



Governance of Digital Transformation

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Resumo

A tecnologia é a maior história nos negócios de hoje. Com o progresso em tudo digital, as restrições estão a ser removidas e novas possibilidades criadas, afetando a vida de todos. Isto significa uma nova revolução digital, geralmente denominada de transformação digital, que é hoje, mais do que nunca, uma realidade. É, portanto, necessário entender esta nova onda, o significado de transformação digital e como governá-la. Embora esta questão não seja específica ao sector público, isto é, dentro de entidades, organizações e empresas públicas, é de particular relevância neste contexto, uma vez que envolve, em regra geral, investimentos pesados e a produção de serviços transversais que resultam de atividades e ligações entre várias instituições. Um despertar para esta questão está a ocorrer na esfera pública, com uma sólida maioria de países a incluir nas suas agendas metas de digitalização da administração pública, mas em poucos casos há uma visão clara de como liderar a transformação. O objetivo deste estudo é identificar uma framework para implementar mecanismos de governança da transformação digital que permita uma coordenação holística e integrada no setor público. Para construir corretamente esta framework, é necessário dar atenção a uma nova geração de executivos para transformação digital, de entre os quais o diretor digital. A ambiguidade e a contenção que cercam este papel e a controvérsia entre ele e o diretor de TI levam a dificuldades internas nas organizações. Neste estudo também analisamos as diferenças entre estes papéis e traçamos uma nova visão das responsabilidades associadas aos mesmos.

Palavras-chave: Transformação Digital; Governança; Governança da Transformação Digital; Framework; Sector Público; Director Digital.

Abstract

Technology is the biggest story in business today. With progress in all things digital, constraints are being removed and new possibilities created, affecting everyone's lives. This means a new digital revolution, denominated as digital transformation, which is now, more than ever, a reality. It is, therefore, necessary to understand this new wave, the meaning of digital transformation and how to govern it. Although this issue is not specific to the public sector, i.e., within entities, organizations and public companies, it is of particular relevance in this context since it can involve hefty investments and the production of cross-cutting services that result from activities and linkages between institutions. An awakening to this issue is taking place in the public sphere, with a majority of countries including in their agenda public administration digitalization goals, but in too few cases is there a clear view of how to lead the transformation. The purpose of this study is to identify a framework to implement mechanisms concerning governance of digital transformation that enable a holistic and integrated coordination in the public sector. To correctly build the framework, it is necessary to give attention to a new generation of C-class executives for the digital transformation, among which the chief digital officer. The ambiguity and contention that surrounds this role and the controversy between itself and the chief information officer, leads to internal difficulties in organizations. In this study, we analyze the differences between these roles and draw a new vision of the responsibilities associated with them.

Keywords: Digital transformation; Governance; Governance of digital transformation; Framework; Public sector; Chief Digital Officer.

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Nomenclature

BTM² Business Transformation Management Methodology

CC Capgemini Consulting

CDO Chief Digital Officer

CIO Chief Information Officer

CMM Capability Maturity Model

COBIT Control Objectives for Information and Related Technologies

DSRM Design Science Research Methodology

DT Digital Transformation

EDM Evaluate-Direct-Monitor

EGIT Enterprise Governance of IT

Greek symbols

GDT Governance of Digital Transformation

IEC International Electrotechnical Commission

IS Information System

ISACA Information Systems Audit and Control Association

ISO International Organization for Standardization

IT Information Technology

ITG IT Governance

MIT Massachusetts Institute of Technology

MM Maturity Model

PAM Process Assessment Model

Chapter 1

Introduction

After the computer revolution, with the invention of the microprocessor, and thanks to the rise of the modern Internet, the technology required for industries to transform themselves through software finally works and can be widely delivered at global scale [1]. With the increasing use of new technologies by all, it's crucial that these industries assimilate and adapt to them to encourage new growth potentials and benefits [2]. Due to these potentials and benefits, nowadays, organizations are almost demanded to, not only embrace, but also take a step forward and push for digitalization.

Nevertheless, the impact of digital in organizations is not something new nor recent. It began with the emergence of the infrastructure and the first digital products, in the late 90s of last century, followed by digital distribution and web, in the beginning of the 21st century, and, in this decade, with the digital transformation of business models.

Industries have already been changing due to digitalization and it is becoming clear that digital technologies and their applications will influence every organization. Since digitalization offers a huge potential to transform businesses, it is also referred to as digital transformation (DT) [3].

Even though digital and transformation are not new expressions, the term combining both – DT - gained prominence recently and is commonly and abundantly used as a comprehensive designation for “the use of technology to radically improve performance or reach of enterprises” [4].

For Perkin and Abraham [5], DT has three assumptions: (1) it is inevitable and will happen regardless of the wants of an individual or organization; (2) it is associated with more than technology and involves elements like strategy, processes, culture, behaviors and people; and (3) it involves a fundamental and wide-ranging change.

This fundamental change is an important aspect of DT and it can come in two different ways, making the transformation a two-phase process: the first phase, where traditional offerings are digitized, and the second phase where entirely new offerings emerge, things that are only possible because of digital technology [6].

But DT goes far beyond the mere digitization of communication processes, work-related processes, or expanded capabilities for data storage. It is an all-encompassing phenomenon reshaping many aspects of life [7]. We are moving into a new digital era, and one major redefinition is the relationship

between the state and the citizen [8].

In fact, DT permeates the state and society through fundamental changes in behavior, dispositions, organizations, interactions, and contextual relations that transcend the individual nation-state [7]. This phenomenon, the public sector, above all other sectors, cannot avoid, regardless of the will or capacity of governments, given the consequences of globalization and the growing demands of citizens for more and better public services. In this sense, the increasing digitalization of spheres of work and private life also opens huge opportunities for public administration. Intelligent networking can help administrators to develop new solutions that ensure good governance and high-quality action [9].

Thanks to these opportunities, public administrations worldwide have increased the number of technology-based solutions due to the increase in the population, the increase in regulation mechanisms, and the pressure from informed citizens in wanting more and better services. Indeed, governments around the world are doing their best to meet citizen demand and capture benefits. According to McKinsey, in 2014, more than 130 countries had public online services [10].

However, there is a common and big problem regarding DT. As described in a wide range of literature, business transformation in general tends to fail, for many reasons [11][12][13]. When it comes to the topic of digital, most organizations struggle to assimilate digital technologies and fully understand the benefits of investing in these technologies, despite the growing awareness about the importance of said technologies and their impact on the reshaping of entire business activities [14]. Companies that use digital technologies to achieve higher profits, better productivity, and superior performance, do exist, but they're rare since most of them fall short of achieving a good transformation [15].

More specifically, DT requires profound changes, processes, information technology (IT) systems, and mentalities that are more challenging to implement in the public sector than in the private sector. A joint study by McKinsey and the University of Oxford found that public sector IT projects that required business change were six times more likely to be costly and were 20 percent more likely to be behind schedule than projects in the private sector [10].

One main obstacle, in both public administrations and the public sector in general, recognized by many governments, is the difficulty of conducting transformation processes - governance – specially in a medium that involves a large number of public entities, organizations and companies in an integrated and holistic way. This directly implies difficulties conducting DT, more specifically, the governance aspect of DT. Westerman and coauthors have conducted qualitative and quantitative studies that show that digital governance is one of the major levers that senior executives can apply to process management transformation [15].

It is due to this problem that we are witnessing a shift within the public sector concerns. One of the best-known examples is the case of Australia. In 2015, the Australian government created the Digital Transformation Agency [16] for governing the digital transformation in public administration, seeking to ensure a structure responsible for the governance of digital transformation (GDT).

Besides the need of new structures to govern DT, a need for new roles also emerged and the chief digital officer (CDO) case is one of the most controversial, but of necessary research. As was seen before, DT encompasses a wide range of tasks and activities that are complex, cross-functional and

interdependent, making it increasingly difficult for the chief information officer (CIO) [17]. On top of that, the recent wave of digital technologies, which make the DT possible in the first place, demands a completely new mind and skill set. There is then a need to assign and spread responsibilities adequately across top managers to ensure a successful DT.

Thanks to this need, organizations may complement the CIO role with the CDO role [18]. For example, Horlacher and Hess studied the CDO role and gave the first insights into the collaboration between CDO and CIO for DT, finding that they not only collaborate closely but also their relationship is symbiotic and interdependent.

Although the demand for this type of C-position is frequent in the entrepreneurial sphere, the public sector has not been immune to this new role and some public or semi-public institutions [19] are beginning to understand how vital this new role is.

The creation of structures and the acceptance of new roles is of value, but it is not enough to ensure the GDT, particularly in the public sector, considering the diversity and dispersal of services and institutions. This research's intention is to answer this issue, as we will see below (section 1.2).

1.1 Research Motivation

Meeting the increasing demands and expectations of more experienced digital users, especially younger citizens, means embracing technology to re-invent the way government does business [20]. By harnessing digital to build and deliver services, governments can transform the relationship between citizen and state.

A successful DT in the public sector context implies cultural and behavioral change, transformation to processes and mentalities, various investments such as new IT systems, and it requires strong leadership at the highest level.

Much has been done since the 2012 Government Digital Strategy, which demonstrated the potential of public service transformation by rebuilding some of the most high volume services to make them 'digital by default' [21].

Due to the need of new mentalities and strong leadership, new digital professions are now established across the public sector. Departments have become better at sharing platforms and components, code, patterns and best practice [21].

By correctly answering all these elements, governments can reap the rewards of true transformation: lower costs, improved service quality, and more satisfied citizens [20]. This is a strong foundation upon which to build.

1.2 Research Problem

DT is more than a buzzword. As stated by Daugulis [22], it became a new dimension of our daily life, either professional or personal. When it comes to the impact of digital technologies on the business

world, we have not seen anything yet. The innovations and disruptions of the past ten years have been nothing short of astonishing, but they are just the beginning of much more of what is to come [15].

As introduced above, DT presents public administrations with special challenges [9]. The new digital governance context and the multiplication of technological options raise challenges and risks for which governments must prepare. The new possibilities and the changing societal expectations that arise from them require governments to re-examine their governance approaches and strategies. Failure to do so could mean an accelerated loss of trust in government and a perception that it is out of touch with societal and technological trends [23].

DT requirements are also harder to implement in the public sector than in the private sector. The challenge is not to introduce digital technologies into public administrations; it is to integrate their use into public sector modernization efforts. Public sector capacities, workflows, business processes, operations, methodologies and frameworks need to be adapted to the rapidly evolving dynamics and relations between the stakeholders that are already enabled – and in many instances empowered – by the digital environment [23].

Despite all the progress made, most governments recognize the difficulty with the governance aspect of DT and are far from capturing the full benefits of digitalization. To do so, governments need to take their DTs deeper, beyond the provision of online services through e-government portals, into the broader business of government itself. That means looking for opportunities to improve productivity, collaboration, scale, process efficiency, and innovation [10].

McKinsey’s analysis also suggests that capturing the full potential of government digitalization could free up to \$1 trillion annually in economic value worldwide, through improved cost and operational performance. Shared services, greater collaboration and integration, improved fraud management, and productivity enhancements enable system-wide efficiencies. At a time of increasing budgetary pressures, governments at national, regional, and local levels cannot afford to miss out on those savings [10]. Dunleavy pointed that developed nations are already spending around 1 percent of the gross domestic product on government information systems (IS), and more than that at some periods and in some countries. [24].

Wasted and missed opportunities in the public sector represent a significant loss or inefficient use of taxpayers’ money and, consequently, the need for more taxes to deliver the same services.

Determining how to put in practice the GDT in the public sector is still a question with no consensual answers that urge a reply. Consulting firms have realized the opportunities and began to offer some solutions for this problem. However, it is urgent to fill in the gap of scientific research in this field as digital governance should not be left to chance. Ineffective governance creates waste and missed opportunities, making DT riskier and costlier than it needs to be [25].

Table 1.1: Problem Definition

Research Problem
Governments are not yet capable of an effective GDT for the public sector, which creates wasted and missed opportunities [10][15][23][25].

Taking into account the problem defined and all the research presented above, the purpose of this work is to analyze and identify a set of mechanisms to implement GDT in the public sector that can be applied in a simple and expeditious manner, allowing not only the validation of the model, but also its continuous improvement.

To achieve this purpose and as our leading objective, **the definition and composition of a framework that integrates the set of governance mechanisms for DT is needed, allowing an holistic and integrated coordination in the public sector.** This framework is will be presented further ahead in chapter 3, including the its specific objectives when related to the public sector, more specifically, the public administration. The necessary knowledge to compose the framework is also to be presented next, in chapter 2.

Of the different mechanisms for GDT (to be integrated by the framework), the interpretation regarding the new roles of DT and their responsibilities, more precisely the CDO role, is crucial for the correct composition of the framework. The CDO is a key sign of the growing importance of the digital revolution and its disruptions and transformations [26].

