

An Integrated Model for ICT Governance and Management

Applied to the Council for Evaluation, Accreditation and Quality Assurance of Higher Education Institutions in Ecuador (CEAACES)

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Abstract—As an effect of the modernization policy in the administrative processes inside the Ecuadorean Central Government, the usage of Information and Communication Technologies (ICTs) has increased during the last years within more than 300 of the most important and high-ranked public institutions. Likewise, the citizen access to Internet and e-Government services has grown due to the democratization of the governmental ICT platform to ensure access to the most important public services, including those offered by Higher Education Institutions (HEIs). However, the applicable regulatory and legal framework in the public sector has very little compliance with governance and management considerations. Our work develops a combined model for ICT governance and management based on academic models for governance and strategic alignment, aided by professional practices in the field, fully compliant with the regulatory mechanisms that operate within the Central Government of Ecuador. Also, our work analyzes the results, limitations and future work regarding the applicability of this model inside the Council for Evaluation, Accreditation and Quality Assurance of Higher Education Institutions (CEAACES) in order to support the process of continuous improvement of public higher education in Ecuador.

Keywords—ICT; IT; governance; management; cobit; model; iso; practices; standard

I. INTRODUCTION

According to the Art. 226 of the Ecuadorean Constitution [1], the Executive Function (Central Government) is part of the public sector, comprised of more than 300 dependencies where more than a hundred of e-Government applications are used [2] [3]. Currently, there are more opportunities to use these e-Government services, as the central Government has promoted citizen access to ICT platforms. In fact, in between 2010 and 2015, the percentage of Internet users amongst the Ecuadorean population has increased from 17 to 51 per cent [4].

In case of governmental dependencies, these maintain ICT platforms to support e-Government services along with their internal processes. Management of these platforms is based on a regulatory and legal framework, which includes Organic and Common Laws, Statutory Instruments, Agreements, Decrees

and General Norms. Out of these, the *Internal Control Norms (ICN)* of the General State Comptroller's Office [5], the *Agreement for Information Security (IS)* of the National Secretariat of Public Administration [6] and the *Agreement for Process-Based Government (PBG)* [7] make direct reference to ICT Management Processes. In Table I, the main characteristics of the legal framework are described.

TABLE I. ECUADOREAN LEGAL FRAMEWORK FOR PUBLIC SECTOR'S ICT MANAGEMENT

Authority	Process	
	Instrument	Description
General State Comptroller's Office (CGE)	Internal Control Norms (ICN)	The processes that should be implemented in public institutions are listed and briefly explained from a controlling perspective.
National Secretariat of Public Administration (SNAP)	Agreement for Information Security (IS)	The directives for using ISO 27001 [8] as National Technical Norm for implementing Information Security Management Systems (ISMS).
Ecuador President's Office	Agreement for Process-Based Government (PBG)	The components for establishing a process-based government, such as governing processes (subjects) and products/services (adjectives) ^a .

a. The adjectives depicted in the agreement are translated as products and services which are provided to the governing processes that are shown as subjects in this agreement.

The Central Government's public institutions, created before 2013, have equivalent processes to those described in Table I. These processes are known as Governing, Value-Aggregator and Enabling Processes (consulting and support). The process known as "Information and Communication Technologies (ICTs)" is considered inside the Enabling Processes (adjectives in PBG). ICTs is seen as an "adjective" process, makes it evident that both institutional and ICT processes must be aligned so that the relevance of the latter can be assured. Nonetheless, these criteria and alignment processes are not detailed enough in the Ecuadorean Legal Framework for ICT Management.

Because of the aforementioned reasons, in our current work, we propose the design of a model-type artifact in order to

integrate ICT Governance and Management for the Ecuadorean public sector.

This artifact is developed by consolidating systematic alternatives, and partial but complimentary solutions, both built over the basis of the analyzed problem, state-of-the-art research and the best practices to solve this issue; the artifact strength relies on keeping internal consistency of its components with the Ecuadorean Framework for ICT Management in the public sector. Then, in order to assess the applicability of this artifact-like model, the Council for Evaluation, Accreditation and Quality Assurance of Higher Education Institutions (CEAACES) is considered as a case study so that criteria for its implementation can be devised from the evaluation results. This research approach is based on the Design Science Paradigm proposed by Hevner, Ram, March and Park [9].

From this point forward, this article is organized as follows:

In Section II, considerations regarding governance, ICT Management and strategic alignment are discussed in depth. Later, these considerations are used to define the model which is fully defined in Section III. In Section IV, the evaluation of the model is described, as it was applied in CEAACES,

Finally, in Section V, a discussion of the obtained results and further work is presented.

