Towards an Information Technology Governance framework selection: criteria determination

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Abstract

Information Technology Governance (ITG) is now an important topic among all organizations. It permits to better exploit the potential of Information Technology (IT) to generate a business value and increase the overall performance. In response to this need, many frameworks now exist. Some are standards while others are research frameworks. The fact that the notion of ITG has many definitions, affects the diversity of the frameworks and choosing a framework becomes an issue. On the other hand, the implementation of an ITG framework is not an easy task but rather a complex, risky and a time consuming enterprise, which reinforce the importance of choosing the right framework. There's a few research done concerning the selection phase of an ITG framework. This paper tries to fill this gap in literature. First, it presents the most well-known ITG frameworks, then, it proposes, based on the literature and experience, a list of criteria that will serve as basis to a multi-criteria decision analysis (MCDA) method. Therefore, a Decision Maker (DM) can decide and choose the best suitable ITG framework to the organization.

Keywords
Information Technology Governance, criteria, Decision-making, MCDA, Selection.

1. Introduction

Information Technology Governance (ITG) is getting an increasingly important subject for all organizations. The companies that have an effective ITG have 40% more revenues than their competitor (Weill and Ross, 2004). Thus, in order to improve the organizational performance (Brynjolfsson and Hitt, 1996, Hendricks et al., 2007), process quality (Boyer et al., 1997) and to gain the competitive advantage, organizations massively invest in Information Technology (IT). Worldwide IT spending is forecast to total $3.41 trillion in 2016. Moreover, for the next four years, it will increase each year at a minimum rate of 2.6 % (Gartner, 2016).

From 2000s financial scandals like Enron (Benston and Hartgraves, 2002) and WorldCom (Frunza, 2016, Heracleous and Werres, 2016) where billions of dollars and thousands of jobs were lost, ITG concept was reinforced. In the United States, the Sarbanes-Oxley act of 2002, the board is accountable of the information accuracy and should put a system that assure the effective information management and use (U.S. Government Printing Office, 2002).

IT have big potential, but implementing IT comes with big risks. Important failures are reported each year regarding IT implementations and large amount of investments are lost in both, public and private sectors. Examples are numerous: in 2012, California abandons $2 Billion court Management System in an attempt to replace seventy legacy system at an estimated initial cost of $260 Million (Krigsman, 2012, Carrizosa, 2012). Flyvbjerg and Budzier reported that among 1471 IT projects analyzed, there is an average cost overrun of 27% and for one in six of the projects, the average cost overrun is of 200% and an average schedule overrun of 70% (Flyvberg and Budzier, 2011). In order to analyze the causes, a study of 99 IT projects shows that 36 classical mistakes of IT projects can be classified in four categories: (1) Process, (2) People, (3) Product and (4) Technology (Nelson, 2007). Whereas, forty three success factors can be organized into three dimensions: Tasks, People and Structure (Petter et al., 2013). This categorization shows that the majority success and failure factors are not related to Technology itself but rather to Processes, Structures and Communications, which are the basis of the ITG (Peterson 2004, Van Grembergen et al., 2004, Weill and Woodham, 2002).

The fact that the notion of ITG has many definitions (Webb et al., 2006), affects the diversity of the frameworks and choosing a framework becomes an issue. Also, the organization size criteria seems to play a role in ITG. Actually, ITG frameworks standards are designed for large organizations. Indeed, there is a need to have ITG framework for Small and Medium Enterprises (SMEs) (ITGI, 2007). The public sector is also specific and has its own characteristics (Campbell et al., 2010). The one size fits all ITG framework may not apply. An ITG framework should be chosen according to criteria and dimensions that correspond to the organization need and priorities. ITG criteria/dimensions will be discussed in more details in section 3. In this research, we try to answer to the following main question:
- What are the criteria or dimensions that will serve to choose an ITG framework?
This paper describes a methodology to help a Decision Maker (DM) to choose an ITG framework for a given organization. This paper is organized as follows: Section 2 presents ITG frameworks. Section 3 presents the criteria according to the literature review. Finally, conclusions are drawn regarding the results and future research directions.

