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# Product-Focused Software Process Improvement

12th International Conference, PROFES 2011  
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Product-Focused Software Process Improvement

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12th International Conference, PROFES 2011  
Torre Canne, Italy, June 20-22, 2011  
Proceedings

# Preface

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On behalf of the PROFES Organizing Committee we are proud to present the proceedings of the 12th International Conference on Product-Focused Software Process Improvement (PROFES 2011), held in Torre Canne, Italy. Since 1999 PROFES has grown in the software engineering community and has become a premium conference that brings together both academia and industry.

The roots of PROFES lie in the professional software process improvement motivated by product, process and service quality needs. The conference retains its high quality and focus on the most relevant research issues by addressing both perspectives, research and practice, from an academic and industrial point of view.

Today's software products and services are perceived as strategic assets for empowering business sectors at every level of the value chain, from strategic to operative. In this scenario, and considering the current global economic downturn, the challenge for developing software products and services consists in managing process diversity in order to reuse strategic software assets in various fields and environments quickly and cost effectively. This was the special theme for PROFES 2011.

In the last few years, many approaches and techniques have been proposed for managing diversity: experience bases for collecting and sharing knowledge and experiences; software development processes able to rearrange common assets in diverse products; process patterns as an instrument for filling the gap between process definition and the amount of customizations needed; estimation and calibration techniques that deal with the different processes in use; parametric and goal-oriented quality models; project management techniques able to fulfil the project goals in spite of project characteristics; cloud computing and service orientation for managing the diversity of hardware and software platforms. All these innovations provide exciting opportunities to make significant progress in understanding and facing real-world challenges.

This year's technical program featured invited talks, research papers, and experience reports on the most relevant topics in the focus area. We received 54 papers submitted from 22 nations, with each paper receiving at least three reviews. After a thorough evaluation, the Program Committee selected 24 technical full papers. The topics addressed in these papers indicate that the PROFES theme is a vibrant research area, but is also of high interest for industry as demonstrated by several papers that report on case studies or experience gained in industry.

We were proud to have two top keynote speakers: (1) Dennis Smith – Senior Member of the Technical Staff at Carnegie Mellon University's Software Engineering Institute and (2) David I. Foster – Senior Technical Fellow, View

short-paper session, two workshops, Managing the Client Value Creation Process in Agile Projects (VALOIR) and Project and Knowledge Management Trends (PKMT), one tutorial, Establishing and Improving Project Management Using Assessment Models for Process Capability and Organizational Maturity, and a Doctoral Symposium.

We wish to thank the University of Bari, the University of Oulu, the competence center Driving Advances of ICT in South Italy-Net (DAISY-NET), the Project Management Institute Southern Italy Chapter (PMI-SIC) and Software Engineering Research and Practices s.r.l. (SER&Practices) – spin-off of the University of Bari – for supporting the conference. We are also grateful to the authors for their high-quality papers and the Program Committee for their hard work in reviewing the papers.

June 2011

Daniilo Caivano  
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# Homogenization, Comparison and Integration: A Harmonizing Strategy for the Unification of Multi-models in the Banking Sector

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**Abstract.** Information Technologies (IT) play a crucial role in the development of the business processes in organizations. Acquiring the best technologies is quickly becoming as important as understanding and improving the business model of organizations. As a result, many (inter)national standards and models for IT Management, IT Government and IT Security have been developed. This situation allows organizations to choose and improve their processes, selecting the models that best suit their needs. Since several relationships between these models can be found, carrying out the harmonization of their similarities and differences will make it possible to reduce the time and effort involved in implementing them. In this paper, we present a harmonization strategy which has been defined to harmonize COBIT 4.1, Basel II, VAL IT, RISK IT, ISO 27002 and ITIL V3. This work intends to support organizations which are interested in knowing how to carry out the harmonization of these models. Furthermore, as a result of the execution of the harmonization strategy we have defined, a unified model for Banking, called ITGSM, is presented. It resolves the conflicts between the models mentioned above and provides a useful reference model to organizations that are planning to adopt them.

**Keywords:** Multi-model, Harmonization, IT Management, IT Government, IT Security, Homogenization, Comparison, Integration.

## 1 Introduction

There is a wide range of standards and models to support the process improvement of organizations. These benefit of international recognition and, according to [1], the models provide the descriptions and/or best practices for different spheres, such as software development, quality management, security, amongst others. In addition to these areas, many organizations are increasingly becoming interested in improving their business processes through IT management and IT security models such as COBIT, ITIL, ISO 27002 (also known as ISO 17799), amongst others. This is the case now more than ever.

