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Existing interactions within COBIT 5 and their driving forces

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Abstract

Given Information Technology (IT)'s pervasiveness and stakeholders' desire for value creation, it is imperative for companies to align IT-related goals with enterprise goals. COBIT5 proves to be a valuable framework for companies to generate value from IT by helping them to balance benefits' realization, resource utilization, and risk optimization. The primary goal of the present research is to provide organizations with valuable insights of COBIT5 in order to facilitate its understanding, adoption, and customization to their enterprise goals. Relationships between processes are studied and tested for the identification of the key factors influencing their performance levels.

Key Words – IT, COBIT5, Metamodel, Maturity

Introduction

There is an ongoing explosion of information, as the velocity, abundance, variety, variability, and complexity of available data augments at and increasingly fast pace. Indeed, a recent study of EMC reveals that digital universe is expected to more than double by 2020, with 44Zb, when compared with the 4.4Zb presented in 2013 (EMC, 2014).

Data pervasiveness creates the necessity for companies to acknowledge its potential value and influence in businesses. Nevertheless, data needs to fulfill some pre-requisites to be considered as valuable. Quality data must address issues such as data suitability – correct in its domain, consistency, completeness, integration, and accuracy – right match ups. (Volonino & Turban, 2011). IT revolution is at the core of data explosion (Hamelink, 1997). In fact, IT has become so omnipresent, that companies must acknowledge its powerful influence in corporate's world in order to remain competitive. To allow for an agile adaptability, companies must have in place a sound Governance Enterprise IT (GEIT), for a better implementation of IT projects, and to leverage the

alignment of IT's strategies, objectives and policies with enterprise goals. Furthermore, the existence of corporate scandals caused by the lack of companies' corporate governance has resulted in an intensification of external regulations. In order to help companies to promptly answer both to internal and external pressures, institutions like ISACA [1] have been gaining relevance worldwide, with new practices, policies, and valuable frameworks. COBIT was one of the outputs of such efforts. COBIT is a worldwide accepted IT governance framework with the purpose of aligning IT and business goals, creating value and optimizing a company's risk management. Although valuable, the framework is complex and dense, and it requires expertise to be properly implemented (Bernroider & Ivanov, 2011). In order to facilitate its implementation, it is crucial for companies to have powerful insights regarding (i) how the framework works and what are its components; (ii) what are the most important processes for an effective implementations, and (iii) what it is critical for their success. This is relevant as there is an underlying assumption that the processes' efficiency will lead to a better performance of IT projects. In order to properly answer to those concerns, a graphic metamodel was built, and three hypotheses related to processes' performance were made and tested. The first and second hypothesis aim to answer which are the factors which can predict and determine a process' capability; the third one relates a process' maturity with the nature of the roles (governance/management or IT) which are needed to perform the activities of each process.

Literature review

Data is pervasive in today's world, so much that the term 'big data' has been gaining significant relevance worldwide. (Troester, 2011). Data, both structured and unstructured, can be described as big once its volume, variety, and velocity are greater than what can be gathered, stored, analyzed, and processed by IT systems (SAS, 2011). Data alone generates no value, it is its quality that it is truly revolutionary (Shaw, 2014) – only then it will be possible to extract knowledge for the

[1] ISACA - Information Systems Audit and Control Association: ISACA® is a global nonprofit, independent association committed to IT Governance, and advocate of information security, assurance, and risk management best practices. (https://www.isaca.org)

improvement of the decision making process. Three data principles should be taken into account: (i) principle of diminishing data value – the older the data, the less valuable and useful it is; (ii) principle of 90/90 use – 90% of data is not used within 90 days and it loses much of its value after 3 months; managers want to have access to the relevant 10% of it; (iii) principle of data into context – data must be integrated, processed, analyzed, and formatted into actionable information – end users need to see data in a meaningful format and context if the data is to guide their decisions and plans (Volonino & Turban, 2011).

In order to gain valuable insights from big data, it is necessary to understand it, to address issues such as data speed and quality, and to continuously analyze it. The process of doing so goes by the name of big data analytics (Rouse, 2014), and it involves a given number of activities which should be integrated in business' architecture (Oracle, 2013) so they are aligned with enterprise goals. Mastering big data analytics will enable both cost reductions and a better, more efficient, decision-making process (Davenport, 2014).

The great engine behind information revolution is the disruption that has been being felt in the IT field (Hamelink, 1997). IT is more than the state-of-the-art technology's upgrades, it is also the data that is produced and managed on a daily basis, or, more succinctly, it is the digital movement of information. Technological advances allow for the transformation of big data into knowledge, by allowing its measurement and comprehension (McAfee & Brynjolfsson, 2012). IT by itself brings no added value to a corporation. In fact, some forms of IT are nothing but mere commodities (e.g. PCs, databases). It is the way IT is applied throughout an organization's business processes that may enable the translation of commodities into competitive assets, and information into power. Other variables which influence the effectiveness of IT employment are the people who will use it, and company's values. In order to exploit the full value of IT, three objectives must be met: (i) sound IT-business alignment; (ii) identification and control over key risks; (iii) compliance with laws, and industry rules and regulations (Volonino & Turban, 2011).

As a direct consequence of the information revolution and technology pervasiveness, the corporate world as we know is in permanent mutation. Yesterday's best practices can no longer be applied linearly to the problems of today, and methodologies rapidly become obsolete. Answers are needed while the questions still remain plausible and applicable. The astonishing amount of information available has the capability to alter business competition in three crucial aspects (Porter & Millar, 1985): (i) First, rules of competition are modified as the industry structure changes (ii) Second, technology is now seen as the key factor to attain competitive advantage, which opposes to the previous idea of having human capital at the core of corporate improvement. More interestingly, IT has the capacity to impact the scope of a company's competitive advantage, by enabling businesses to better coordinate activities at a global level. (iii) Lastly, new technologies bring forth new businesses. Recognition from companies of these alterations can be seen in the results of a recent survey composed by 1.139 answers, which verified a 125% increase from 2014 to 2015 on the number of companies which engaged in data-driven projects, and that companies recognized the importance of investing in big data analytics to leverage business value (IDG Enterprise Marketing, 2015).