2. Review of IT Governance frameworks

Since the appearance of ITG in the 1990s (Henderson and Venkatraman, 1993), many definitions exist in the literature and there are some researches that review all these definitions in order to present one global definition (Simonsson and Johnson, 2006, Webb et al., 2006, Novotny et al., 2012). We present the following well-known definitions:

- "IT Governance is the responsibility of the board of directors and executive management. It is an integral part of Enterprise Governance and consists of the leadership and organizational structures and processes that ensure that the organization's IT sustains and extends the organization's strategies and objectives." (ITGI, 2001).
- "The system by which the current and future use of IT is directed and controlled" (ISO, 2008).
- "IT Governance: specifying the decision rights and accountability framework to encourage desirable behavior in the use of IT" (Weill and Ross, 2004).

Even if there are many definitions, some characteristics can be deduced: (1) ITG about an alignment between IT and the business in order to achieve a business value. (2) ITG tools consists of structures, processes and relational mechanisms that form a system that makes IT and Business aligned.
The multiple definition of ITG has as a consequence the existence of multiple ITG frameworks. The following paragraphs show some standards ITG frameworks and well-known research frameworks.

2.1 ISO 38500

The first edition of ISO 38500 appeared in 2008 and was revised in 2015. The standard's objective is to provide a framework of principles for directors to use when evaluating, directing and monitoring the use of Information technology (IT) in their organization (ISO, 2008). It comprises six principles and a model.
The model for the governance of IT shows that directors should govern IT through three main tasks:
- **Evaluate** the current and future use of IT.
- **Direct** the elaboration and implementation of plans and policies to ensure that use of IT meets the organization's objectives.
- **Monitor** the performance against the plans and conformance to policies.
For each governance task, Directors should take into account the six principles:
a) Responsibility: users and IT department understand and accept their responsibilities concerning the supply or use of IT.
b) Strategy: the IT strategy is included in the corporate strategy and satisfy the current and ongoing needs of the organization.
c) Acquisition: IT acquisitions are made based on an analysis and a transparent decision making, with a balance between benefits, opportunities, costs and risks in the short term and the long term.
d) Performance: IT supports current and future business needs by providing services, levels of service and service quality.
e) Conformance: IT must comply with all mandatory legislations and regulations.
f) Human behavior: IT decisions must take into account the current and evolving needs of all the people in the process.

2.2 ITIL

Information Technology Infrastructure Library (ITIL) is a framework of best practices guidance for IT Service Management (ITSM) developed during the 1980s by a British public body, the Central Computer and

Telecommunications Agency (CCTA). The objective is to deliver a high quality customer service regarding IT services, and to increase the effectiveness of ITG. Unlike the first version which was confined in the UK and Netherlands, ITIL version 2 replaced the first version between 2000 and 2004 and gained a worldwide acceptance and became a recognized standard for ITSM. ITIL V3 was published in 2007 and revised in 2011 and consist of five core publications that cover the service lifecycle (ITSM UK, 2012).
The five steps of the service lifecycle is as follows:
1. Service Strategy: decide which services and capabilities the IT organization should offer and develop.
2. Service Design: design the new IT services.
3. Service Transition: build and deploy IT services.
4. Service Operation: ensure that IT services are delivered effectively and efficiently.
5. Continual Service Improvement: A seven-step improvement process 1. Identify the strategy for improvement 2. Define what you will measure 3. Gather the data 4. Process the data 5. Analyze the information 6. Present and use the information 7.Implement improvement.
There is little research on the application of ITIL with SMEs in an environment of a shortage of technical talent and insufficient financial resources (Cruz-Hinojosa and Gutierrez-de-Mesa, 2016). Some research propose a version of ITIL framework that is adapted to SMEs like "ITIL Lite" (Fry, 2010). While theses frameworks are not an official proposition from ITSMF, it shows the need for this category for a framework that best suit their needs and constraints.

