Governance of Digital Transformation

in the Public Sector
(extended abstract of the MSc dissertation)

João R. Catarino
Departamento de Engenharia Informática
Instituto Superior Técnico

Advisor: Prof. Dr. Miguel Leitão Bignolas Mira da Silva

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

Abstract: Technology is the biggest story in business today. With the recent progress in all thing digital, constraints are being removed and new possibilities created, that affect everyone's lives. This means a new digital revolution, generally denominated the 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 in the context of the public sector, i.e., within entities, organizations and public companies, it is of particular relevance in this context since, as a rule, it involves hefty investments and the production of cross-cutting services that result from activities and linkages between various institutions. An awakening to this issue is taking place in the public sphere, with a solid 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 digital transformation governance 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 the itself and the chief information officer, leads to internal difficulties in organizations. In this study we also analyze the differences between these two roles and draw a new vision of the responsibilities associated to them.

1 INTRODUCTION

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) [Nylén and Holmström, 2015].

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 [Martini and Binder, 2015]. We are moving into a new digital era, and one major redefinition is the relationship between the state and the citizen [Masson, 2014]. 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 [Martini and Binder, 2015]. This phenomenon, the public sector, above all other sectors, cannot avoid.

However, 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. One main obstacle, in the public sector in general, recognized by many governments, is the difficulty in 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. Failures in the public sector context 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 governance of DT (GDT) in the public sector is a question with no consensual answers that urge a reply. Our goal 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 goal, this paper defines and composes a framework that integrates the needed set of governance mechanisms for DT allowing an holistic and integrated coordination in the public sector.

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. 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 [Horlacher and Hess, 2016]. 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. In this sense, this paper will also define the role of CDO and its responsibilities.

This research done follows the Design Science Research Methodology (DSRM) [Peffers et al., 2008] and it is structured in five chapters: Introduction (introduces the topics of discussion and problem/objectives behind this research), Background (displays the state of the art regarding the scope of this work), A Framework (describes the composed framework that integrates governance mechanisms for DT that allow an holistic and integrated coordination in the public sector), the CDO role (identifies the responsibilities of the new CDO role in the enterprise context and articulate them with the CIO responsibilities) and finally, the Conclusion (presents an overview of the realized work).

2 BACKGROUND

First, we present some necessary background information for the design of the framework for implementing GDT in the public sector and for the definition of the CDO role and its responsibilities.

2.1 Digital Transformation & Governance

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. Every organization, whatever the type, is investing significant resources in the development of digital capabilities to drive a sustainable future [Duparc, 2013]. Although several definitions can be found for DT, it can be understood as 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 [Uhl and Gollenia, 2016].

Governance has a fundamental role in DT. To differentiate management from governance, Hoogervorst accounts 'management' from an implementing, operational point of view, while he uses the term 'governance' in the context of enterprise change [Hoogervorst, 2012]. Governance provides the steering wheel and guardrails to keep transformations on the wanted direction [Westerman et al., 2014]. 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 [Tannou and Westerman, 2012] advocate that there are three common digital governance mechanisms to specially consider: shared digital units; firm-level committees, and new digital roles.

2.2 Enterprise Governance of IT

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 [Grembergen, 2010], the concept IT governance (ITG) emerged and gained more focus due to the increasing dependency on IT.

However, due to the focus on "IT" in the naming of the concept, the ITG discussion mainly remained a discussion within the IT area. It is clear that business value from IT investments cannot be realized by IT, but will always be created at the business side. 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) [Haes and Grembergen, 2015]. 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 [Haes and Grembergen, 2015].

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) and of those bunch, the COBIT 5 framework was selected as the main ITG (EGIT) framework for this work.

2.3 CIO vs CDO

According to Groysberg, in the mid to late 90s the CIO was a senior executive who was able to understand new technologies and how to apply them to the business strategy. They were the link that intermediated the relation between business leaders and the IT department. Meanwhile, a phenomenon was emerging: globalization. IT managers were faced with new challenges and, though IT had become better aligned with the business, IT executives needed to conduct rigorous analyses of return on investment and make complex decisions. The IT function demanded a leader who was able to understand the increased complexity of business and how to interact with the IT strategy, business strategy, risk management, and finance [Groysberg et al., 2011].