Notwithstanding, a large number of managers still fail to understand the true value behind an IT department, mostly due to the difficulty of quantifying its Return on Investment (ROI). Indeed, it is estimated that on average, and independently of the industry, large IT projects exceed 45% the initial budget, are 7% overtime, and generate 56% less value than expected (Bloch, Blumberg, & Laartz, 2012). The implementation of new technologies in a company is not immediately translated into profitability or improvement (Brynjolfsson & Hitt, 1998). In fact, the costs of doing so go beyond the initial investment in the hardware/software, as it is also necessary to train people on how to effectively use the new hardware/software, and to properly explain the reasons behind this decision in order to minimize their resistance to change, and to maximize future performances (Heatfield, 2016). It is imperative for IT departments to be able to improve management's

understanding of IT's opportunities, identify requirements (e.g. technology resources, IT and managerial skills), and clarify the value of the needed investment. The goal is to lead managers to understand the true value behind an IT investment. In order to maximize the potential of IT solutions and services, a company may have to make adjustments in its business, business' processes, skills and competencies, and its organization. It is also required to move from project management to program management, in order to set understandable and quantifiable business results. Other requirements involve effective portfolio management, so to invest strategically in the resources available, and engagement on full cycle governance to convert theory into actual benefits. An important concept to introduce is Enterprise Value management (EVM). EVM is a dynamic, strategic process aimed at value creation which calls for an agile strategic governance approach in order to identify which investments are worth engaging in to (Thorp & Fujitsu, 1998).

In this context, it is essential for companies to integrate business and IT. IT-business alignment relates to the degree to which the IT department understands business priorities and applies it resources, makes investments, and provides information according to these priorities. One way of assuring the alignment between business and IT strategy is to develop a strong enterprise architecture (EA). EA can be seen as blueprint for business processes and IT capabilities. This will ensure consistency between IS and corporate priorities, decisions, and projects (Ross, 2006).

At the core of this adaptability is the Corporate Governance of each company. Corporate Governance gained relevance since the identification of the agency theory (Wells, 2010), and it can be defined as the corporate leadership and control with the final objective of enabling the success of the business (Shleifer & Vishny, 1997), thus being concerned with the seamlessly of the relation between all corporate stakeholders (Clarke & Brink, 2011).

Value creation can be seen as the final objective of companies and, as such, it is where governance is directed to. Value creation goes beyond profit maximization, as it can also be to provide charitable or public services, among others (Hughes, 2013). Goals can be attained by

exploiting resource's utilization to maximize benefits, while achieving an optimal risk level (Brand & Boonen, 2004).

By its turn, Governance Enterprise IT (GEIT) is concerned with ensuring that organizational investments in IT deliver full value. It covers control across five key areas: support of corporate strategy, value delivery, and risk, resource and IT performance management (Volonino & Turban, 2011). IT Governance is not about making operating decisions; that should be a task assigned to Management. The focus is in the evaluation, direction and control of IT, while incorporating the IT' strategies and policies required to smoothly implement new technologies in a corporation (ISO/IEC, 2015).

Having sound IT governance in place will lead to greater returns up to 40% than competitors who do not acknowledge GEIT's importance, for the same IT investment (Brynjolfssin, Hitt, & Yang, 2002). By creating value, it is clear the responsibility for GEIT lies with Governing Boards, and its execution is dependent on senior management. In fact, corporate governance is seen as the main influence to GEIT's shape (Wilking & Chenhall, 2010). The purpose is to achieve IT value and alignment, accountability, and performance and risk management (Grembergen & Haes, 2009). The term was born in 1992 to describe the bungle of mechanisms needed to exploit IT capabilities (Loh & Venkatraman, 1992).

Researchers on the topic began in 1963 (Garrity, 1963) to merely examine centralized and decentralized designs. On a second stage, they attempted to provide more fluid governance structures which would better fit the way companies operate in real life. These vertical and horizontal distinctions are still used as a baseline for contemporary research. They follow in the first IT Governance stream – "IT governance forms" - concerned with the decision-making structures adopted by IT institutions (Brown & Grant, 2005). The second branch of research – "IT governance contingency analysis" - follows a different path, and it is a direct response to the consensus that there is no such thing as an ideal universal IT Governance strategy that suits every company. The

focus is on understanding which option would be the best for each organization, taking into consideration contingencies such as the size of the company (Jr., 1992), the industry in which it operates (Jr., 1992), its business strategy (Venkatraman, 1997), and its organizational structure (Herderson & Venkatraman, 1993). Although valuable, the prior mentioned researches did not reflect the density of business environments, as they each focused in one single contingency separately. Attempts to grasp the complexity of real world are made in contemporary research, where there is a convergence of the two streams, e.g. Weill and Ross study an amalgam of IT governance solutions across disparate business departments for a given IT service (Weill & Ross, 2009). Despite all the work done, it is not possible to precisely grasp which factors, and up to which extent, influence the effective implementation of IT corporate governance. It is only possible to affirm that companies with predominant GEIT will have higher profits than the ones with inferior governance for the same strategic goals (Weill & Ross, 2009). Also, having sound communication into place across the company is crucial to achieve alignment between the objectives of all business units, including GEIT and Corporate Governance (Symons, 2005).

Corporate scandals instigated by the anorexic implementation of Corporate Governance practices have led to the intensification of the establishment of several external rules and regulations (e.g. Sarbanes-Oxley Act (SOX) in 2002, a US federal law on Corporate and Auditing Accountability and Responsibility), thus contributing to a highly restrictive corporate environment. External pressures aligned with the ever-increasing pressure for companies to make the right IT investments were the slingshot for ISACA (1) to create the IT Governance Institute (ITGI). The purpose was to conduct researches related to IT governance and related subjects, and to convey frameworks which bring together huge quantities of disparate data in a way that creates value. The outcome would help corporate leaders to comprehend the importance of sound governance when aligning corporate and IT goals, to improve IT investments' ROI, and to manage internal and external risks and opportunities (IT Governance Institute, 2011). Sources for GEIT include Committee of Sponsoring

Organizations of the Treadway Commission (COSO), Code of Practice for Information Security Management (ISO/IEC 17799/BS7799), ITL, CMM/SPICE (ISO/IEC 15504) (ITL and CMM relate mostly to management and tactics over governance and strategy), Common Criteria (ISO/IEC 15408), Quality models (Deming, EFQM, BNQP, IS09000), Balance Scorecard (BSC), and Control Objectives for Information and related Technology (COBIT) – see *Annex 1*. IT standards relate to the tactical level within the IT function. The growing adoption of such frameworks and models suggests a growing concern of companies in aligning business and IT, in order to manage IT related risks and to increase a company's value creation.

COBIT was one of the outputs of ISACA's effort to assist companies to successfully go through the complex and multifaceted practice of GEIT, and to help them to be in control. Control can be seen as a combination of tools to arrive successfully at the corporate's strategic goal (Simons R. , 1990). COBIT adopts this point of view, in which the ones responsible for implementing control are foremost to goal achievement. Shortly put, COBIT is an internationally accepted IT governance and comprehensive control framework for aligning IT with business objectives, delivering value, and managing associated risks. It provides a reference for management users, and IS audit, control, and security practitioners.

