

Implementing COBIT 5 in Small and Medium Enterprises

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Abstract—The pervasive use of Information Technology (IT) led most organizations to a critical dependency. Despite the benefits, it exposes organizations to several risks. Hence, a significant focus on Enterprise Governance of IT (EGIT) is required. There are best practices frameworks that support an EGIT implementation and COBIT 5 is a reference. These frameworks are considered highly complex and require investments and resources which are extremely scarce in Small and Medium Enterprises (SMEs). Therefore, the research problem is the lack of support for the implementation of COBIT 5 in SMEs. This research proposes a solution that identifies the fundamental EGIT mechanisms for SMEs and then, establishes a mapping with the COBIT 5 components that support its implementation. The proposed solution was evaluated according to several methods, including expert interviews and other methods to evaluate IT artifacts.

Index Terms—Information Technology, Enterprise Governance of IT, Enterprise Governance of IT Mechanisms; COBIT 5; Small and Medium Enterprises.



1 INTRODUCTION

Information Technology (IT) has been increasingly used to automate and integrate business processes, contributing to increase productivity and achieve a competitive advantage [1]. It has also been used to develop new business strategies, becoming recognized as a strategic partner instead of a mere service provider. [2]. Despite all the advantages, the use of IT exposes organizations to several threats [3]. The pervasive role of IT made organizations dependent and raised the need to deliver more value from IT investments while managing IT risks [1]. Consequently, a significant focus on Enterprise Governance of IT (EGIT) is required [3].

Benefits achieved through effective EGIT vary. These are valid for large enterprises but also to Small and Medium Enterprises (SMEs) [4]. SMEs are considered the backbone of Europe's economy, representing 99% of all businesses¹. Throughout this research, the authors will consider an SME as an organization with less than 250 employees, following the European Union (EU) criteria [5]. It is essential to recognize that challenges experienced by SMEs and larger organizations are quite different [6]. When compared, SMEs are usually constrained in terms of material, financial and human resources [7].

In order to support the implementation of EGIT, there are good practice frameworks, from which COBIT 5 is recognized as the best and most complete EGIT framework. [8]. Undoubtedly, SMEs are also dependent of IT and need to manage their IT-related

assets. However, COBIT5 involve an huge number of interrelated components that can make implementation a quite difficult task for larger organizations which do not know where to start [9]. According to De Haes et al., there is a lack of knowledge regarding which components of the framework are perceived by the organizations as effective and easy to implement. [10].

Therefore, taking the first step towards implementing COBIT5 can be even more challenging for SMEs since they have more constraints, such as scarce IT resources [11]. This can contribute to the extremely low levels of COBIT5 adoption in SMEs.

1.1 Research Problem

In every country, the vast majority of organizations are SMEs [12] which represent a key engine to promote socio-economic development by ensuring employment to the majority of the workforce and encouraging flexibility and innovation to address new market demands [13]. Considering the relevance of these organizations, it is crucial their IT-related investments deliver the expected value while the assets are managed and controlled to prevent that such risks compromise their business operations.

A reliable way to ensure this is by implementing EGIT recognizing that the challenges experienced by SMEs and larger organizations are significantly different [6]. The characteristics of SMEs does not promote the adoption of comprehensive EGIT frameworks, leading to the existent perception that the implementation process is too expensive and unfeasible [14].

1. https://ec.europa.eu/growth/smes_en

Generally, organizations decide to implement EGIT using well-established best-practice frameworks [9]. COBIT 5 is a complete and broad framework providing a set of practices and objectives that all organizations should follow to effectively implement EGIT [15].

In spite of the undeniable usefulness [9], COBIT 5 implementation is recognized as excessively complex [10]. Another factor is the lack of detailed guidance to correctly plan and begin a difficult and expensive implementation as the COBIT 5 implementation, namely choosing the processes and the order in which these must be implemented [10]. Therefore, the perceived complexity can act as a barrier to the adoption of COBIT 5 in SMEs [15].

Considering the lack of detailed guidance for COBIT5 implementation, its inherent complexity and the fact that SMEs characteristics does not favor the implementation of frameworks like COBIT5, the authors believe that COBIT5 implementation in SMEs requires further research. Therefore, the problem that will be addressed is **the lack of support for the implementation of COBIT5 in SMEs**.

2 RESEARCH METHODOLOGY

The research methodology selected to guide this thesis was Design Science Research (DSR).

Despite all the in research of IT Governance (ITG), the practitioners still fail to implement ITG successfully in their organizations [16]. Several authors stated the lack of professional relevance of IS research [17]. The goal of DSR is to develop knowledge that practitioners can use and apply in the field [18]. The adoption of DSR in IS research promotes closer ties between researchers and practitioners [19]. DSR is an iterative methodology that aims to create and evaluate IT artifacts that solve identified organizational problems [20].

The design-oriented IS research follows an iterative process comprising four phases [21]:

- 1) **Analysis:** The business problem is identified and research objectives, questions, and gaps are specified. The state of the art of problem-solving approaches known in business and science is analyzed.
- 2) **Design:** Artifacts should be created using generally accepted methods, be justified as much as possible and be contrasted with existing solutions.
- 3) **Evaluation:** Scientific rigor demands validation of artifacts produced against the objectives specified. The review process prior to scientific publications is part of the evaluation.
- 4) **Diffusion:** The obtained results should be diffused among the target groups mainly

through scientific papers, practitioner papers or dissertation theses.

3 LITERATURE REVIEW

3.1 EGIT

Steven de Haes et al. defined EGIT as “an integral part of corporate governance, exercised by the Board, overseeing the definition and implementation of processes, structures and relational mechanisms in the organization that enable both business and IT people to execute their responsibilities in support of business/IT alignment and the creation of business value from IT-enabled business investments” [3]. Fundamentally, EGIT covers every aspects of all IT-related decisions, such as “how decisions are made, who makes the decisions, who is held accountable, and how the results of decisions are measured and monitored” [22].

EGIT comprises a set of high-level definitions, including principles, values and goals that should be operationalized through different types of mechanisms [23]. Organizations should adopt a holistic approach by using a mixture of several types of EGIT mechanisms, namely structures, processes and relational mechanisms [24].

