, in addition to a number of others in the tax and procurement areas.

FMIS require a sound legal foundation to operate effectively. A system can be launched without a complete financial administration law, as practice in different countries shows, but this is not the best approach. It is preferable to have laws or regulations in place that establish a common classification system, the alignment of budget classifications and accounting classifications in the chart of accounts, and the types of entities covered by the law.

At the same time, the review, improvement, optimization, and integration of PFM processes provide the foundations for modernization of the FMIS. It is not worth implementing a new system unless the processes on which it is based are updated to incorporate recommendations for modernizing PFM (TSA, accrual-based accounting based on IPSAS standards, a single chart of accounts, etc.). Technical staff from the PFM functional areas involved in each process should participate in the identification, description, and modernization of those processes, preferably with the support of external advisors, who can also contribute a fresh, unbiased perspective. These processes should be documented and kept up to date, using standard notation (e.g., Business Process Model Notation). It is important that a unit responsible for constantly modernizing and documenting PFM business processes be created under the FMIS project, most likely in the central agency.

This handbook emphasizes the role of the system conceptual model in helping to understand, agree upon, and even simulate the new system. Developing the model is a priority activity for the project team and—to the extent possible—should be undertaken prior to implementation. A good conceptual model is a necessary condition for ensuring the success of an FMIS project, but not a sufficient one. Challenges in building the model stem mainly from pressure to implement the system as soon as possible without a clear vision of the system and the general framework it seeks to support. Weak stakeholder participation and underestimation of the complexities of PFM and the system are additional problems. Underestimating complexities can lead to failures or increased costs and delays in delivering an FMIS.

Implementation of an FMIS represents a framework for modernizing PFM. It is important to develop a modern vision of this type of management, its processes, and its requirements. To that end, it is important to secure the participation of external consultants. The most important areas to be considered when contracting external consultancies are i) project management, ii) change management, iii) IT architecture, iv) procurement processes (specifications and market knowledge), v) treasury, vi) accounting, and vii) budget. Depending on the complexity of the project and the intended degree of innovation, consulting services may be offered by either individual consultants or specialized companies. There are successful and unsuccessful examples of both approaches, and it is important to bear in mind that one of the main requirements is an understanding of public finances (not just technologies or the financial processes of private companies). Consultants who participate from the beginning of the project, including the process of designing the conceptual model, will be able to provide better suggestions and refine them as the project moves forward.

To ensure the success and sustainability of an FMIS, it is essential that outcome and output indicators (including their respective baselines) be developed at the beginning of the project, as well as measuring and monitoring progress towards these indicators over the course of the project and at completion. This facilitates timely, reliable evaluation of the system. The requirements for the FMIS should include the generation of both PFM outcome indicators and operational indicators for the FMIS itself. These indicators range from statistics relating to operation and performance of the IT system to several of the standard PFM indicators proposed under the Public Expenditure and Financial Accountability (PEFA) program.⁴

The IT system warrants special attention in this document. It includes issues ranging from the choice of implementation model (custom made in-house, custom made using external human resources, or customization of a commercial system, including models for evaluating the alternatives) to decisions regarding the IT platform that will be used to operate the system and its maintenance. Some of the critical decisions in this area are the following:

- *Method of deployment of the new system:* While the adoption of commercial off-the-shelf (COTS)⁵ software solutions has grown worldwide, their use in Latin America remains limited. At the same time, countries using COTS systems complain of growing maintenance and support costs. The decision about whether to use a COTS solution should take into account the political will of the public financial administration to observe international standards and best practices. Where significant numbers of individualized PFM business processes and functional requirements need to be implemented in a COTS system through programming, this will lead to additional system adaptation and maintenance costs. A golden rule of 80/20 is proposed to help decide whether a COTS approach is worth adopting, indicating that at least 80

⁴ <https://www.pefa.org/about>.

⁵ This involves systems that can be adapted to local conditions through customization.

percent of functional requirements should be implemented through customization (rather than custom developed).

- *Hiring consultants through consulting firms:* Whether to develop software or provide advisory services, particular care should be taken in the contracting process when consultants are hired through consulting firms. The proposals submitted by companies generally include top-tier resumes, yet the specialists involved when work begins will not always be the same ones. Substitutions are natural, but the contracting party should be cautious in accepting them, conducting a detailed evaluation of the level of training of the proposed candidate as compared to the specifications put forward in the initial resume. An interview should also be conducted to assess effective experience and ability to work as part of a team. Many projects experience serious difficulties when they accept such substitutions without thorough evaluation of the new resume.
- *In-house system development:* Levels of awareness and understanding of state-of-the-art practices within the financial administration should be taken into account, as well as the level of experience required to translate these practices into a comprehensive set of computerized business process models. In such cases, it is strongly recommended that external consultancies be used for all functional segments and for the system development and implementation process.
- *Estimating system development costs:* One of the problems most frequently associated with custom development of an FMIS is estimating development and implementation costs. In the case of in-house development, the proposed timeline for the project can be used to estimate the size of the team. Where an external company develops the system, the estimate becomes more critical as it will determine the parameters for bidding processes, particularly the amount to be paid. Unrealistic estimates (generally underestimates) mean that many contracts have to be adjusted once underway to avoid delays in project completion or reductions in the scope of the contract.

In such cases, one option is to estimate development costs using function point metrics based on simplified methods available in the market, such as NESMA.⁶

- *IT platform:* Financial administrations will need to choose between two main alternatives when selecting the IT platform for the FMIS: (i) IT equipment located in on-premises data centers, or (ii) cloud services, generally using hybrid models. Evaluating the use of cloud services is particularly recommended for backup and disaster recovery solutions, subnational or small-country FMIS, and related systems.⁷

IT platforms in on-premises data centers currently use software-defined data center (SDDC) architecture with hyper-converged infrastructure (HCI), which offers more flexible and scalable arrangements. Given constant innovation in this area, market research should be carried out shortly before publication of the specifications, with a view to capitalizing on the most recent upgrades.

⁶ Netherlands Software Metrics Users Association.

⁷ For example, many commercial systems for human resource management and procurement were originally developed for the cloud.

Alternatively, a reference architecture may be stipulated, giving providers the freedom to offer the most suitable products at the time of bidding. A downside of this is that evaluating these types of bidding processes can be more complex or subject to complaints due to differences in interpreting the reference architecture.

- *FMIS management and maintenance:* It is recommended that a formal structure for managing the system be established under the FMIS project, and that this be transferred to the central agency's IT department at the end of the project. This structure should follow good international practices, such as ITIL or COBIT.⁸

This measure aims to ensure that the system's life cycle is maximized while maintaining quality and efficiency, thus avoiding the need for new versions of the FMIS every 5 or 10 years. With the adoption of good life cycle management practices, the FMIS can be updated and offer constantly improving services without requiring investments in entirely new systems every few years. To implement these good practices, however, it is important to verify the availability of the required budget resources. Another important issue for FMIS management is the operation of a comprehensive information security policy encompassing issues from the encryption of system components and adoption of electronic signatures through to protocols and rules to support the physical integrity of data centers and monitoring and enforcement of security processes, with proper risk management and continuous training for all system users.

- *Deployment of the new system:* Exhaustive system tests should be conducted, based primarily on the use cases that have been determined. System testing specialists are very useful for creating and implementing testing procedures. Automated system testing tools are also essential, particularly in the case of regression testing, which is any kind of system testing aimed at discovering bugs, functional deficiencies, or functional divergence with respect to expected system performance that may have been caused by changes to a program.

A gradual, phased approach to implementation is generally preferred, starting with central agencies before moving on to management entities and then executors. The initial mix of participating entities is determined based on the context in each country. The implementation plan should be widely disseminated and the necessary resources (financial, human, communications, transportation, paperwork, etc.) planned and made available in advance.

FMIS implementation is usually synchronized with the budget cycle (although mid-year implementation is also an option). The new budget is prepared in both the new system and the legacy system, with backup plans and procedures that are activated if the new system fails or performs poorly (Uña, Allen, and Botton, 2019).

- *Subnational FMIS:* There are a number of effective alternatives for the implementation and deployment of subnational FMIS, such as (i) a centralized system with

⁸ ITIL is a good-practice framework that guides organizations in the use of IT as a tool for facilitating growth, change, and transformation in business. COBIT is a good-practice framework for IT governance created by the Information Systems Audit and Control Association (ISACA).

internet-based access for subnational entities (the central government provides and operates a centralized system that subnational governments access using the internet, an alternative that is used in Bolivia and Honduras, for example); (ii) associations for developing or customizing a common system (used by some Brazilian municipalities and a number of island nations in the Caribbean); and (iii) shared information systems (used particularly in the Brazilian states, with a state sharing the source code⁹ for its system that is then adapted by the original provider for use in another state, thus eliminating licensing costs and reducing deployment time frames).

Open-source software is the best alternative for maximizing the opportunities for sharing systems. Hosting the system in the cloud can also be an effective alternative, as it avoids the investment and maintenance costs associated with on-premises data centers, which are often vulnerable and offer low-quality services.