II. GOVERNANCE AND IT MANAGEMENT CONSIDERATIONS

According to Webb, Pollard and Ridley [10], whilst IT executives and managers (Information Technology Management - ITM) deploy and supervise business strategies, other structures handles organizational policies, culture and IT investment (Information Technology Governance - ITG). In other words, ITG defines and spreads mechanisms required to ensure the current and future business-technology alignment objectives [11] whereas ITM must ensure that the governance mechanisms are in place in order to fulfil the corresponding strategies [12].

ITG can be implemented by combining diverse relational structures, processes and mechanisms; plenty of research has been done in the last decade about how to implement ITC in a structured and process-oriented way [13] [14]. Recently, ISO 38500 [15] has become the first international standard that depicts general directives about implementing ITG inside organizations, however it does not include mechanisms, techniques or specific tools, so it lacks of practical contribution.

Regarding ITM, the Business-Driven Information Management model (BDIM) is the application of models, practices, techniques and tools for mapping and quantitatively evaluate the interdependencies amongst the business performance and IT solutions in order to improve IT service quality and the related business outcomes [16] [17] [18]. Currently, ITIL [19] and COBIT [20] are the most developed frameworks for IT service delivery and governance, respectively.

For the integrated implementations of ITG and ITM two models can be found in specialized literature *Business-Objectives driven IT Management (IT-MBO)*, and the

Guidelines and Areas-based Model. The first is conceived around a set of key concepts: objectives, key performance indicators (KPIs) and organizational perspectives (financial, customer, processes and learning/growth) [21]. In this case, COBIT is a clear adaptation of this model.

A combined framework has already been created based on Guidelines and Areas [22] [23]. After comparing this model with others, it has been reported to be similar to COBIT 4.1. In COBIT 5 [20] all the criteria of the previous version are covered and enhanced, so COBIT 5 can be considered as the most complete framework for combining ITG and ITM [24].

Returning to a broad approach, in spite of COBIT and ITIL providing an excellent choice of IT frameworks for governance and service provision, respectively; they both have limitations. In one hand, the definition of impact, risk and other measurements are vague and not necessarily quantitative [21] [25]. On the other hand, they do not provide implementation details, which obliges the usage of other guides or standards for filling the gaps, as it has been reported in previous work [26] [27].

A. IT Strategic Alignment

IT alignment aids institutions by maximizing IT investment return, generating competitive advantage through information systems, and delivering orientation and flexibility to react to new opportunities [28].

Some models have been identified and described as alignment research trends [29] [30] [31]. These models adopt the *Strategic Alignment Model (SAM)* [32] which has been widely adopted [31], and has been considered as a design paradigm [9] on which our proposal is developed. The SAM model is comprised of four domains which are related in various ways. Each of them describes one perspective that displays both links (strategic adjustment and functional integration) in order to obtain a proper IT alignment inside an institution (Fig. 1).

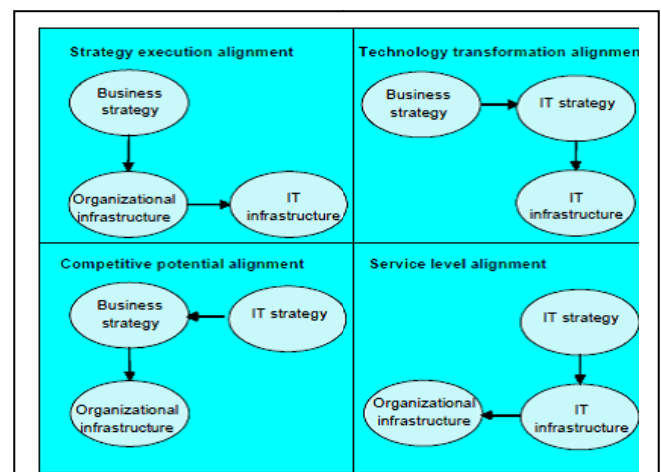


Fig. 1. IT Strategic Alignment Domains [45]

For example the second perspective, or technologic transformation, describes the business strategy implementation through IT. Then, as business strategies are conductors for alignment, they provide vision and objectives to meet business

goals by changing and organizing IT infrastructure and its processes at operative level.

A case in point for strategic alignment can be found in COBIT 5, which states that the needs of each interested party must be transformed into a feasible corporative strategy through its ‘goal cascade process’ [20]. This process translate the needs into useful and customized business goals, IT-related goals and specific catalyst goals. Thus, the whole goal cascade process in COBIT is fully compliant with the second perspective in the SAM model.