There is enough resistance based on organizational and cultural factors and with not having clear roles definitions, it makes it risky for workers to push for DT. According to the survey results conducted by the Massachusetts Institute of Technology (MIT) Sloan Management Review and Capgemini Consulting (CC), when asked about the most significant organizational barriers to DT, 28 % replied that roles and responsibilities are not clear [14].

Discussions around C-level roles are not new. In fact, there is quite a contentious issue around the CDO and CIO and plenty of diverging references on both roles [27]. However, some defend that the CDO can be considered the ultimate realization of a type of CIO. More connected to business, innovative and able to build relationships across all levels and functions of the organization.

With the extreme focus on enterprise DT, most companies today are in a state of technology flux. At the same time, IT organizations are faced with a host of tactical challenges, from defending against increasingly sophisticated cyber security threats to incorporating the proliferation of cloud computing offerings and evolving IT delivery models [28].

Taking into account all of the above, some say the role of the CIO is at risk and there are voices claiming that the chief digital officer and chief data officer are eating into the traditional scope of the CIO and putting the function at risk [29].

Although many CDO positions have already been established and the phenomenon has received significant attention from practitioners, academic research in this field is very incipient. There is still confusion about what CDOs are expected to achieve, what their responsibilities are, and how they can collaborate with their CIOs [17]. It turns out that many companies hire the CDO before completely defining the role thereof [30].

The current lack of clear responsibilities of the CDO role and profile also creates some space for eventual conflicts with the CIO when they co-exist. Because of this, this research's second objective is **to correctly define and understand the role of CDO and its responsibilities.** This clarification is urgent and required in order to prevent conflicts and misapplications from occurring.

This clarification is also seen as an objective for this thesis work, since it is essential to achieve the first objective described. The research regarding this CDO role is done in a broader (not specifically focusing on the public sector) but more in-depth way, and it is presented in chapter 4. The necessary knowledge to clarify the CDO's responsibilities is also to be presented next, in chapter 2.

1.3 Research Methodology

In this thesis, the seven Design Science guidelines [31] were taken into account. The research followed the Design Science Research Methodology (DSRM) [32] and its six activities: problem identification and motivation, definition of the objectives, design and development, demonstration, evaluation and communication.

Although the outline of this document does not directly reflect the six activities stated through its five chapters, as we will see explained below in section 1.4, the two main chapters of this thesis (tackling its two major objectives) follow DSRM in their composition, with the problem identification and motivation and objectives definition activities already tackled above.

As stated by Hever et al., DSRM is appropriate for research that seeks to extend the boundaries of human and organizational capabilities, by creating new and innovative artifacts. This methodology can also be applied to IT and digital environments in order to solve organizational problems. DSRM differs from other research paradigms because it tries to develop and reach artifacts that can be proven effective in real world scenarios [32].

1.4 Thesis Outline

As was seen above, specially in section 1.2, when describing the problem and defining the objectives of this research, two bigger related but separate subjects stood out, the first being the need to define a framework to implement GDT in the public sector, and the second being the appearance of new roles, more specifically the CDO role, as one major aspect of said framework.

Due to this reality, the work done in this thesis is divided in two main chapters, those being chapters 3 and 4, where in chapter 3 the proposed framework is described, along with all its components and specific aspects, and in chapter 4, the component of said framework regarding new roles for DT, more specifically the role of CDO, is tackled in a broader but more detailed manner.

Both these chapters start with the definition of a proposal for their corresponding objectives to be answered, chapter 3 has a section demonstrating the application of the composed framework, and both end with an evaluation of the work produced. Although both the proposal and evaluation are presented in a separated manner, one for each chapter, the conclusion of the work done in both chapters is handled jointly in a chapter Conclusion, chapter 5.

In short, this thesis is structured into the following five chapters:

- **Chapter 1: Introduction** - This chapter introduces the topics of discussion for this thesis, declaring the motivation and problem/objectives behind this research work.
- **Chapter 2: Background** - This chapter displays the state of the art regarding the scope and the necessary knowledge, frameworks, theory and technologies for achieving the proposals presented.
- **Chapter 3: A Framework (Implementing Governance of Digital Transformation in the Public Sector)** - This chapter describes a composed framework that integrates a set of governance mechanisms for DT that allow an holistic and integrated coordination in the public sector.
- **Chapter 4: Chief Digital Officer (A new role)** - This chapter identifies the responsibilities of the new CDO role in the enterprise context and articulate them with the CIO responsibilities.
- **Chapter 5: Conclusion** - This chapter presents an overview of the realized research work, its limitations and future work. It also has a section regarding the communication done.

There is also a References section at the end.

Chapter 2

Background

In this chapter, the relevant topics related to the scope of this study are brought together and discussed. The subjects introduced result from research done to some of the literature associated to this thesis' context.

As explained in section 1.4, this work has two main chapters, namely chapters 3 and 4, and the topics here presented are directly associated to each one of them, or to both. In the end of this chapter these associations will be specified for each topic introduced.

First, we start by defining and describing what digital transformation is in section 2.1, followed by small overview on the topic of governance in section 2.2, due to its connection and importance when talking about DT. Next, in section 2.3, the topic of enterprise governance of IT (also named IT governance) is introduced, with its definition in subsection 2.3.1 and related frameworks in subsection 2.3.2. Then, section 2.4 presents the two central roles regarding DT, these being the CDO and CIO, the topic of business transformation management follows in section 2.5 and in section 2.6, the COBIT 5 framework is described. Finally, section 2.7, and subsections 2.7.1 and 2.7.2 respectively, analyze two different maturity models, the COBIT 5 process assessment model, COBIT 5 PAM, and an IT governance maturity model from Smits and Hillegersberg.

All these topics have a fundamental relation with governance. In fact, as hopefully underlined by this work, even the theme of transformation is part of governance's intrinsic nature.

2.1 Digital Transformation

Nowadays, it's difficult to not come across the term DT throughout the Internet or even on a bookshelf. It is everywhere, directly or indirectly, and people and companies cannot escape it. Digital revolution is happening, and companies are encouraged (or pushed into) to transform their business. Now more than ever, digital technology plays a crucial part in corporate strategy.

Every organization, whatever the type, is investing significant resources in the development of digital capabilities to drive a sustainable future [33].

However, despite being a universal term, several definitions can be found for DT (Table 2.1):

Table 2.1: Digital Transformation Definition

Digital Transformation
DT is a specialized type of business transformation where IT plays a commanding role. In the digital age, new business opportunities emerge, and companies transform their processes, structure, strategy and culture using the power and potential of digital media and the internet [34].
DT is the use of technology to improve radically the performance or reach of companies [4].
DT is an all-encompassing phenomenon reshaping many aspects of life, far beyond mere electrification of communicative and work-related processes or expanded capacities for data storage. Rather, digital transformation permeates society through fundamental changes in dispositions, organizations, behavior, contextual relationships and interactions that go beyond the individual nation-state [7].
DT is the profound and rapid transformation of business activities, competencies, models and processes, to completely leverage the changes and opportunities of digital technologies and their impact across society in a strategic and prioritized way, with present and future permutations in mind [35].
DT is the use of new digital technologies (like analytics, embedded devices, mobile or social media) to grant major business improvements (such as creating new business models, enhancing customer experience or even stream-lining operations) [14].

DT is a massive new reality for companies and businesses to tackle. The joint MIT & CC research study [36] states that 78 % of respondents commented that achieving DT will become necessary and crucial to their organizations within the next two years; however, 63 % said that the pace in which the technology is changing in their organization is too slow [14].

2.2 Governance for Digital Transformation

Governance has a fundamental role in DT. In fact, Hoogervorst distinguishes governance from management using both origins of words. To differentiate management from governance, he accounts 'management' from an implementing, operational point of view, while using the term 'governance' in the context of enterprise change [37].

The term 'governance' originated from the Latin word *gubernare*, which means to control or to steer, in the original meaning, the steering of a ship [15][37]. Governance provides the steering wheel and guardrails to keep transformations on the wanted direction [15].

Hence there is a close relationship between governance associated with DT and enterprise governance of IT. The governance processes are crucial for driving transformation, whatever its nature.

Tannou and Westerman [25] advocate that there are three common digital governance mechanisms to specially consider: shared digital units; firm-level committees, and new digital roles. All of them should be evaluated according to the benefits and challenges expressed in Figure 2.1.

	Role in sharing and coordination	Typical benefits and challenges
Shared Digital Units	<p>Sharing is the main objective of these units. Resources with specific skills are pooled together to develop digital services for all units in the company. Some coordination also comes naturally as the units develop technology standards and implement policies governing use of their services. However, coordination of digital initiatives requires additional mechanisms.</p>	<p>Benefits: New digital skills, shared digital services, economies of scale.</p> <p>Challenges: Structure and positioning in the organization, coordination difficulties with local unit leaders, definition of the “service catalog.”</p>
Firm-Level Committees	<p>Firm-level committees aim for coordination</p> <ul style="list-style-type: none"> ▪ Steering committees: Making investment decisions, prioritizing resources, ratifying policies and standards. ▪ Innovation committees: Identifying technology-enabled opportunities, proposing rules and standards around new technologies. <p>However, some of the decisions and policies adopted by the committees may mandate sharing of resources and capabilities.</p>	<p>Benefits: Digital standards and policies, consistency across digital initiatives, resource optimization, adoption of new digital trends.</p> <p>Challenges: Additional mechanisms are often required to lead transformation or to enforce standards and policies.</p>
New Digital Roles	<p>New digital roles drive the use of shared digital resources, such as helping local units to adopt firm-level solutions or use centralized resources. These roles also coordinate across different initiatives and organizational units.</p>	<p>Benefits: Relay the digital strategy, help to enforce firm-level policies, facilitate adoption of shared capabilities by local units, facilitate cultural changes</p> <p>Challenges: Positioning in the organization, relationship with the local units, building the networks of local champions.</p>

Figure 2.1: Digital Governance Mechanisms [25].

2.3 Enterprise Governance of IT

Enterprise Governance of IT played a very important role in this research for a number of reasons: it was essential to understand the relevance of the strategy for IT in the public administration and to distinguish the strategic plan from the operational plan; it was equally instrumental in introducing the theme of governance and the various existing frameworks.

2.3.1 Definition

As we all know and experience, organizations depend more and more on IT [38]. Defined as the organizational capacity exercised by the board, executive management and IT management, to control the formulation and implementation of IT strategy and in this way ensure the fusion of business and IT [39], the concept IT governance (ITG) emerged and gained more focus due to this increasing dependency on IT. The perceived benefits of implementing ITG are numerous. Among them one can highlight: clear allocation of roles and responsibilities for IT functions, effective management of IT, increase IT control and standards, prioritization of IT initiatives, alignment between business and IT, and competitive advantage [40].

However, due to the focus on “IT” in the naming of the concept, the ITG discussion mainly remained a discussion within the IT area [41]. While many ITG implementations are still mainly an issue “within IT”, one would expect that the business would and should take a leading role here as well [39].

It is clear that business value from IT investments cannot be realized by IT, but will always be created at the business side [41]. IT-enabled investments should be treated as business programs, composed

of a collection of business and IT projects delivering all the capabilities required to create and sustain business value [39]. This situation raised the issue (that the involvement of business is crucial) and initiated a shift in the definition of ITG towards Enterprise Governance of IT (EGIT) [41]. Figure 2.2 presents the definition of EGIT.

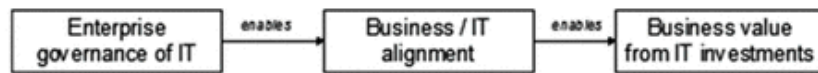


Figure 2.2: Definition of Enterprise Governance of IT [41].

The definition of EGIT means that it clearly goes beyond the IT-related responsibilities and expands towards (IT-related) business processes needed for business value creation [41].

2.3.2 Related Frameworks

Over the last years, several IT frameworks have been designed, developed, proposed, and others updated, from many sources, in order to mitigate some ITG gaps as well as improve other ITG topics. For example, the International Standard 38500 [42] or even COBIT [43]. However, no single framework or standard provides a full set of ITG tools and, collectively, they can provide a confusing picture that actually hinders the core purpose of ITG [44].

There are many IT Frameworks, but the majority is too specific for a certain domain. However, some frameworks are more complete, such as COBIT, ITIL, Capability Maturity Model (CMM) Integration for Services, or IT Capability Maturity Framework, as described by Pereira in [45].

For this thesis work, the COBIT 5 framework was selected as the main ITG (EGIT) framework. To make this choice, some arguments were taken into consideration, thought to be essential for DT:

- Value and risk management — COBIT 5 provides all the required processes and other enablers to support business value creation and risk management by using IT. COBIT builds on balanced scorecard concepts as developed by Kaplan and Norton (1996);
- Business life cycle — COBIT 5 covers all functions and processes within the enterprise. COBIT 5 does not focus only on the “IT function”, but treats information and related technologies as assets or capabilities that need examination along with other assets in the enterprise;
- Integration — COBIT 5 explains that efficient and effective implementation of governance and management of enterprise IT requires a holistic approach;
- Incorporation of principles defined in international standards related to governance — COBIT 5 makes a distinct difference between governance and management. This draws heavily on the guidance in the ISO/IEC standard on “corporate governance of IT” (ISO 38500) (ISO/IEC 2008) and general governance frameworks such as COSO. In COBIT 5, the organization of governance processes follows the evaluate-direct-monitor model (EDM) as set out in ISO 38500.