The project was developed by qualified and skillful audit professionals and IT Service Management practitioners, and by presidents of ISACA chapters and academics (Brand & Boonen, 2004). The first version was built around a comprehensive set of Control Objectives for IT Purposes to allow for better quality audits. The framework includes processes, activities, metrics, Critical Success Factors, and Tools to assign roles and responsibilities for IT processes. It is also strongly connected to other governance and IT frameworks and standards. The latest version (COBIT 5) is a GEIT and management framework which illustrates several best-practices to be applied by the board and senior operational and IT management (Haes & Grembergen, 2013). The framework is mainly focused on processes, although COBIT 5 puts a higher emphasis on people than earlier

versions. Processes can be seen a set of interconnected activities (or behaviors) which require resources (e.g. time, money) to convert inputs into outputs. Outputs from one process will serve as inputs to other processes, up to the achievement of the initially set goal business dictionary (Business Dictionary). All processes are characterized by its purpose, inputs, management/governance practices (called sub-processes from now-on), outputs, and feedback. Feedback is what brings stability into the system. COBIT 5 includes 37 processes which are further split into smaller and more manageable units. Nevertheless, these management/governance practices can also be seen as processes themselves, according to the proposed definition of process. As such, companies may not have to consider only 37 processes, but 211 (which is the total amount of management/governance practices proposed by COBIT). The large amount of processes will allow for companies to customize the framework in accordance to its size, structure, and complexity, while making sure that both governance and management's objectives are met.

The importance of value creation and Risk management of IT is addressed by complementing COBIT with Val IT (BB) and Risk IT (CC) frameworks (ISACA, 2009c). COBIT 5 also differentiates itself from previous versions given the higher emphasis put on enterprise architecture, asset and service management, it presents a revised maturity model, and it introduced five key principles to guide IT governance, described as follows:

Principle one, **"Meeting Stakeholders' needs",** states that there should be a customization of Governance and Management System, given that different shareholders may be moved by a great variety of drivers (e.g. technology evolution). In common there is the desire for value creation. COBIT 5 then provides a goals cascade – a mechanism starting from stakeholders' drivers to increasingly specific goals, all related to the company (see *Annex 2* for the goals cascade). This will allow the translation of high level enterprise goals into manageable and specific IT related Goals that will lead to specific processes and practices. The first principle requires the alignment between the board, operational management, and IT.

The second principle, **"Covering the Enterprise end-to-end",** or **"Governance Approach"** transmits the applicability of COBIT throughout the entire enterprise, and not only to the IT department. The governance approach is made possible by providing Responsible, Accountable, Consulted, and Informed (RACI) charts for each of its processes. RACI charts clearly specify the roles that should be taken by IT and the ones which are management's responsibility. As such, for every Service Level Agreement (SLA – written document specifying what one entity/department must provide to another), there will be a distinct separation between what is business responsibility and accountability, and what falls into the IT's domain – *Annex 3* for an example of a RACI chart applied to the governance practice EDM01. Note that while several lines may be Responsible, Consulted, and Informed, only one should be accountable for delivering the task; this is important to eliminate redundant activities, and to clearly assign ownership over the tasks and decisions. While the different processes allow for each company to adapt the framework horizontally to its needs, RACI charts allow for vertical customization (Grembergen & Haes, 2009), thus enabling a better management and governance of information and related technology.

The third principle, or **"Applying a single, integrated Framework"** addresses the issue of having disparate information across different databases which impedes an efficient use of it (Firestone, 2003). COBIT 5 integrates previous ISACA's frameworks (Val IT, COBIT, and Risk Management), researches such as ITIL, TOGAF, ISO (DD), the latest standards and frameworks, and offers GEIT and management best practices (e.g. PMBOK (EE)).

"**Enabling a holistic approach**" comes as the fourth principle which provides a valuable list of enablers which may include both internal and external resources. Enablers englobe activities and responsibilities of both IT and non-IT functions, so it can be applied throughout the entire company. There are seven integrated enablers defined in COBIT 5, given that each enabler will use other enablers' outputs as inputs, and it will provide inputs to other enablers (see *Annex 4*).

Lastly, principle five – **"Separating Governance form Management"** acknowledges the existing difference between governance and management in terms of purpose, responsibilities, types of activities, and supporting organizational structures. The framework thus divides the processes into two distinct domains: Evaluate, Develop and Monitor (EDM) will fall into governance's category, while Plan, Build, Run, and Monitor (PBRM) will stand for management processes. PBRM is further dissected into more specific nomenclatures, according to the IT's life-cycle: Plan consists in Align, Plan and Organize (APO – how IT can contribute to business objectives), Build includes Build, Acquire, and Implement (BAI – what are the requirements for IT's successful implementation), Run is concerned with the Deliver, Service, and Support (DSS – assures the delivery of IT services), and Monitor includes Monitor, Evaluate, and Assess (MEA). The latest is seen as an ongoing activity to be taken throughout the other three, in order to assess if the objectives are being met and, if not, to take immediate corrective actions. While PBRM makes sure all activities are performed, controlled, and in line with the strategic direction set by governance, EDM is about making sure stakeholders' needs are: (i) Evaluated to determine the objectives to achieve, (ii) Directed via efficient prioritization and decision making, and (iii) Monitored to assess the achievability of the objectives initially set. See complete list of processes in *Annex 4*. See *Annex 5* for summary of principles and their points of reference.

Despite the global recognition it possesses, COBIT 5 was also target of several criticisms, mostly when it comes to its implementation. The framework is said to be too abstract and requiring extended expertise for effective implementation (Bernroider & Ivanov, 2011).

To answer to those concerns, COBIT5 also possesses an implementation guide, which proposes seven phases of implementation. It also suggests seven steps for three dimensions: Program management, change enablement, and continual improvement lifecycle (check *Annex 6*) Nevertheless, the guide is also vague and abstract, still leaving users with questions about which procedures to take first, and about the relationships between processes.