2.3 Project Management Body of Knowledge (PMBoK) guide

The PMBoK guide is a subset of the project management body of knowledge, elaborated by the Project Management Institute (PMI), which is generally recognized as good practice. Project management is defined as the application of knowledge, skills, tools, and techniques to project activities to meet the project requirements. (PMI, 2013). Currently, the PMBoK now is in its fifth edition.
The PMBok framework identifies 47 processes that are grouped into five Process groups:
- **Initiating**: processes that define a new project or a new phase of a project,
- **Planning**: processes that define the scope, objectives and all the actions needed to achieve the fixed goal,
- **Executing**: processes that execute the work according to the plan,
- **Monitoring and controlling**: processes that track the progress and the performance of the project.
- **Closing**: processes that finalize all activities in order to close the project.
The project management processes are also regrouped into ten knowledge areas: (Integration, Scope, Time, Cost, Quality, Human Resources, Communication, Risk, Procurement, and Stakeholder management). Each Project Management process is described in terms of its inputs, tools and techniques, and outputs.

2.3 Capability Maturity Model Integration (CMMi)

The Software Engineering Institute (SEI) at Carnegie Mellon University (CMU) developed the Capability Maturity Model (CMM) framework version 1.1 in 1993 (Paulk et al., 1993a). The SEI is mainly funded by the US Department of Defense (DoD) and develop a method for assessing the capability of the federal government software contractors. CMM was software oriented but other disciplines and functions were developed such as Systems Engineering, people, software acquisition and others. Since the version 1.2 in 2006, Capability Maturity Model Integration (CMMI) integrates the different CMM disciplines and functions:
1. Product and service development — CMMI for Development (CMMI-DEV),
2. Service establishment, management, — CMMI for Services (CMMI-SVC), and
3. Product and service acquisition — CMMI for Acquisition (CMMI-ACQ).
The current version of CMMI is 1.3. The SEI has transferred CMMI-related products and activities to the CMMI Institute, which was acquired in March 2016 by ISACA, the professional association for governance assurance and cybersecurity professionals (ISACA, 2016). CMMI helps software and services organizations in a variety of industries to align meaningful process improvement with business and engineering goals for cost, schedule, productivity, quality, and customer satisfaction (ISACA, 2016).

The CMM is composed of five maturity levels (SEI, 2010, Table 1). With the exception of Level 1, each maturity level is composed of several key process areas.

Table 1. Maturity Levels of CMMI-DEV V1.3 (Adapted from SEI, 2010)

Maturity Level	Description	Number of Processes

1 – Initial	No defined process	0
2 - Repeatable	Disciplined process	7
3 - Defined	Standard, consistent process	11
4 - Managed	Predictable process	2
5 - Optimizing	Continuously improving process	2

2.3 ISO 31000

ISO 31000 is a family of standards relating to risk management elaborated by International Organization for Standardization (ISO) in 2009. The objective is to provide principles and generic guidelines on risk management. The risk concept is defined as an effect of uncertainty on objectives. It is important to note that the notion of risk is neutral, it can have positive or negative consequences. The positive impact is considered as an opportunity.
The standard recommends that organizations should have a framework that integrates the process for managing risk into the organization's overall governance, strategy and planning, management, reporting processes, policies, values and culture (ISO, 2009). ISO 31000 describes the components of a risk management implementation framework as follows:
- Mandate and commitment.
- Design of framework for managing risk: Organization, risk management policy, integration to organization process
- Implement risk management: implement the framework and the risk management processes.
- Monitor and review of the framework.
- Continual improvement of the framework.

For the SMEs that want to implement a risk management framework, ISO published a practical guide for these type of organizations (ISO, 2015).

2.4 ISO 27001 / 27002

While ISO 31000 is an Enterprise Risk Management framework, ISO 27000 family standard is about information security. ISO 27001:2013 that replaces the 2005 version provides requirements for establishing, implementing, maintaining and continually improving an information security management system (ISMS) (ISO, 2013b). The ISMS consists of a risk management process that, if followed, preserves the information security characteristics: Confidentiality, Integrity, and Availability. Since the 2005 version, the standard adopts the Plan-Do-Check-Act (PDCA) model (ISO, 2005):
Plan (establish the ISMS): Establish the information security policy, objectives, processes and procedures in order to manage risk and improve information.
Do (implement and operate the ISMS): Implement and operate the information security policy, controls, processes and procedures.
Check (monitor and review the ISMS): Assess and measure process performance against the information security policy, objectives.
Act (maintain and improve the ISMS): Take corrective and preventive actions, based on the results of the internal information security audit and management review, to achieve continual improvement of the ISMS.
ISO 27002 presents a list of controls to be that can be implemented to ensure risks are reduced to an acceptable level. (ISO, 2013a). These controls should be adapted according to the organization’s environment in terms of risk acceptance, risk response, and legal compliance. ISO 27002 contains 14 security control categories, which corresponds to 35 objectives and 114 controls.