In section 2.6, the COBIT 5 framework is presented and detailed in relation to the scope of this research.

2.4 Roles in Digital Transformation

Below is a description of the most common and relevant roles associated to DT. On the one hand, an older and more common role in IT/IS management, the CIO. On the other hand, the most recent and explicitly designated DT manager, but which many companies consider to be a temporary position.

2.4.1 Chief Information Officer

The name CIO appeared at the end of the 1980s, early 1990s [46], after countless others (MIS managers, EDP Managers, IT Managers) [29], but although the name has remained the same, the fact is that the role itself has gone through continual changes and developments ever since.

According to Groysberg [47], in the mid to late 90s the CIO was a senior executive who understood not only new technologies but also how they applied to business strategy. They were able to broker the complex relationship between business leaders and the IT department and were less exclusively concerned with the technology itself and more attuned to how it could generate competitive advantage – and more focused on leadership and organizational effectiveness.

Meanwhile, another phenomenon was emerging: globalization. IT managers were faced with new challenges and had to deal with integrating and standardizing processes and platforms across multiple operating companies, group functions, and regions. Later, in 2008, as credit began to dry up, business needs shifted again. Though IT had become better aligned with the business, IT executives had to make complex decisions based on stringent analyses of return on investment. Their jobs became less about managing projects well and more about managing the right projects well. Major technology expenditures needed to be justified. A number of CIOs found themselves in over their heads; the IT function required a leader who understood the increased complexity of business and how IT strategy, business strategy, risk management, and finance interacted [47].

Questions about the future of CIOs are quite substantial. As Westerman states, CIOs who do great things in leading IT soon gain extra responsibilities. By helping business leaders to improve their businesses, the CIO becomes an obvious candidate to fill any open role that involves technology, process, or strong governance. Many of the CIO's roles are challenges that great CIOs have already mastered in their own domains. But some, such as brand synergy, are new to the CIO. Diverse companies are responding to the digital leadership challenge in different and dynamic ways [36].

2.4.2 Chief Digital Officer

Despite there being no clear guidance on how an organization should tackle the increase the power of digitalization in order to achieve sustained competitive advantage, this has not inhibited practitioners from developing their own strategies, leading to a situation where practice is ahead of research [48].

As a result, more and more companies have recently introduced an additional position at top management level, which they have called CDO. This phenomenon was first observed at MTV Networks, who hired the first CDO ever in 2005 [17]. Since then, the number of CDOs has roughly doubled each year and is estimated to reach 2,000 by the end of 2015. The CDO is one of the fastest growing C-level positions and it is a global phenomenon [19][49][27][50].

Although there is no one single definition for the CDO, many of the concepts encountered have a common base (Table 2.2):

Table 2.2: Chief Digital Officer Definition

Chief Digital Officer
CDO, a senior executive who sits at the right hand of the CEO and is seen as instrumental to the future of the organization. CDO oversees the full range of digital strategies and drive change across the organization [51].
CDOs think holistically about how a company’s strategy is executed across all digital channels. They own and drive digital strategy throughout the organization to help business unit leaders unlock value [50].
The CDO plays in the place where the enterprise meets the customer, where the revenue is generated and the mission accomplished. They’re in charge of the digital business strategy [52].
The CDO uses tech to drive innovation and transformative solutions [53].

Horlacher presented a first conceptualization of the CDO’s position, suggesting that their primary focus is on the strategic and communicational aspects of DT, and that they closely collaborate with their CIOs if both positions exist in a company. This research was based on case studies and results and shows that the role of CDOs is to proactively drive the company’s cross functional DT. They take on (1) the strategic aspects of the DT, devising and implementing digital strategies as entrepreneurs, and (2) the communicational aspects, countering cultural resistance in their companies as spokespersons and leaders. The CIOs, in turn, always focus on the technical aspects of the transformation. This implies that the roles of the CDO and CIO differ. Although their relationships are symbiotic and interdependent, their responsibilities clearly differ [17].

Complementary, Haffke identified four distinct CDO role-types: evangelist, coordinator, innovator, and advocate as described in Figure 2.3, and assessed the implications for the CIO role in the context of DT [48].

In this research, the four distinct CDO role-types are primarily determined by the CIO’s role orientation and the perceived implications of digitization.

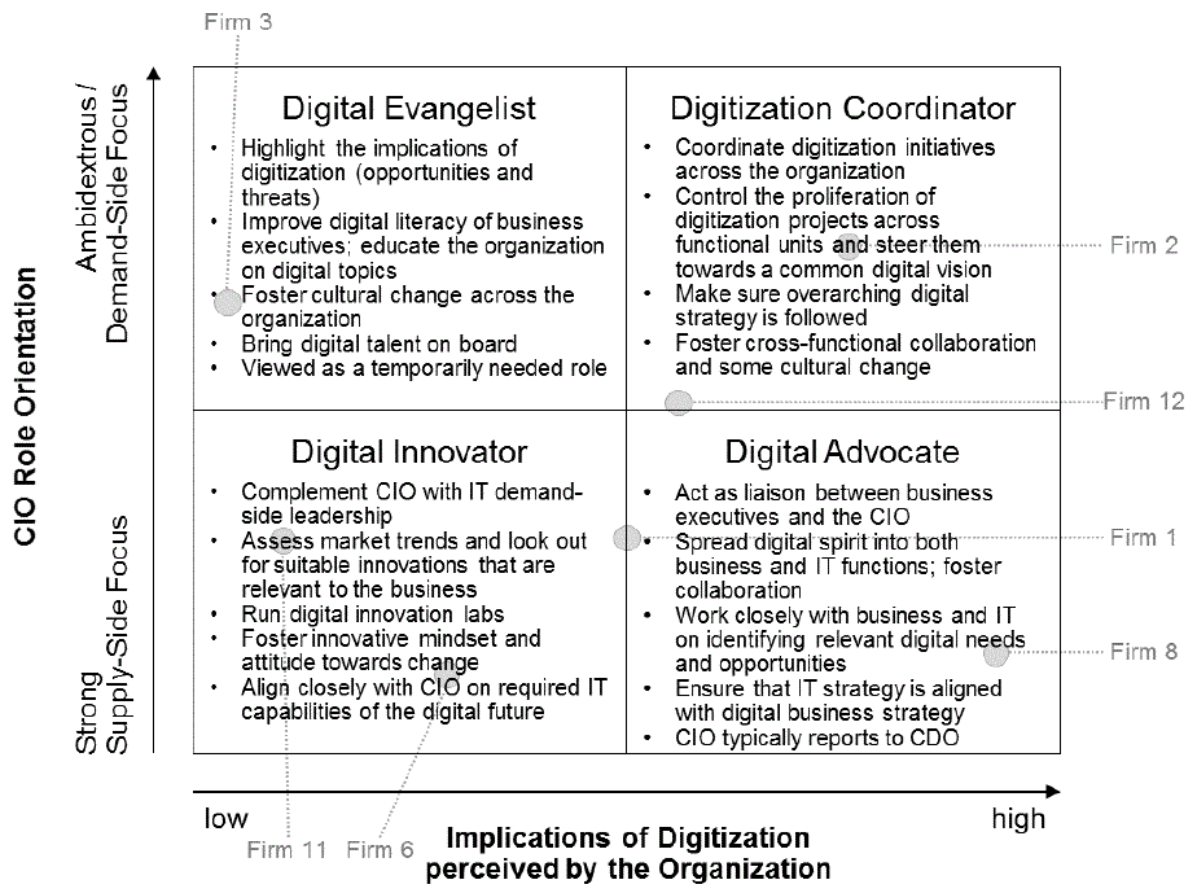


Figure 2.3: Chief Digital Officer Role-Types [48].

2.5 Business Transformation Management

As we saw while defining DT in section 2.1, DT is specialized type of business transformation. This notion easily explains the direct connection between these two topics, DT and business transformation. Business transformation is the result of important and complex changes in the organization of companies or in their relations with each other and with the economy and the society at large.

To understand how to deal with business transformation processes, in addition to governance, it is crucial to understand the management side of the transformation.

Regarding this research on how to deal with business transformation processes, we looked at the existing references in literature and found innumerable references to business transformation, but most of them were academic studies or proposals that lack the applicability benchmarking.

In order to select a methodology, we established some criteria on which we based our study. Accordingly, we looked for:

- An integrative methodology designed to articulate individual management disciplines;
- A methodology whose effectiveness has been proven in practice;
- A methodology designed to address major and complex changes;
- A recent methodology that learns from existing ones.

Based on these criteria, Business Transformation Management² (BTM²) was considered the most suitable methodology and it was clear that it already takes advantage of the application of eight existing and well-established disciplines.

Business transformation management methodology is based on a framework (see Table 2.3) that was developed by the Thought Leadership Network on the basis of case studies [54], existing models and related literature. The BTM² comprises four phases (envision, engage, transform, and optimize) and integrates specific technical and methodological expertise from various relevant areas. It also provides guidance and support for transformation projects by aggregating several management disciplines dealing with strategies, values, risks, IT transformation, programs, projects, change, processes and competences.

Table 2.3: Business Transformation Management Methodology [55].

Business Transformation Management Methodology (BTM²)							
Meta Management			<i>Orchestration of individual disciplines: Guidelines, Leadership, Culture, Values and Communication</i>				
Direction Disciplines			Enablement Disciplines				
Strategy Manag.	Value Manag.	Risk Manag.	Process Manag.	Project Manag.	IT Transformation Manag.	Organizational Change Manag.	Competence & Training Manag.

The framework structure consists of three levels: orchestration, direction and enablement. The orchestration is in charge of meta management, the direction encompasses the disciplines that determine the course to be followed, and the enablement is the level that supports the set of events.

Meta management is business-driven and value-oriented. It integrates three pillars - management disciplines, transformation life cycle and leadership - and a set of key principles: leadership, business transformation objective, culture and value, and communication and coordination, as listed in Table 2.4 for its components.

Table 2.4: Meta Management Components and Objectives [55].

Group	Components of Maturity Model	Objective
<i>Pillars</i>	Business Transformation Goal Setting	Set up the articulation with the 8 disciplines according to the direction and enablement model.
	Transformation Life Cycle	Set up the 4-phase model.
	Management Roles	Define the formal management roles and informal management roles.
<i>Principles</i>	Business Transformation Objective	Set up a Balanced Scorecard for goal definition.
	Communication and Coordination	The communication of the reasons why transformation (“why can’t we stay the same”) is needed – that is, its purpose and the main goals; Establishing a common language to ensure unambiguous interpretation of key concepts – for example, through a glossary; The communication of transformation values, principles and guidelines to create the cultural “ground” for transformation.
	Leadership	Provide vision and sense of mission, gain respect and trust; Use symbols to focus efforts, express important purposes in simple ways; Promote intelligence, rationality and careful problem-solving; Give personal attention, treat each employee individually; Live the transformation: “Walk the talk.”; Be clear in what is accepted and what is not; In conflicts, find fair solutions and avoid winners and losers.
	Culture and Values	Define values and facilitate internalization; Set up a cultural environment by skillful use of communication.

2.6 COBIT 5

COBIT 5 is the latest edition of ISACA’s globally accepted framework. It provides an end-to-end business view of EGIT, reflecting the central role of information and technology in creating value for enterprises of all sizes [56].

COBIT 5 enables IT to be governed and managed in a holistic manner for the whole enterprise, taking in the full end-to-end business and IT functional areas of responsibility, and considering the IT-related interests of internal and external stakeholders [57].

One of the guiding principles in COBIT is the distinction made between governance and management (Figure 2.4). In line with this principle, every enterprise would be expected to implement a number of governance processes and a number of management processes to provide comprehensive enterprise governance and management of IT.