B. ITG in the Public Sector

A plethora of research have been done in recent years that address the challenges for ICT management in the public sector [33] [34] [35]; particularly, regarding centralized management figures and decision making. For example, according to Winkler [36], unlike the private sector, which is focused on generate value for investors, the public sector business core is based on the services it can provide to the community (public value). Furthermore, beyond improving governmental operations, it is required to consider political and social effects due to the fact that in the public sector, IT governance objectives are multifaceted and more difficult to measure than in the private sector. Here, Winkler analyzes the fact that, in contrast with private economy, public organisms create even more centralized structures for decision making, as it happens in the Ecuadorean Central Government, as described in the instruments depicted in the Ecuadorean Legal Framework for ICT Management in the public sector (Table I).

C. ITG Implementation

As mentioned before, there are many advantages of implementing ITG since different governance perspectives contribute to achieve different results. Hence, it is important to

analyze possible implementation patterns that can be used by organizations.

A first approach establishes that institutions assign their ‘decision rights’ to different ‘archetypes’ [37]. The results show three important patters for decision making; one of them depicts the preponderance of business, which is very similar to the Ecuadorean public sector schemes.

Secondly, a baseline for ITG practices can be taken, as suggested by De Haes and Van Grembergen [38] whose application was evaluated in financial service institutions in Belgium. This research shows that some of these practices are more effective and easier to implement than the others. The set of practices perceived as ‘very effective’ are Management Committees, management communication lines (CIO reports to CEO), and Executive Boards in which CEOs are active members.

Finally, it has also been suggested [39] to select a set of structures, processes and relationships for ITG out of case studies analyzed within specialized literature review. From the global results, characteristics are selected considering a frequency value which is set depending the number of times that a characteristic is applied in the case study. These characteristics can be structures, processes or any other relevant relationships that can be generalized and applied to ITG implementations.

III. INTEGRATED MODEL FOR ITG/ITM

Based on all the previous considerations, we propose an integrated model for IT Governance and Management, based on the SAM Model proposed by Henderson and Venkatraman [32]. In Table II, the components of the Integrated Model for ITG/ITM are summarized.

TABLE II. INTEGRATED MODEL FOR ITG/ITM

			ITG	ITG/ITM		
			Public Sector	Implementation Criteria	IT-MBO	Guidelines and Areas
Governance (ITG) - Internal and External Approach - Organization as a Whole - Strategic Future - Benefit-Making - Adequate Investment - Delegation	Basic Framework	Structure	Hybrid or Centralized decision structure organized as a duopolistic archetype.	<ul style="list-style-type: none"> - IT Alignment Task Integration in roles and responsibilities. - Management Committee establishment. - IT organizational structure considerations. - CEO as member or Executive Board. - CIO reporting to CEO - Existence of Manager, as a role for business/IT relationships. 	COBIT as Governance Domain. ISO 38500	Guidelines: - IT Objectives - IT and Business Alignment Areas - Strategy

			ITG	ITG/ITM		
			Public Sector	Implementation Criteria	IT-MBO	Guidelines and Areas
		Processes	<ul style="list-style-type: none"> - Acquisition. - Service Q&A. - Information Architecture. Management - IT Strategic Planning. 	<ul style="list-style-type: none"> - IT Strategic Planning. - IT Project Portfolio Management. - IT Project Follow-Up. 		
		Relationships	<ul style="list-style-type: none"> -Mechanisms for Communication Improvement in between IT and Organizational Sectors. -Development of required skills for decision making and critical ITG processes execution. 	<ul style="list-style-type: none"> - Shared understanding of business objectives. - ITG awareness campaigns. - Shared management of IT accounts. 		
	Strategic Alignment (BITA)	SAM Model	A hierarchical model like the Technology Transformation Alignment Mechanism.		COBIT: Goal Cascade. ITIL: Duopolistic Committees (IT + Business).	Guidelines: - IT and Business Alignment. Areas: - Strategy
Management (ITM) - Internal Approach. - Departments and Individuals. - Present Strategy. - Projects and Operations. - Cost and Quality. - Budget Accountability. - Current work.	Business-Driven Information Management Model (BDIM)	A service-oriented model based on COBIT and ITIL			COBIT: Management Domains. ITIL: - Service Strategy (SS). - Service Design (SD). - Service Transition (ST). - Service Operation (SO). - Service Configuration (CM).	Guidelines: - Business Structures/Processes/Mechanisms. - IT Processes. - IT Balanced Score card (BSC). - Best-practices. - Auditing. - Improvement. - Innovation. Areas: - Service. - Resources. - Risk. - Development. - Architecture. - Projects. - Support and Q&A. - Investment. - Outsourcing. - Compliance. - Improvement. - Innovation.
	Specific Strategies: - Information Security. - Business Continuity. - Risk Management. - Software Development. - Other strategies.	ISO 27000 ISO 22301 ISO 31000 ISO 12207 CMMI Others.				