2.5 TOGAF

The Open Group Architecture Framework (TOGAF) is an architecture framework that assists in the acceptance, production, use, and maintenance of architectures (TGO, 2011b). It is developed by The Open Group. The first version appears in 1995 and the last and current version is 9.1.
Enterprise architecture (EA) is the process of translating business vision and strategy into effective enterprise change by creating, communicating and improving the key requirements, principles and models that describe the enterprise's future state and enable its evolution (Lapkin, et al., 2008). Are concerned, the information and technology, but also people, processes. Enterprise architects compose holistic solutions that address the business challenges of the enterprise and support the governance needed to implement them (Lapkin, et al., 2008). While there are many definitions of EA, they focus on the definition of the future state in terms of business process, technology and

information that ensure the organization meets its strategic goals. Also, EA shows the path to get from the current state to the future state.
TOGAF is an iterative process and is based on the TOGAF - Architecture Development Method (ADM) that describes a step-by-step approach to developing an EA and is supported by best practices and a re-usable set of existing architecture assets (Figure 1).
TOGAF covers the development of four related types of architecture:
Business Architecture: it translates the business strategy, organization, and key business processes.
Data Architecture: it shows the structure of logical and physical data assets.
Application Architecture: it presents the applications and their interactions that should be implemented to support the business needs.
Technology Architecture: concerns all the logical software and hardware capabilities that are required to support the deployment of the business, data and technology architectures.

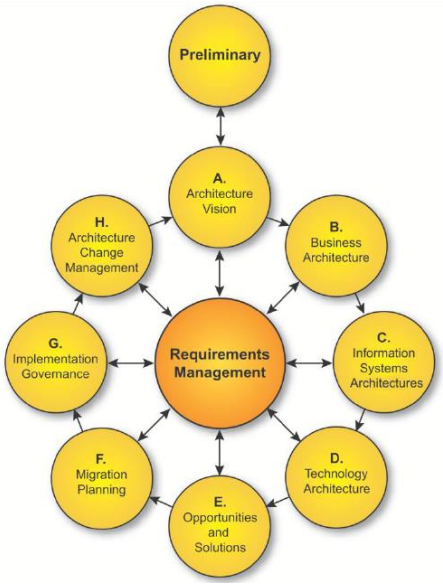

Figure 1. TOGAF - Architecture Development Method (ADM), (TGO, 2011a).

2.6 COBIT 5

COBIT is a standard framework, created by Information Systems Audit and Control Association (ISACA) and the IT Governance Institute (ITGI), for promoting and implementing ITG in organizations in order to maximize value from IT investments and to gain a competitive advantage. Originally published in 1996 as a set of control objectives for auditing purpose, it became in the last published version in 2013, a business framework for the governance and management of enterprise IT. COBIT 5 is based on five principles, seven enablers and four dimensions (ISACA, 2012b). As COBIT 5 is a generic framework, it should be customized according to the organization needs and environment.
The five key principles for governance and management of enterprise IT are (1) Meeting Stakeholder Needs, (2) Covering the Enterprise End-to-end, (3) Applying a Single, Integrated Framework, (4) Enabling a Holistic Approach (5) Separating Governance from Management. The seven enablers are:
Principles, policies and frameworks permits to link the strategic direction to the tactical and operational level.
Processes describe activities that achieve IT goals, which in turns, support the strategic goals.
Organizational structures are the key decision-making entities in an enterprise.
Culture, ethics and behavior, these success factors should be taken into account during the ITG implementation and IT operationalization.
Information includes all information the enterprise needs to function properly and to gain a competitive advantage.
Services, infrastructure and applications include all the technology in terms of infrastructure and applications that are used to support the organization.
People, skills and competencies represent the resource that execute activities and make decisions.
COBIT 5 presents a process reference model divided into two areas: Governance and Management (Figure 2). The Governance area contains the Evaluate-Direct-Monitor (EDM) domain with five processes and the management area

contains four domains that are based on the PDCA cycle (ISACA, 2012b): (1) Align, Plan and Organize, (2) Build, Acquire and Implement, (3) Deliver, Service and Support, (4) Monitor, Evaluate and Assess.
COBIT 5 defined a goals cascade system that consists of matrices that link together Stakeholders needs, Enterprise goals, IT-related goals, and Enabler goals.