When considering processes for governance and management (Figure 2.4 in the context of the enterprise), the difference between types of processes lies within the objectives of the processes:

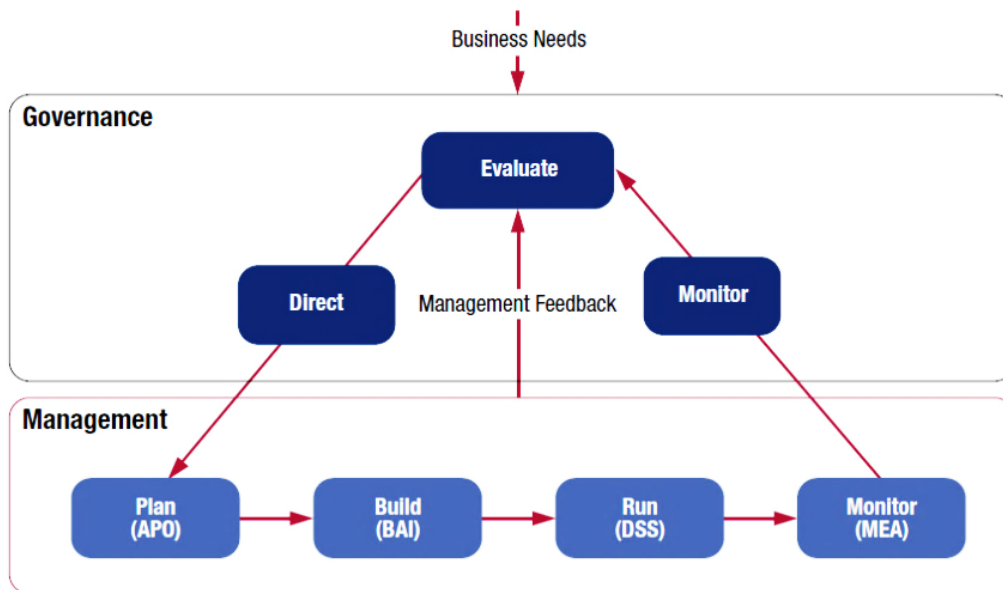


Figure 2.4: Overview of COBIT5's domains [58].

- **Governance processes** – Governance processes deal with the stakeholder governance objectives – value delivery, risk optimization and resource optimization – and include practices and activities aimed at evaluating strategic options, providing direction to IT and monitoring the outcome (EDM – in line with the ISO/IEC 38500 standard concepts).
- **Management processes** – In line with the definition of management (see COBIT 5, executive summary), practices and activities in management processes cover the responsibility areas of PBRM enterprise IT, and they have to provide end-to-end coverage of IT.

Although the outcome of both types of processes is different and intended for a different audience, internally, from the context of the process itself, all processes require ‘planning’, ‘building or implementation’, ‘execution’ and ‘monitoring’ activities within the process.

The COBIT 5 framework is built around five core principles: (1) meeting stakeholder needs; (2) covering the enterprise end-to-end; (3) applying a single, integrated framework; (4) enabling a holistic approach; and (5) separating governance from management [59].

In theory, an enterprise can organize its processes as it sees fit, as long as the basic governance and management objectives are covered. Smaller enterprises may have fewer processes; larger and more complex enterprises may have many processes, all with the same objectives.

The governance domain in COBIT 5 has five processes and within each process EDM practices are listed below, in Table 2.5.

Table 2.5: Processes for the implementation of governance in COBIT 5 [58].

Process Identifier	Identification	Description
EDM01	Ensure Governance Framework Setting and Maintenance	Analyze and articulate the requirements for the governance of enterprise IT, and put in place and maintain effective enabling structures, principles, processes and practices, with clarification of responsibilities and authority to achieve the enterprise's mission, goals and objectives.
EDM02	Ensure Benefits Delivery	Optimize the value contribution to business processes, IT services and IT assets resulting from investments made by IT at acceptable costs.
EDM03	Ensure Risk Optimization	Ensure that the enterprise's risk appetite and tolerance are understood, articulated and communicated, and that risk to enterprise value related to the use of IT is identified and managed.
EDM04	Ensure Resource Optimization	Ensure that adequate and sufficient IT-related capacities (people, process and technology) are available to effectively support the enterprise objectives at an optimal cost.
EDM05	Ensure Stakeholder Transparency	Ensure that enterprise IT performance and conformance measurement and reporting are transparent, with stakeholders approving the goals and metrics and the necessary remedial actions.

Therefore, when addressing the subject of DT, the governance layer becomes a critical element since it is responsible for the high-level conduction of the whole process.

2.7 Maturity Models

Generally speaking, a maturity model (MM) is a tool that describes and analyses the behaviours, practices and processes that enable an organization to reach reliable and sustainable results. An up-to-date relevant description of the capability level of a process enables the stakeholders to clearly identify the weaknesses and strengths of that process and prioritize the actions that should be taken in order to raise the maturity levels, thereby improving business and budget planning [60].

2.7.1 COBIT 5 PAM

Process maturity has been a core component of COBIT for more than a decade [59]. Assessment of process maturity is arguably a necessary condition for adopting EGIT practices.

In COBIT 5, process maturity has been replaced by the concept of process capability [58], based on the ISO/IEC 15504 standard. One benefit of this assessment model is the improved focus on confirming that a given process is actually achieving its purpose and delivering the required outcomes as expected [59].

The new process assessment model (PAM) uses a measurement framework that is similar in terminology to the existing maturity models in COBIT 4.1 [59]. However, while the descriptions are similar, the scales are not the same. In this new assessment model, realizing a capability level 1 is already an

important achievement for an enterprise [59]. A process at PAM level 1 means that the goals of this process are achieved; a strong message, but clearly different from the CMM initial/ad hoc level 1. In the COBIT 4.1 MM, a process could achieve a level 1 or 2 without fully achieving all the process objectives [59].

2.7.2 IT Governance Maturity Model from Smits and Hillegersberg

Smits and Hillegersberg [61] also studied ITG maturity: Developing a MM using the Delphi Method wherein the authors advocate that ITG has soft and hard components. This approach is particularly relevant due to its holistic and integrated view, and is much more aligned with the previous assessment from a high-level perspective.

The developed model takes into account other dimensions from social sciences, such as leadership, understanding, and trust. It encompasses three dimensions (Table 2.6) and within each dimension it is associated to existing frameworks followed by the analysis of practitioner’s groups in Group Decision Support System format.

Table 2.6: IT governance model foundation [61].

Governance	Domain	Focus Area
Soft	Behavior	Continuous improvement
		Leadership
	Collaboration	Participation
		Understanding and trust
Hard	Structure	Functions and roles
		Formal networks
	Process	IT decision-making
		Planning
		Monitoring
Context	Internal	Culture
		Informal Organization
	External	Sector

The dimensions were denominated: soft, hard and context, respectively related to human characteristics, processes characteristics and enterprise characteristics.

In their study, the authors concluded that participants defined different needs for the required MM for hard and soft governance. In their study, the CMM was selected for the hard governance based on the arguments that the five-level ranking system introduced for CMM is often used for maturity models.

However, these arguments also apply to COBIT 5, since it uses the international standard ISO/IEC 15504. For soft governance, it was considered less appropriate and in line with the suggestion by several researchers that CMM does not effectively deal with the social aspects of organizations. Soft governance needs different maturity models for each focus area. This requirement can be fulfilled by designing a MM focus area. The context can be seen as the situational part of the maturity model.

Their study also referred that research from Uehara showed that the Soft power theory could be applied to COBIT, more specific to the COBIT processes.

2.8 Summary

The theory, knowledge and work presented in this section is directly related to the work done in the two following chapters, chapters 3 and 4. The topics here displayed and their relationships with the two next chapters is described in Table 2.7:

Table 2.7: Background Summary

Background Section	Knowledge used in
Digital Transformation	Chapters 3 and 4
Governance	Chapters 3 and 4
Enterprise Governance of IT	Chapter 3
Roles in Digital Transformation	Chapter 4
Business Transformation Management	Chapter 3
COBIT 5	Chapters 3 and 4
Maturity Models	Chapter 3

Chapter 3

A Framework

Implementing Governance of Digital Transformation in the Public Sector

3.1 Context

This section intends to summarize what was said so far regarding the need for a framework for GDT, and what is the intention besides the work done in chapter 3 altogether.

Technology and Information management presents a huge challenge that includes a dual approach: the objective (evolutionary leap) and the conditions to achieve it (resources, knowledge, capacities, etc.), and the growing complexity of these dimensions makes this challenge unmanageable without the support of specific tools.

It was precisely with this problem in mind that EGIT sought to define and articulate the processes and structures of the organization.

However, the pace of evolution and disruption has increased and we have witnessed a much more complex and profound digital revolution called DT. It is important, therefore, to understand this new wave, the meaning of DT, GDT and how to get there based on the existing EGIT reality.

In the public sector, where in very few cases there is a clear vision of how to conduct the process, this issue has a particular relevance since it involves large investments and the creation of transversal services resulting from activities and articulation between institutions.

3.1.1 Research Focus

The work done in this chapter realizes the solution for the identified objective of **defining and composing a framework that integrates the set of governance mechanisms for DT, allowing an holistic and integrated coordination in the public sector**. The proposal presented will use various knowledge,

such as the BTM² framework, COBIT5 and its maturity model, COBIT 5 PAM, the MIT&CC research and other theory depicted in chapter 2.

3.2 Proposal

In 2014, OECD recommended that governments develop and implement digital government strategies [23].

This recommendation was an important milestone in raising awareness of the need for governments to adopt a digital strategy. However, this recommendation lists a set of guidelines but does not define which governance mechanisms should be implemented.

This proposal intends to fill this void and present a framework for GDT in the public sector.

3.2.1 Requirements

Taking into account the diversity and complexity of institutions and organizations in public administration, the requirements on which our proposal is based are:

1. To be based on familiar concepts and existing practices;
2. Relate to existing standards;
3. It should not represent an administrative burden;
4. Must incorporate recent and recognized studies on digital transformation;
5. It should be comprehensive;
6. It should be simple to implement.

It can be argued that these requirements/assumptions are valid for any context and we can not fail to recognize the validity of the argument. However, in the public sector they carry a much greater weight than in any other context, because our solution is not for a company, but for a vast array of entities, of a different nature, supported by public money and often competing in a political arena. Therefore, if the proposal does not take these aspects into account, their added value may not be sufficient for the feasibility of their implementation.

In addition, it is important to note the scope of this study. By governance, we mean the direction of the general policy of organization, culture and strategy. It does not include the management dimension as so many related frameworks when they are designated as governance structures.

The purpose of the proposed artifact is to provide a solution to:

- The activities to be carried out regarding governance and identifying the respective results of these activities - processes and MM;
- The types of governance structures - collaborative structures that foster innovation;

- Assessment of integrated and holistic management capacity - MM of meta-management;
- Definition of the responsibilities associated with the new roles for conducting DT - responsibilities of the CDO role;

These four aspects translate as components of the framework like shown in Figure 3.1.

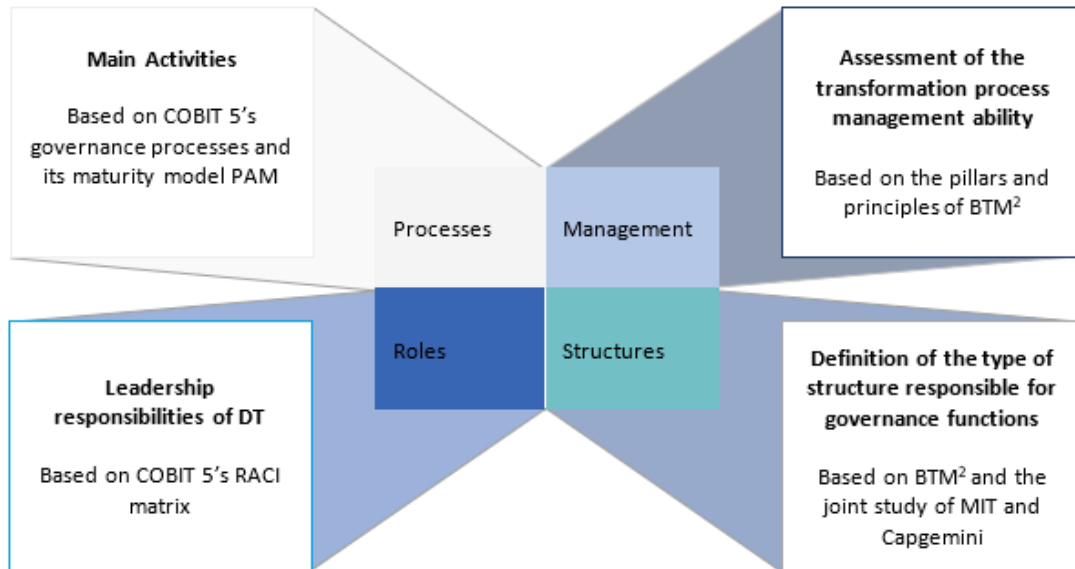


Figure 3.1: Components of the Framework for Governance of Digital Transformation

3.2.2 Design

The application of the requirements defined and principles listed above (subsection 3.2.1) into the design of the artifact was based on the following reasoning:

1. The solution should be based on familiar concepts and existent practices.

As described in the Background chapter, governance is not a new concept. In fact, in the IS/IT field, governance is a common and widely used concept. There are several frameworks, as pointed by Pereira [45] but the majority is too specific for a certain domain. However, some frameworks are more complete than others, as we saw already, such as COBIT, ITIL, Capability Maturity Model Integration for Services (CMMI SVC), or IT Capability Maturity Framework (IT-CMF).

From this list, COBIT 5 was selected as it is the only one that makes a clear distinction between governance and management and while the entire framework being completely structured around the separation of these two fundamental dimensions.