The strategy for defining the model is explained as follows:

- i. COBIT is adopted as generic practice for Governance and Management, considering its content and completeness level.
- ii. For ITG, a basic framework is adopted: structures, processes, relationships and strategic alignment. Also, the recommendations for implementation are aligned with the local legal framework for the public sector so that compliance can be ensured throughout the whole model.

- iii. For ITM, ITIL and COBIT service-related processes are considered along with the eventual usage of specific norms and guidelines according to the needs.

The model components or mechanisms are comprised of recommendations, processes, strategic alignment, guidelines and norms. These mechanisms must be applied as follows:

1) *If strategic alignment employs technology transformation in the SAM Model (Business Strategy -> IT Strategy -> IT Infrastructure):* The COBIT Goal Cascade technique has to be applied in order to define the main ITG COBIT processes to be implemented.

2) *According to the organization restrictions and reality:* Some ITG recommendations depicted in the model

should be ignored. For instance Acquisition, IT Project Portfolio Management and IT Project Follow-Up are centralized activities in the public sector that may be overlooked. Whenever it is feasible, recommendations should be adapted to meet the closest ITG COBIT processes.

3) *Adopting COBIT processes related to ITM:* Alternatively, there are ITIL services that can be considered; however, in doing so, these services must be integrated with ITG components. Then, it has to be defined if processes need to be decomposed, and if the granularity level given to them requires applying specific guidelines and norms. Eventually, current process capabilities and their maturity may be assessed by using a maturity/capacity model, or else including/discarding processes according to specific organizational needs.

IV. APPLYING THE ITG/ITM MODEL IN THE COUNCIL FOR EVALUATION, ACCREDITATION AND QUALITY ASSURANCE OF HIGHER EDUCATION INSTITUTIONS IN ECUADOR (CEAACES)

The proposed ITG/ITM Model has been applied to the Council for Evaluation, Accreditation and Quality Assurance of Higher Education Institutions in Ecuador (CEAACES).

The model was considered suitable for its application in CEAACES due to the multifaceted nature of this institution from the political and public point of view.

From the political context, this institution has its own organic structure [40] created to ensure transparency, quality and continuous improvement within the processes for evaluation, accreditation and academic quality assurance inside Ecuadorian higher education institutions (HEIs). Mainly, CEAACES along with the Council of Higher Education (CES) are in charge of ensuring political and

strategical alignment in between the National Plan for Good-Living [41], and the academic strategy inside the Universities' current study programs and research projects.

From the public context, CEAACES is a public institution that is regulated by the Ecuadorean Legal Framework (Table I). Therefore, as a public institution, it is controlled by the Central Government in Ecuador. Since CEAACES regulates academic quality inside Ecuadorean HEIs, it is clear that its institutional mission is focused in education as a public service. Furthermore, Ecuador has promoted e-Government platforms to democratize access to public information and provide equal opportunities for citizens, including access to public higher education programs.

As consequence, the information that CEAACES manages have direct impact in the public and political scenario in which Ecuador deploys its national strategy. This information and its management processes requires Governance models that can start at Strategy levels and end up at Operational IT Areas. Thus, in order to apply the proposed model inside CEAACES, three alignment scenarios have been identified.

- i. **Corporative goals alignment** in which COBIT processes are taken into account.
- ii. **IT goals alignment** to ensure that information infrastructure, its processes and strategies are aligned with the corporative goals.
- iii. **Business Processes Alignment** to ensure that the processes are deployed in compliance with the whole corporative and IT goals. These processes are classified by their priority according their contribution level: one IT goal (low priority), two IT goals (medium priority), three or more IT goals (high priority).

The alignment results are shown in Table III.

TABLE III. IT STRATEGIC ALIGNMENT IN CEAACES

Scenario 1: Corporative Goals	Scenario 2: IT Goals	Scenario 3: Business Processes
Focused on customer orientation and internal policy compliance. Emphasis on benefit making; majorly on risk management optimization.	Customer orientation and business process functionality optimization. Emphasis on risk management and resource optimization; majorly on benefit making.	Customer orientation. Emphasis on benefit making, resource optimization; majorly on risk management optimization.