Also to strengthen the alignment between processes and businesses, the Balance Score Card (BSC) was incorporated in COBIT's Framework. The BSC is a strategy performance management framework with the purpose of leveraging a company's management system by (i) aligning business activities with the vision and strategy of the company, (ii) leveraging internal and external communications, and (iii) monitoring company's performance against strategic goals (Kaplan & Norton, 1996). The BSC generates a strategic focus, as it translates the company's vision and strategy into operational objectives and performance measures for 4 perspectives: Financial, Customer, Internal Business Processes, and Learning and Growth. The underlying reasoning behind including both types of performance measures is that it provides a more *balanced* and accurate perspective of the overall company, thus allowing planners to better identify what should be done first, and how it should be measured. The most important objectives for each perspective should then be articulated, and there should be a cause-and-effect relationship among them so to strategically link them. To set the objectives, it is imperative to fully understand what each strategy must achieve, and what it is critical for its success. These objectives should then be translated into specific performance Measures, Targets (level of performance rate of improvement that is required), and Initiatives (key action programs needed to reach the objectives set). Each objective should have at least one measure associated. (Epstein & Rejc, 2005) suggest a maximum number of 20 measures, but there is no key number of Measures to adopt, as it will depend on innumerous factors (e.g. business profile, competitive environment, customers' needs).

Despite being a worldwide accepted framework, the BSC can be an over designed solution for start-up companies with no experience (H. Peter Holzer, 1986). Another pitfall concerns its dependency on the commitment from top management and strong involvement of middle management in its implementation (Frigo, 2012). Furthermore, the cause-and-effect relationships, can be considered ambiguous, with no empirical support (Nørreklit, 2000), the framework does

omit other important perspectives (e.g. environmental), and it does not put enough emphasis on the extent that external competitive environment may have on the business (Simons R. , 1995).

To answer the concerns of the application of the model to companies in different maturity levels (meaning with different levels of formality and optimization of processes), COBIT 5 is complemented with the Process Assessment Model (PAM), in compliance with ISO/IEC 15504-2. The primary goal is to aid companies to assess their processes' maturity against COBIT 5, so improvements can be made. The model can be used to assess the current stage of development of a company's processes, and provide valuable insights regarding the existent gap between actual and expected processes' maturities. The PAM is fact-based, thus providing for a more reliable, consistent, and dependable assessment of processes' capability levels within IT governance and management areas. A process capability level refers to the extent in which the process meets both current and future business goals. It has 6 levels, with a total of 9 process attributes/measurable characteristics. Each level can either be "not achieved" (N when there is no evidence of achieving it), (see *Annex 7*). A process can only move up to the next capability level if it is rated as largely or fully achieved. (See *Annex 8* for an example of PAM's application)

The higher the process capability, the lower the risk of not meeting the desired outcome, but the more costly it will be to operate. COBIT's Maturity Model is based on the scale of the original Capability Maturity Model (CMM). It is acknowledged that the existing gap between Expected and Actual Time and Budget of a company's project is one of the greatest issues of companies, mostly due to a project's management poor performance (Paulk, Weber, & Chrissis, 1993). The CMM was developed in 1986, as an attempt to diminish the described gap, by aiding enterprises in acquiring the appropriate software, and improving the existing ones (Jiang, Klein, & al, 2004).

In COBIT, PAM's application is based on the premises that efficient processes improve project's achievements, the maturity of the software development influences the company's performance (Herbsleb & Goldenson, 1996), and the leading cause for project failures relates to the

lack of project management control (Keider, 1984). Given COBIT's strategic level approach and focus on processes of IT management, PAM's ultimate goal is to allow for benchmarking and targeting the process maturity levels, thus enabling the customization throughout the various stages of development of each company's processes.

Methodology

The primary goal of the present research is to provide companies with valuable insights of COBIT 5 so to facilitate its understanding, adoption, and customization to a company's values, goals, and strategy. The importance of knowing the best way to implement COBIT5 will allow for a better time, resource and budget management.

Identified Issue-A – the great density of the framework makes it harder for companies to understand how to effectively implement COBIT 5.

Methodology for addressing Issue-A – given the importance of data visualization for the seamlessly of the decision making process, a graphic metamodel was built so to enable a more intuitive perception of the elements that constitute COBIT5, and influence its performance. Models can be divided into two major groups: descriptive and prescriptive. As the name suggests, descriptive models describe how things are done, and are capable of reducing big data into consumable information, thus being important in knowledge capture and retention (Heusser, 2005). On the other hand, prescriptive, or specification models, depend on existing data, action and feedback to deliver a reliable starting point for sound decision making. The developed metamodel fits into the first category.

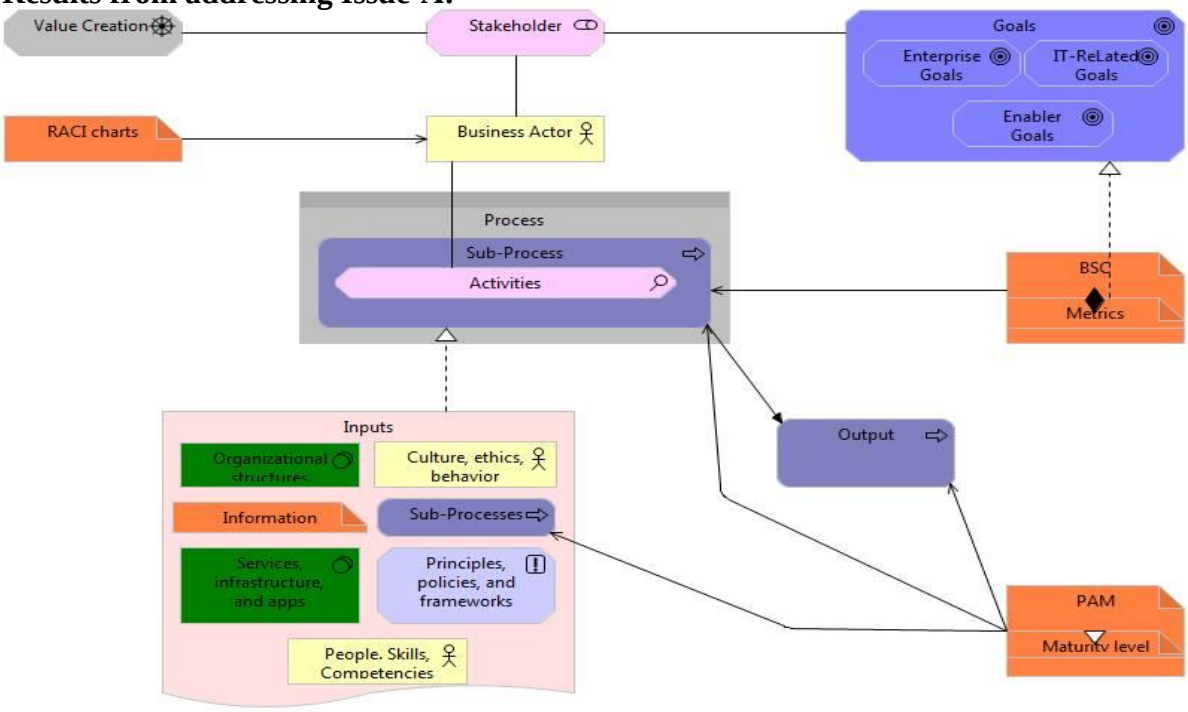
The target audience is mainly composed by business stakeholders, and it is not solely aimed at IT stakeholders. As such, the language adopted is not to be read by a computer, but to be intuitive for business entities. Each process will have its own nomenclature, even though each process is used

more than once. The components of the metamodel have specific colors. The purpose is to reduce the chances of developing an ambiguous chart.