The availability of new digital technologies offers significant opportunities for improving FMIS projects. These new technologies include the following:

- Cloud services (recommended initially for related systems, subnational or small-scale national FMIS, and disaster recovery as a service (DRaaS) solutions)
- Distributed ledger technologies or blockchain (currently used for issuing bonds and improving management processes, with high potential for use in human resources and public procurement systems)
- Virtual assistants (suitable for use in help desks)
- Predictive analytics (supporting improvements in the supervision of macroeconomic analyses, budget formulation, and combating fraud and corruption)
- Data visualization (special facilities for nonspecialized users)
- Open fiscal data (data publication in accordance with international standards)
- Mobile money (particularly for the targeting of subsidies for citizens)

Developing an FMIS represents an important framework for the modernization of PFM and it should have the full support of senior management. The involvement of staff from the management entities and other institutional stakeholders is essential for project success and should be pursued using effective change management measures, in addition to a continuous training plan for all users.

The contracting of external support—whether individual consultants or companies—is recommended at various stages in the project. Accordingly, it is important that the project have the capacity to properly manage consultancies during both the design stage (the terms of reference) and the selection and contracting processes. Monitoring and follow-up capabilities will also be required to ensure good consulting performance and the effective assimilation of outputs by the permanent structure of the ministry or other government units.

⁹Under the terms of the contracts, the source code for the system belongs to the state

General Annexes

GENERAL ANNEX 1

FMIS SURVEY IN LATIN AMERICA AND THE CARIBBEAN 2020: REPORT OF RESULTS (SUMMARY)



Inter-American Development Bank



International Monetary Fund

FMIS SURVEY IN LATIN AMERICA AND THE CARIBBEAN 2020

REPORT OF RESULTS

Carlos Pimenta
Gerardo Uña
Antonio Seco
Rodrigo Suescun
Evelyn Cermeno

October 2020

Authors:

Carlos Pimenta: Principal Specialist in the Fiscal Management Division
(Inter-American Development Bank)

Gerardo Uña: Senior Economist in the Fiscal Affairs Department
(International Monetary Fund)

Antonio Seco: Consultant with the Fiscal Management Division
(Inter-American Development Bank)

Rodrigo Suescun: Principal Specialist in the Fiscal Management Division
(Inter-American Development Bank)

Evelyn Cermeno: Consultant with the Fiscal Management Division
(Inter-American Development Bank)

Support was provided by Eugenio Berehulka and José Miguel Tueni (Department of Public Financial Information Systems in the Ministry of Finance, Dominican Republic).

Executive Summary

During the event “FMIS in Latin American and Caribbean Countries and the Korean Experience” (Washington D.C., 20–22/11/2019), representatives of the 24 countries present proposed that the IDB and IMF conduct a survey of Latin American and Caribbean countries to establish the current status of FMIS in the region in terms of (i) general system data; (ii) the main functional aspects (budget execution and internal controls, accounting and financial reporting, and treasury and cash management); (iii) links with other systems; (iv) the main technological and cybersecurity issues; (v) user support; (vi) the main features of data analysis tools; and (vii) prospects for the development of new FMIS.

The 88-question survey was prepared using the tool Survey Monkey, and responses were received in the March-July period of 2020, from countries accounting for 92 percent of regional GDP. Support for operationalization of the survey was provided by the Department of Public Financial Information Systems in the Ministry of Finance of the Dominican Republic.

The survey revealed that significant progress has been made on functional issues, including the increasingly widespread use of Treasury Single Accounts, an expansion in functional coverage, alignment between the chart of accounts and budget classifications, growing use of IPSAS accounting standards, and consolidation of the synchronized control of expenditure stages. An emphasis can also be seen on recording revenue in a timely manner, direct integration with tax administration entities, and the use of information from electronic invoices to support payments and procurement management. In addition, more than 50 percent of FMIS are reported to share automatic links with human resource, procurement, and public debt systems.

In terms of technological features, databases and programming languages are dominated by Oracle and Java, respectively. Moreover, (i) 39 percent use some type of open source software; (ii) 33 percent use electronic signatures for at least some transactions; (iii) 56 percent use some form of agile software development methodology; (iv) the most frequently used means of communication are optical fiber/internet; (v) 28 percent use some type of cloud service; and (vi) 89 percent state that they have some kind of information security policy in place. However, only 3 of 18 countries use encryption in their database and network, and only 11 of 18 countries have adopted a service management framework.

Based on these results, it can be concluded that there is a need in the functional area to continue efforts to expand the functional scope of FMIS, ensure the timely recording of revenue, adopt IPSAS standards, strengthen TSAs, and adopt data analytics tools to support managers.

In terms of IT platforms, emphasis should be placed on adopting a satisfactory framework for system maintenance, as well as consolidating cybersecurity actions in a comprehensive information security policy (spanning the encryption of system components through to the adoption of electronic signatures and evaluation of the use of cloud services as an alternate data center).

1. FMIS Survey Period:

February-August 2020.

2. Coverage of the National FMIS Survey:¹

Responded: (19)	
Argentina	Haiti
Bahamas	Honduras
Brazil	Jamaica
Chile	Mexico
Colombia	Nicaragua
Costa Rica	Panama
Dominican Republic	Paraguay
Ecuador	Trinidad and Tobago
El Salvador	Uruguay
Guatemala	

Coverage: 19 countries (92 percent of LAC GDP).²

3. Survey Methodology

The FMIS Survey in Latin America and the Caribbean contained 88 questions, structured as follows: (i) general system data; (ii) main functional aspects (budget execution and internal controls, accounting and financial reporting, and treasury and cash management); (iii) links with other systems; (iv) main technological and cybersecurity issues; (v) user support; (vi) main features of data analysis tools; and (vii) prospects for the development of new FMIS.

Some of the questions were applicable only to a subset of participants, depending on the response to the previous question (branched questions).

The survey was prepared in Spanish and English using the tool “Survey Monkey.” The Department of Public Financial Information Systems in the Ministry of Finance of the Dominican Republic was in charge of operationalizing the survey. The link for participating in the online survey was sent to the head of the FMIS in each country (or to the official indicated by him/her). The questions were answered and received via the internet.

4. Presentation and Analysis of Selected Responses

For the purposes of analyzing the survey responses, the most relevant questions by group were selected for this report, based on the issues considered to be of greatest general interest.

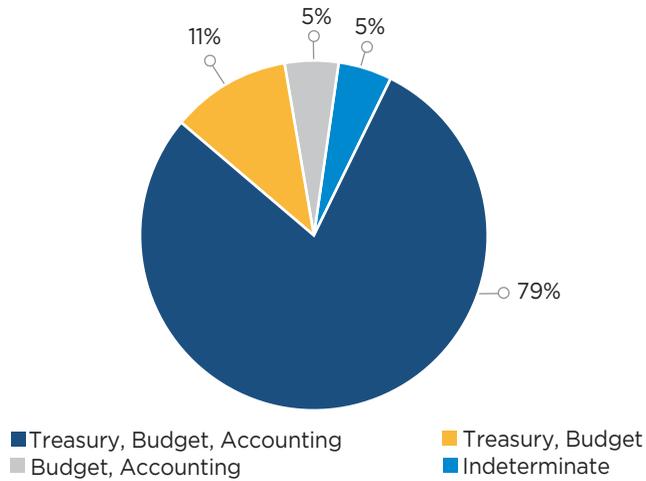
¹Partial response from Trinidad and Tobago, up to question 51. For statistical purposes, 18 participating countries were included for questions 51 to 88.

²Source: Economic Commission for Latin America and the Caribbean, LAC GDP(2019).

I - GENERAL DATA

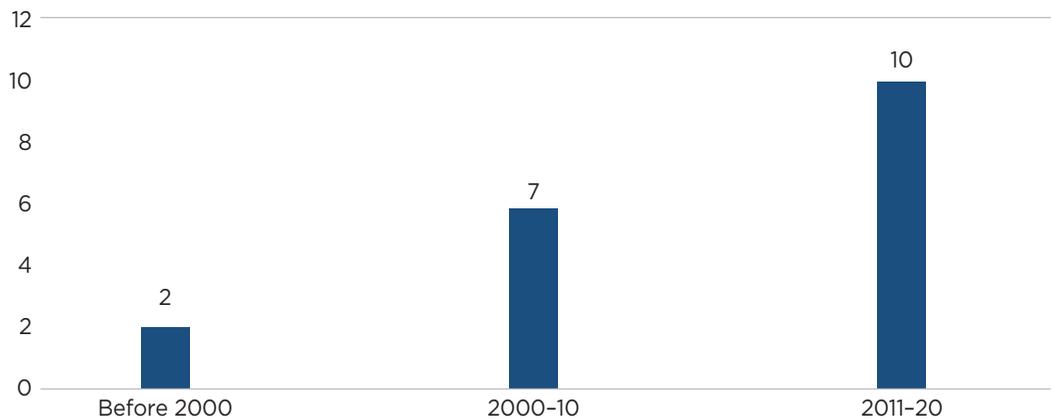
Question 3

Core Subsystems



Question 4

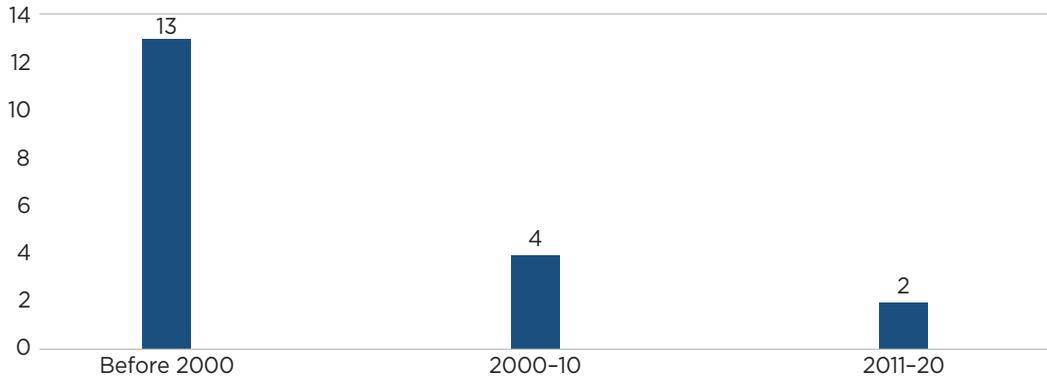
FMIS Start operation year (CURRENT VERSION)



More than 50 percent of FMIS have been in place for less than 10 years. FMIS that are not operating in a satisfactory manner should undergo an assessment to verify functional and technological modernization requirements. For additional details, see Pimenta and Seco (2019) and Uña, Allen, and Botton (2019).