- Structure mechanisms refers to organizational units and roles responsible for IT-related decisions, such as IT strategy committee or architecture steering committee [3], [2].
- Processes mechanisms corresponds to formal processes of strategic IT decision-making and IT monitoring, like portfolio management and IT performance measurement [3], [2].
- Relational mechanisms include the active participation of, and the collaboration among, the corporate executives, IT managers and business managers that contribute to disseminate EGIT principles. It can include cross-training or EGIT awareness campaigns [3], [2].

However, it is fundamental to understand that there is a host of internal and external factors influencing the design of an effective EGIT. Therefore, determining the appropriate mechanisms to implement EGIT can be a rather complex task [25].

3.2 COBIT 5

COBIT 5, developed by ISACA, is an internationally well-established best-practices framework that assists the board, executive managers and operational managers from business and IT in achieving their objectives for EGIT [3]. In theory, this framework is recognized as “generic and useful for enterprises of all sizes, whether commercial, not-for-profit or in the public sector” [26].

COBIT 5 framework is based on five core principles that are considered crucial to the governance and management of IT within organizations: Meeting Stakeholder Needs, Covering the Enterprise End-to-End, Applying a Single Integrated Framework, Enabling a Holistic Approach, and Separating Governance from Management. Following an holistic approach, COBIT 5 describes seven types of enablers: Principles, policies and frameworks, Processes, Organizational Structures, Culture, ethics and behavior, Information, Services, infrastructure and applications and People, skills and competencies.

This framework provides a reference guide to the 37 COBIT 5 processes distributed over governance and management domains. For each process, it provides a short description and purpose statement. Each process is decomposed in base practices that provide a set of high-level requirements for the process, in total it defines more than 200 practices. Then, for each practice are defined the inputs and outputs and also a RACI chart indicating the Organizational Structures, from the 26 defined by COBIT 5, that will be involved. Finally, each practice is decomposed into a set of activities that describes the required steps to implement the practice.

The complexity of COBIT 5 and its initial implementation problems require specific and detailed guidance [10].

3.3 EGIT in SMEs

SMEs are considered as a key element to promote economic growth, innovation, job creation, and social integration. These organizations play a fundamental role in nowadays economies, so their issues should be rigorously addressed and investigated. As bigger companies, SMEs also want to create value by applying IT in their strategic activities. "It would be wrong to think that SMEs are not concerned by it, just as it would be wrong to think that they have nothing to gain, strategically speaking, from it" [27]. Thus, EGIT is also fundamental to SMEs and must be studied [28].

Most of EGIT frameworks, such as COBIT 5, are often criticized for being less appropriate for SMEs since they do not consider the characteristics of SMEs [28], such as their organizational structures, financial and IT resources and IT management postures [4]. SMEs do not always have a board of directors. The decision-making organizational structures tend to be centralized, flat and informal [6]. These are centralized around the CEO or owner, enabling him to personally influence the decision processes [29]. Financial and IT resources limitations are much bigger in SMEs, hence they spend much less on IT [30] and have difficulty in attracting capable IT staff which afterwards impact the IT management posture.

In turn, adopting a broad and complete EGIT framework requires capable IT staff with EGIT expertises which normally do not exist in SMEs. Most organizations maintain small IT departments that are focused on short-term solution and operational efficiency [29]. SMEs lack long-term vision of their business and adopt a more operational than a strategic view [31].

To summarize, the resources limitations and the lack of IT knowledge will have a negative impact in the adoption of IT. These SMEs' characteristics make the implementation of broad and large EGIT frameworks extremely difficult. They are complex and costly to implement, hence SMEs perceive it as a frightening and unpractical implementation process [14]. Thus, the best approach is to scale-down and adapt the existing frameworks to fit within those particular SMEs [32].

3.4 Minimum Baseline of EGIT Mechanisms

The complexity of broad best-practice frameworks for EGIT implementation, and especially COBIT 5, is a problematic issue. According to De Haes et al. [10], problems with COBIT 5 implementation starts at an early phase when practitioners have to decide what are the processes to implement.

A possible and suitable solution is to identify a capable minimum baseline of EGIT mechanisms that could serve as starting point or basis to effectively implement EGIT in organizations [1], [9]. However, different organizational contexts may imply different EGIT mechanisms [33]. Therefore, it is clear that the minimum baseline will not be suitable and sufficient to all organizations. The minimum baseline should be used as a roadmap to implement the most significant EGIT mechanisms in specific organizational contexts [34].

4 RESEARCH PROPOSAL

The main objective of the proposed solution is to **facilitate COBIT 5 implementation in SMEs**. In order to achieve this, we consider that the proposed solution should comply with the following objectives: (1) Identify the fundamental mechanisms to implement effective EGIT in SMEs; (2) Establish the correspondence between the fundamental EGIT mechanisms for SMEs and the Processes and Organizational Structures defined in COBIT5.

In order to realize the aforementioned objectives and solve the research problem, we propose a solution that implies the development of two artifacts. The first artifact consists in a minimum baseline of EGIT mechanisms for SMEs. This baseline will be extracted from an overarching list of mechanisms that was based on several researches [1], [35]. The procedure will

be based on semi-structured interviews with several experts knowledgeable of the IT decision-making process in a SME context, ensuring that the baseline is appropriate and connected as much as possible to the real environment of SMEs.

The second artifact intend to establish the mapping between each EGIT mechanism present in the baseline and the COBIT 5 Processes and Organizational Structures that support the implementation of such mechanisms, ensuring their purpose. Then, COBIT 5 best-practices could be used to support the implementation of the desired mechanism. Furthermore, it will be possible to identify differences between the mechanisms and the mapped COBIT 5 component or even EGIT mechanisms that are not present in the COBIT 5 framework, which can also be a great contribution.

5 MINIMUM BASELINE OF EGIT MECHANISMS FOR SMEs

5.1 Design

In order to collect suitable and valuable information about EGIT mechanisms in SMEs, eleven semi-structured interviews were performed. All the interviewees were IT experts with knowledge and experience in SMEs. It includes CEOs, CIOs, IT Directors and IT Managers which are the main roles involved in the IT-related decision-making [36], thereby ensuring that the results are appropriate and linked as much as possible to the reality of SMEs. Several SMEs and experts were contacted presenting our study and inviting them to an interview. When accepted, the interview was scheduled and the EGIT mechanisms definitions and the questionnaire were sent to each interviewee.