It was necessary to adopt a platform which allowed for the graphitization of the meta-model. As previously pointed out, data visualization is fundamental in the decision making process. Considering programming was not the focus of the present research, it was preferred not to build one from scratch, but to embrace an already existent tool. One fundamental requirement was the allowance for an architectural stratification, capable of portraying several levels of abstraction on a single model. The imperativeness of the stratification relates to the necessity of developing with depth each level of abstraction, without losing sight of the full picture. All levels need to coexist, and it has to be possible to access each one of them at any point in time. This will enable key entities to make decisions related to the business and IT systems in a more efficient way, by allowing them to focus on a particular area of interest while being aware of the connections it possesses with another layers of the architectural design. On a final instance, it will provide a solid ground to actually measure the implications that changes on process will have in the whole system.

Given those three primary conditions, Archimate was chosen to do the task. Archimate is an enterprise architectural language, developed by the Open Group (TOGAF) to allow for a graphical display of a company's architecture, with the underlying concern of attending stakeholders' needs (The Open Group, 2012-2013). The terms used in Archimate were adopted from TOGAF's standards, and despite being of a more operational language, they are flexible enough to adapt to other conceptual domains, e.g. Governance (The Open Group, 2012-2013). The tool is divided into three layers: Business, Application, and Technology, and permits both structural and dynamic relations between them, and also other relationships (e.g. grouping, indicating different objects which possess a common feature). By differentiating behavior from implementation, data abstraction allows users to make local alterations and adapt the meta-model to every process, without interfering with the full model (Liskov, 1988).

Results from addressing Issue-A:



Looking at the Metamodel, it is now more intuitive to see the different elements which compose COBIT5. For example, it is made clear that stakeholders are moved by value creation, and this will be reflected in the goals cascade. The actions of business actors will also be dependent on stakeholders' needs and desires, and they will be defined by RACI charts. Metrics of the BSC will be used to assess if the process goals are being achieved or not. There are two BSC in COBIT, one for IT-related goals, and other for enterprise goals. Furthermore, the elements which can influence the performance of each process are grouped as inputs. This allows companies to understand that it is not enough to have one input (e.g. process) optimized to ensure the seamlessly of the following process. The performance of an output will depend as well on the other enablers. The maturity level will be determined through PAM and it is applicable to all processes.

Identified Issue-B – Given the density of the framework, it is not crystal clear the full extent of the existing interactions in COBIT 5. As such, it becomes harder to identify which processes should be implemented first in order to optimize COBIT's implementation.

Reasoning B1: prioritize processes which contain a larger number of connections with other processes. For example, a process which serves more times as input to other COBIT's processes

should be implemented before processes with lower levels on interactions within the framework. The purpose is to create a solid basis for future interactions.

Methodology (B1) for addressing Issue-B – all the 211 management/governance practices were listed, plus the inputs that may come from outside COBIT and the internal outputs. The full listing resulted in a matrix of 212x212. One benefit of further segmenting COBIT's processes is that it generates smaller, less complex processes which are easier to digest and to manage. On the other hand, the total number of 212 sub-processes to implement may sound too overwhelming. All inputs and outputs were considered, so to gain a wider perspective of the complexity of COBIT 5.

Results from Methodology (B1) [2] – When considering the sub-processes instead of processes, it was possible to see that the number of times a sub-process (1) is used as an input for another sub-process (2) is greater than the number of times the sub-process (1) itself is an output of other sub-processes. Having a process which is more times an input than an output is helpful when implementing the framework since it makes it easier to identify which processes to start from. The effect is lost when considering processes rather than sub-processes (*Annex 9* for primary findings). In here, the amount of processes that serve as outputs largely the number it is needed as input. Having more outputs than inputs creates a serious problem in the implementation of the framework, as it makes it harder to identify a starting point to create a sound structure.

As such, an important finding is that companies should consider the so called sub-processes when implementing COBIT, and not necessarily the processes as a whole. Also, the processes which were less times outputs of other processes were from the governance domain, which makes sense given its nature. It is expected that these play an important role in the guidance of implantation of the processes of the management domain, and that management practices will influence the most other management practices rather than governance ones. Lastly, the processes

[2] It was possible to catch an inconsistency in the framework. While BAI04.02 has APO09.03 as input, APO09.03 does not have BAI04.02 as output. Although it might seem like a minor mistake, it should be corrected so not to damage COBIT's reliable image and strong reputation.

which serve more times as inputs are mainly from APO and MEA domains. It is a logical conclusion as Aligning, Planning, and Optimizing should be a first step of a company towards improvements in IT-business alignment, and Monitor, Evaluate, and Assess is crucial for providing feedback and optimizing processes.

Reasoning B2: prioritize processes which are of more importance according to its influence in attaining enterprise goals.

Methodology (B2) for addressing Issue-B – This can easily be done at a theoretical level by just assigning numbers to the mapping of COBIT 5 IT related goals to processes and the mapping of COBIT5 enterprise goals to IT Related goals (*Annex 9*). To classify the relationship between each process and each enterprise goal, the letter P (primary) was assigned with one, S (Secondary) with ½ and Non-existent with zero. See *Annex 10* for an application of the exercise, with the process EDM01 and financial enterprise goals.

Results from Methodology (B2) – The 18 processes which present a higher influence in attaining enterprise goals are presented in *Annex 11*. The results are somewhat consistent with the findings of the first test. In here, the importance of APO and MEA is also made evident. Nevertheless, a higher relevance is given to EDM. This makes sense as governance practices are at the core of achieving enterprise goals. [3]

[3] One limitation of the framework is that it is only possible to do such exercise for the processes, and not for the sub-processes. Taking into account the finding that sub-processes should be considered when implementing the framework, it would certainly be important to have a similar mapping for sub-processes as well. Nevertheless, within the description of every sub-process, there is an overview of what should be attained by the sub-process, and what should be done in order to arrive at the desired state, which can easily be translated into specific goals. This makes it easier to assign IT-related goals with each sub-process. Then, it is possible to relate it with an enterprise goal. Providing even more detail to the framework would not leverage significantly its value, and it could even make it more dense and difficult to use.