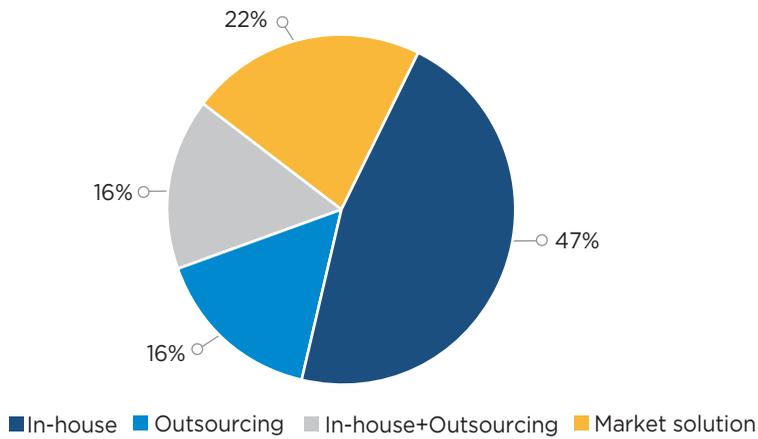
Question 5

Start operation year of FIRST FMIS VERSION



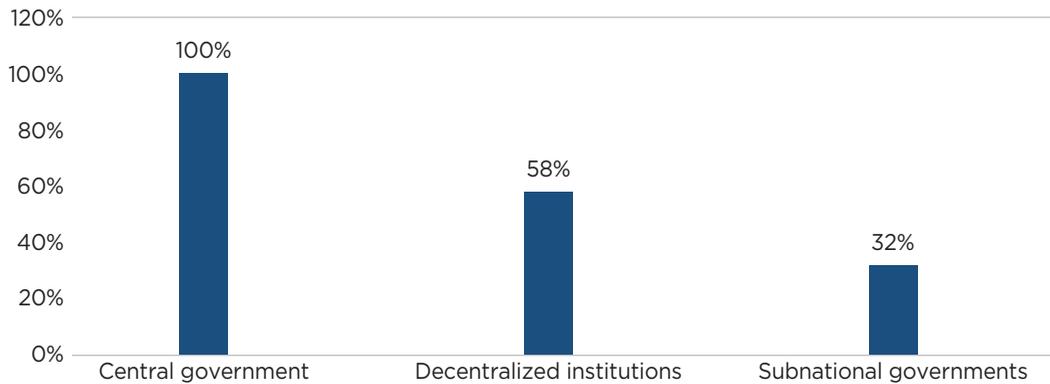
Question 6

FMIS Development



Question 8

FMIS Institutional Coverage



Most systems in LAC are custom made (in-house, in-house plus outsourcing, or outsourcing). This preference is due to the greater autonomy it offers for introducing individualized financial management practices. These systems are more vulnerable to problems of obsolescence, however, for the following reasons: (i) a lack of sufficient permanent resource flows for maintenance; (ii) uncompetitive remuneration for local technical staff; (iii) a failure to adopt international best practices relating to software maintenance management; and (iv) a lack of administrative, budgetary, and technical autonomy on the part of the financial administration.

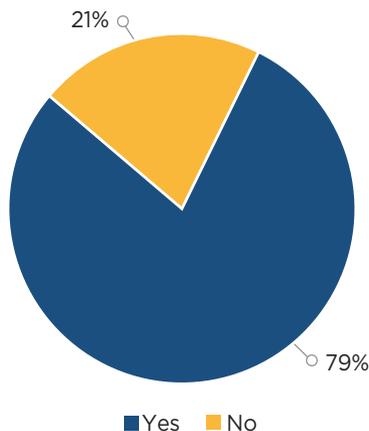
Meanwhile, systems available on the market already incorporate international best practices in the area of financial management and can be implemented quickly. However, they can also become complex and costly where financial administrations attempt to maintain individualized financial management practices. They can also be vulnerable to (i) problems relating to financial agreements with the provider for maintaining and modernizing the software; (ii) excessive manipulation of software code to adapt it to specific aspects of local financial management; and (iii) a lack of administrative, budgetary, and technical autonomy on the part of the financial administration.

II – MAIN FUNCTIONAL FEATURES

I.1 – BUDGET EXECUTION AND INTERNAL CONTROL (1/3)

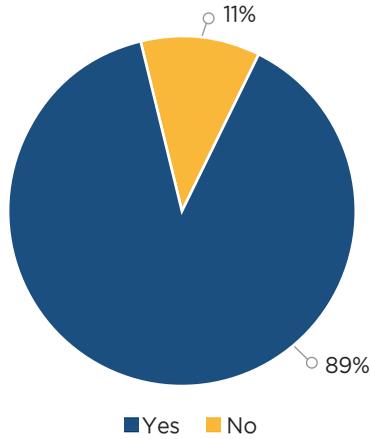
Question 11

All the expenses finances with the BUDGET—debt, loans and donations—are executed through FMIS.



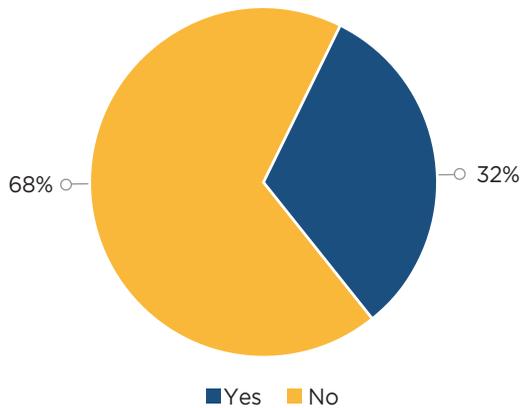
Question 12, 13, and 14

Is there control on the three expenditure stages (commitment, accrual, payment)?



Question 15

Use of Electronic Invoice



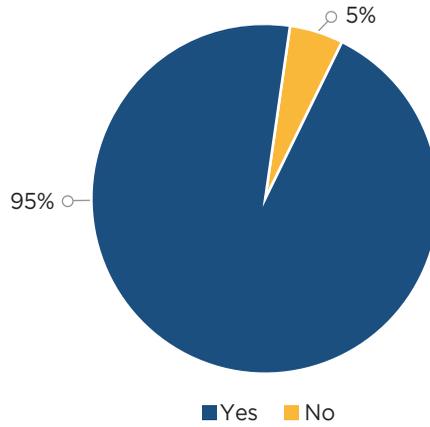
The use of electronic invoicing is a practical approach, particularly for public procurement systems. Some financial administrations use this practice to manage prices in government bidding processes.

II - MAIN FUNCTIONAL FEATURES

I.2 - ACCOUNTING AND FINANCIAL REPORTING (2/3)

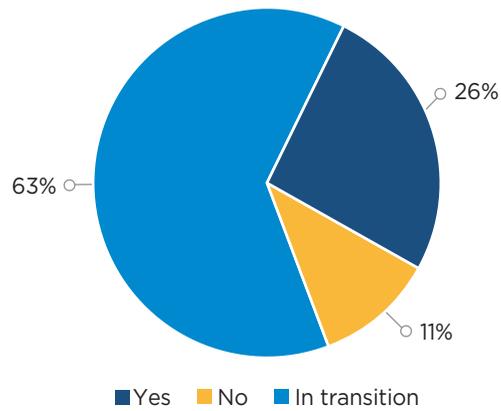
Question 17

Chart of accounts and budget classifier area aligned



Question 28

Adoption of IPSAS

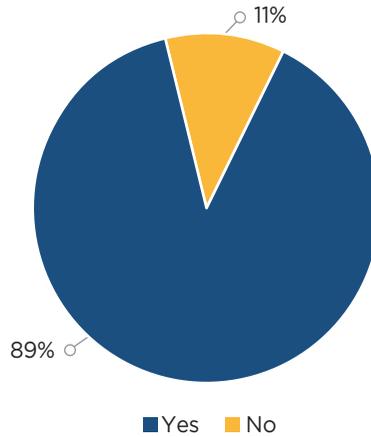


II - MAIN FUNCTIONAL FEATURES

I.3 - TREASURY AND CASH MANAGEMENT (3/3)