This questionnaire starts with a few personal questions, while the second part is related with the evaluation of EGIT mechanisms, comprising two parameters: the difficulty of implementation and potential effectiveness in SMEs' context. Subsequently, each interviewee was asked to select the ten most important mechanisms. The difficulty of implementation is defined as the quantity of time and effort required to implement the mechanism and the effectiveness is defined as the extent to which it contributes to the achievement of IT-related goals and objectives. The evaluation was based on a Likert scale [37], ranging from 0 to 5. Therefore, 0 means "not difficult at all" and "not effective at all" while 5 means "extremely difficulty" and "extremely effective". In next section, the analysis of collected data is presented.

5.1.1 Data Analysis and Discussion

The results of the evaluation performed during the interviews are presented in Table 1. This table contains

the list of EGIT mechanisms and eleven columns presenting interviewees' answers. Each column includes two sub-columns, representing the both parameters evaluated. The column 'D' corresponds to the difficulty of implementation while the column 'E' corresponds to the effectiveness. Lastly, the column 'E-D' corresponds to the difference between the total values of 'E' and 'D'. Furthermore, interviews were recorded and transcribed enabling a qualitative analysis. This analysis allowed the authors to get further details about EGIT mechanisms.

After the evaluation, each interviewee selected the ten fundamental EGIT mechanisms to effectively implement EGIT in SMEs (see Table 2). The columns represent the eleven interviewees and the cells in grey indicates the mechanisms they selected as fundamental. The 'Freq.' column indicates the number of times that each mechanism was selected.

Given the number of interviewees, the authors consider that the minimum baseline should be composed of EGIT mechanisms that were selected as fundamental to SMEs at least by five experts. Following this criterion, nine distinct mechanisms were identified as the minimum baseline of EGIT mechanisms for SMEs (highlighted in Table 2).

This minimum baseline should be considered as a good starting point to effectively implement EGIT in SMEs. However, the minimum baseline may not be the sufficient set to every organization. Therefore, the authors recommend looking at the remaining mechanisms with high classifications of 'E-D' as a possible complement. From the data analysis performed, several interesting findings were revealed. It includes a comparison between mechanism types and other conclusions concerning EGIT mechanism in SMEs extracted from the qualitative feedback provided.

5.2 Evaluation

Hevner et al. [38] state that the business environment influences requirements of the constructed artifact and its evaluation is an essential. DSR processes have been criticized for performing this evaluation late in the process. Different evaluation sequences and methods can be applied depending on the context and objectives of the evaluation [39]. Particularly, if the Design phases are extremely time-consuming or expensive, it can be advantageous to prevent disappointments by applying early control measures, such as *ex ante* evaluation. The *ex ante* evaluation intends to evaluate the artifact before its design and construction, the researchers are able to forecast and identify important guidelines and restrictions of the design of the artifact [40]. Furthermore, expert interviews are considered as appropriate and pertinent to be applied in *ex ante* evaluations [39].

TABLE 1
Results from interviews with IT experts.