In addition, COBIT 5 is one of the best known and adopted frameworks in the world [62].

2. The solution should be related to existing standards.

Using solutions based on standards in the public sector provides the necessary maturity and sustainability for such a complex and dispersed environment as public administrations. In fact, public administration is known to be deeply resistant to changes due to its nature: political influence,

heavy administrative and bureaucratic culture and too many informal powers. The situation may vary from country to country but these are common patterns in all public administrations.

The option to use COBIT 5 for our proposal was very much influenced by the fact that it incorporates the principles [59] defined in international standards related to governance:

- Value and risk management - COBIT 5 provides all the required processes and other enablers to support business value creation and risk management by using IT. COBIT builds on balanced scorecard concepts as developed by Kaplan and Norton (1996) - principle 1;
- Business life cycle - COBIT 5 covers all functions and processes within the enterprise. COBIT 5 does not focus only on the “IT function”, but treats information and related technologies as assets or capabilities that need examination along with other assets in the enterprise – principle 2;
- Integration - COBIT 5 explains that efficient and effective implementation of governance and management of enterprise IT requires a holistic approach – principle 4;
- Incorporation of principles defined in international standards related to governance - COBIT 5 makes a distinct difference between governance and management. This draws heavily on the guidance in the ISO/IEC standard on “Corporate Governance of IT” (ISO 38500) (ISO/IEC 2008) and general governance frameworks such as COSO. In COBIT 5, the organization of governance processes follows the EDM model as set out in ISO 38500 - principle 5.

3. The solution should not represent an administrative burden.

Regarding this objective, we followed two guidelines: (1) the reuse of existing practices and (2) the degree of familiarity with them. Both arguments influenced us to look for references in ITG practices that are currently in use in public institutions. As mentioned in the previous point, COBIT is among the most common implemented frameworks together with ITIL and CMMI.

4. The solution should incorporate recent and recognized studies on DT.

Tanoou and Westerman showed that governance is a key determinant of success in managing DT and in their study, they identified three mechanisms for implementing GDT [25][15]: shared units, governance committees and digital leadership roles. Respective goals, benefits and challenges are described in order to allow the most appropriate choice for each specific case. Due to their relevance, these mechanisms are also incorporated in our artifact.

5. The solution should be comprehensive.

As stated by Uhl and Gollenia, despite the plethora of books, cases and how-to manuals, the transformation process remains a body of failure. Among the reasons why this is the case, 2 factors stand out: the transformation process addresses the future and always involves people, and so, issues of personality, attitude, ability to change and political behaviour emerge and these are, by their nature, very difficult to predict and control [55]. Hence an holistic approach is fundamental. For that reason, our governance framework is based on the three dimensions for governance indicated in the study of Smits and Hillegersberg: soft, hard and context [61].

6. The solution should be simple to implement.

Simplicity is a key issue in the public sector, where change is deeply influenced by internal and external factors, including, among others: bureaucratic protectiveness, existing laws and regulations, political interference, privacy concerns, obsolete technologies and infrastructures unsuited for the adoption of high-level technologies [63].

Thus, the designed proposal intends to bring mechanisms easy to relate with and easy to understand. The familiarity dimension expressed in the first point is directly and closely related to the simplicity of the solution.

By framing all the principles and the associated components, we obtain the framework, our artifact, described in Table 3.1.

Table 3.1: Proposed Framework for Governance of Digital Transformation.

Governance	Domain	Focus Area	Implementation	Main Input
Soft	Behaviour	Continuous improvement	Innovation committees	MIT&CC research
		Leadership	Steering committees	MIT&CC research and BTM ²
	Collaboration	Participation	Maturity assessment	BTM ² and MIT&CC
		Understanding and trust	Maturity assessment	BTM ² and MIT&CC
Hard	Structure	Functions and roles	New digital roles	COBIT 5 and Horlacher & Hess
		Formal networks	Share digital units	MIT&CC research
	Process	Digital/IT decision-making	Ensure governance framework setting and maintenance; Ensure benefits delivery; Ensure risk optimization; Ensure resource optimization; Ensure stakeholder transparency;	COBIT 5 and PAM
		Planning		
Monitoring				
Context	Internal	Culture	Culture and values - level 1 in Maturity assessment	BTM ² and MIT&CC
		Informal Organization	Culture, values and leadership principles - level 1 in Maturity assessment	BTM ² and MIT&CC
	External	Sector	Innovation committees and advisory board feedback	MIT&CC research and BTM ²

The joint study and research conducted by MIT & CC referenced both in Figure 3.1 and Table 3.1 [4] presents relevant contributions in describing essential pieces in the governance structure:

- Innovation committees;
- The executive committees;
- The shared digital drives.

The way these pieces articulate can and should differ according to the organization and with the strategies defined by each organization.

Thus, in structuring the developed components (Figure 3.1) around the three dimensions of governance indicated by the authors Smits and Hillegersberg, the aim is to ensure an integrated and holistic vision in the implementation of governance, that is, to seek a practical benchmark for conducting DT.

3.3 Demonstration

As explained in the previous section, the proposed artifact is a framework for GDT in the strict sense of the term. That is, the proposal does not cover the aspects related to the management of DT and its design was based on the distinction between governance and management found in COBIT 5, which, in turn, is based on the principles of the international standard ISO/IEC 38500. The proposed framework incorporates four components referred to in Figure 3.1 that are translated to a simplified language and identified in Figure 3.2.

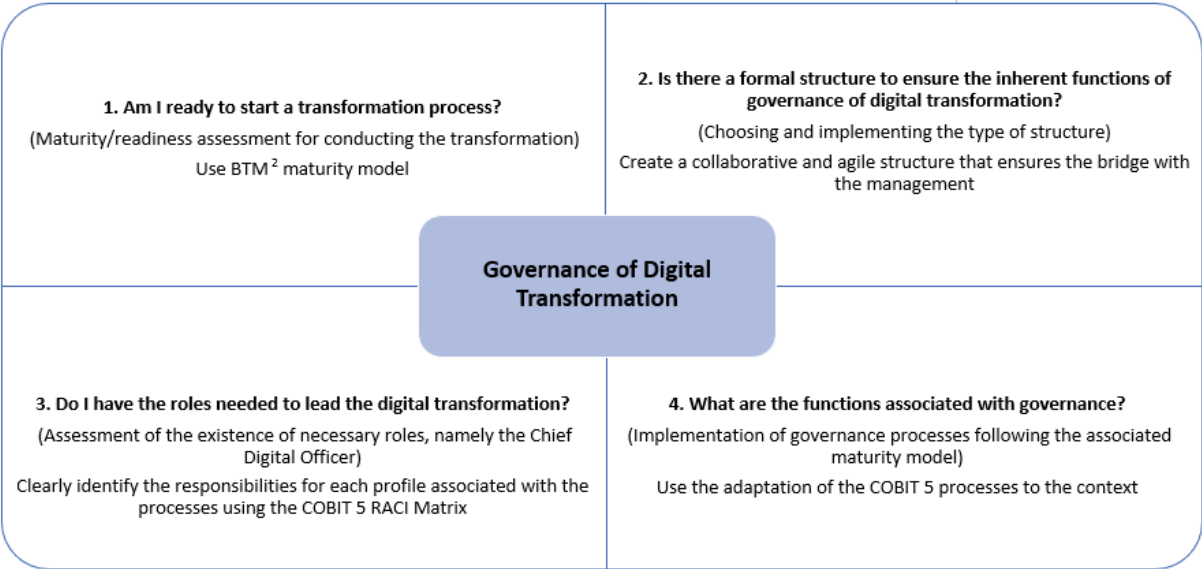


Figure 3.2: Questions associated to the framework components for Governance of Digital Transformation.

Each of the four components corresponds to the following:

- **BTM² Maturity Model** - (Figure 3.3) [64] based on the meta management layer described in section 2.5. It is an instrument of awareness and to gauge the extent to which the conditions for conducting a process of transformation are met. The same instrument also serves to support the identification of the degree of sophistication wanted to be achieved by conducting the transformation.

	Business Transformation Goal Setting	Transformation Life Cycle	Management Roles	Business Transformation Objectives Management	Communication and Coordination	Leadership	Culture and Values
Maturity Levels							
Nivel 0							
Nivel 1							
Nivel 2							
Nivel 3							
Nivel 4							
Nivel 5							

Figure 3.3: Assessment of the conditions for moving forward with Digital Transformation.

- **Governance structure** - (Figure 3.4). Considering that the structure is intended to be in the scope of public administration, the proposal presents a possibility analyzed in the article [65]. The artifact aims to achieve the following objectives: (1) be a collaborative system; (2) incorporate a core dedicated to innovation through the innovation committee; (3) rely on feedback from experts on the subject through the advisory committee; (4) ensure articulation with the management layer, namely at the level of associated programs and projects. Other configurations may also make sense since the final choice should take into account the culture and values of each country and each political and social-economic context. This type of governance structure ensures a collaborative decision model that will make all the difference in the public sector, in particular due to the increasing number of cross-sectional projects that involve several public entities. Moreover, this type of structure will enforce shared responsibility, which is fundamental for the success of DT.

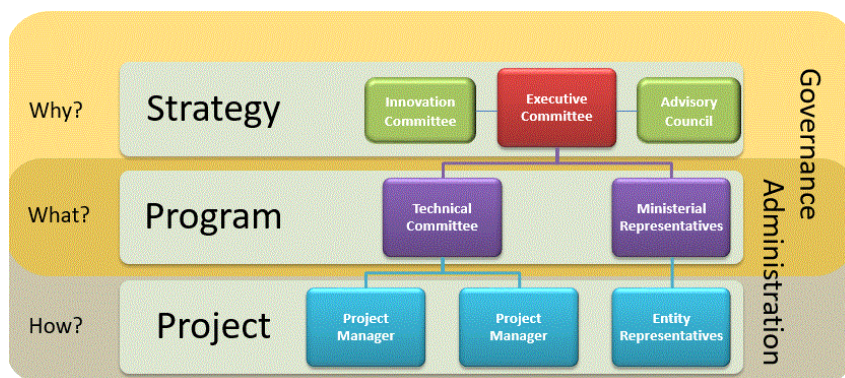


Figure 3.4: Proposal of a Governance Structure for Digital Transformation in Public Administration.

- **Roles needed for GDT** - New profiles associated with GDT have emerged in recent times. One of the most known and controversial is the CDO role, which is not always accepted or understood in organizations, especially in those where the CIO also exists. In order to better understand the CDO and CIO roles when they coexist in a particular organization, we have studied and analyzed their responsibilities in the context of governance processes using the COBIT RACI matrix 5. As explained before, this is the research work done presented in chapter 4, where a more in-depth study regarding these roles is done.
- **Governance processes** - Although the word governance is employed in many domains and with different goals and meanings, the strict sense of the term was the focus here. In this sense, what was intended to be studied and proposed is exactly which are the activities and procedures that are associated with the implementation of governance mechanisms. As explained in subsection 3.2.2, we used the COBIT 5 processes (Figure 3.5) that can and should be adapted to the context of DT. Moreover, when using this benchmark, the MM of COBIT 5, COBIT 5 PAM, can also be applied to allow a programmed and phased implementation.

	Main Objectives	Outcomes
EDM01: Ensure Governance Framework Setting and Maintenance	The strategic decision-making model for DT is effective and efficient and is aligned with the internal and external environment of the Public Administration and the stakeholder requirements; The governance system for DT is implemented in the Public Administration; Evidence exists that the governance system for DT is effectively operationalized;	1. GDT principles; 2. Decision-making model; 3. Authority Levels; 4. GDT communications; 5. Rewards system approach; 6. Feedback on governance's effectiveness and performance.
EDM02: Ensure Benefits Delivery	The Public Administration obtains the best value from its portfolio of initiatives approved for DT, as well as the associated services and assets; The ideal value is derived from DT's investment through efficient value management practices in the Public Administration; The specific investments in DT contribute to the optimization of the value achieved.	1. Evaluation of strategic alignment; 2. Evaluation of investment and portfolios; 3. Investment types and criteria; 4. Requirements for stage-gate reviews; 5. Feedback on portfolio and program performance; 6. Actions to improve value deliver.
EDM03: Ensure Risk Optimization	The risk thresholds are defined and communicated, and the critical risk associated to the DT is known; The Public Administration manages the critical risks related to the DT effectively and efficiently; The identified risk thresholds are not exceeded, and the impact of the DT risk is evaluated and managed.	1. Risk appetite guidance; 2. Approved risk tolerance levels; 3. Evaluation of risk management activities; 4. Risk management policies; 5. Key objectives to be monitored for risk management; 6. Approved process for measuring risk management; 7. Remedial actions to address risk management deviations; 8. Risk management issues for the Government.
EDM04: Ensure Resource Optimization	The resources required for Public Administration are used optimally; Resources are allocated to better meet Public Administration priorities within budgetary constraints; The optimal use of resources is achieved throughout their entire economic cycles.	1. Guiding principles for allocation of resources and capabilities; 2. Guiding principles for system architecture; 3. Approved resources plan; 4. Communication of resource strategies; 5. Assigned responsibilities for resource management; 6. Principles for safeguarding resources; 7. Feedback on allocation and effectiveness of resources and capabilities; 8. Remedial actions to address resource management deviations.
EDM05: Ensure Stakeholder Transparency	Reports to interested parties are in accordance with the requirements; The report is complete, timely and concise; Communication is efficient and the stakeholders are satisfied.	1. Evaluation of system reporting requirements; 2. Reporting and communication principles; 3. Rules for validating and approving mandatory reports; 4. Escalation guidelines; 5. Assessment of reporting effectiveness.