Consequently, a growing number of companies and organizations started to introduce an additional position into their managerial grid, which they have called "Chief Digital Officer" (CDO). Horlacher presented an initial conceptualization of the CDO's position, suggesting that their primary responsibilities are on the strategic and communicational aspects of the DT, and, if both positions co-exist, that they closely collaborate with their CIOs. The CIOs, in turn, deal with the technical aspects of the transformation. This means that despite the roles/responsibilities of the CDO and CIO are different, their relationships can be symbiotic and interdependent [Horlacher and Hess, 2016].

2.4 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. To understand how to deal with business transformation processes, in addiction to governance, it is crucial to understand the management side of the transformation. To understand this side, the Business Transformation Management^2 (BTM^2) methodology was considered the most suitable and it was clear that it already takes advantage of the application of eight existing and well-established disciplines.

This methodology comprises four phases (envision, engage, transform, and optimize) and integrates specific technical and methodological expertise from various relevant areas. It is also based on a framework which 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.

2.5 COBIT 5 and COBIT 5 PAM

COBIT 5 is a framework that 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 [International, 2016]. It enables IT to be governed and managed in a holistic manner for the whole enterprise. COBIT makes the direct distinction between governance and management and both governance and management processes are needed to provide comprehensive enterprise governance and management 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 [Haes et al., 2013]. The governance domain in COBIT 5 has five processes: Ensure Governance Framework Setting and Maintenance, Ensure Benefits Delivery, Ensure Risk Optimization, Ensure Resource Optimization and Ensure Stakeholder Transparency.

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

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. Process maturity has been a core component of COBIT and its assessment is arguably a necessary condition for adopting EGIT practices.

COBIT's process assessment model (PAM) confirms that a given process is actually achieving its purpose and delivering the required outcomes as expected. Realizing a capability level 1 is already an important achievement for an enterprise [Haes et al., 2013] since it means that the goals of this process are achieved.

2.6 IT Governance Maturity Model from Smits and Hillegersberg

Smits and Hillegersberg [Smits and Hillegersberg, 2015] 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: soft, hard and context, respectively related to human characteristics, processes characteristics and enterprise characteristics. Each dimension is associated to existing frameworks, being CMM selected for hard governance, based on the argument that the five-level ranking system introduced for CMM is often used for maturity models. This argument also applies to COBIT 5. However, CMM is not correct for soft governance, since it 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 MM.

3 A FRAMEWORK - Implementing Governance of Digital Transformation in the Public Sector

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 depicted in section 2, such as the BTM^2 framework, COBIT5 and its MM (COBIT 5 PAM), the MIT&CC research, and so on.

3.1 Proposal

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

3.1.1 Objectives

Taking into account the diversity and complexity of institutions and organizations in public administration, the objectives on which our proposal is based are: To be based on familiar concepts and existing practices; Relate to existing standards; It should not represent an administrative burden; Must incorporate recent and recognized studies on digital transformation; It should be comprehensive; It should be simple to implement.

Even though these objectives are valid to any context, in the public sector they carry a much greater weight since the solution our is not for a company, but for a vast array of entities. If the proposal does not take these objectives 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.

The purpose of the proposed artifact is to provide a solution to four aspects translated as components of the framework like shown in Figure 1:

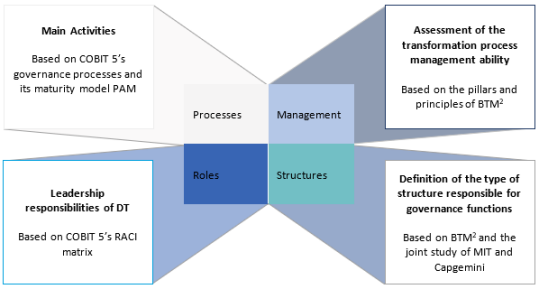

Figure 1: Components of the Framework for Governance of Digital Transformation

3.1.2 Design

The application of the objectives defined into the design (Figure 1) of the artifact was based on the following reasoning:

1. **The solution should be based on familiar concepts and existent practices.**
   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 [ISACA, 2014].