Mechanisms	1		2		3		4		5		6		7		8		9		10		11		TOTAL		
Structures	D	E	D	E	D	E	D	E	D	E	D	E	D	E	D	E	D	E	D	E	D	E	D	E	E-D
Centralized IT Organization Structure	1	3	0	3	1	5	1	4	0	5	0	4	1	4	0	5	0	5	0	5	0	4	4	47	43
CIO reporting to CEO and/or COO	1	4	2	5	2	5	1	2	1	4	0	3	2	4	0	5	3	4	0	5	0	5	12	46	34
Governance Tasks in Roles and Responsibilities	2	4	4	5	1	5	3	5	0	5	2	3	2	5	1	5	2	4	1	5	0	5	18	51	33
CIO on Executive Committee	2	4	2	5	3	5	2	4	2	3	1	3	2	4	2	5	5	3	0	4	0	5	21	45	24
IT Expertise at Level of Board	1	3	2	4	2	3	2	4	0	5	1	4	2	4	3	4	2	4	4	3	3	5	22	43	21
IT Investment Committee	1	3	2	3	1	5	2	4	1	4	2	4	5	2	3	2	1	5	3	4	1	3	22	39	17
CIO on Board	2	4	2	5	3	5	2	4	2	3	1	4	4	2	5	2	5	2	1	4	0	5	27	40	13
IT Strategy Committee	3	4	1	5	4	3	3	5	2	4	2	3	1	4	5	1	5	3	3	5	0	4	29	41	12
IT Project Steering Committee	3	3	3	4	3	4	2	4	1	4	1	3	2	5	5	2	5	3	1	4	2	3	28	39	11
Security / Compliance / Risk Officer	3	2	3	3	3	2	1	4	2	4	3	2	3	4	4	4	1	5	4	3	2	5	29	38	9
Business/IT Relationship Managers	3	4	4	5	3	5	1	4	2	3	2	2	3	5	4	0	4	4	3	4	3	4	32	40	8
IT Steering Committee	3	4	1	3	4	2	3	4	1	4	2	3	3	5	5	1	1	4	3	3	2	3	28	36	8
ITG Function/Officer	4	2	1	3	4	2	1	4	2	3	2	3	5	4	3	5	5	3	2	5	2	3	31	37	6
IT Security Steering Committee	4	2	3	3	4	2	3	4	1	4	2	2	3	4	5	2	1	4	3	3	2	5	31	35	4
Architecture Steering Committee	4	2	2	5	4	1	3	4	4	2	2	3	5	4	5	0	2	4	3	4	2	3	36	32	-4
IT Audit Committee (at level of board)	4	2	2	3	4	4	3	4	2	3	3	2	4	4	5	1	5	3	1	1	2	3	35	30	-5
Decentralized IT Organization Structure	3	1	4	5	3	1	1	3	3	2	2	3	5	2	2	2	0	4	1	2	3	31	23	-8	
Federal IT Organization Structure	3	4	2	4	4	3	3	3	2	3	2	3	5	2	5	0	5	0	3	2	3	3	37	27	-10
IT Councils	4	1	2	3	4	1	3	2	2	3	1	3	5	2	5	0	5	3	5	2	2	3	38	23	-15
IT Leadership Councils	4	1	3	2	5	2	3	2	2	2	1	3	5	2	5	0	5	0	5	2	2	3	40	19	-21
Processes	Structures Average																					27.6	36.6	9.0	
IT Budget Control and Reporting	1	4	1	3	1	4	2	4	1	4	1	4	1	5	3	4	1	5	2	5	2	4	16	46	30
Demand Management	3	3	3	4	1	4	2	4	1	5	2	4	2	3	1	4	1	5	1	5	1	5	18	46	28
Strategic Information System Planning	3	4	3	5	2	3	3	4	1	4	1	3	2	4	1	5	1	5	0	5	2	4	19	46	27
Service Level Agreement	2	5	2	4	3	2	2	4	1	4	3	4	1	4	3	4	2	5	1	5	0	5	20	46	26
Portfolio Management	2	4	2	3	1	5	2	4	1	4	1	4	3	3	3	3	1	5	1	4	1	4	18	43	25
Business/IT Alignment Model	3	2	4	5	2	5	3	3	1	4	2	3	3	5	2	5	1	5	2	3	3	4	26	44	18
ITG Frameworks/ Standards	2	3	2	4	1	2	3	4	2	5	2	3	3	5	4	5	3	4	4	3	2	4	28	42	14
IT Performance Measurement - IT BSC	4	2	3	5	3	4	3	3	1	5	2	4	2	5	3	2	3	5	3	3	2	4	29	42	13
Benefits Management and Reporting	3	4	1	4	3	3	3	3	1	4	3	4	4	5	4	3	4	4	2	4	3	5	31	43	12
Project Governance/Management Methodologies	3	3	2	4	2	2	2	4	3	3	3	4	3	4	3	5	4	4	4	2	0	4	29	39	10
ITG Maturity Models	3	2	3	4	4	2	3	4	2	3	3	5	2	5	4	1	3	3	4	1	2	5	33	35	2
Chargeback	2	3	3	3	4	2	2	4	4	4	2	2	5	2	1	3	3	4	4	2	2	3	32	32	0
Architectural Exception Process	3	2	3	3	0	1	3	4	1	4	3	4	5	1	5	0	3	4	1	4	3	2	30	29	-1
ITG Assurance and Self-assessment	2	3	2	4	4	1	3	4	3	3	2	3	3	4	5	3	5	1	4	1	1	4	34	31	-3
Relational Mechanisms	Processes Average																					25.9	40.3	14.4	
Informal Meetings (Business and IT Seniors)	2	3	1	5	0	4	1	4	1	4	1	4	0	5	2	1	2	4	0	5	1	4	11	43	32
Business/IT Co-location	1	3	3	4	1	5	2	3	1	4	3	4	0	5	2	5	3	3	0	5	2	5	16	46	30
Shared Understanding of Business/IT Objectives	3	2	1	5	2	5	2	4	1	4	3	4	3	5	1	5	1	5	1	5	2	3	18	47	29
Cross-Training	2	4	1	4	2	5	3	3	3	3	2	4	2	5	2	5	1	4	1	5	1	4	19	46	27
IT Leadership	3	2	2	4	1	5	2	4	2	4	2	4	3	5	2	3	1	4	0	5	1	5	18	45	27
Senior Management giving the good example	1	3	2	4	2	5	1	4	1	4	3	3	2	5	1	5	2	4	3	3	2	4	18	44	26
Senior Management Announcements	3	2	1	3	0	4	1	4	2	3	2	3	1	4	1	4	1	3	2	4	1	4	14	38	24
Knowledge Management (On ITG)	2	3	2	4	2	4	2	4	1	3	2	4	1	4	3	3	1	4	2	2	1	4	18	39	21
Organizational Internal Communication	2	2	1	4	3	3	1	4	3	5	3	4	1	4	3	5	1	2	3	4	1	4	21	41	20
Office of CIO or ITG	2	2	2	4	1	4	3	4	1	5	3	5	3	5	4	5	4	4	4	4	1	4	27	46	19
ITG Awareness Campaigns	3	3	1	4	4	3	1	4	2	4	2	3	1	4	3	4	1	4	4	2	2	4	22	39	17
Partnership Rewards and Incentives	2	4	3	4	1	5	1	4	4	1	5	4	3	2	4	5	4	3	4	5	1	5	31	42	11
Business/IT Account Management	4	3	3	5	3	5	1	4	2	3	3	4	3	5	4	0	4	4	3	4	3	4	30	41	11
Job-Rotation	3	2	3	4	2	5	3	3	2	4	4	3	4	2	5	2	4	3	4	1	3	4	34	33	-1
	Relational Mechanisms Average																					21.2	42.1	20.9	

TABLE 2
Ten most important mechanisms selected by each interviewee.

Structures	1	2	3	4	5	6	7	8	9	10	11	Freq.
Governance Tasks in Roles and Responsibilities												8
Centralized IT Organization Structure												6
IT Project Steering Committee												5
IT Expertise at level of Board												3
Security/Compliance/Risk Officer												3
IT Strategy Committee												2
CIO on Board												2
CIO on Executive Committee												2
IT Steering Committee												2
IT Investment Committee												2
CIO reporting to CEO and/or COO												2
IT Governance Function/Officer												1
IT Security Steering Committee												1
Architecture Steering Committee												1
Business/IT Relationship managers												1
Processes												
IT Budget Control and Reporting												5
Service Level Agreement												5
Strategic Information System Planning												5
IT Performance Measurement - IT BSC												4
Portfolio Management												4
Business/IT Alignment Model												4
Demand Management												4
IT Governance Maturity Models												3
Project Governance / Management Methodologies												1
ITG Assurance and Self-Assessment												1
Relational Mechanisms												
Shared Understanding of Business/IT Objectives												7
Informal Meetings (Business and IT Seniors)												6
IT Leadership												6
Cross-Training												4
Business/IT Co-location												3
Partnership Rewards and Incentives												3
Senior Management Announcements												2
Organizational Internal Communication												1
Executive management giving the good example												1

Therefore, we consider that all the interviews performed with IT experts from SMEs to evaluate the EGIT mechanisms and elicit a minimum baseline for SMEs can be seen as an *ex ante* evaluation of this artifact. Through these interviews, the authors were able to extract important guidelines and restrictions regarding the design of the artifact such as the mechanisms evaluations and the mechanisms selected as fundamental for SMEs, thereby contributing to guarantee that resulting artifact will not be a failure.