Figure 3.5: Governance Processes and Results.

The articulation plan between these four components is not rigid, however, we describe a sequence of steps (Figure 3.6) that interconnects the components and results in the application of the GDT framework.

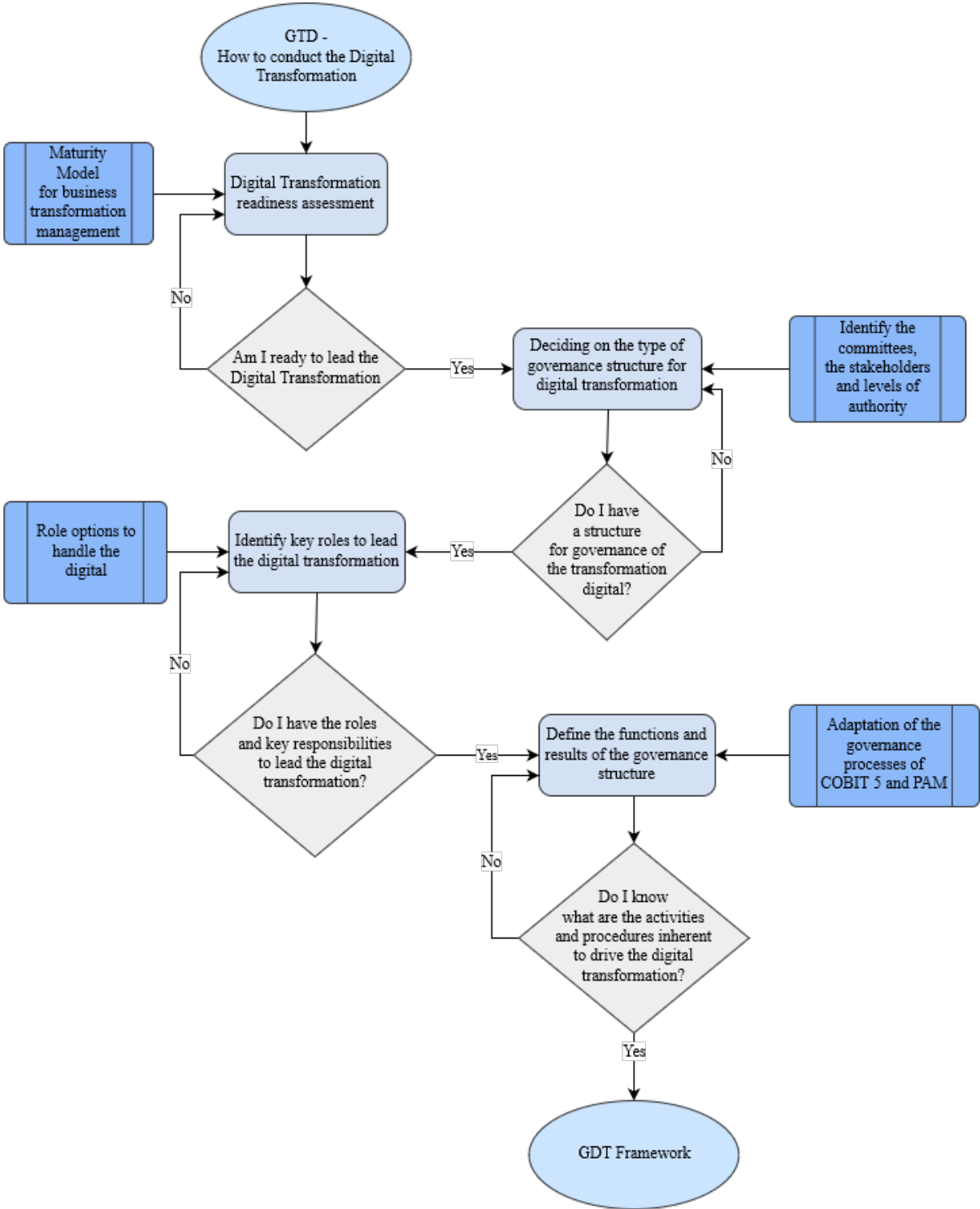


Figure 3.6: Articulation of the framework components for Governance of Digital Transformation.

3.4 Evaluation

The proposed artifact is the result of an iterative investigation process and its components have been subjected in an evolutionary way to complete cycles of investigation in accordance with the DSRM methodology.

For the purpose of measuring applicability as well as evaluating the artifact, the choice was made in the context of electronic contracting, which is undergoing major changes in the European Union.

The current legal framework [66] mandates the mandatory implementation of three phases of the electronic contraction - announcement, access to documentary submissions and submission of proposal - in all EU member states by October 2018. The level of development in this field is very heterogeneous, varying substantially from country to country.

However, the development of this public activity goes far beyond the mere digitization of services. In many cases, there have been extraordinary cases of profound organizational, procedural and even new realities, clearly entering the field of DT of the public sector.

With the possibility of contacting representatives from several countries and working groups in the field of electronic contracting, we tried to identify the cases in which there could be a more structured system of governance.

The case of Finland has immediately highlighted how it is of interest to analyze the components that respect the governance processes and their degree of implementation, since it is a country where the governance theme is of particular importance and the level of institutional trust is atypically high.

Therefore, a representative was requested to fill out a questionnaire to assess the level of implementation of governance processes according to the MM of COBIT 5 - COBIT 5 PAM; on the other hand, some complementary questions were also included to better understand the implemented solution and the results of the maturity evaluation.

The final evaluation presented by the perspective of a specialist respondent Finland regarding the implementation of processes and governance is summarized in Figure 3.7.

Evaluation		Level 1 of COBIT 5 PAM - Execution			
COBIT 5 Ref.	Governance Processes – Evaluation, Direction and Monitorization	Not reached (0-15%)	Partially reached (15-50%)	Widely reached (50-85%)	Completely reached (85%-100%)
EDM01	Ensure Governance Framework Setting and Maintenance			X	
EDM02	Ensure Benefits Delivery			X	
EDM03	Ensure Risk Optimization		X		
EDM04	Ensure Resource Optimization		X		
EDM05	Ensure Stakeholder Transparency			X	

Figure 3.7: Evaluation of governance processes from the perspective of a specialist respondent on Finland.

In this case, the exercise allowed not only to identify the maturity in the implementation of the governance processes, but also allowed to create an awakening for what could still be done in this field, being considered by the respondent a reference for the improvement of the current situation.

In the case of the MM component to gauge the degree of preparation for conducting the DT - maturity of meta-management in conducting the transformation [64] - it was decided to carry opinion studies based on interviews with senior specialists [67].

The studies were carried out in four institutions linked to electronic public contracting (one private and three public) in Portugal, generally having a very positive assessment, and above all, the respondents indicated that the use of these MMs allows better driving and management of the transformation itself, seeing a 31% increase in the expected success rate with this type of tool [64].

In the case of the component of the new roles linked to DT, the evaluation method followed an identical format [67], but this will be also explained in more detail in chapter 4, where the role of CDO is studied in a broader but more in-depth setting, as explained before.

In short, the components of the proposed framework, despite having been evaluated/tested at different times and in different contexts, have had a positive evaluation by experts and a high degree of acceptance by the community involved in DT, particularly in the context of e-procurement, which leads to the conclusion that there is a basis for furthering this kind of research.

Chapter 4

Chief Digital Officer

A New Role for COBIT 5

4.1 Context

Equally to section 3.1, this section intends to summarize what was said so far regarding the new role CDO, and what is the intention besides the work done in chapter 4.

Due to the demand of organizations to assign and spread managerial responsibilities adequately across top managers to ensure a successful DT, a need for new roles has emerged, among which the CDO. As studied by Horlacher and Hess [17], this CDO role does not replace any previously existing roles, but rather collaborate closely and have a symbiotic and interdependent relationship with the known CIO.

However, the ambiguity and contention that surrounds the definition of the CDO is a problem needing to be solved. In particular, the controversy between both roles, of the CDO and CIO, leads to internal difficulties in the organization of a company, with an obvious impact on their ability to adapt to an increasingly unpredictable and demanding world.

In this chapter, after understanding the importance of correctly defining the role of the CDO, not only for our framework (presented in chapter 3), but also for the correct application of GDT, we analyzed the differences between these two roles, CDO and CIO, and, based on COBIT 5, drew a new vision of the responsibilities associated thereto.

This research is in line with Horlacher's previous studies [68] and shows that the CDO's primary responsibilities are those related to ensuring value optimization and stakeholder communication.

4.1.1 Research Focus

The work done in this chapter realizes the solution for the identified objective of **correctly defining and understanding the role of CDO and its responsibilities**. The proposal intends to identify the

responsibilities of the CDO role in the enterprise context and articulate them with the CIO responsibilities using the RACI matrix from COBIT5 benefiting from the fact that is the only governance framework based in international governance standards (ISO/IEC 38500) and with a clear distinction between governance and management.

4.2 Proposal

Now that DT is sure to reach every organization, it's important to note that governance is essential for a successful DT [25]. As proposed by Hoogervorst, to differentiate between management and governance, he associates governance to the context of change or transformation. Thus, governance guides developments that lead to a new (or partly new) organization that needs to be managed [37].

As explained, in this chapter we propose a set of responsibilities for the emerging CDO's role for GDT and adjust the CIO's responsibilities in the new context. Our proposal is also based on two fundamental principles: simplicity and ease of use. Due to that, it was relevant to use well known and extensively accept frameworks. This will be possible by using the RACI matrix from COBIT 5.

To identify the responsibilities of the CDO and CIO within the enterprise context, we use the reference RACI matrix from COBIT that already identifies those responsibilities for the CIO in the 37 processes that comprise its last version. COBIT 5 describes the responsibilities associated to the key practices that make up each process as a RACI matrix.

In these matrices, responsibilities (A-accountable, R-responsible, C-consulted and I-informed) are distributed into 26 key roles in the context of enterprises, which in turn are grouped into two major groups: general (17 business related) and specific (9 IT related).

As we saw in chapter 2 and related sections, the COBIT 5 framework can be considered to be in line with the GDT since COBIT was designed for ITG. Moreover, COBIT makes a very pragmatic distinction between governance processes and management processes – a positive aspect in change/transformation and, more specifically, in DT.

Considering the concept of CDO as the manager of DT, then we can consider that its role should be grounded on the governance area. Governance provides direction. This induced us into the vision to the role of CDO as a bridge between IT and the business (Figure 4.1).

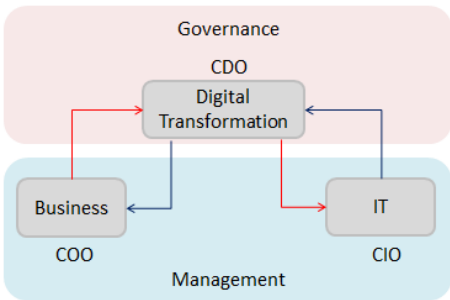


Figure 4.1: The CDO as the bridge between IT and Business.

Our research focuses on the reassessment of the CIO's responsibilities should the new role of the CDO be introduced in the organizational context.

Given the premise that derives from the concept of governance, the functional area that manages change and transformation, and considering that the CDO's role is, by definition, DT management, only the governance processes under the framework have been studied:

- Ensure Governance Framework Setting and Maintenance
- Ensure Benefits Delivery
- Ensure Risk Optimization
- Ensure Resource Optimization
- Ensure Stakeholder Transparency

The responsibilities associated to each key practice of the five governance processes are described in Figure 4.2, the focus falling on those currently assigned to the CIO.