Identified Issue-C – there is a need to identify which are the factors that enable the optimization of processes' performance. This will help companies to focus their efforts into critical factors for a sound implementation of the framework.

Regarding enablers, it is possible to see that some of them will have a great impact when evaluating the adoption of COBIT5 across different companies. For example, a company with a proactive culture which recognizes and understands the power of IT will be more receptive and likely to succeed at the implementation of the framework. The same reasoning can be applied to the other enablers. One constant among companies will be the processes, given that theoretically they will all converge to the adoption of processes described in COBIT5. What will differentiate them in this scenario will be the maturity of each process. Processes' capability thus plays a big role when customizing the framework across companies. As such, it is important to understand which factors, and up to which extent, they influence the level of performance of each process. Given the importance of maturity when it comes to the framework's implementation, it proves to be valuable to grasp its impact across processes, e.g. by how much will it influence the capability of subsequent processes? Is it possible to automatically conclude that if an input has a maturity of 1, and other input has the maturity of two, that the output will have a maturity of 1.5 (the pondered average)? Or will it have a maturity of the lowest, 1? One thing is true: the higher the capability of the inputs, the higher the likelihood of the output to present a higher maturity level as well. It is not expected to have inputs with maturities of one resulting in a process with maturity of five. In order to understand why, a comparison can be made to the game Jenga. In the game, the goal is to stack up wooden blocks, and then to start removing pieces sequentially until the whole block falls apart. The tower can stand up even if some blocks are removed, but it will get to a point where the whole structure will collapse. If a solid base is created, the longer the tower will hang on. The same goes for processes. Processes require a solid foundation for better performance.

Hypothesis C1 – the maturity of inputs will be the factor which provides the greatest influence on the maturity of a subsequent process.

Methodology for testing Hypothesis C1 – some processes were selected using the results from the first exercise made, and a company was chosen to determine the maturity of those processes. The sub-processes which need less inputs (meaning, the ones which are less times outputs of others) were chosen, so to minimize the effect of external factors, and isolate as much as possible the maturity aspect of it – EDM01.01 and EDM01.02 were picked. Given that the company is not yet fully developed, it was also necessary to show some flexibility, and to incorporate sub-processes that the company already had into place – DSS06.02 was added to the previous sub-processes. After deciding the processes, all of their inputs were also listed to be analyzed. The underlying reasoning is that by assessing both the maturity of a sub-process and its inputs, it would be possible to address the existence or absence of relationship between their maturity levels. In order to assess their maturity, COBIT's Self-Assessment Template was used (see *Annex 8* for an example of PAM's application to APO01).

Results from Hypothesis C1 (see *Annex 12*) **–** The results show that it is possible to have outputs with both greater and lower levels of maturity than its inputs. For example, EDM01.1 has a zero capability level, despite the majority of its inputs possess maturity levels of one. On the other hand, DSS06.02 has a capability of three, even though a lot of its inputs have lower maturities. It was showed that there is not a stable relationship between the maturity of inputs and outputs, given the discrepancies and inconsistencies presented. This required us to dig further, to Hypothesis C2.1.

Hypothesis C2.1 – The maturity level of a process depends mostly on the performance level of the other enablers (Organizational structures; Information; services, infrastructure, apps; principles, policies, and frameworks, culture and ethics, and behavior; and people, skills, and competencies).

Methodology for testing Hypothesis C2.1 – to assess the relevance of the remaining enablers in the present exercise, the company was further asked if the quality of the other enablers was somehow constant between processes, to which the answer was affirmative.

Results from Hypothesis C2.1 – Enablers' quality was mostly constant throughout processes. For example, the information across processes was of the same quality. The exception was the enabler 'Culture, Ethics, and Behavior'. According to the company's culture, some activities were perceived as more important than others. As such, a company's culture is a core determinant of which activities were chosen to be performed more accurately, which leads us to Hypothesis C2.2:

Hypothesis C2.2 – The maturity level of a process depends mostly on the performance level of the activities within it.

Methodology for testing Hypothesis C2.2 – the company was further asked to rank the level of performance of the activities of each process. Level of one was attributed to perfectly performed activities, ½ to activities which are performed but not optimized, and zero to non-performed ones (see Annex 15).

Results from Hypothesis C2.2 – Indeed, the results suggest that a better indicator of a process' capability is the level of performance of the activities within it, rather than the level of maturity of the process' inputs. It is possible to say that activities' performances are determinant of a process' success. Without seamlessly performing the activities within the process, it will not be possible for it to present a developed maturity.

Hypothesis 3 – the maturity of processes is influenced by the nature of roles required to perform its activities (management/governance roles vs. IT roles).

Methodology for testing Hypothesis 3 – For every sub-process already analyzed with the company, their RACI charts were analyzed. These charts are divided into two groups: the first one is composed by seventeen roles which relate to the positions of management/governance, while the

second group is composed by nine roles related to activities assigned to IT personnel. Given the company does not have an IT culture much yet developed, it was expected that processes with higher maturity levels would require less activities performed by IT personnel, and processes with low capabilities would ask for a more active role of IT professionals than management/governance. The sub-processes were divided in 3 groups: Group one with processes of capabilities of zero and one, group two with levels of maturity of two and three, and group three composed with processes which reported capability levels of four and five. Then, the number of times a position was assigned with R, A, C, and I was assessed. This is important for the present test, as it is more relevant to assess who is accountable, responsible, and consulted, while the significance of being informed falls to a second plan.

Results from Hypothesis 3 ***(****Annex 14)* – for Group one, there are more responsibilities for entities of governance/management to be accountable, consulted, and informed, while there is a higher need for IT responsible roles. The exact same results were obtained for processes with capabilities of two and three. For the last group, the results are identical except for entities accountable, which are the same number from governance/management and IT. Given that the results do not vary significantly, it is not possible to retrieve concrete conclusions out of it.