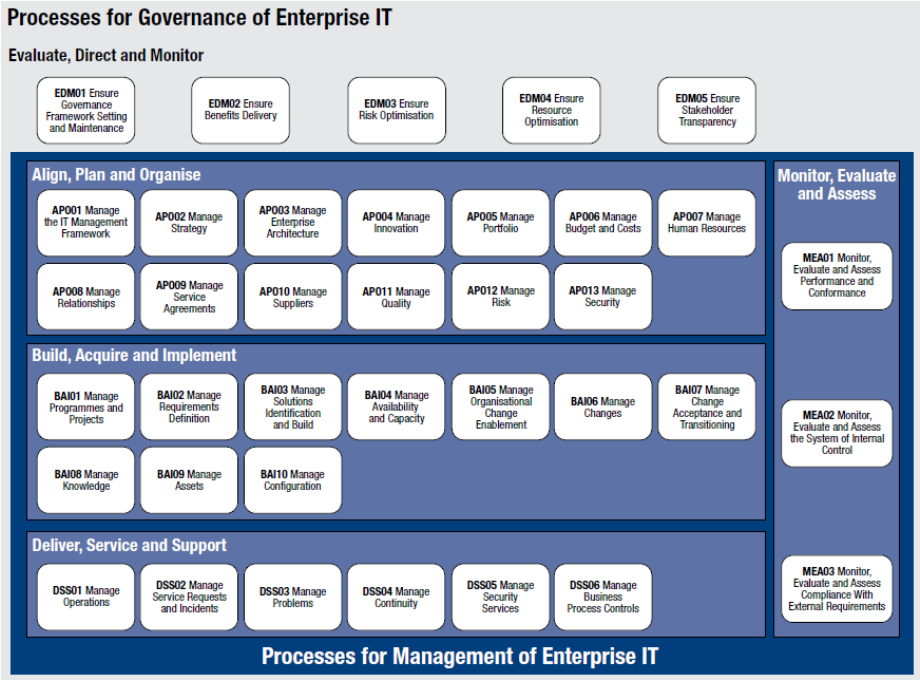

Figure 2. COBIT 5: Process Reference Model (ISACA, 2012b)

2.7 COBIT Quickstart

In theory, an enterprise can choose which process to implement as long as the governance and management objectives are satisfied. While SMEs may have fewer processes, larger and more complex enterprises may have many processes (ISACA, 2012a). COBIT Quickstart is a simplified version of the version 4.1 of COBIT which consists as "a baseline for many SMEs and other entities where IT is less strategic or not absolutely critical for survival, and a starting point for larger enterprises in their first moves towards an appropriate level of control and governance of IT" (ITGI, 2007). It can be used to detect the additional control required or to prioritize actions. COBIT Quickstart is suitable for organization that have an environment as follows:
- A simple command structure
- A short communications path
- A limited span of control
- An IT environment that is not particularly complex (IT sophistication)
- IT is not that strategically important
- The IT expenditure is not very significant
- Not much segregation of responsibilities

The Quickstart framework is simplified, it contains less Control Objectives and Management Practices than the full COBIT 4.1 (Table 2).

Table 2. CobiT Quickstart as Compared to CobiT 4.1 (ITGI, 2007)

	COBIT 4.1	**Quickstart**
Domains	4	4
Processes	34	32
Control Objectives/ Management Practices	210	59

2.8 Van Grembergen Framework

ITG can be implanted by a mix of structures, Processes and relational mechanisms (Van Grembergen et al., 2004). Examples of these structures, processes and relational mechanisms are presented based on the Peterson's framework (Peterson, 2004):
Structures: Roles and responsibilities, IT organization structure, IT strategy committee, IT steering committee.
Processes: Balanced (IT) scorecards, IT/Business alignment, strategic Information Systems Planning, Service Level Agreement, COBIT, ITIL, Information economics.
Relational mechanisms: collaboration between stakeholders, Business/IT colocation, Cross-functional business/IT training.