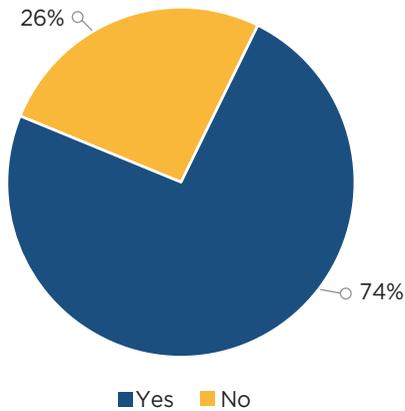
Question 29

Support to TSA



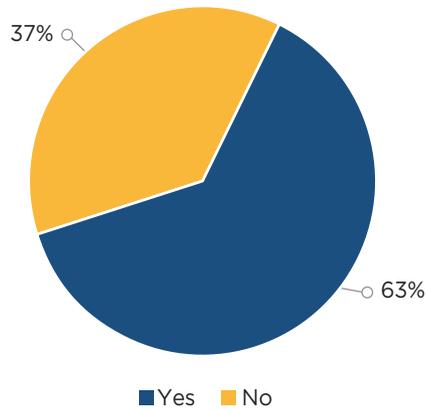
Question 35

Timely record of ALL Income (Tax and Non-Tax)



Question 36

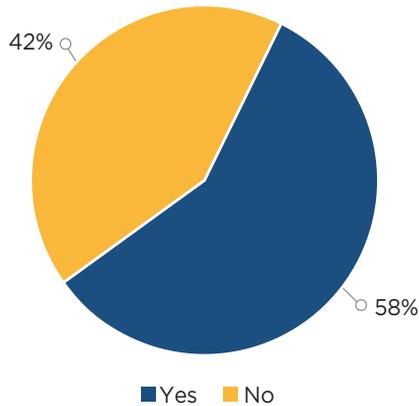
Daily automatic income and expense conciliation Versus the authomatic load of the banks



III - LINKS WITH OTHER SYSTEMS

Question 40

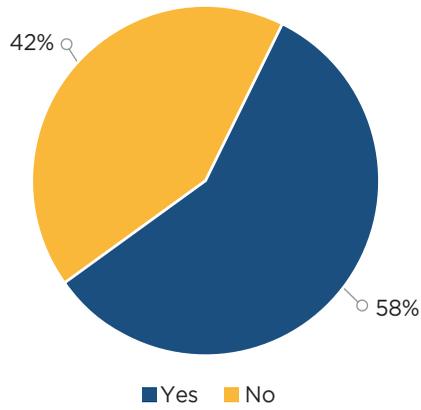
FMIS link to the tax collection authority for authomatic record of income



Financial administrations should aim to ensure the timely and automated recording of all revenues, as well as automated reconciliation of revenue and expenditure, as these are essential elements of effective cash management.

Question 44

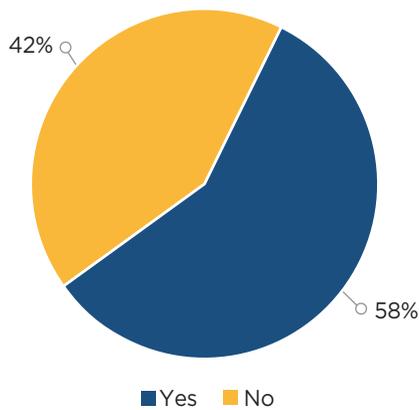
FMIS link for automatic validation of the provider's Tax Identification Number by the Tax collection authority



Automated validation of a supplier's fiscal identification number (número de identificación fiscal, or NIF) is obtained by accessing the Tax Information System Taxpayer Register module. This function helps to improve the FMIS register of suppliers.

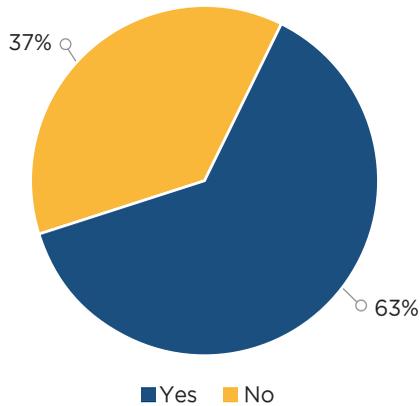
Question 46

Link to the Procurement and Contracting System



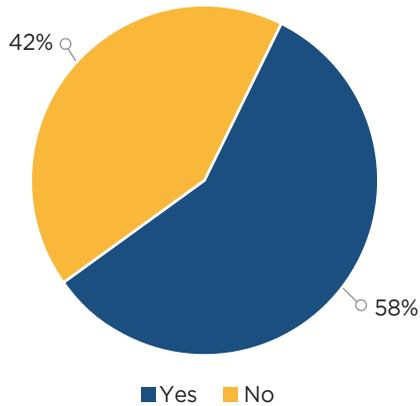
Question 48

Link to the Personnel Management System



Question 50

Link to the Public Debt Management System

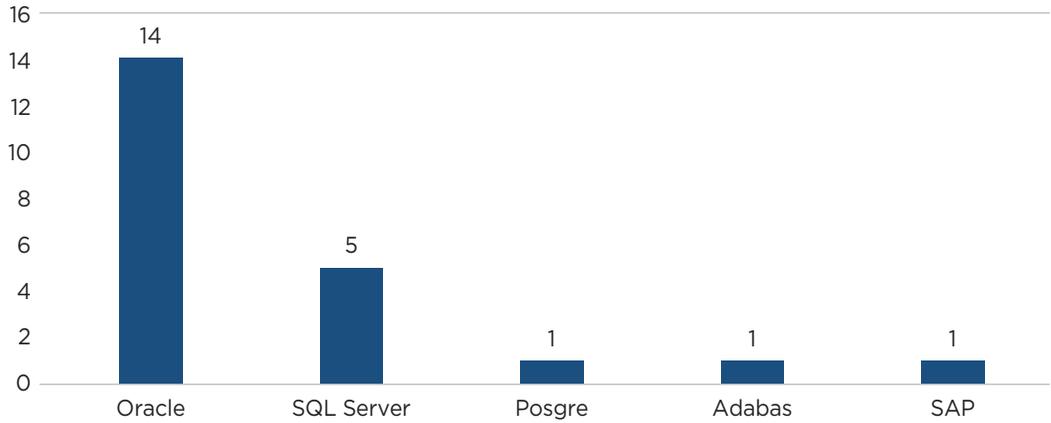


Linking the FMIS to related systems—particularly procurement, human resources, and public debt systems—leads to marked improvements in public financial management due to the high value of expenditure managed through these systems. The introduction of automatic links should be an objective, particularly with respect to the stages of expenditure.

IV - MAIN TECHNOLOGY AND CYBERSECURITY FEATURES

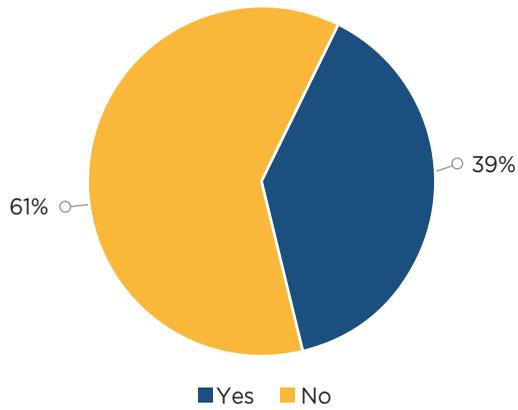
Question 54

Database managers



Question 57

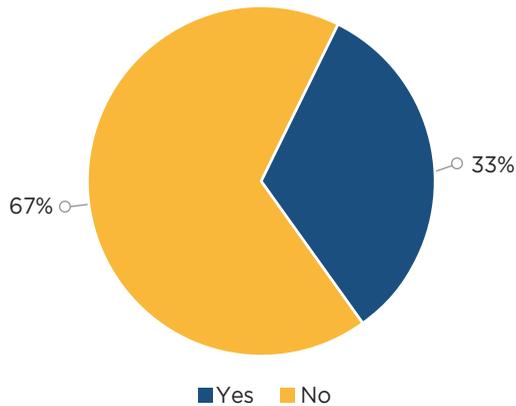
Use of Open Source software



The availability of open software has grown, and its use in FMIS has become increasingly feasible in terms of both systems development (e.g., Camunda, in Uruguay's SIF2 project) and service systems or modules (e.g., document management software).