Governance Processes	Board	Chief Executive Officer	Chief Financial Officer	Chief Operating Officer	Business Executives	Business Process Owners	Strategy Executive Committee	Steering (Programs/Projects) Committee	Project Management Officer	Value Management Officer	Chief Risk Officer	Chief Information Security Officer	Architecture Board	Enterprise Risk Committee	Head Human Resources	Compliance	Audit	Chief Information Officer	Head Architect	Head Development	Head IT Operations	Head IT Administration	Service Manager	Information Security Manager	Business Continuity Manager	Privacy Officer		
EDM01: Ensure Governance Framework Setting and Maintenance																												
Evaluate the governance system	A	R	C	C	R	R				C	C	C	C	C	C	C	C	R	C	C	C							
Direct the governance system	A	R	C	C	R	I	R	I	I	I	C	I	I	I	I	I	C	C	R	C	I	I	I	I	I	I	I	
Monitor the governance system	A	R	C	C	R	I	R	I	I	I	C	I	I	I	I	I	C	C	R	C	I	I	I	I	I	I	I	
EDM02: Ensure Benefits Delivery																												
Evaluate value optimization	A	R	R	C	R	R				C	C	C	C	C	C	C	C	R	C	C	C							
Direct value optimization	A	R	R	C	R	I	R	I	I	I	I	I	I	I	I	I	I	R	C	I	I	I	I	I	I	I	I	
Monitor value optimization	A	R	R	C	R	R				R	C	C	C	C	C	C	C	R	C	C	C							
EDM03: Ensure Risk Optimization																												
Evaluate risk management	A	R	C	C	R	C	R			I	R	C	I	C	C	C	C	R	C								C	
Direct risk management	A	R	C	C	R	C	R	I	I	I	R	I	I	I	I	I	I	C	C	R	C	I	I	I	I	I	I	
Monitor risk management	A	R	C	C	R	C	R	I	I	I	R	R	I	I	I	I	I	C	C	R	C	I	I	I	I	I	C	
EDM04: Ensure Resource Optimization																												
Evaluate resource management	A	R	C	C	R	R				I	C	C	C	C	C	C	C	R	C	C	C							
Direct resource management	A	R	C	C	R	I	R	I	I	I	I	I	I	I	I	I	I	I	R	C	I	I	I	I	I	I	I	
Monitor resource management	A	R	C	C	R	I	R	I	I	I	I	I	I	I	I	I	I	C	C	R	C	I	I	I	I	I	I	
EDM05: Ensure Stakeholder Transparency																												
Evaluate stakeholder reporting requirements	A	R	C	C	C	I												C	C	R	I							
Direct stakeholder communication and reporting	A	R	C	C	C	I												C	C	R	I							
Monitor stakeholder communication	A	R	C	C	C	I												C	C	R	I							

Figure 4.2: RACI matrix for governance processes in COBIT 5 [58].

Note that in these five processes the same responsibilities were also assigned to the CEO. In the case of business executives, strategy (program/project) committee, the responsibilities are also the same, except for the last process “Ensure Stakeholder Transparency”. It is equally important to note that only the board is accountable in either of these processes.

With the introduction of the new CDO's role, the new proposed distribution is as shown in Figure 4.3.

	Board	Chief Executive Officer	Chief Financial Officer	Chief Operating Officer	Business Executives	Business Process Owners	Strategy Executive Committee	Steering (Programs/Projects) Committee	Project Management Officer	Value Management Officer	Chief Risk Officer	Chief Information Security Officer	Architecture Board	Enterprise Risk Committee	Head Human Resources	Compliance	Audit	Chief Digital Officer	Chief Information Officer	Head Architect	Head Development	Head IT Operations	Head IT Administration	Service Manager	Information Security Manager	Business Continuity Manager	Privacy Officer	
Governance Processes																												
EDM01: Ensure Governance Framework Setting and Maintenance																												
Evaluate the governance system	A	R	C	C	R	R				C	C	C	C	C	C	C	C	R	C	C	C	C						
Direct the governance system	A	R	C	C	R	I	R	I	I	C	I	I	I	I	I	C	C	R	C	C	C	I	I	I	I	I	I	I
Monitor the governance system	A	R	C	C	R	I	R	I	I	C	I	I	I	I	I	C	C	R	C	C	C	I	I	I	I	I	I	I
EDM02: Ensure Benefits Delivery																												
Evaluate value optimization	A	R	R	C	R	R	R			C	C	C	C	C	C	C	C	R	R	C	C	C						
Direct value optimization	A	R	R	C	R	I	R	I	I	I	I	I	I	I	I	I	I	R	C	C	I	I	I	I	I	I	I	I
Monitor value optimization	A	R	R	C	R	R	R			R	C	C	C	C	C	C	C	R	C	C	C	C						
EDM03: Ensure Risk Optimization																												
Evaluate risk management	A	R	C	C	R	C	R			I	R	C		I	C	C	C	R	R	C								C
Direct risk management	A	R	C	C	R	C	R	I	I	I	R	I	I	I	C	C	C	R	C	C	I	I	I	I	I	I	I	I
Monitor risk management	A	R	C	C	R	C	R	I	I	I	R	R	I	I	C	C	C	R	R	C	I	I	I	I	I	I	I	C
EDM04: Ensure Resource Optimization																												
Evaluate resource management	A	R	C	C	R	R	R			I	C	C	C	C	C	C	C	R	R	C	C	C						
Direct resource management	A	R	C	C	R	I	R	I	I	I	I	I	I	I	I	I	I	R	R	C	I	I	I	I	I	I	I	I
Monitor resource management	A	R	C	C	R	I	R	I	I	I	C	C	C	C	C	C	C	R	R	C	C	C	I	I	I	I	I	I
EDM05: Ensure Stakeholder Transparency																												
Evaluate stakeholder reporting requirements	A	R	C	C	C	I											C	C	R	C	I			I				
Direct stakeholder communication and reporting	A	R	C	C	C	I											C	C	R	I	I			I				
Monitor stakeholder communication	A	R	C	C	C	I											C	C	R	I	I			I				

Figure 4.3: Proposed RACI matrix for CDO role.

Our proposal is based on the following basic vectors:

- CDO will be responsible for the governance processes;
- The responsibilities of the process “ensure resource optimization” will be shared by the CDO and the CIO due to the direct link with the infrastructure’s management responsibilities of the CIO;
- Both roles are responsible for evaluating the benefits since this activity requires both perspectives from business and from deep IT knowledge.
- Both roles share the responsibility of evaluating and monitoring the risk management owing to the wide spread of the risk’s source;
- Although the CIO is no longer responsible in all remaining activities, it should be consulted except for the directing and monitoring the stakeholders’ communication for two reasons: this is a CDO core activity and the CIO shouldn’t waste his efforts on the same practices and be able to concentrate on his core activities also.

With this proposal, we have a stronger responsibility of the CDO on the three processes “Ensure Governance Framework Setting and Maintenance”, “Ensure Benefits Delivery” and “Ensure Stakeholder Transparency”, and a shared responsibility with the CIO on the remaining two processes: “Ensure Risk Optimization” and “Ensure Resource Optimization”.

4.3 Evaluation

Given the controversy of this topic, the choice of the proposal assessment has fallen on the use of “User Opinion Study” [67]. Not only did we want to obtain a proposal assessment, but also to understand how the community closest to the topic sees both roles, that of the CDO and CIO.

Fifteen people replied to the questionnaire, all senior professionals in their line of work, with an average career span of about 22 years. Nationality-wise, 13 are Portuguese, 1 is Brazilian and 1 is Dutch. It should be added that in the Portuguese group, 3 respondents work abroad, in several countries at the same time. The activities of the respondent group are also of a mixed type: public service (5) and private institutions (10). In terms of area of activity/functions, the respondents’ composition is broken down in CEO – 4, Digital – 3, Academic – 3, ICT – 5.

The questionnaire was designed to be self-explanatory and structured into 5 sections: respondent’s characteristics; views on the topic; general proposal assessment; detailed proposal assessment; identification of 3 functions and 3 characteristics associated with the CDO and CIO.

Regarding the information component, the questionnaire also contained a summary of the proposal as well as its background.

The questionnaire had three types of questions: multiple choice questions, open questions and scaled questions (graded on a scale from 1 to 10, in which 1 – completely disagree and 10 – completely agree). This last group contains the most relevant component of the proposal assessment – the responsibilities assigned to each role – and which was presented as shown below in Figure 4.4.

	CDO	Evaluation (1-10)	CIO	Evaluation (1-10)
Governance Processes				
EDM01: Ensure Governance Framework Setting and Maintenance				
Evaluate the governance system	R		C	
Direct the governance system	R		C	
Monitor the governance system	R		C	
EDM02: Ensure Benefits Delivery				
Evaluate value optimization	R		R	
Direct value optimization	R		C	
Monitor value optimization	R		C	
EDM03: Ensure Risk Optimization				
Evaluate risk management	R		R	
Direct risk management	R		C	
Monitor risk management	R		R	
EDM04: Ensure Resource Optimization				
Evaluate resource management	R		R	
Direct resource management	R		R	
Monitor resource management	R		R	
EDM05: Ensure Stakeholder Transparency				
Evaluate stakeholder reporting requirements	R		C	
Direct stakeholder communication and reporting	R		I	
Monitor stakeholder communication	R		I	

Figure 4.4: Section of the assessment of each role’s responsibilities.

The analysis of the results shows some interesting conclusions:

While digital professionals are, in general, more supportive of the proposal, those more connected to information and communication technologies are, in general, less supportive. The reason for this is the growing controversy that the role of the CDO is a threat to that of the CIO, and also to the sense of rivalry between these two roles that transpires from the media.

According to some comments, the CDO is a fad, therefore it has a transitional role, is on the verge of disappearing, and its functions will be shared by other roles, in particular by the board.

In one of the questions, respondents were asked to list three characteristics for each profile. Although they are described differently, there is a convergence of points from which the following stand out:

- CDO profile – business oriented, leading skills, visionary, risky profile, strategic thinking, strong relationship builder, problem-solving attitude; reward assessment capabilities; innate design/lean thinking.
- CIO profile – IT oriented, focused mind; detail-oriented; result oriented; collaborative; tech savvy; business supporter; ability to execute on change; ability to translate strategy into execution; technical leadership.

This shows how these two roles require substantially different characteristics.

In regards to the functions played by the CDO and the CIO, one of the questions was to list the main three functions, and the following are worthy of note:

- CDO functions - define the digital strategy/vision; align/converge the digital strategy with the corporate strategy; create a digital culture in the company; disrupt; transform to digital; change management.
- CIO functions - implement IT project; build IT strategy; change management; establish a technological landscape that incorporates future business needs with less impact; ensure time to market; ensure an adequate ITG framework.

Despite all the controversy that the proposal assessment raises, overall it is rather positive.

The charts below (Figure 4.5 and Figure 4.6) show the assessment average scores obtained, respectively of the CDO and the CIO.

Note the overall average scores for the responsibilities associated with the CIO role and the ones associated with the CDO role: 6.99 and 7.29 points, respectively.

Such results lead to a somewhat surprising conclusion. If the question on the assignment of responsibilities of governance processes is formulated in a general way, the degree of agreement in both cases is, as a rule, much lower. If the question addresses the specific responsibilities of each process, then the degree of agreement is clearly higher.

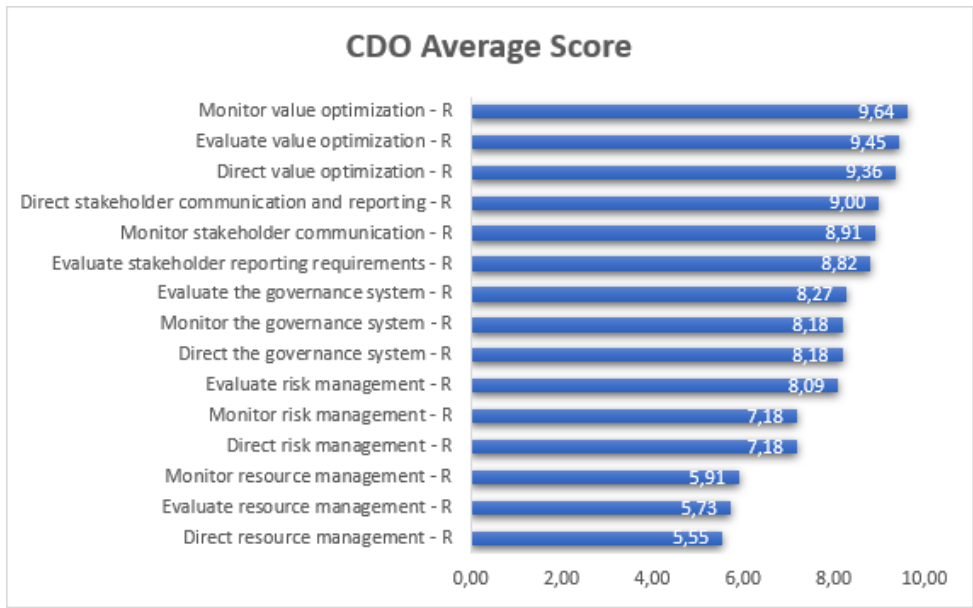


Figure 4.5: CDO responsibilities average evaluation.