We have also used Österle et al. principles, which defines a set of principles to which all DSRs in IS must comply [21]:

- **Abstraction:** The proposed minimum baseline of EGIT mechanisms is useful and applicable to SMEs that intend to implement effective EGIT.
- **Originality:** Based on the literature review performed, there are no studies addressing the EGIT mechanisms in SMEs with the purpose of evaluate them and elicit a minimum baseline for this specific context.
- **Justification:** The proposed artifact was constructed based on reputable work. The presented motivation and research problem justify the need for this artifact. The methods applied are described and justified in a clear and transparent.
- **Benefit:** The stakeholders that will benefit from

this artifact are the managers and practitioners from SMEs that intend to implement EGIT in their organizations.

6 MAPPING BETWEEN BASELINE MECHANISMS AND COBIT 5

6.1 Design

After the elicitation of the minimum baseline for SMEs, the authors were able to start the development and definition of the proposed mapping. The authors established the correspondence between each mechanism and a specific practice whose description, activities and respective inputs and outputs are extremely related with mechanism description and, thereby, the best practices defined in COBIT 5 framework can contribute to its implementation. Except when the description clearly states that the mechanism is composed by people such as an officer, a committee or a council. In this case, the authors did not searched for a Process but focused their attentions on the Organizational Structures Enabler of COBIT 5 and sought an organizational structure that includes the functions or responsibilities performed by the mechanism.

The proposed mapping is presented in Table 3. The left side, in blue, corresponds to the EGIT mechanisms present in the baseline for SMEs and the respective descriptions. The right side, in grey, contains the COBIT 5 components selected by the authors and the respective description taken from the COBIT 5 manuals [26], [41]. The main objective was not to establish an exhaustive mapping with all the related components in COBIT 5, if so this will result in a extensive list of components for each mechanism. This represents the complexity associated with the COBIT 5 framework which can act as barrier for its implementation in SMEs.

Analyzing the resulting mapping, all the identified Practices are from APO Processes. This domain addresses the planning and organization of enterprise IT to the achievement of the business objectives, thereby including the strategic alignment between business and IT. This fact is extremely interesting since the authors identified that SMEs lack long-term vision of their business and tend to adopt a more operational than a strategic view. Therefore, the mechanisms elicited based on the practitioners' feedback and now mapped with APO Practices can contribute to mitigate this problem that still exists in this type of organizations. Considering that the baseline should be seen as a good starting point, it is extremely important to begin with practices that promote the planning and the strategic alignment from an early phase.

Moreover, the authors identified a correspondence for eight of the nine mechanisms of the baseline, thereby suggesting there are guidelines and best practices provided by the COBIT 5 framework that can also

TABLE 3
Mapping between Baseline Mechanisms and COBIT 5 Components

	Mechanism	Mechanism Description	COBIT 5 Component Description	COBIT 5 Component
1	Governance Tasks in Roles and Responsibilities	Clear and unambiguous definitions of the roles and the responsibilities of the involved parties are a crucial prerequisite for an effective ITG. It includes governance/alignment tasks for business and IT people and it is the responsibility of the board and executive management to communicate and to make sure that they are clearly understood throughout the whole organization. The best idea is to document all roles and responsibilities.	Establish, agree on and communicate roles and responsibilities of IT personnel, as well as other stakeholders with responsibilities for enterprise IT, that clearly reflect overall business needs and IT objectives and relevant personnel's authority, responsibilities and accountability.	Practice APO01.02 Establish roles and responsibilities
2	IT Organization Structure	The possibility of effective governance over IT is also determined by the way the IT function is organized and where the IT decision-making authority is located in the organization. The adoption of a particular mode is influenced by different determinants, such as history, economies of scale, size, industry. Decision-making structures are the natural approach to generate commitment within the organization.	Position the IT capability in the overall organizational structure to reflect an enterprise model relevant to the importance of IT within the enterprise, specifically its criticality to enterprise strategy and the level of operational dependence on IT. The reporting line of the CIO should be commensurate with the importance of IT within the enterprise.	Practice APO01.05 Optimize the placement of the IT function.
3	IT Project Steering Committee	Steering committee composed of business and IT people focusing on prioritizing and managing IT projects.	A group of stakeholders and experts who are accountable for guidance of programmes and projects, including management and monitoring of plans, allocation of resources, delivery of benefits and value, and management of programme and project risk.	Organizational Structure Project and Programme Steering Committee
4	IT Budget Control and Reporting	Processes to control and report upon budgets of IT investments and projects.	Implement a cost management process comparing actual costs to budgets. Costs should be monitored and reported and, in the case of deviations, identified in a timely manner and their impact on enterprise processes and services assessed.	Practice APO06.05 Manage costs
5	Strategic Information System Planning	Formal processes to define and update the IT strategy of the organization, including aligning IT with business goals, exploiting IT for competitive advantage, directing efficient and effective management of IT resources, and developing technology policies and architectures. These processes should assure the IT priorities and investments are strictly aligned with the mission, objectives and goals of organization	Create a strategic plan that defines, in co-operation with relevant stakeholders, how IT-related goals will contribute to the enterprise's strategic goals. Include how IT will support IT-enabled investment programmes, business processes, IT services and IT assets. Direct IT to define the initiatives that will be required to close the gaps, the sourcing strategy and the measurements to be used to monitor achievement of goals, then prioritize the initiatives and combine them in a high-level road map.	Practice APO02.05 Define the Strategic Plan
6	Service Level Agreement (SLA)	A Service Level Agreements (SLA) is defined as "a written contract between a service provider of a service and the customer of the service". The functions of SLAs are: Define what levels of service are acceptable by users and are attainable by the service provider; define the mutually acceptable and agreed upon set of indicators of the quality of service. Three basic types of SLAs can be defined: in-house, external and internal SLAs.	Define and prepare service agreements based on the options in the service catalogues. Include internal operational agreements.	Practice APO09.03 Define and prepare service agreements
7	Shared Understanding of Business/IT Objectives	Mechanism that promote the mutual understanding of business and IT objectives and plans by business and IT people and the respect of each other's contribution. Therefore, business and IT people can accurately interpret and anticipate actions and, if necessary, coordinate adaptively. This mechanism is considered a paramount for attaining and sustaining business/IT alignment.	Understand current business issues and objectives and business expectations for IT. Ensure that requirements are understood, managed and communicated, and their status agreed on and approved.	Practice APO08.01 Understand business expectations
8	Informal Meetings (Business and IT Seniors)	Informal meetings, with no agenda, where business and IT senior management talk about general activities, directions, etc. (e.g. during informal lunches)		
9	IT Leadership	Ability of CIO or similar role to articulate a vision for IT's role in the company and ensure that this vision is clearly understood by managers throughout the organization. The goal is the coordination across the organization.	Communicate awareness and understanding of IT objectives and direction to appropriate stakeholders and users throughout the enterprise.	Practice APO01.04 Communicate management objectives and direction