Further conclusions, Limitations and Future research

Assessing the maturity of processes is a valuable exercise, as it unveils the most critical areas for improvement. The greatest benefit of addressing a company's weaknesses is the allowance for taking corrective actions as early as possible. For example, after measuring the capability of only 24 sub-processes, it was clear to see that the company was not fully aware of the importance of having established a GEIT culture. Processes such as EDM01.1 – "Evaluate the governance system" were defined with a zero maturity level. When asked about it, the company stated there are no specific roles for IT practices within the company. This pitfall is also justified by the current stage of

development of the company. Given its still embryotic phase, implementing a more complex IT assessment is not yet seen as mandatory. The company merely adopted software for storing and controlling projects' information. With the future increase of human resources, it is already recognized the upcoming need for implementing control tools which are more effective, both in commercial and operational aspects of business. A possible way to overcome the issue would be to engage in a COBIT's governance initiative itself. Other issues were detected. APO01.01 – "define the organizational structure", with a maturity level of zero, reveals the necessity for development of the enterprise's architecture; TOGAF can provide a lot of insights on that matter. One of the process' capability which sounded more alarming was the one given to APO13.02 – "define and manage and information security risk treatment plan", also assigned with a zero capability level. This is especially important in the consulting industry, where it is not easy for clients to evaluate the performance of a consulting service a priori. Even after the service is provided, there are innumerous external factors influencing the outcome that it becomes harder to judge a consultant's performance. As such, when opting for a consulting company, clients often rely on reputation, and "social proof" – meaning the academic development of the people constituting the consulting team (Christensen, Wang, & Bever, 2013). Having established the right controls and information security will provide more confidence into the business, and will make it more trustworthy, enabling the building of a better, stronger reputation. ITIL can be a powerful allied in doing so. Lastly, MEA01.04 (analyze and report performance), MEA01.05 (ensure implementation of corrective actions), and MEA02.01 (monitor internal controls) were also given a maturity of zero. The underlying issue will have consequences when optimizing processes, given monitoring and feedback are what stabilizes the system and what provides agility to it. Considering agility as one of the key aspects for companies to remain competitive, it is imperative for the company to start using monitoring tools and implementing performance measures. Furthermore, COBIT5 PAM is already complemented with Base Practices (BPs) for each sub-process. For example, the best practice

EDM01-BP1 supports EDM01.01 and it described by “Continually identify and engage with the enterprise’s stakeholders, document an understanding of the requirements, and make judgment on the current and future design of governance of enterprise IT”. A company could use these BPs as a guideline for the actions to engage with in order to leverage a process’ capability.

Considering the first segment of the research, the resulting metamodel is valuable for companies as it allows a quick assessment of all COBIT’s components and integrated frameworks. It also provides a foundation for the development of an application system which would allow the navigation within COBIT5. Regarding the ***Hypothesis C1***, and given the information provided by the company, it was not possible to build a model around it which could translate the relationship between inputs and outputs’ maturity. Collecting more data for the testing of the first hypothesis would not add much value to it, as it was already proven that there is no coherent relationship between processes’ maturities. One possible justification is the density of the framework. Given the exhaustive amount of factors which play a role in it, it is difficult to determine one factor which links the performances of the different processes. For a better validation of the ***Hypothesis C2***, it would be interesting to obtain more data. Several questions could then be answered with a higher degree of certainty. For example: ‘Is it true that for a process to be completely developed, all its activities must be seamlessly performed?’, and ‘may it be the case that processes may portrait the maximum capability level while not excelling at the activities proposed?’. Such insight would be helpful for companies when implementing/optimizing processes. Also, with more data, collected from different companies, in different industries, at different development stages, it would be possible to unveil patterns within ***Hypothesis 3***. Furthermore, it would be interesting to have experts acknowledging the true potential of considering sub-processes rather than processes. Knowing which steps to take will improve time and budget management, which is a top concern of key decision makers. It could also help to develop a more precise and quantitative implementation guide, to answer to users’ needs.

Bibliography

Al Omari, L. B. (2012). *Optimising COBIT 5 for IT Governance: Examples from the Public Sector.* Brisbane, Australia: Queensland University of Technology.

Bernroider, E. W., & Ivanov, M. (2011). IT project management control and the Control Objectives for IT and related Technology (CobiT) framework. *International Journal of Project Management 29*, 325-336.

Bloch, M., Blumberg, S., & Laartz, J. (2012, October). *Delivering large-scale IT projects on time, on budget, and on value.* Retrieved May 11, 2016, from McKinsey: www.mckinsey.com

Brand, K., & Boonen, H. (2004). *IT Governance based on COBIT - a pocket guide.* Zaltbommel: Van Haren Publishing.

Brown, A. E., & Grant, G. G. (2005). Framing the framworks: a review of IT governance Research. *Communications of the Association for Information Systems*, pp. 696-712.

Brynjolfssin, E., Hitt, L., & Yang, S. (2002). *Intagible Assets: How the interaction of computers and organizational Structures affects stocks market valuations.*

Brynjolfsson, E., & Hitt, L. (1998, June). *Beyond the Productivity Paradox: Computers are the Catalyst fot bigger Changes.* Retrieved May 11, 2016, from eusiness.mit.edu: http://ccs.mit.edu/erik/

Business Dictionary. (n.d.). Retrieved from http://www.businessdictionary.com/definition/process.html

Christensen, C. M., Wang, D., & Bever, D. v. (2013, May). Consulting in the cusp of disruption. *Harvard Business Review*.

Clarke, T., & Brink, A. (2011). *Corporate Governance and Business Ethics.* Springer.

Davenport, T. (2014). *Three big benefits of data analytics*. Retrieved May 11, 2016, from SAS: https://www.sas.com/en_sa/news/sascom/2014q3/Big-data-davenport.html

EMC. (2014, April). *The digital universe of opportunities: Rich data and the increasing value of the internet of things*. Retrieved June 2016, from http://www.emc.com/leadership/digital-universe/2014iview/executive-summary.htm

Epstein, M. J., & Rejc, A. (2005). How to measure and improve the value of IT. *Strategic Finance 87(4)*, 34-41.

Firestone, J. M. (2003). *Enterprise Information Portals and Knowledge Management .* Routledge.

Frigo, M. L. (2012). The Balance Scorecard: 20 years and counting, . *Strategi Fincance 94 (4)* , 49-53.

Garrity, J. T. (1963). Top management and computer profits. *Harvard Business Review (41)4*.

Gerke, L. &. (2006). *Towards an abbreviated COBIT framework for use in an Australian State Public Sector.* Adelaide: School of Accounting & Corporate Governance, Formerly of School of Information Systems, University of Tasmania.

Grembergen, W. V., & Haes, S. D. (2009). *Enterprise Governance of Information technology: achieving strategic alignment and Value.* New York: Springer International Publishing .

H. Peter Holzer, H.-M. W. (1986). *Managerial accounting and analysis in multinational enterprises* . Dublin, New York: W. de Gruyter.