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. The option to use COBIT 5 for our proposal was very much influenced by the fact that it incorporates the principles [Haes et al., 2013] defined in international standards related to governance:
   - Value and risk management - principle 1;
   - Business life cycle - principle 2;
   - Integration - principle 4;
   - Incorporation of principles defined in international standards related to governance - principle 5.
3. **The solution should not represent an administrative burden.**
Regarding this objective, we looked 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 [Tannou and Westerman, 2012] [Westerman et al., 2014]: shared units, governance committees and digital leadership roles. Due to their relevance, these mechanisms are also incorporated in our artifact.
5. **The solution should be comprehensive.**
An holistic approach is fundamental to answer this objective.
For that reason, our governance framework is based on the three dimensions for governance indicated in the study of Smith and Hillegersberg: soft, hard and context [Smits and Hillegersberg, 2015].
6. **The solution should be simple to implement.**
Simplicity is a key issue in the public sector. 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 Figure 2.

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

Figure 2: Proposed Framework for Governance of Digital Transformation

The joint study and research conducted by MIT & CC referenced both in Figure 1 and Figure 2 [Westerman et al., 2011] presents relevant contributions in describing essential pieces in the governance structure:

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

In structuring the developed components (Figure 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.

3.2 Demonstration

The proposed framework incorporates four components referred to in Figure 1. Each of the four components corresponds to the following:

- **BTM^2 Maturity Model** - based on the meta management layer described in section 2.4. It is an instrument of awareness and to gauge the extent to which the conditions for conducting a process of transformation are met.
- **Governance structure** - Considering that the structure is intended to be in the scope of public administration, the proposal presents a possibility analyzed in the article [Rosa et al., 2015]. 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.This type of governance structure ensures a collaborative decision model that will make all the difference in the public sector.

- **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 when CIO also exists. We have studied and analyzed their responsibilities in the context of governance processes using the COBIT RACI matrix 5. This research is done in section 4, where a more in-depth study regarding these roles is done.
- **Governance processes** - We intended to study and propose the exact activities and procedures that are associated with the implementation of governance mechanisms. We used the COBIT 5 processes 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.

The articulation plan between these four components is not rigid and can be up to the one implementing the framework.

3.3 Evaluation

For the purpose of measuring applicability as well as evaluating the artifact, the choice regarding its application was made in the context of electronic contracting. The development of this public activity goes far beyond the mere digitization of services. In many cases, it clearly enters 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 since it is a country where the governance theme is of particular importance and the level of institutional trust is atypically high.

Therefore, a Finish 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; The final evaluation presented by the perspective of a specialist respondent Finland regarding the implementation of processes and governance is summarized in Figure 3.

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: 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.

In the case of the MM component to gauge the degree of preparation for conducting the DT, it was decided to carry opinion studies based on interviews with senior specialists [Pries-Heje et al., 2004]. The studies were carried out in four institutions linked to electronic public contracting generally having a very positive assessment with the respondents indicating that the use of these MMs allows better driving and management of the transformation itself.

In the case of the component of the new roles linked to DT, the evaluation method followed an identical format [Pries-Heje et al., 2004], but this will be also explained in more detail in section 4, where the role of CDO is studied in a broader but more in-depth setting, as explained before.

4 CHIEF DIGITAL OFFICER - A New Role for COBIT 5

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.

4.1 Proposal

Now that DT is sure to reach every organization, it's important to note that governance is essential for a

successful DT [Tannou and Westerman, 2012]. As explained, in this section 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.

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.

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).

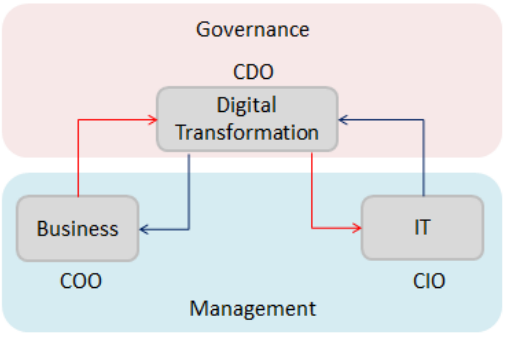

Figure 4: The CDO as the bridge between IT and Business.