Question 60

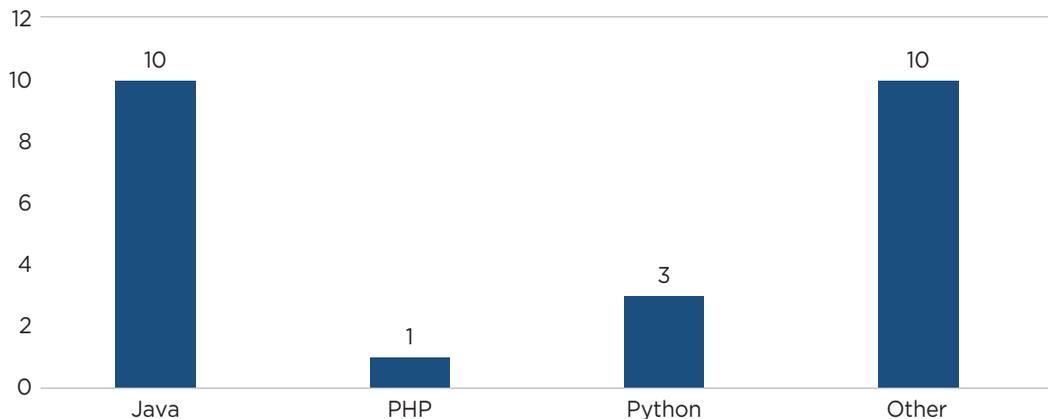
Use of Electronic Signature



The use of electronic signatures significantly improves transaction security in an FMIS, particularly with respect to the non-repudiation requirement. Digital signatures attached to documents also provide additional security in the system.

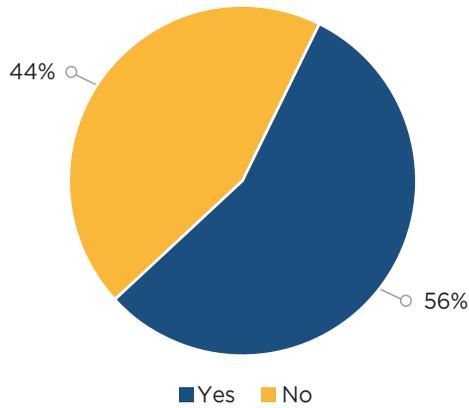
Question 61

Programming languages



Question 63

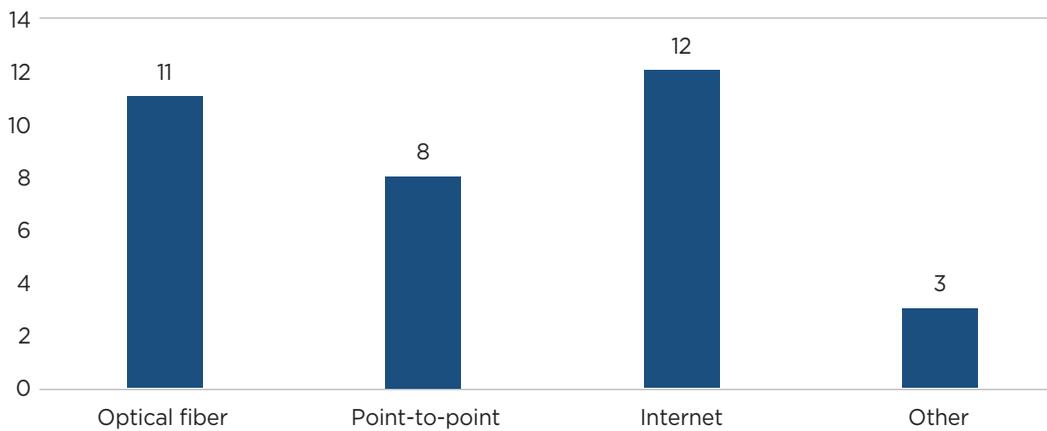
Use of agile methodology



The use of agile methodologies allows shorter time frames for software delivery. As with all methodologies, there are a number of risks, such as the loss of system documentation. Financial administrations must choose the most suitable methodology and closely follow its guidelines.

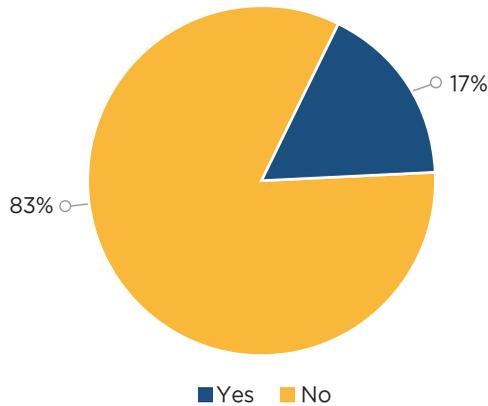
Question 65

Entities connection modes (Types of data networks used)



Question 66

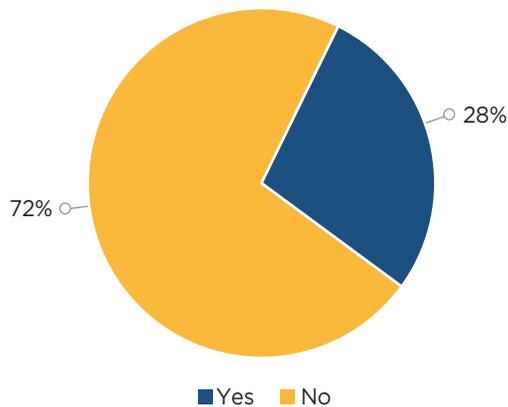
App availability for access to FMIS



The use of apps on mobile devices expands use of the FMIS. Examples of standard applications for senior public financial officials include balance inquiries for certain accounts, the availability of funds, and the status of payments to suppliers. It is best to begin with balance inquiries so that the information obtained can be used to explore more complex transactions.

Question 67

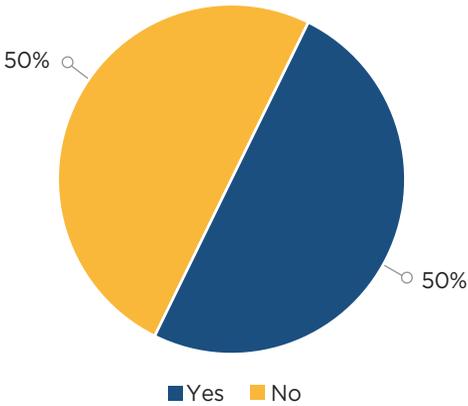
Use of Cloud Services



The potential benefits of cloud services should be assessed. The use of commercial solutions (generally offered through the cloud) and administrative systems (e.g., institutional email) offers significant immediate advantages for a number of related systems. In the case of subnational or smaller national financial administrations, it represents an opportunity to improve FMIS operability, reducing operating costs. See Schijman et al. (2020) for an evaluation of cloud services and Pimenta and Seco (2019) for additional considerations.

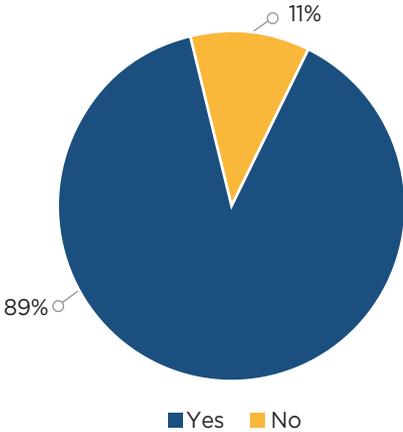
Question 68

Systems to retrieve information (Open Data)



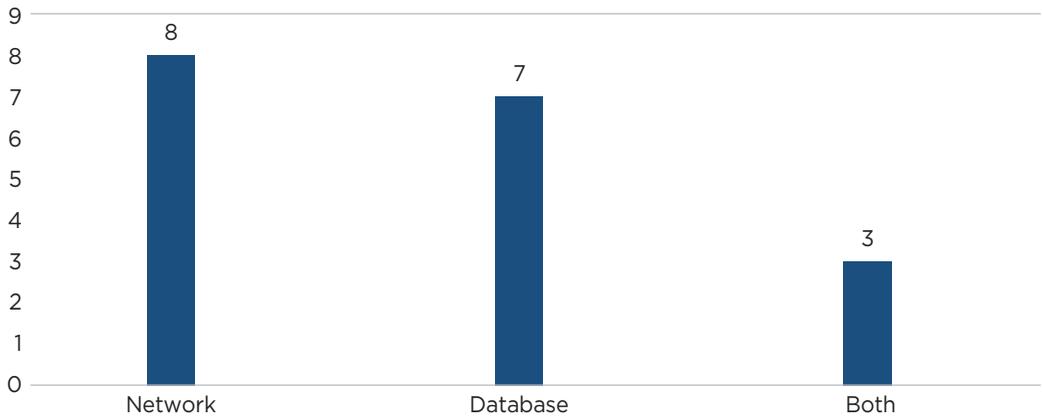
Question 69

FMIS Cybersecurity Policy Availability



Question 70

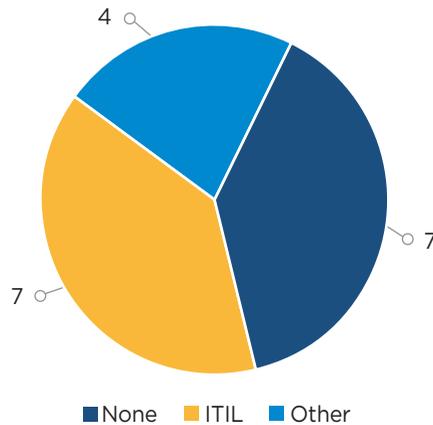
Use of cryptography



The use of network and database encryption helps to strengthen FMIS security.