Mission and Strategic Objectives	<p>Mission Exercise management of public politics for quality assurance or higher education in Ecuador, through processes of evaluation, accreditation and categorization of Higher Education Institutions (HEIs).</p> <p>Strategic Objectives</p> <p>a) To evaluate and accredit universities and polytechnic schools, their undergraduate and graduate academic programs.</p> <p>b) To evaluate and accredit superior institutes and their academic programs.</p> <p>c) To place CEAACES as a reference in matters of higher education quality, introducing it in the national, regional and international academic debate.</p> <p>d) To ensure academic quality of undergraduate and graduate students of HEIs.</p>		
Mission of ICT Management	To advice and provide technological support regarding management of evaluation, accreditation, categorization and quality assurance processes; as well as information technology management, through infrastructure and computer services for management, storage, custody and data, information, and knowledge technical management.		
Corporative Goals	Customer-oriented service culture.	Customer-oriented service culture.	
	Business service continuity and availability.	Business service continuity and availability.	Business service continuity and availability.

Scenario 1: Corporative Goals	Scenario 2: IT Goals	Scenario 3: Business Processes
Focused on customer orientation and internal policy compliance. Emphasis on benefit making; majorly on risk management optimization.	Customer orientation and business process functionality optimization. Emphasis on risk management and resource optimization; majorly on benefit making.	Customer orientation. Emphasis on benefit making, resource optimization; majorly on risk management optimization.

		Internal policy compliance	Business process functionality optimization.	Information-based strategic decision making.	
IT Goals		IT and business strategy alignment.	IT and business strategy alignment.	IT and business strategy alignment.	
		IT Compliance and Support regarding business, laws and external regulations.	Managed IT-related business risks.		
		Managed IT-related business risks.	Managed IT-related business risks.	Managed IT-related business risks.	
		IT service delivery according to business requirements.	IT service delivery according to business requirements.		
		Information security, processing infrastructure and applications.	Information security, processing infrastructure and applications.	Information security, processing infrastructure and applications.	
		Relevant and useful information available for decision making.	Relevant and useful information available for decision making.	Relevant and useful information available for decision making.	
		IT compliance with internal policies.			
COBIT Processes	Priority	High (+3 IT goals)	EDM03, APO13, BAI06, DSS03, DSS04, DSS05, MEA01, MEA02	APO13, BAI06, DSS03, DSS04	APO13
		Medium (2 IT goals)	EDM01, EDM02, APO01, APO02, APO08, APO09, APO10, APO012, BAI01, BAI02, BAI04, BAI10, DSS01, DSS02, DS06, MEA03	EDM01, EDM02, EDM03, APO02, APO08, APO09, APO10, APO012, BAI01, BAI02, BAI04, DSS01, DSS02, DSS05, DS06, MEA01	EDM03, APO012, BAI01, BAI06, DSS03, DSS04, DSS05
		Low (1 IT goal)	EDM05, APO03, APO05, APO07, BAI03	APO01, APO03, APO05, APO07, BAI10, MEA02, MEA03	EDM01, EDM02, APO01, APO02, APO03, APO05, APO07, APO08, APO09, APO10, BAI02, BAI04, BAI10, DSS01, DSS02, DSS06, MEA01, MEA02, MEA03

In *Scenario 1*, the high-priority processes encompass the others, so they are considered for further analysis. Next, considerations are made regarding corporative governance in CEAACES, along with particular processes interests so that definitive mechanisms can be established (Table IV).

TABLE IV. MECHANISMS IDENTIFIED AFTER APPLYING THE ITG/ITM MODEL IN CEAACES

		Mechanisms	
Governance (ITG)	Basic Framework	Structure	<ul style="list-style-type: none"> - ICT structure with centralized decision, inherent of supporting public processes, according to organizational structure of CEAACES. - Creation of Technology Committee at Advisor Lever, led by CEAACES Chairman, or representative. - Integration of alignment ICT tasks in roles and responsibilities attached to the ICT Department and/or Technology Committee. - Presidency of ICT Department in the Technology Committee, reporting and accomplishing administrator roles of ICT business relationships.
		Processes	<ul style="list-style-type: none"> - EDM03 Risk Optimizations Assurance - APO02.05 Define Strategic Plan and Waybill - AP009 Service Level Agreement Management - APO03 Enterprise Architecture Management
		Relationships	<ul style="list-style-type: none"> - Shared understanding of business objectives through the Committee of Technology. - ITG Awareness Campaigns.
	Strategic Alignment (BITA)	SAM Model	- See Table II. Integrated Model for IGT/ITM