As explained, our research reassesses 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, digital transformation 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 and finally Ensure Stakeholder Transparency.

With the introduction of the new CDO's role, the new proposed distribution is as shown in Figure 5.

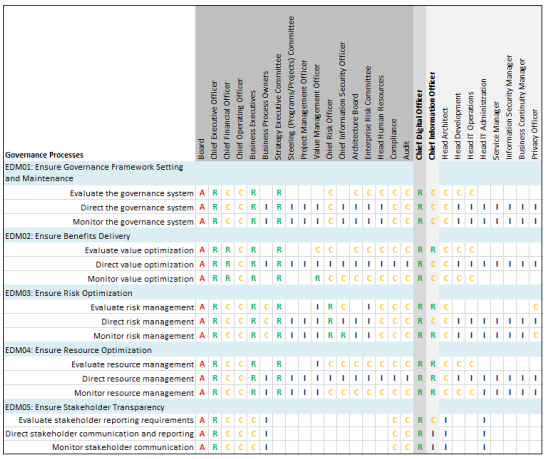

Figure 5: Proposed RACI matrix for CDO and CIO role.

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".

5 Evaluation

Given the controversy of this topic, the choice of the proposal assessment has fallen on the use of "User

Opinion Study" [Pries-Heje et al., 2004]. 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 6.

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.

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.

Governance Processes	CDO	Evaluation (1-10)	CIO	Evaluation (1-10)
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 6: Section of the assessment of each role's responsibilities.

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 7 and Figure 8) 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.

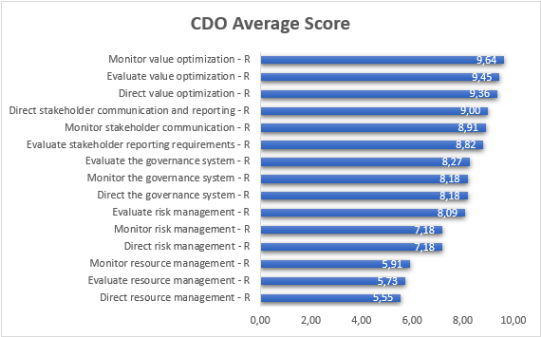

Figure 7: CDO responsibilities average evaluation.

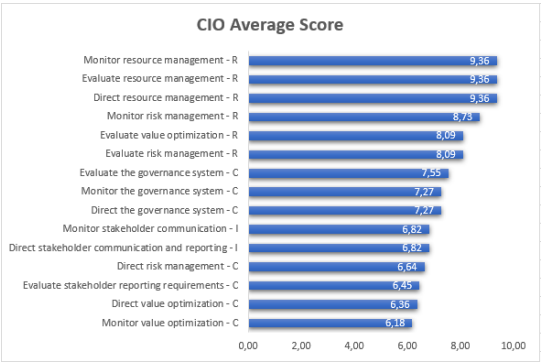

Figure 8: CIO responsibilities average evaluation.

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.

However, we note (Figure 9) 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 [Horlacher and Hess, 2016].

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 and by the CIO, and it was precisely in this process that the CIO achieved most agreeing answers.

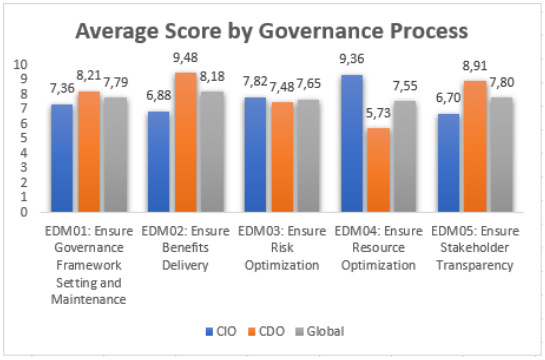

Figure 9: Average evaluation results by governance process for CIO and CDO roles.