Question 71

FMIS management framework availability

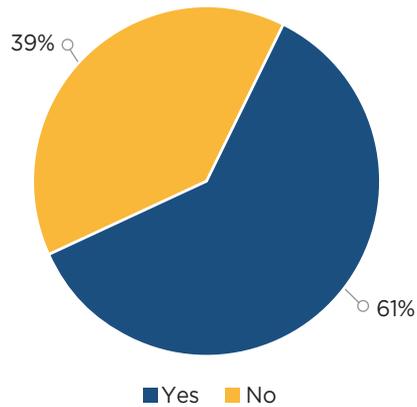


Proper maintenance of the FMIS is essential for providing improved services at lower cost and for prolonging the system life cycle. Financial administrations can select from a variety of international best practice frameworks. ITIL is one of the most frequently used in LAC, and specialized consultancies are available to support FMIS managers with this framework. See Pimenta and Seco (2019) for further details.

V - USER SUPPORT

Question 75

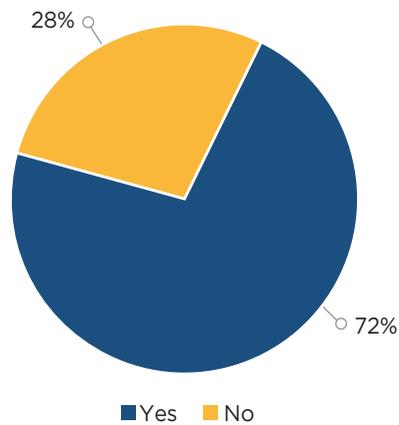
Use of users' surveys to improve FMIS



User surveys are a very valuable tool for identifying FMIS improvements. When processed effectively, they can guide improvements in processes and FMIS user interfaces.

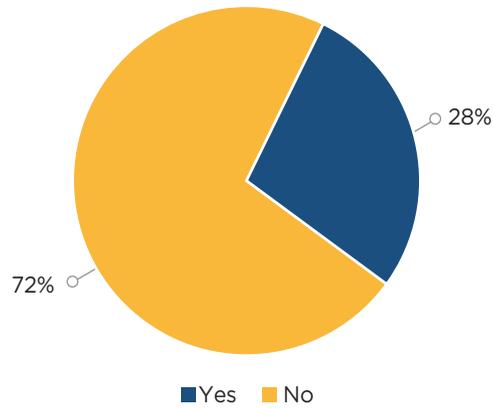
Question 76

Cubes availability - Accounting/Budget



Question 81

Cubes availability – Multisectoral (portal)

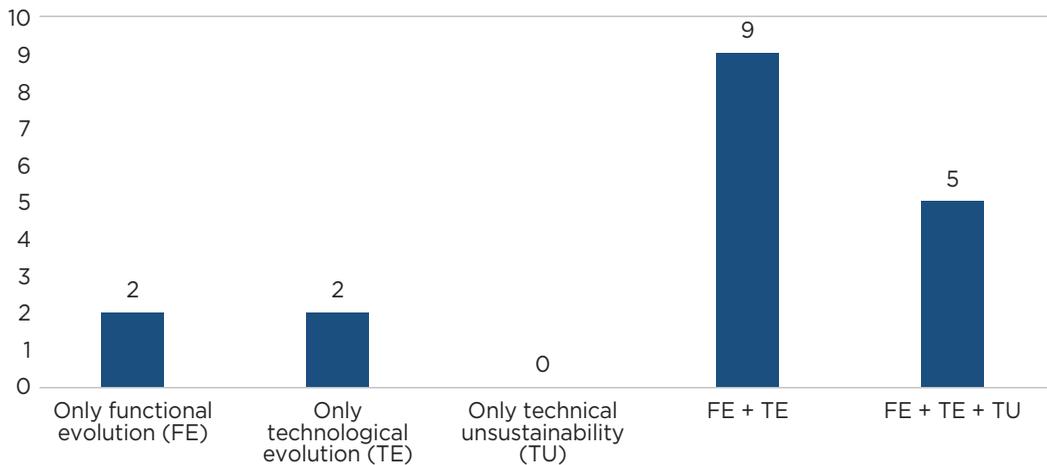


Multisector data cubes enable overviews of the data that help to improve managerial decision-making.

VII – DEVELOPMENT OF A NEW FMIS

Question 84

Motivations for a new FMIS



The reasons for developing a new FMIS can be broken down as follows:

EXAMPLES OF REASONS	
Technology	Function
Updating the software architecture	Process simplification
Intuitive, user-friendly interface	Inclusion of business processes
Cloud native software	Centralized payment processes
Predictive analysis tools	Budget codes
Open Source - Java	Implementation of program-based budgeting
Migration to open platforms	Systems integration
Modernization of the IT platform	Multiyear and results-based budgets
Integration of data analytics into transactional operations	Full adoption of international standards in the chart of accounts and budget classifications
Services-based modular redesign	Electronic signatures
	Improve user experience

5. Key Conclusions

Surveys offer a snapshot of the current reality and a comparative overview of the strong and weak points of each participant that should be interpreted in the light of their specific situation. This survey revealed that significant progress has been made on functional issues, including the increasingly widespread use of Treasury Single Accounts, an expansion in functional coverage, alignment between the chart of accounts and budget classifications, growing use of IPSAS accounting standards, and consolidation of the synchronized control of expenditure stages. An emphasis can also be seen on recording revenue in a timely manner, direct integration with tax administration entities, and the use of information from electronic invoices to support payments and procurement management. In addition, more than 50 percent of FMIS are reported to share automatic links with human resource, procurement, and public debt systems.

In terms of technological features, databases and programming languages are dominated by Oracle and Java, respectively. Moreover, (i) 39 percent use some type of open source software; (ii) 33 percent use electronic signatures for at least some transactions; (iii) 56 percent use some form of agile software development methodology; (iv) the most frequently used means of communication are optical fiber/internet; (v) 28 percent use some type of cloud service; and (vi) 89 percent state that they have some kind of information security policy in place. However, only 3 of 18 countries use encryption in their database and network, and only 11 of 18 countries have adopted a service management framework.

Based on these results, it can be concluded that there is a need in the functional area to continue efforts to expand the functional scope of FMIS, ensure the timely recording of revenue, adopt IPSAS standards, strengthen TSAs, and adopt data analytics tools to support managers.

In terms of IT platforms, emphasis should be placed on adopting a satisfactory framework for system maintenance, as well as consolidating cybersecurity actions in a comprehensive information security policy (spanning the encryption of system components through to the adoption of electronic signatures and evaluation of the use of cloud services as an alternate data center).

Lastly, regular surveys should facilitate the more dynamic measurement of progress in relation to FMIS while also highlighting new requirements arising from trends in public financial management.

Survey Bibliography

- Pimenta, C. and A. Seco. 2019. Technological Opportunities and Recommendations for Modernizing Integrated Financial Management Information Systems in Latin America and the Caribbean. Washington, DC: Inter-American Development Bank. Available at: <https://publications.iadb.org/es/oportunidades-tecnologicas-y-recomendaciones-para-la-modernizacion-de-los-sistemas-integrados-de>.
- Schijman et al. 2020. Computación en la nube: Contribución al desarrollo de ecosistemas digitales en países del Cono Sur. Washington, DC: Inter-American Development Bank. Available at: <https://publications.iadb.org/es/computacion-en-la-nube-contribucion-al-desarrollo-de-ecosistemas-digitales-en-paises-del-cono-sur>.
- Uña, G., R. Allen, and N. Botton. 2019. How to Design a Financial Management Information System: A Modular Approach. International Monetary Fund “How to” series. Washington, DC: International Monetary Fund. Available at: <https://www.imf.org/-/media/Files/Publications/HowToNotes/HowToNote1903.ashx>.

GENERAL ANNEX 2

DATA CENTER AND HARDWARE ARCHITECTURE (BASIC)³

Data Centers

Where the FMIS is hosted in the financial administration's data center, the architecture of the hardware to be procured takes on considerable importance. This architecture should also facilitate vertical and horizontal scalability, independence from software vendors, and automatic hardware configuration. Ultimately, the data center may participate in a future hybrid cloud.

Virtualization is currently the main trend in relation to data centers. It refers to the abstraction of computer resources, with the introduction of a software abstraction layer between the hardware of the physical machine and the operating system of the virtual machine, dividing the resources into one or more execution environments. This is a vital aspect of cloud computing.

Virtualization may be implemented using hypervisors, which consist of a software layer separating the operating system from the hardware of a machine. Another way is through the use of containers, which involves implementing various server applications in isolated virtual environments (containers) that all run on the same operating system.

These concepts are important for creating a software-defined data center (SDDC), in which infrastructure is virtualized through abstraction, resource pooling, and automation utilizing intelligent software. SDDCs improve equipment performance, facilitate scalability, and reduce the need for infrastructure management specialists (Figure AG2.1).

Software-defined network technologies are included in SDDCs. One example is the Cisco Application Centric Infrastructure (ACI), which combines the design of underlay and overlay networks through specialized switches to operate under the orchestration and automation of the cluster node of the solution. Some upgrading solutions require the download to specialized devices of network functions that require high processing capacity, such as Secure Sockets Layer (SSL)⁴ encryption processing, and Distributed Denial of Service (DDOS)⁵ mitigation.