2.9 Weill and Ross Framework

The Weill & Ross Framework provide practical guidelines to improve the return from IT investments. The framework was conceived in a way to respond to a Director challenging need "What should I do tomorrow in order to implement the ITG in the organization?". The framework consists of answering three questions: (1) What decisions must be made to ensure an effective use of IT? (2) Who should make these decisions? And (3) How will these decisions be made and monitored? The Governance Arrangement Matrix addresses the two first questions (Table 3). While the answer to the third question consists of a mix of structures, processes and relational mechanisms that will enable the decision-making process which will produce the desirable behavior of IT (Weill and Ross, 2004).

Table 3. Governance Arrangements Matrix

	IT principles	IT Architecture	IT Infrastructure strategies	Business Application needs	IT Investments
Business monarchy					
IT monarchy					
Feudal					
Federal					
IT duopoly					
Anarchy					
Don't know					

The five key IT decisions concern the:
IT principles: specifying the strategic role of IT.
IT architecture: Defining standardization and integration needs.
IT infrastructure: Determining shared and enabling IT services.
Business application needs: Specifying the business needs for purchased or internally developed IT applications.
IT investments and prioritization: Determining what IT project to fund and how much.
The archetypes defines the type of people involved in making an IT decision as shown in the (Table 4). It helps to determine the issues in IT decision making process.

Table 4. Key players in IT Governance Archetypes Weill, 2004, p60

	C-level executives	Corporate IT and/or Business unit IT	Business unit leaders or key business process owners
Business monarchy	✓		
IT monarchy		✓	
Feudal			✓
Federal	✓	✓	✓
	✓		
IT duopoly	✓	✓	
		✓	✓
Anarchy			

3. Criteria and contingency factors identification

In the literature, some authors proposes frameworks or approaches to classify or select an ITG framework. The method proposed by Brown and Grant (2005) split the ITG frameworks into two streams: (1) stream one, the ITG forms, deals with the decision–making structures (centralized, decentralized), and (2) stream two, ITG Contingency Analysis, deals with contingencies that affects IT organizational structure decisions. Another work classifies the ITG frameworks into four cluster using Cobit and base on the PDCA cycle (NasserEslami et al., 2007). ISACA proposes a classification under two criteria: (1) detailed degree of the guidance in terms of technical or operational profundity, and (2) the completeness degree of the guidance (ISACA, 2011).
Larsen et al. (2006) presents two criteria: (1) the decision-making processes (Decision-making processes, Core Business processes, Support processes) and (2) the organizational entity (Business system, Business Unit, Activity, Procedure).
An approach proposed by Chakir et al. (2015) is based on the five ITG pillars of ISACA and an objective function of maximization is resolved to define the best framework. The approach compares between five standard frameworks.
In this section, we determine the necessary criteria that twill serve to evaluate the ITG frameworks. The work is based on different literature reviews (Pereira, da Silva, 2012a, 2012b, Novotny et al., 2012, Simonsson and Ekstedt, 2006, Webb et al., 2006) and previous works (Bartens et al., 2015, ISACA, 2011, Looso and Doeken, 2010, Muller, 2009, ITGI, 2003). The following table shows the ITG areas (Table 5). Each publication has some specific keywords to express the same concept. The keywords that have the same meaning were grouped to only one area per concept. Exemple: Quality management is grouped with Performance management (Novotny, 2012, ISO, 2015). Strategy management is grouped with Business/IT management.