6 CONCLUSIONS

Our research was dedicated to GDT and 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 Figure 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.

Regarding the research done around the new CDO role and its responsibilities, 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 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 [Horlacher and Hess, 2016].

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, this study is still taking its very first steps and there's still a lot of work to do regarding these topics and DT in general.

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 [Westerman et al., 2014].

REFERENCES

Duparc, P. F. (2013). Evolution in the c-suite as organizations maximize growth opportunities: The chief digital officer takes centre stage. *Boyden's Global Technology & Digital Practice*. https://www.boyden.com/media/global-technology-and-digital-practice-evolution-in-the-c-suite–169871/index.html.

Grembergen, W. V. (2010). From it governance to enterprise governance of it: A journey for creating business value out of it. *IFIP Advances in Information and Communication Technology*, 341. https://bit.ly/2IZ3uin.

Groysberg, B., Kelly, K., and MacDonald, B. (2011). The new path to the c-suit. *Harvard Business Review*. https://hbr.org/2011/03/the-new-path-to-the-c-suite.

Haes, S. D., Grembergen, W., and Debreceny, R. (2013). Cobit 5 and entreprise governance of it. *Journal of Information Systems*, pages 307–324.

Haes, S. D. and Grembergen, W. V. (2015). *Enterprise Governance of Information Technology, Achieving Strategic Alignment and Value, Featuring COBIT 5*. Springer International Publishing.

Hoogervorst, J. (2012). On the realization of strategic success, a paradigm shift needed: Enterprise governance and enterprise engineering as essential concepts. *CIAO Network*. https://bit.ly/2P3M2yy.

Horlacher, A. and Hess, T. (2016). What does a chief digital officer do? managerial tasks and roles of a new c-level position in the context of digital transformation. *49th Hawaii International Conference on, IEEE (2016) 5126–5135*.

International, A. (2016). *COBIT® 5 Qualifications*. http://www.apmg-international.com/en/qualifications/cobit5/cobit5.aspx.

ISACA (2014). Cobit recognition. *ISACA COBIT*. http://www.isaca.org/COBIT/Documents/Recognition-table.pdf.

Martini, M. and Binder, N. (2015). Transformation of the state in the digital age. *German Research Institute for Public Administration*. http://www.foev-speyer.de/en/research/digitization.php.

Masson, B. L. (2014). Digital disruption ushering in a new era of public services in europe: A call to action. *The Lisbon Council*. http://www.lisboncouncil.net/publication/publication/117-delivering-public-service-for-the-future.html.

Nylén, D. and Holmström, J. (2015). Digital innovation strategy: A framework for diagnosing and improving digital product and service innovation. *Business Horizons*, 58(1):57–67.

OECD (2014). Recommendation of the council on digital government strategies. Technical report, Brussels.

Peffers, K., Tuunanen, T., Rothenberger, M., and Chatterjee, S. (2008). A design science research methodology for information systems research. *Journal of Management Information Systems*, 24(3):45–77.

Pries-Heje, J., Baskervile, R., and Venable, J. (2004). Strategies for design science research evaluation. *European Conference on Information Systems*.

Rosa, I., Tribolet, J., and Silva, M. (2015). Portuguese public procurement governance model. *APSI*, pages 529–554.

Smits, D. and Hillegersberg, J. (2015). It governance maturity: Developing a maturity model using the delphi method. *48th Hawaii International Conference on System Science, IEEE Computer Society*.

Tannou, M. and Westerman, G. (2012). *Governance: A Central Component of Successful Digital Transformation*. https://bit.ly/1g4Qpnf.

Uhl, A. and Gollenia, L. (2016). *Digital Enterprise Transformation, A business-driven approach to leveraging innovative IT*. Routledge, New York.

Westerman, G., Bonnet, D., and McAfee, A. (2014). Leading digital: Turning technology into business transformation. *Harvard Business Press*, page 292.

Westerman, G., Calméjane, C., Bonnet, D., Ferraris, P., and McAfee, A. (2011). Digital transformation: A roadmap for billion-dollar organizations. *MIT Digital Community*. http://digitalcommunity.mit.edu/docs/DOC-1069.