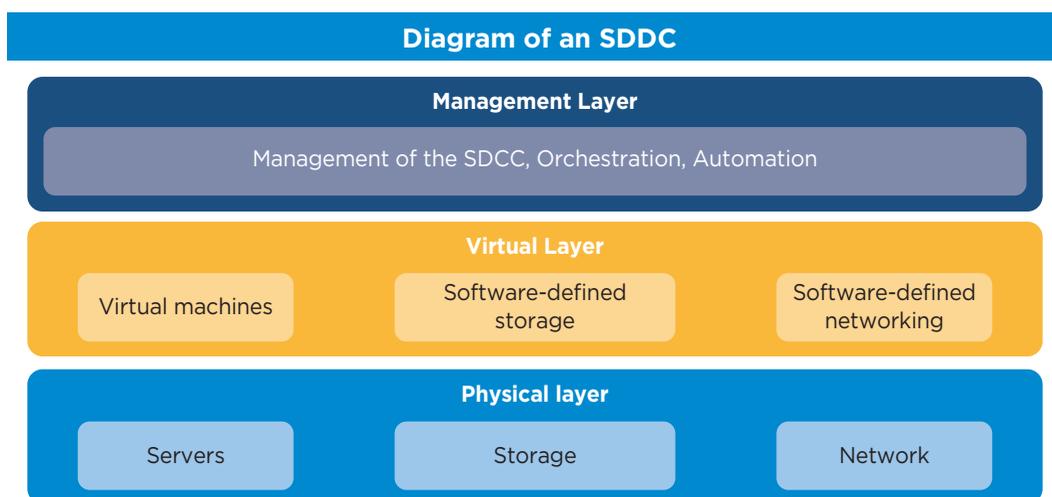
Expandable storage capacity is a requirement for FMIS data centers, so that in addition to the operating data itself, centers can handle needs associated with data warehousing, data mining, artificial intelligence, the Internet of Things, and others. Under any scenario, there will be a need for automatic replication and access controls. High-performance data storage systems, such as Hitachi, IBM, Dell, and others, are available for evaluation and offer advanced management capabilities.

³Based on Corvalán, Irigaray, and Seco (2020).

⁴This is a global security standard that creates an encrypted channel between a web server and a browser.

⁵This is a type of attack that attempts to overload a network resource until its response capacity has been exceeded.

FIGURE AG2.1



Source: Authors' elaboration.

Another trend in SDDCs is hyper-converged infrastructure (HCI), which merges the main IT components—servers, storage, and network components—into a single location that can be a scalable device (or rack). This allows the data center to be modernized, with simplified management, improved performance, and elastic scalability. HCI software is located in the hypervisor layer or on top of it, in the virtual machine.⁶

Devices such as load balancers improve data center performance, controlling the distribution of loads across servers and forwarding incoming requests to less saturated machines (Figure AG2.2).

Corvalán, Irigaray, and Seco (2020) provide more complete information and additional technical references, and also review the experience of implementing a modern data center in Paraguay's tax administration.

Data Networks

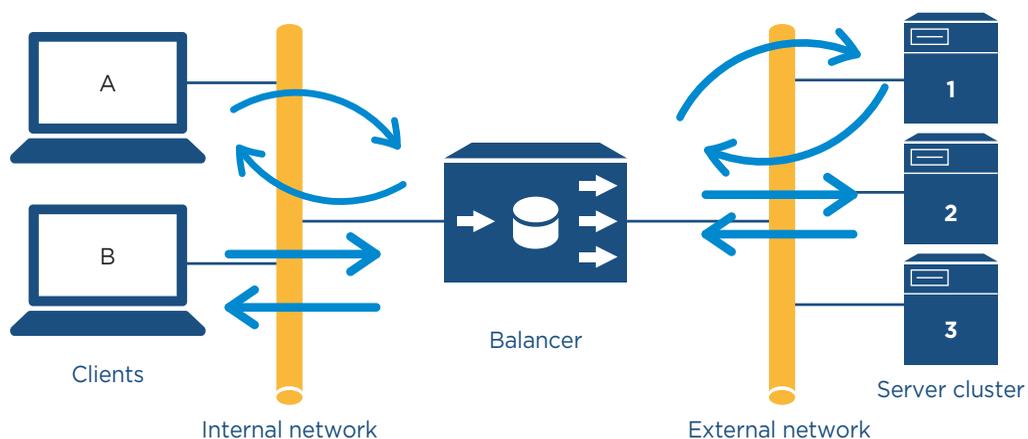
Network architecture and information security are intertwined and should be addressed as a whole. The transmission media generally used in FMIS are the internet, optical fibers, and wide area networks (WAN), among others. The choice of means depends on strategic decisions and the conditions of local communications services.

In a survey of 18 LAC financial administrations carried out by the IDB in the first half of 2020, 5 stated that the internet was used as the sole communications network for users external to their FMIS, while 2 used only optical fiber and the others used two or three different transmission media.

⁶ <https://blogbrasil.westcon.com/o-que-e-infraestrutura-hiperconvergente>.

FIGURE AG2.2

Diagram of a Load Balancer



Source: Authors' elaboration based on Corvalán, Irigaray, and Seco (2020).

Financial administrations should avoid becoming communications providers, that is, installing and operating their own communications media. The best option is to arrange contracts with local communications providers to provide connections, stipulating the level of quality required for the service. The complexity of establishing security mechanisms in a communications network means that specialists need to participate in their design, implementation, and operation.

Bibliography

- Ainsworth, R. and V. Viitasaari. 2017. Payroll Tax and the Blockchain. Working Paper No. 17-17. Boston University School of Law.
- Alpha & Beta. 2018. Digital Innovation in PFM: Opportunities and Implications for Low-income Countries. AlphaBeta Strategy Economics. Available at: <https://www.alphabeta.com/wp-content/uploads/2018/07/pfm-technology-paper-long-version.pdf>
- Andrews, M. 2013. The Limits of Institutional Reform in Development: Changing Rules for Realistic Solutions. New York, NY: Cambridge University Press.
- Bartel, M. 1996. Integrated Financial Management Systems: A Guide to Implementation. World Bank LATPS Occasional Paper Series 19. Public Sector Modernization Division. Alexandria, VA.
- Inter-American Development Bank. 2019a. Policies for the Procurement of Goods and Works Financed by the Inter-American Development Bank. Document GN-2349-15. Available at: <http://idbdocs.iadb.org/wsdocs/getdocument.aspx?docnum=ezhare-1132444900-24605>.
- Inter-American Development Bank. 2019b. Policies for the Selection and Contracting of Consultants Financed by the IDB. Document GN-2350-15. Available at: <http://idbdocs.iadb.org/wsdocs/getdocument.aspx?docnum=ezshare-1132444900-24606>.
- Inter-American Development Bank. 2020. Procurement Compass. Mimeo. Washington, DC: IDB.
- Inter-American Development Bank/International Monetary Fund/Korea Public Finance Information Service. 2019. Seminar: FMIS in Latin American and Caribbean countries and the Korean experience. Report on Seminar Proceedings. Washington, DC: IDB.
- British Standards Institute. 2018. Information and Cyber Challenges in the Public Sector - Survey 2018. London, United Kingdom: BSI Group Whitepaper.
- Bok, B. et al. 2018. Macroeconomic Nowcasting and Forecasting with Big Data. *Annual Review of Economics* 10: 615-43.
- Carvajal, F. 2017. Arreglos institucionales: algunas recomendaciones prácticas. Presentation in Santiago, Chile (December 2017).
- Chung, L., A. Nixon, E. Yu, and J. Mylopoulos. 2000. Non-Functional Requirements in Software Engineering. Heidelberg, Germany: Springer.