Haes, S. D., & Grembergen, W. V. (2013). COBIT 5 and Enteprise Governance of Information Technology: Building Block and Research Opportunities. *Journal of Information Systems*, 307-324.

Hamelink, C. J. (1997, June). New information and communication technologies, social development and cultural change. *UNRISD Discussion paper no. 86*.

Heatfield, S. M. (2016, May 6). *How to reduce employee resistance to change*. Retrieved May 11, 2016, from humanresources: http://humanresources.about.com

Herbsleb, J. D., & Goldenson, D. R. (1996). *Systematic Survey of CMM Experience and Results.* Pittsburgh: Software Engineering Institute, Carnegie Mellon University.

Herderson, J. C., & Venkatraman, N. (1993). Strategic Alignment: Leveraging Information technology for Transforming Organizations. *IBM Systems Journal*, 472-485.

Heusser, M. (2005, December 30). *Methodology Design: The Way We Do Things Around Here.* Retrieved May 11, 2016, from informit: http://www.informit.com/articles/article.aspx?p=434641

Hughes, J. (2013, May 17). *What value creation will look like in the future.* Retrieved May 10, 2016, from Harvard Business Review: HBR.org

Huissoud, M. (2005). IT self-assessment project, current results and next steps. Presentation to EUROSAI IT working group. *IT self-assessment project, current results and next steps.* Cypress.

IDG Enterprise Marketing. (2015, May 9). *Big Data and Analytics survey 2015*. Retrieved May 10, 2016, from IDGenterprise: http://www.idgenterprise.com

Integrated frameworks on Business/IT alignment. (n.d.). Retrieved from acis professional center: https://www.acisonline.net/wp-content/uploads/2013/08/210.png

ISACA. (2009c). *The Risk IT Framework: Risk IT Based on COBIT.* Algonquin Road: Rolling Meadows.

ISO/IEC. (2015, February 15). ISO/IEC-38500. *Information Technology - governance of IT for the organization*.

IT Governance Institute. (2011, September 12). *Amended and restasted articles of incorporation of IT governance institute.* Retrieved May 11, 2016, from ISACA: www.isaca.org

Jiang, J. J., Klein, G., & al, e. (2004). An exploration of the relationship between software development process maturity and project performance. *Journal Information and Management, vol 4, issue 3* , 279-288.

Jr., T. D. (1992). Corporate Systems Management: An Overview and Research Perspective. *Communications of the ACM*, 61-86.

Kaplan, R., & Norton, D. P. (1996). *The Balance Scorecad: Translating Strategy into action.* Harvard Business Review Press; 1 edition.

Keider, S. P. (1984). Why Systems Development Projects Fail. *Journal of Information Systems Management, vol 1, issue 3*, 33-38.

Liskov, B. (1988). Data Abstraction and Hierarchy. *ACM SIGPLAN Notices - Special issue: 'OOPSLA '87: Addendum to the proceedings* , 17-34.

Loh, L., & Venkatraman, N. (1992). Diffusion of Information Technology Outsourcing: Influence sources and the kodak effect. *Information Systems Research*, 334-359.

McAfee, A., & Brynjolfsson, E. (2012). Big Data - the management revolution. *Harvard Business review*.

Nørreklit, H. (2000). The balance on the balanced scorecard—a critical analysis of some of its assumptions. *Management Accounting Research, Vol 11, issue 1*, 65-88.

Oracle. (2013). *Big data analytics.* Redwood Shores: Oracle Corporation.

Paulk, C. M., Weber, C. V., & Chrissis, M. (1993). *Capability Maturity Model for software, version 1.1.* Pittsburgh: Software Eng. Inst., Carnegie Mellon Univ.,.

Porter, M. E., & Millar, V. E. (1985). How Information Technology gives you competitive advantage. *HBR, Technology Magazine*.

Ross, J. W. (2006, April 19). *Enterprise Architecture: Driving Business Benefits from IT (selected research briefings).* Retrieved May 11, 2016, from cisr: http://cisr.mit.edu

Rouse, M. (2014, October). *Big Data Analytics*. Retrieved May 11, 2016, from Search busienss analytics: http://searchbusinessanalytics.techtarget.com/definition/big-data-analytics

SAS. (2011). *Big Data meets Data Analytics.* Retrieved from SAS: http://www.sas.com/content/dam/SAS/en_us/doc/whitepaper1/big-data-meets-big-data-analytics-105777.pdf

Shaw, J. (2014). Why "Big Data" is a big deal . *Harvard Magazine*.

Shleifer, A., & Vishny, R. W. (1997). A survey of Corporate Governance . *Journal of Finance Vol LII, no 2*, 737-783.

Simons, R. (1990). The role of management control systems in creating competitive advantage: new perspectives. *Accounting, Organizaztions and Society, vol 15, no1/2*, 127-143.

Simons, R. (1990). The Role of Management Control Systems in Creating Competitive Advantage: New Perspectives. *Accounting, Organizaztions and Society, vovl 15, no1/2*, 127-143.

Simons, R. (1990). The Role of Management Control Systems in Creating Competitive Advantage: New Perspectives.

Simons, R. (1990). *XX.*

Simons, R. (1990). XX.

Simons, R. (1995). *Levers of Control: How Managers Use Innovative Control Systems to Drive Strategic Renewal.* Boston: Harvard Business School Press.

Simons, R. (n.d.). *Levers of control.*

Symons, C. (2005). IT Governance Framework. *FOrrester research*.

The Open Group. (2012-2013). *ArchiMate® 2.1 Specification.* Retrieved May 11, 2016, from OpenGroup: http://pubs.opengroup.org/architecture/archimate2-doc/

Thorp, J., & Fujitsu, C. C. (1998). *The information paradox.* Whitby: McGraw Hill.

Troester, M. (2011). *Big Data meets Big data analytics.* SAS.

Venkatraman, N. (1997). Beyond Outsourcing: Managing IT Resources as a Value Center. *Sloan Management Review*, 51-65.

Volonino, L., & Turban, E. (2011). *Information Technology for management.* Danvers: Wiley.

Weill, P., & Ross, W. J. (2009). *IT Savvy: What Top Executives Must Know to go from pain to gain.* Harvard Business Press.

Wells, H. (2010). The Birth of Corporate Governance. *Seattle University Law Review, vol: 33*, 1247-92.

Wilking, C. L., & Chenhall, R. H. (2010). A review of IT Governance: A taxonomy to inform accounting information systems. *Journal of Information Systems 24 (2)*, 107-146.