		Mechanisms
Management (ITM)	Business-Driven Information Management Model (BDIM)	<ul style="list-style-type: none"> - APO13 Security Management - BAI06 Change Management - BAI03 Identification and Solution Construction Management. - DSS03 Problem Management. - DSS04 Continuity Management. - DSS05 Service Security Management. - MEA01 Supervise, Evaluate and Value Performance and Continuity. - MEA02 Supervise, Evaluate and Value Internal Control System.
	Specific Strategies and Norms: - Information Security. - Security services - Problem Management. - Business Continuity.	<ul style="list-style-type: none"> - ISO 27001 and ISO 27002 for Information Security and Security Services (APO13 + DSS05) - ISO 22301 and ISO 27001 for Business Continuity and Problem Management (DSS03 + DSS04) - ISO 25000 and Agile Methods for Solution Development (BAI03)

A. Model Implementation Restrictions

Service orientation that constitutes one of the model elements was not explicitly covered in the case study because the strategic alignment mechanism employed in CEAACES did not required this characteristic.

Now, in those cases where model implementation is required, doubts coexist regarding the difficulties that may come up. These uncertainties are more evident during COBIT implementations [38]. On this count, strategic alignment constitutes a practical ‘filter’ to establish important processes to be implemented. In this case study, 12 out of 37 processes were required to be implemented; almost a third of the COBIT framework.

Additionally, implementation efforts must be added to the previous restriction because effort depends on the current situation and the organizational context. Thus, assessment is a very important tool in order to devise effort levels that can be otherwise undistinguishable. In CEAACES assessing different scenarios enabled a formal definition of both service-oriented and business-continuity activities as implementation strategy.

V. DISCUSSION OF RESULTS AND FUTURE WORK

As a result of having applied the model, and after an evaluation against COBIT Capacity Model, processes with low development, but with higher priority were deeply analyzed. For example the IT organizational structure was redefined, including the responsibilities for strategic alignment. Also, both the Committee of Technology and the Committee of Information Security were created in CEAACES, based on COBIT and ISO 27001 (APO13, DSS05), respectively. Basic practices to support a Business Continuity Management System (BCMS) were developed based on COBIT, ISO 22301 and ISO 27001 (DS04, DSS03), and an ICT Strategic Plan was developed (APO02.05) to reflect the strategic alignment.

The model applicability was demonstrated through the experiences taken from the case study at CEAACES. In the model specification, contributions from different theoretical models that were previously analyzed (Section II) can be explicitly differentiated, as well as the practical approach that was taken from professional frameworks. The theoretical models depict the state-of-the-art practices that have been developed in recent years, whereas the

professional frameworks contribute with their practical experiences. The model was developed using a systematic approach, having the aforementioned contributions as baseline. Then, after testing the model in three different scenarios, the necessary steps for implementing it are explained, using the experiences of its application in CEAACES. The results of its application are obviously reflecting changes at strategic and operational levels; in order to validate the model’s public and political contribution, a more extended assessment period should be considered. However, we believe that through the alignment of business strategy and IT goals, activities carried out in CEAACES for evaluation, accreditation and categorization of Higher Education Institutions could show a very different result in the medium and long term.

As it can be noticed in Table IV, for ITM implementation, selecting ITM Guidelines and Norms, as implementation mechanisms is a required and complementary activity. In order to blend this mechanisms with other aspects in the model, it is necessary to consider the integration details in between mechanisms and the granularity level that the implementation must have, as processes need to be decomposed into simple and traceable activities. This requirement is an opportunity for further work in this topic, taking into account that some interesting research has been already done in order to overcome operative difficulties [42] [43] [44], which have not been yet devised in the proposed model.

Finally, the preponderant usage of COBIT in the model, shows a logical result which, unlike the academic alternatives that were analyzed, demonstrate its applicability and flexibility for strategic alignment using its Goal Cascade within different scenarios in order to identify and prioritize the results. This corroborates the statement made by De Haes, Van Grembergen, and Debreceny [24] regarding the research opportunities around COBIT, which are not restricted by the framework practices, but can be expanded and combined into an ecosystem of complementary frameworks and guidelines (COBIT, ITIL, ISO 38500, and others) which can guide the live cycle of IT processes for strategic alignment.

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