be relevant and appropriate for SMEs. This contradicts the idea that the COBIT 5 framework is only suitable for large organizations and that the provided best practices are not applicable to SMEs.

With this mapping, the authors intend to facilitate the implementation of COBIT 5 in SMEs by indicating which are the principal components that could support the implementation of almost all the fundamental EGIT mechanisms for SMEs. This solution can help to overcome the problem related to the lack of orientation in the initial phases.

6.2 Evaluation

The design researcher should balance the interests of practitioners and researchers. The practitioners are concerned with usefulness whereas the researchers are focused on the validity of the artifact and in ensuring the rigor in the process [39]. This artifact will be evaluated according to the Wand and Weber method, Österle et al. principles and expert interviews.

The Wand and Weber method is based on the ontological deficiencies that can be found in the mapping, namely Incompleteness, Redundancy, Overload and Excess. Two deficiencies were identified in this mapping. Starting by incompleteness, the mapping is incomplete since there is no correspondence for the mechanism Informal Meetings between Business/IT Seniors. It means that COBIT 5 does not specify a practice that support the implementation of the mechanism. Next, the mapping is clearly excessive. This was expected since it establishes the mapping with COBIT 5 Practices and Organizational Structures. The COBIT 5 define more than 200 Practices and 26 different organizational structures whereas the elicited baseline is composed only by 9 EGIT Mechanisms. This shortcoming was expected and do not affect the purpose of the mapping.

The Österle et al. principles, to which all DSRs in IS must comply, were also verified [21]:

- **Abstraction:** The proposed mapping is useful to practitioners from SMEs that desire to implement the fundamental EGIT mechanisms by following the COBIT 5 guidelines and best practices.
- **Originality:** After the literature review, the authors verified that there are no studies addressing the adoption of COBIT 5 in SMEs. More specifically there are no studies addressing the fundamental EGIT mechanisms for SMEs and their correspondence to COBIT 5 components.
- **Justification:** This mapping is based on published articles and in COBIT 5 official documentation. The authors consider that the motivation and research problem presented justify the need for the proposed mapping. The steps

applied in construction and validation of the artifact are described.

- **Benefit:** The stakeholders that will benefit from this artifact are the managers and practitioners from SMEs. The mapping enables these practitioners to know the COBIT 5 components that support the implementation of the baseline mechanisms.

Several authors declared that expert interviews are an appropriate method to apply in DSR evaluation [21], [39], especially when other evaluation methods may not be feasible [38]. Therefore, the authors decided to perform expert interviews, through a semi-structured approach, with professionals knowledgeable about EGIT and, more specifically, about the COBIT 5 framework. After scheduling the interview, the proposed mapping and the questionnaire were sent to the interviewees.

After providing ratings for the 8 correspondences, the interviewees then provided ratings for a subset of the criteria proposed by Prat et al. [42] to evaluate IS artifacts. From this overarching hierarchy, the authors selected the criteria that considered the most appropriate to evaluate our artifact: Efficacy, Level of Detail, Consistency, Utility for people and Ease of use. These criteria will be evaluated based on semi-structured interviews. This feedback will be essential to realize the opinions and experience of people that can use and be directly affected by the proposed solution.

Starting with the evaluation of the correspondences established in this mapping, the average results can be seen in Figure 1. Herein, the letter C represents the correspondences.

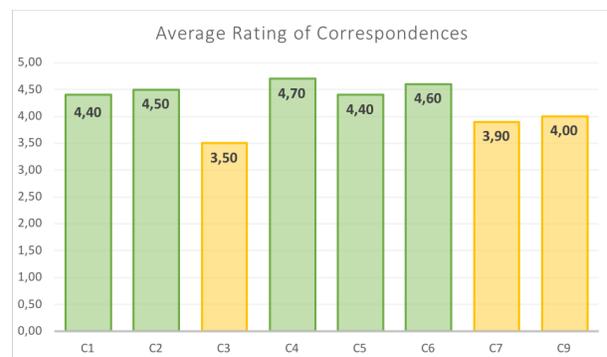


Fig. 1. Average ratings of correspondences

Five of the eight correspondences obtained an average rating equal to or higher than 4.40. This is a fairly good and satisfactory average value, thereby suggesting that these correspondences are appropriate and little improvement can be made. Furthermore, the vast majority of the experts interviewed provided a

positive feedback (4 - Agree or 5 - Strongly Agree) regarding these correspondences.

However, there are three correspondences that got lower average values. Some of the most consensual reasons, provided by the experts, are presented. This qualitative feedback will be fundamental to identify several possibilities of improvement of the proposed mapping, namely regarding the C3, C7 and C9.

Regarding the lack of a correspondence for the mechanism Informal Meetings between Business and IT Seniors, seven of the nine interviewees understood and agreed with vision followed by the authors, however, several experts recommended to search in other COBIT 5 Enabler, the Culture, Ethics and Behavior, which was not considered in the scope of this research. Therefore, investigation addressing the other COBIT 5 Enablers can be an excellent future work.

Regarding the criteria selected for evaluation, there are two criteria that obtained less than 4.00. The Efficacy criteria address the degree to which the artifact produces its desired effect and got an average of 3.90. This is not an optimal result but the authors believe that this value can be extremely higher if the problems of the mapping are solved. Despite some of the problems, 80% of the interviewees gave a positive answer. Thus, the authors consider that a large part of the mapping goal was achieved.