- Inter-American Center of Tax Administrations and Inter-American Development Bank. 2013. *State of the Tax Administration in Latin America: 2006–2010*. Washington, DC: Inter-American Center of Tax Administrations and Inter-American Development Bank.
- Corvalán, L., M. Irigaray, and A. Seco. 2020. *Arquitectura de sistemas y alternativas de infraestructura de TIC*. In: Borja, D., A. Seco, R. Zambrano, et al. (Eds.). *Las TIC como herramienta estratégica para potenciar la eficiencia de las administraciones tributarias*. Panama, Republic of Panama: Inter-American Center of Tax Administrations and Bill & Melinda Gates Foundation. Available at: <https://biblioteca.ciat.org/opac/book/5731>.
- Dumas, M. et al. 2013. *Fundamentals of Business Process Management*. Heidelberg, Germany: Springer.
- EY. 2019. *EY Global Information Security Survey 2018–19*. Available at: https://assets.ey.com/content/dam/ey-sites/ey-com/en_ca/topics/advisory/ey-global-information-security-survey-2018-19.pdf.
- Fainboim, I. and S. Pattanayak. 2011. *Treasury Single Account: An Essential Tool for Government Cash Management*. International Monetary Fund Technical Notes and Manuals. Washington, DC: International Monetary Fund.
- Latin American Treasury Forum (FOTEGAL). 2019. *La gestión de tesorería en América Latina*. FOTEGAL. Available at: https://fotegal.org/documentos/biblioteca_virtual/la-gestion-de-tesoreria-en-america-latina-fotegal.pdf.
- Fritz, V., M. Verhoeven, and A. Avenia. 2017. *Political Economy of Public Financial Management Reforms: Experiences and Implications for Dialogue and Operational Engagement*. Washington, D.C.: World Bank. Available at: <https://openknowledge.worldbank.org/handle/10986/28887>.
- GSMA. 2020. *State of the Industry Report on Mobile Money 2019*. Mobile Money Programme, with the support of the Bill & Melinda Gates Foundation.
- Gupta, S. et al. (Eds.). 2018. *Digital Revolution in Public Finance*. Washington D.C.: International Monetary Fund. Available at: https://www.elibrary.imf.org/view/IMF071/24304-9781484315224/24304-9781484315224/Other_formats/Source_PDF/24304-9781484316719.pdf.
- Hammer, M. 1990. Reengineering work: Don't automate, obliterate. *Harvard Business Review*, July-August issue. <https://hbr.org/1990/07/reengineering-work-dont-automate-obliterate>.
- Hashim, A. and M. Piatti. 2018. *Lessons from Reforming Financial Management Information Systems: A Review of the Evidence*. Independent Evaluation Group. Washington, D.C.: World Bank. Available at: <http://documents.worldbank.org/curated/en/504361516629959446/pdf/WPS8312.pdf>.
- Hashim, A., K. Farook, and M. Piatti-Fünfkirchen. 2020. *Ensuring better PFM outcomes with FMIS investments*. World Bank Guidance Note No. 6. Available at: <http://documents1.worldbank.org/curated/en/917121592283326885/pdf/Ensuring-Better-PFM-Outcomes-with-FMIS-Investments-An-Operational-Guidance-Note-for-FMIS-Project-Teams-Designing-and-Implementing-FMIS-Solutions.pdf>.
- International Federation of Accountants and Association of Chartered Certified Accountants. 2020. *Is cash still king?* International Monetary Fund Blog. Available at: <https://blog-pfm.imf.org/pfmblog/2020/06/-is-cash-still-king-.html>.

- International Public Sector Accounting Standards Board. 2020. COVID-19: Relevant IPSASB Accounting Guidance. Available at: https://www.ifac.org/system/files/publications/files/IPSASB-Staff-QA-COVID-19-Relevant-Accounting-Guidance_0.pdf.
- ISO/IEC 27001. 2013. Information Security Management. Geneva, Switzerland: International Organization for Standardization.
- ISO/IEC 27000. 2018. Security Techniques, Overview and Vocabulary. Geneva, Switzerland: International Organization for Standardization.
- International Tax Compact and Kreditanstalt für Wiederaufbau. 2015. Information technology in tax administration in developing countries. Bonn, Germany: KfW Development Bank.
- Malavolta, I. 2017. Requirements Engineering with UML. Course slides, Vrije Universiteit Amsterdam.
- PEFA Handbook. 2018. PEFA Handbook 2016. Volume II (Second edition). Washington, DC: PEFA Secretariat.
- Martins, W., O. Nieto, A. Seco, and R. Zambrano. 2020. Tecnologías y servicios habilitantes. In: Borja, D., A. Seco, R. Zambrano, et al. (Eds.). *Las TIC como herramienta estratégica para potenciar la eficiencia de las administraciones tributarias*. Panama, Republic of Panama: Inter-American Centre of Tax Administrations and Bill & Melinda Gates Foundation. Available at: <https://biblioteca.ciat.org/opac/book/5731>.
- Martins, W. and A. Seco. 2020. Gestión de soluciones e infraestructuras de TIC. In: Borja, D., A. Seco, R. Zambrano, et al. (Eds.). *Las TIC como herramienta estratégica para potenciar la eficiencia de las administraciones tributarias*. Panama, Republic of Panama: Inter-American Centre of Tax Administrations and Bill & Melinda Gates Foundation. Available at: <https://biblioteca.ciat.org/opac/book/5731>.
- Moura, H. and M. Oliveira. 2019. Blockchain e Banco Central: um contraponto da tecnologia. *Revista da Procuradoria Geral do Banco Central*. 13(2). Banco Central do Brasil.
- Olowo-Okere, E. 2020. Investing in Financial Management Information Systems for Better Public Financial Management Outcomes. World Bank Governance for Development Blog. Available at: https://blogs.worldbank.org/governance/investing-financial-management-information-systems-better-public-financial-management?cid=EXT_WBBlogTweetableShare_D_EXT.
- Pessoa, M. and A. Khan. 2010. Conceptual Design: A Critical Element of a Successful Government Financial Management Information System Project. Washington DC: International Monetary Fund.
- Pimenta, C. and A. Seco. 2019. Technological Opportunities and Recommendations for Modernizing Integrated Financial Management Information Systems in Latin America and the Caribbean. Discussion Paper No. IDB-DP-651. Washington, DC: Inter-American Development Bank. Available at: <https://publications.iadb.org/en/technological-opportunities-and-recommendations-modernizing-integrated-financial-management>.
- Pimenta, C. and M. Pessoa (Eds.). 2015. *Public Financial Management in Latin America: The Key to Efficiency and Transparency*. Washington, DC: Inter-American Development Bank, International Monetary Fund. Available at: <https://publications.iadb.org/en/public-financial-management-latin-america-key-efficiency-and-transparency>.

- Roa, M. et al. 2017. Panorama del dinero móvil en ALC. Colombia: Centro de Estudios Monetarios Latinoamericanos. Available at: <https://www.cemla.org/PDF/otros/2017-06-panorama-del-dinero-movil.pdf>.
- Schijman, A., P. Valenti, C. Pimenta, et al. 2020. Computación en la nube: Contribución al desarrollo de ecosistemas digitales en países del Cono Sur. Washington, DC: Inter-American Development Bank. Available at: <http://dx.doi.org/10.18235/0002474>.
- Seco, A. 2020. Hoja de ruta para modernizar un sistema de información tributario. In: Borja, D., A. Seco, R. Zambrano, et al. (Eds.). Las TIC como herramienta estratégica para potenciar la eficiencia de las administraciones tributarias. Panama, Republic of Panama: Inter-American Centre of Tax Administrations and Bill & Melinda Gates Foundation. Available at: <https://biblioteca.ciat.org/opac/book/5731>.
- Seco, A., and A. Muñoz. 2018. Panorama del uso de tecnologías y soluciones digitales innovadoras en la política y la gestión fiscal. Discussion Paper No. IDB-DP-602. Washington, DC: Inter-American Development Bank. Available at: <https://publications.iadb.org/es/panorama-del-uso-de-las-tecnologias-y-soluciones-digitales-innovadoras-en-la-politica-y-la-gestion>.
- _____. 2019. Asistentes conversacionales virtuales en las administraciones tributarias. Washington, DC: Inter-American Development Bank. Available at: https://publications.iadb.org/publications/spanish/document/Asistentes_conversacionales_virtuales_en_las_administraciones_tributarias_Principios_modelos_y_recomendaciones.pdf.
- Silver, B. 2011. BPMN Method and Style. 2nd Edition. Altadena, CA: Cody-Cassidy Press.
- Sirois, B. 2020. Building Strong PFM Foundations to Support Resilient Recovery. International Monetary Fund Public Financial Management Blog. Washington, DC : International Monetary Fund. Available at: <https://blog-pfm.imf.org/pfmblog/2020/11/-building-strong-pfm-foundations-to-support-resilient-recovery-.html>.
- Tapscott, D. and A. Tapscott. 2016. Blockchain Revolution. New York, NY: Penguin Random House.
- Uña, G. and C. Pimenta. 2015. Integrated Financial Management Information Systems in Latin America: Strategic Aspects and Challenges. In: Pimenta, C. and M. Pessoa (Eds.). Public Financial Management in Latin America: The Key to Efficiency and Transparency. Washington, DC: Inter-American Development Bank and International Monetary Fund. Available at: <https://publications.iadb.org/en/public-financial-management-latin-america-key-efficiency-and-transparency>.
- Uña, G., R. Allen, and N. Botton. 2019. How to Design a Financial Management Information System: A Modular Approach. How to notes/19/02. Washington, DC International Monetary Fund. Available at: <https://www.imf.org/~/media/Files/Publications/HowToNotes/HowToNote1903.ashx>.
- United States Agency for International Development. 2008. Integrated Financial Management Information Systems – A Practical Guide. Washington, DC: United States Agency for International Development.
- Yaker, I., C. Albuquerque, and J. Vargas. 2015. The Treasury Single Account in Latin America: An Essential Tool for Efficient Treasury Management. In: Pimenta, C. and M. Pessoa (Eds.). *Public Financial Management in Latin America: The Key to*

Efficiency and Transparency. Washington D.C.: Inter-American Development Bank and International Monetary Fund. Available at: <https://publications.iadb.org/en/public-financial-management-latin-america-key-efficiency-and-transparency>

Zaballos, A. and E. Rodríguez. 2017. Economía digital en América Latina y el Caribe. Situación actual y recomendaciones. Washington, DC: Inter-American Development Bank. Available at: <https://publications.iadb.org/publications/spanish/document/Econom%C3%ADa-digital-en-Am%C3%A9rica-Latina-y-el-Caribe-Situaci%C3%B3n-actual-y-recomendaciones.pdf>.