Table 5. ITG Areas based on publications

Publication / Areas	**Pereira 2012b**	**Novotny 2012**	**Webb 2006**	**ITGI 2003**	**ISACA 2011**	**Simonsson 2006**	**ISO 38500**	**Weill 2004**	**Muller 2009**
Resource management	✓			✓	✓				
Risk / management	✓	✓	✓	✓	✓				
Application management	✓				✓	✓	✓	✓	✓
Architecture management	✓				✓	✓		✓	✓
Project management	✓				✓				
Infrastructure management	✓	✓			✓	✓			
Investment management	✓	✓			✓			✓	
Compliance management	✓	✓			✓		✓		✓
Performance / Quality management		✓	✓	✓	✓	✓	✓		
IT decision Authority, responsibility		✓	✓		✓		✓	✓	✓
ITG improvement		✓							
Business/IT alignment	✓	✓	✓	✓	✓	✓	✓	✓	✓
Business value delivery			✓	✓	✓			✓	
Scope (strategy-tactics)					✓	✓			
Decision making process						✓	✓		

Human behavior (People)	✓	✓	✓	

There is another dimension that is important: the contingencies factors. ITG implementation success depend on these factors, which are presented in the following table (Table 6). The organization size is an important context factor (Novotny, 2012). Also, in the literature, as the ITG standard frameworks can not simply be extrapolated to SMEs (Devos, 2012), there are propositions to have a "light" framework in order to suit the SME needs (ITGI, 2007) or a ITG framework for a specific public environment (Campbell et al. 2010, Pang et al. 2014, Vogt and Hales, 2010).
The ITG maturity play a role during implementation. For example, COBIT Quickstart is recommended for SMEs and large organization that want to start an ITG implementation (ITGI, 2007). Even for large organization, we find proposition of a minimum baseline Cobit 5 based ITG framework in order to reduce the implementation complexity (Bartens et al., 2015, Weill and Ross, 2004).
From experience, the learning curve of the ITG framework is an interesting factor that shouldn't be neglected. When convinced of the ITG benefices, the organization wants immediately to know what to do the next days and weeks (Weil and Ross, 2004). With a simplified ITG framework presentation and a prioritized list of action, the organization is more encouraged to go on with the implementation phase. Too much notions can be confusing and can spark a change resistance.

Table 6. Contingencies factors from the literature

Publications / Contingencies factors	**Pereira 2012b**	**ISACA 2012a**	**Weill 2004**	**Novotny 2012**	**Bartens et al. 2015**
Organizational culture	✓			✓	
Organizational structure / IT-line interunit ties	✓	✓	✓	✓	
Firm size	✓	✓	✓	✓	✓
Industry	✓		✓		
Regional differences	✓		✓		
Maturity	✓	✓	✓		✓
Strategy	✓		✓		
Ethical	✓				
Trust	✓				
Diversification level			✓	✓	
IT agility				✓	
IT unit's business knowledge				✓	
Line function's technical knowledge				✓	
IT unit age				✓	
IT investment intensity		✓		✓	
IT investment characteristics				✓	
Implementation factors				✓	
Environmental contingencies				✓	
External influence				✓	
IT Relatedness				✓	
Business Process Relatedness				✓	

The final criteria and domains retained are listed in table 7:

Table 7. Proposed criteria

Goal	**Criteria**	**Description**	**Sub-criteria**
Selection of an ITG framework	Area	The areas addressed by the ITG framework	Business / IT alignment
			Architecture management
			Infrastructure management
			Application management
			IT investment / Portfolio management
			Project Management
			Risk / Security management

		Performance management
		Resource management
		IT decision Authority, responsibility
Scope	The depth of the ITG framework	Strategic
		Tactic
		Operational (Looso, 2010)
Contingency factors	The organization type and size (Large organization, Public, SME)	Organization type
	Degree of experience/maturity of ITG implementation	ITG maturity
	Degree of the learning curve of the ITG framework	ITG framework complexity / learning curve

4. Conclusion

The paper addresses the first step during the selection of the most suitable ITG framework for an organization. First, the paper reviews the standard and research ITG frameworks. Then, it reviews, based on the literature, the different domains and criteria of ITG that will serve as a base for selection of an ITG framework.
The contribution of this paper is (1) providing an overview of the standards and well-known frameworks; (2) proposing a list of criteria that are relevant to the analysis and selection phase. The criteria shows the complexity of the ITG with the number of areas concerned, the scope of the ITG and also the contingency factors like organization size and ITG maturity of the organization.
We plan to continue this work, and propose a Multi Criteria Decision Analysis method to select the best ITG framework for a public pharmaceutical supply chain in a developing country.
Future research may go into exploring the impact of major contingency factors on the ITG framework selection and implementation in large and public organizations as well as SMEs.

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