The other criteria that got a lower average value was the Level of Detail with an average of 3.50. It is a relatively low value for a criteria that can affect the perception of the correspondences established. According to the experts, the problem of this criteria is related to the definitions provided for some of the EGIT mechanisms. Further analysis of the literature may be required to extract more detailed definitions. The authors believe that if this aspect is improved, the correspondences established could achieve higher classifications.

The criteria of Consistency and Ease of Use obtained quite good ratings, with an average of 4.40. Moreover, 90% of the experts responded positively and 50% of them gave the maximum rating. This substantiates the quality of the proposed artifact.

Regarding the Utility criteria, the artifact obtained an average of 4.00. Despite not being an excellent result, the authors consider it is a reasonable and interesting value. In addition, 80% of the experts provided a positive feedback. These results suggest that the proposed mapping would be useful in practice for practitioners from SMEs.

It is important to reinforce that the large majority of the COBIT 5 experts interviewed had previously experience in SMEs, therefore, the authors consider that the feedback provided about the evaluated criteria is extremely significant and close to reality.

7 CONCLUSION

During this research work, the authors proposed and developed two artifacts. First, the minimum baseline of EGIT mechanisms for SMEs was identified. This resulted from the elicitation of the fundamental mechanisms for these organizations, through interviews with experts. The second artifact is a mapping between the identified EGIT mechanisms and the COBIT 5 components that can support its implementation. The proposed artifacts intend to solve a significant organizational problem: the lack of support for the implementation of COBIT5 in SMEs.

First, the minimum baseline of EGIT mechanisms was evaluated through qualitative semi-structured interviews with experts and based on the Österle et al. principles. Next, the proposed mapping was evaluated using the Wand and Weber method and the Österle et al. principles. Furthermore, semi-structured interviews with COBIT 5 experts were performed to evaluate the correspondences established and the evaluation criteria for IS artifacts selected.

The minimum baseline of EGIT mechanisms for SMEs was constructed based on the feedback of IT experts knowledgeable in the context. Thus, the authors consider that the objective 1 was accomplished. Given the results obtained, the authors conclude that objective 2 was partially achieved. Despite having 80% or more of positive answers for the Efficacy, Consistency, Utility for people and Ease of use, some improvements can be done to address the incomplete correspondences and the level of detail presented. In spite of, one objective not being totally achieved, the results demonstrated the proposed solution could be advantageous for practitioners from SMEs that intend to implement EGIT by adopting COBIT 5 framework.

The two major contributions of this research are the artifacts produced. However, there are other minor contributions associated. Furthermore, there are also some limitations. First, regarding the baseline, all the collected data was limited to the eleven semi-structured interviews and only one person of each organization was interviewed. Next, the mapping also present limitations, such as the three correspondences assessed as incomplete by the experts.

During this thesis, two scientific papers were submitted. The first paper was presented and published in the 20th IEEE International Conference on Business Informatics whereas the second was submitted to the Information Systems Management Journal, which is awaiting acceptance. Both papers address the minimum baseline of EGIT mechanisms for SME.

Further research on this topic may focus on interesting aspects such as the identification of new EGIT mechanisms specifically used in SMEs or the impact of the other EGIT contingency factors in SMEs' context.