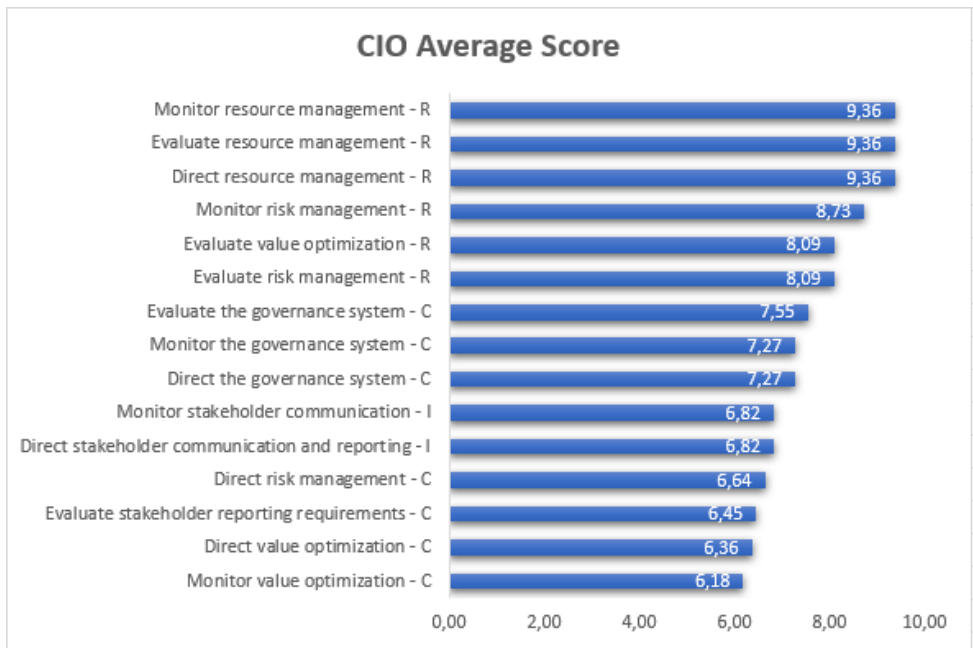


Figure 4.6: CIO responsibilities average evaluation.

However, we note (Figure 4.7) a higher agreement on the responsibilities of CDO in the processes regarding value optimization, stakeholders' communication and governance system, in line with Horlacher and Hess's conclusions about the CDO's primarily focus on strategic and communication aspects [17].

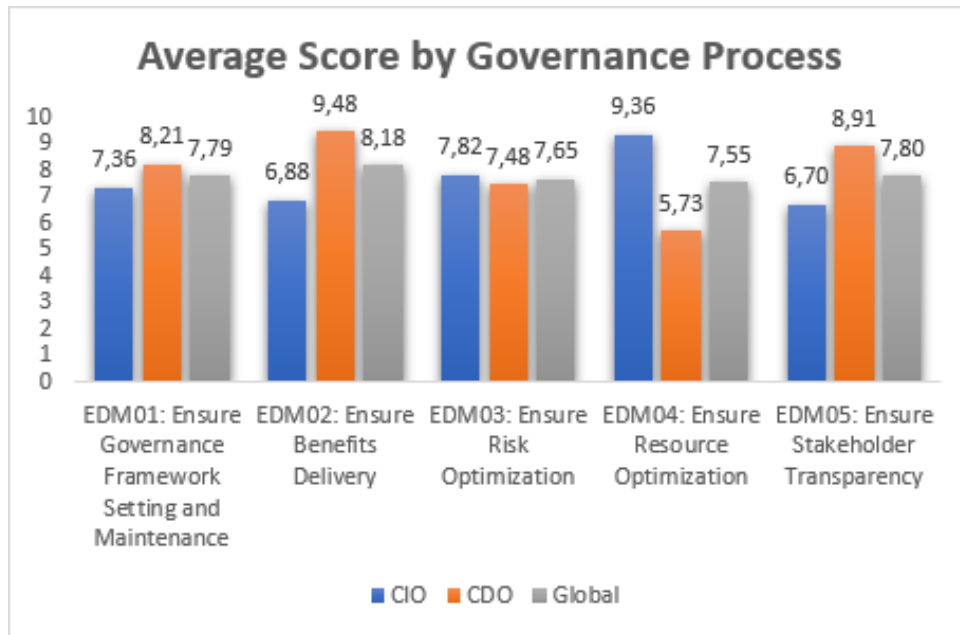


Figure 4.7: Average evaluation results by governance process for CIO and CDO roles.

The “ensure value optimization” process is the one with the highest average score – 8.18 –, a consequence of the high degree of agreement on the responsibilities assigned to the CDO, the average score of which is 9.48. The “ensure resource management” process has the lowest average score – 7.55 –, a direct consequence of the low degree of agreement on the responsibilities assigned to the CDO, although in this case the degree of agreement with the CIO’s responsibilities is rather high.

In short, the results of the questionnaire show that the COBIT 5 RACI matrix can be a very important tool in defining/redefining both roles in the organizational context of DT and its formulation leads us to rethink the current situation. What is clear from the charts is that the agreement on the CIO’s responsibilities is lower when the responsibility shifts from R (Responsible) to C (Consulted) or I (Informed). In the case of the CDO, in which all processes have the R responsibility, the clear disagreement falls on the “ensure resource management” process. Interestingly, though, this process was proposed with shared responsibility with the CIO, and it was precisely in this process that the CIO achieved most agreeing answers.

Chapter 5

Conclusion

There are numerous challenges associated with the application of digital technologies in the reform of government structures, in the implementation of public policy and in improving the functioning of public administration, and digital governance is one of the next steps for governments to reduce costs, meet expectations and achieve economic recovery goals [63].

Our research has been dedicated to GDT and had followed the trends and concerns in the public administrations worldwide: from EGIT, BTM and the new roles and responsibilities associated with DT, we analyzed them all and deepened the research on each topic with complete cycles of investigation.

The work done in this thesis integrates all these components and proposes a holistic framework to implement GDT that covers three dimensions of governance: soft, hard and context – a framework for GDT in the public sector. The schema of the composed framework is presented in Table 3.1.

The components of the framework were designed in an iterative manner, having associated complete cycles of investigation, and, wherever possible, the electronic public procurement (e-procurement) was chosen as the specific field of the DT to test the studies and proposals.

In short, the components of the framework, despite having been evaluated/tested at different times and in different contexts, have had a positive evaluation by experts and a high degree of acceptance by the community involved in DT, particularly in the context of e-procurement, which leads to the conclusion that there is a basis for furthering this kind of research.

However, this research produced is only the tip of the iceberg, given that scientific production in this field is still very incipient. We are aware of the limitations of this research, and these will be detailed in the next section.

Regarding the research done around the framework's component regarding new roles and responsibilities, more specifically, the CDO role, the results were also positive. Its results, and in particular the responses of practitioners who participated in the proposal assessment, show that using the RACI matrix to define the CDO and CIO's responsibilities is quite feasible and, above all, very useful to clarify the articulation and boundaries between the two roles. The overall scores for both proposals were very positive, 7.62 for the CIO and 7.96 for the CDO, in a scale of 0-10 points.

Clear roles at the C-level are essential to boost the enterprises' capabilities in times of disruption.

The highest scores for the CDO are in line with the 2016 research results, according to which this role assumed the main function as catalyst of change [17][69][50].

Communication, value optimization and governance structure related processes were the most accepted as responsibility of the CDO. The resources management related process had the higher agreement for CIO responsibilities. In the case of the related risk management process, the scores were very similar.

Even with positive feedback, as Horlacher mentioned in both academic works published on this topic [17][68], we would like to stress that this study, equal to the research on the GDT framework, is still taking its very first steps and that it takes more than qualitative studies to consolidate the findings on this topic.

As Westerman referred, that are no optimal solutions in implementing GDT, but lack of governance is never optimal. Digital Governance helps to steer the company's digital activities in the right direction. It turns the diverse energy of employees through the organization into a coherent engine that drives DT [15].

5.1 Limitations

After all the work produced, and even during its production, through the results of the evaluations, it was possible to identify some limitations that we now expose.

In regards to the first part of this thesis, the work done around the framework to apply GDT in the public sector, there are some limitations easy to identify. The main limitation stands by the fact that the framework was not applied in its entirety in a real situation. It was not possible to apply it directly in a field of DT in the public sector and evaluate its results as whole. Its components were only evaluated/tested separately, at different times and in different contexts, which makes it accurate to give a direct and completely reliable answer on the framework's quality and level of applicability in the public sector.

For example, the answers given by the Finish representative working in the field of electronic contracting were only related to the level of implementation of governance processes. It would still possible to assess the viability of governance processes in Finland and, in the specific case of e-procurement. It is also important to note that this tackles only one of the components of the framework.

This reality concerning the lack of application in a real world scenario also means limitations regarding its direct applicability. It is possible that the framework has not the same level of usefulness when the innovator applying it doesn't have much experience in the field, the adequate innovation mindset or even the holistic view and knowledge provided by the bibliography followed in the research conducted. The framework is not a stand-alone tool, does not substitute the reading of the familiarity with the methodologies and tools it is founded in.

Related to the second part of this thesis, the research on the new CDO role, the work produced focused solely on the CDO and CIO responsibilities in the context of the COBIT 5 governance processes. This in itself is a limitation, since basing answers of this magnitude in only one framework is not enough to define a role in a foolproof manner.

In a more specific sense, when evaluating the proposal for both roles' responsibilities, we found that most respondents had difficulties clearly distinguishing between governance and management. This difficulty in distinguishing between both terms implies that the roles' functions/activities, objectives and required skills are not an evident and substantiated answer for those evaluating our proposal.

In addition, the CDO and its responsibilities were defined in a general enterprise context, given the priority in understanding the role. Since our framework is built for the public sector, the defined responsibilities may not be 100% true, accurate, and applicable in the public sector, and these will always depend on the context to which they are linked. Different parts of the public sector mean different responsibilities.

Finally, qualitative studies are not enough to consolidate the findings on this topic of new roles for DT.

5.2 Communication

Communication activities that present to relevant audiences both a problem to be solved and a possible solution using the research and work conducted are of major importance. Throughout this document we have shown the problem, strategies to tackle it, and our solutions to solve it. This DSRM step exists to communicate the conducted research, and expose its utility, and effectiveness. In addition to this, we must clarify the problem's importance to the target audience, and attempt to evaluate the proposed solution.

The work done in this thesis' the two major chapters resulted in three articles that were submitted and accepted, with one of them being already published. These three articles presented the work performed and discuss the results achieved.

The first article tackles the produced framework for GDT in the public sector, it is written in Portuguese with its title being "Uma arquitetura de referência para implementar a governança da transformação digital no sector público.", and it took the format of a book chapter, published in a book titled "Transformação Digital: Oportunidades e ameaças para uma competitividade mais inteligente".

The second and third articles are on the research done regarding the new CDO role. The first of these is titled "The role of Chief Digital Officer", also taking the format of a book chapter and it was accepted to be published in a book titled "Digital Transformation". The other article is titled "Chief Digital Officer – A New Role for COBIT 5" and it was submitted and accepted to be part of the upcoming ISACA journal - volume 6.

The list of articles produced is summarized in Table 5.1.

Table 5.1: List of produced articles.

Communication		
Submitted to:	Article	Status
Book: "Transformação Digital: Oportunidades e ameaças para uma competitividade mais inteligente"	"Uma arquitetura de referência para implementar a governança da transformação digital no sector público."	Published
Book: "Digital Transformation"	"The role of Chief Digital Officer"	Accepted
ISACA's Journal vol. 6	"Chief Digital Officer – A New Role for COBIT 5"	Accepted

5.3 Future Work

There is still plenty of research that can be done having this thesis as a basis. We are still at the very early stage of a whole new approach on how to conduct DT, especially in the public sector. The work produced can answer so much, there is still a lot to learn and to do.

First and foremost, regarding the first segment of work of this thesis, it would be of major value to deploy and apply the framework for GDT in its entirety, in a real public sector setting, since the components of the framework were only tested separately. By following the application directly, and seeing its results in the context to which it is being applied, would mean being able to give a reliable answer on its quality and applicability. While we evaluated the framework's components in different settings, both Hungary and Italy accepted to use the framework for GDT as a reference respectively for implementing and improving their solutions of electronic public procurement, which represents one of the largest digitalization projects in public administration in any country. The fact that both countries are available to collaborate with this study is already a positive sign and its application would be the next step.

Regarding the research on the CDO role, there are also various possibilities of work to be done next. It would be important to start by figuring out if the definition of the CDO role and the responsibilities assigned for both the CDO and the CIO in our work are compatible and make sense in a public sector context. This would be possible to check when using the framework for GDT in the electronic public procurement context of one of the countries stated above, since the new roles for DT, more specifically, the CDO role, is one of the four components of our framework.

In a more particular aspect, it would also be interesting to understand the CDO's responsibilities related to management processes. For though the predominance of responsibilities of the CIO role at this level is more predictable, this is not to say that in some processes responsibilities could not be shared between the two, in particular in the following processes: "Manage innovation", "Manage strategy" and "Manage relationships".

Finally, it will be very important to understand if we'll see the emergence of frameworks of digital enterprise governance, and in this matter, how both roles will be addressed by the community of practitioners.

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