REFERENCES

- [1] S. De Haes and W. Van Grembergen, "An Exploratory Study into the Design of an IT Governance Minimum Baseline through Delphi Research," *The Communications of the Association for Information Systems*, vol. 22, pp. 443–458, 2008.
- [2] P. Weill and J. W. Ross, *IT Governance: How Top Performers Manage IT Decisions Rights for Superior Results*. Boston, Massachusetts: Harvard Business School Press, 2004, no. Harvard Business School Press Boston, Massachusetts.
- [3] S. De Haes and W. Van Grembergen, *Enterprise Governance of Information Technology: Achieving Alignment and Value, Featuring COBIT5*, ser. Management for Professionals. Springer International Publishing, 2015.
- [4] R. Huang, R. W. Zmud, and R. L. Price, "Influencing the effectiveness of IT governance practices through steering committees and communication policies," *European Journal of Information Systems*, vol. 19, no. 3, pp. 288–302, 2010.
- [5] OECD, *OECD SME and Entrepreneurship Outlook 2005*. OECD Publishing, 7 2005.
- [6] X. Yang and J. Fu, "Review of IT/IS Adoption and Decision-Making Behavior in Small Businesses," *Tsinghua Science & Technology*, vol. 13, no. 3, pp. 323–328, 6 2008.
- [7] P. Cragg, M. Caldeira, and J. Ward, "Organizational information systems competences in small and medium-sized enterprises," *Information & Management*, vol. 48, no. 8, pp. 353–363, 12 2011.
- [8] D. Radovanović, T. Radojević, D. Lučić, and M. Šarac, "IT audit in accordance with Cobit standard," in *The 33rd International Convention MIPRO*, 2010, pp. 1137–1141.
- [9] Y. Bartens, S. De Haes, Y. Lamoën, F. Schulte, and S. Voss, "On the way to a minimum baseline in IT governance: Using expert views for selective implementation of COBIT 5," *HICSS*, vol. 2015-March, pp. 4554–4563.
- [10] S. De Haes, W. Van Grembergen, and R. S. Debreceny, "COBIT 5 and Enterprise Governance of Information Technology: Building Blocks and Research Opportunities," *Journal of Information Systems*, vol. 27, no. 1, pp. 307–324, 2013.
- [11] L. Milner, "COBIT 5 Advantages for Small Enterprises." *COBIT Focus*, no. November, pp. 1–2, 2014.
- [12] A. J. Berry, R. Sweeting, and J. Goto, "The effect of business advisers on the performance of SMEs," *Journal of Small Business and Enterprise Development*, vol. 13, no. 1, pp. 33–47, 2006.
- [13] M. J. Byrd and L. C. Megginson, *Small Business Management: An Entrepreneur's Guidebook*. McGraw-Hill Irwin, 2009.
- [14] C. Upfold and D. Sewry, "An investigation of Information Security in Small and Medium Enterprises (SMEs) in the Eastern Cape," *ISSA Conference*, pp. 1–17, 2005.
- [15] R. Pereira and M. Mira da Silva, "Designing a New Integrated IT Governance and IT Management Framework Based on Both Scientific and Practitioner Viewpoint," *International Journal of Enterprise Information Systems*, vol. 8, no. 4, pp. 1–43, 2012.
- [16] C. Marnewick and L. Labuschagne, "An investigation into the governance of information technology projects in South Africa," *International Journal of Project Management*, vol. 29, no. 6, pp. 661–670, 8 2011.
- [17] K. De Maere and S. De Haes, "Is the Design Science Approach fit for IT Governance Research?" in *Proceedings of the 16th European Conference on Research Methods in Business and Management: 22-23 June, 2017, Dublin, Ireland / Buckley, Anthony P. [edit.]*, 2017, pp. 399–407.
- [18] J. E. Van Aken, "Management research as a design science: Articulating the research products of mode 2 knowledge production in management," *British Journal of Management*, vol. 16, no. 1, pp. 19–36, 2005.
- [19] J. G. Walls, G. R. Widmeyer, and O. A. E. Sawy, "Assessing Information System Design Theory in Perspective: How Useful was our 1992 Initial Rendition?" *Journal of Information Technology Theory and Application*, vol. 6, no. 2, pp. 43–58, 2004.
- [20] K. Peffer, T. Tuunanen, M. A. Rothenberger, and S. Chatterjee, "A Design Science Research Methodology for Information Systems Research," *Journal of Management Information Systems*, vol. 24, no. 3, pp. 45–77, 2007.
- [21] H. Österle, J. Becker, U. Frank, T. Hess, D. Karagiannis, H. Krcmar, P. Loos, P. Mertens, A. Oberweis, and E. J. Sinz, "Memorandum on design-oriented information systems research," *European Journal of Information Systems*, vol. 20, no. 1, pp. 7–10, 1 2011.
- [22] C. Symons, M. Cecere, O. Young, and N. Lambert, "IT Governance Framework - Best Practices," *Forrester*, pp. 1–17, 2005.
- [23] G. Wiedenhöft, E. M. Luciano, and M. A. Macadar, "Information Technology Governance in Public Organizations: Understanding the Expectations of Its Adoption through the Lens of Organizational Citizenship," *European Conference on Information Systems (ECIS) 2016*, 2016.
- [24] S. De Haes and W. Van Grembergen, "An Exploratory Study into IT Governance Implementations and its Impact on Business/IT Alignment," *Information Systems Management*, vol. 26, no. 2, pp. 123–137, 4 2009.
- [25] R. Nolan and F. W. McFarlan, "Information technology and the board of directors," *Harvard business review*, vol. 83, no. 10, pp. 96–106, 157, 2005.
- [26] ISACA, *A Business Framework for the Governance and Management of Enterprise IT*, 2013.
- [27] S. Blili and L. Raymond, "Information technology: Threats and opportunities for small and medium-sized enterprises," *International Journal of Information Management*, vol. 13, no. 6, pp. 439–448, 1993.
- [28] F. Bergeron, A. M. Croteau, S. Uwizeyemungu, and L. Raymond, "IT Governance Theories and the Reality of SMEs: Bridging the Gap," in *HICSS*, 1 2015, pp. 4544–4553.
- [29] M. Levy and P. Powell, *Strategies for growth in SMEs: the role of information systems and information technology*. Elsevier Butterworth-Heinemann, 2005.
- [30] J. Y. Thong, "Resource constraints and information systems implementation in Singaporean small businesses," *Omega*, vol. 29, no. 2, pp. 143–156, 4 2001.
- [31] T. Mazzarol, "Strategic Management of Small Firms: A Proposed Framework for Entrepreneurial Ventures," in *Proceedings of the Small Enterprise Association of Australia and New Zealand Conference 2004*, N.A, Ed., vol. N.A. Small Enterprise Association of Australia and New Zealand Conference 2004, 2004, p. N.A.
- [32] M. Ayat, M. Masrom, S. Sahibuddin, and M. Sharifi, "Issues in implementing IT governance in Small and Medium Enterprises," in *ISMS 2011*, 2011, pp. 197–201.
- [33] K. Jairak, P. Praneetpolgrang, and P. Subsermsri, "Information technology governance practices based on sufficiency economy philosophy in the Thai university sector," *Information Technology & People*, vol. 28, no. 1, pp. 195–223, 3 2015.
- [34] R. Pereira, M. Mira da Silva, and L. V. Lapão, "Business/IT Alignment through IT Governance Patterns in Portuguese Healthcare," *International Journal of IT/Business Alignment and Governance*, vol. 5, no. 1, pp. 1–15, 2014.
- [35] R. Almeida, R. Pereira, and M. da Silva, "IT Governance Mechanisms: A Literature Review," in *Exploring Services Science: 4th International Conference, IESS 2013, Porto, Portugal, February 7-8, 2013. Proceedings*, J. e Cunha, M. Snene, and H. Nóvoa, Eds. Springer Berlin Heidelberg, 2013, pp. 186–199.
- [36] ITGI, *Board Briefing on IT Governance - 2nd Edition*, 2003.
- [37] R. Likert, "A technique for the measurement of attitudes," *Archives of Psychology*, vol. 22, no. 140, pp. 1–55, 1932.
- [38] A. R. Hevner, S. T. March, J. Park, and S. Ram, "Design Science in Information Systems Research," *MIS Quarterly*, vol. 28, no. 1, pp. 75–105, 2004.
- [39] C. Sonnenberg and J. Vom Brocke, "Evaluation patterns for design science research artefacts," in *Communications in Computer and Information Science*, vol. 286 CCIS. Springer, Berlin, Heidelberg, 10 2012, pp. 71–83.
- [40] P. Verschuren and R. Hartog, "Evaluation in Design-Oriented Research," *Quality & Quantity*, vol. 39, no. 6, pp. 733–762, 12 2005.
- [41] ISACA, *Enabling Processes*, 2012.
- [42] N. Prat, I. Comyn-Wattiau, and J. Akoka, "Artifact Evaluation in Information Systems Design-Science Research - A Holistic View," in *18th Pacific Asia Conference on Information Systems*, no. 23, 2014.