Since Information Technologies (IT) are important for the development of almost all operations and activities of organizations, many organizations are showing an ever-growing interest in them. As in the case of other approaches, there is an abundance of good practices related to security, management and governance of IT. It has already been said that the good thing about standards is that there are so many of them [2], because when there are many standards, organizations can use a particular one or choose several of them in a certain situation.

This situation allows organizations to select and complement their processes from the models which fit their contexts well, e.g. if a model focusing on Computer Security, like the NIST Handbook [3] is not suitable, an organization can go for the implementation of ISO 27002. Organizations can also implement more than one model, as well as improve more than one specific subject of their business processes, e.g. providing support for the risks of IT and managing IT investment, using models such as RISK IT [4] and VAL IT [5].

According to [2], experts and practitioners should use the better parts of existing standards as building blocks and be prepared to deconstruct standards. However, professional skills alone are not enough. The people involved need a map or guideline to tell them how to carry out the harmonization of multiple standards. This makes it possible to decrease the costs associated with the implementation of models, by not implementing each one separately [1]. For instance, the PO4 (Plan and Organize) practice of COBIT 4.1 in charge of the task "defines and implement process in an organization" is closely related to the VG2 (Value Governance) practice defined in VAL IT V2.0. The process engineers can take advantage of those relationships and incorporate them into a single management practice, which can fulfill the requirements of both models, thereby reducing the time and effort which would have been involved in implementing two practices. At present, some proposals related to the harmonization of multiple models have been defined [1]. They do not, however, provide formal toolkits such as techniques, methods, processes or methodologies, which make it easier to discover "how to" carry out the harmonization of multiple models.

Given the benefits that can be obtained from harmonization of multiple IT models, it is important to have information on how the practices of different models can be put in harmony with each other. In that sense, this article presents the harmonization strategy designed to harmonize the latest versions of COBIT 4.1, Basel II, VAL IT, RISK IT, ISO 27002 and ITIL V3, thus giving support to multiple regulations that the banking sector is subject to. The harmonization strategy is accomplished by means of three techniques: homogenization, mapping and integration, which have been joined together in a single strategy and give support to certain considerations: (i) resolving

the issues related to structural differences, (ii) mapping between multiple models and (iii) unifying process entities from a formal integration criterion.

This paper proceeds as follows. Section 2 presents related work. Section 3 gives an overview of the harmonization framework and harmonization strategy that has been designed. A summary of the execution of the harmonization strategy and the unified model obtained is presented in Section 4. Lastly, some relevant discussion is set out, along with the conclusions we have drawn and the future work we have planned.

## 2 Related Work

The literature presents some work that involves comparisons and mappings between different models. Among these pieces of work, those related to IT Management or IT Government are:

- In [6] a mapping between ITIL V3 and COBIT 4.1 is described.
  - In [7] the relationships between COBIT 4.1, ITIL V3 and ISO/IEC 27002 are set out.
- Similarly, the following studies have been conducted regarding the identification and analysis of the importance of different models in relation to the financial sector:
- In [8], a study aiming to identify to what extent Governance practices have been implemented in the financial sector in Romania is presented. It is a comparative study, with respect to the data presented by the IT Global Governance Status Report - 2006 of the ITGI. The models identified were: COBIT, BASEL II, BSC, ITIL and ISO 17799.
  - In [9], we find an empirical study which made it possible to explore the importance and implementation of COBIT processes in Saudi organizations.
  - In [10], a methodology, based on the COBIT processes, to bring about regulatory fulfillment of legislations like SOX and BASEL, is discussed.
  - In [11], a study which investigates the way in which the companies of the financial sector of Belgium are applying IT Governance is presented; its aim is also to verify how this practice supports the alignment between IT and business.
  - In [2], a study whose aim was to identify in a general way the family of standards that support IT Governance is described, along with their relationships and the value that each of these standards contributes to the management. The family of standards found was: COBIT, ITIL, ISO 13569, ISO 13335, MOF, ISO 17799, ISO 9001, BS 15000, COSO, PRINCE 2, PMBOK and PAS56.

As it can be seen from the work presented above, the most widely-used models in mapping and comparisons are: COBIT, BASEL II and ITIL. However, from the analysis of these studies it has been possible to find that the process entities (PEs) involved in the comparisons or mappings are of high-level abstraction, that is, they do not carry out the analysis of PEs, such as activities or tasks. Moreover, it has not been possible to find an integrated model which would harmonize multiple approaches to support IT Governance. Such a harmonization could reduce the effort and costs associated with the implementation of a new integrated model, which unifies the multiple regulations that the banking sector is subject to.

According to [1], we can note that there are few studies that provide solutions such as, amongst other elements: methodology, process, framework, activities, tasks, steps, for supporting the harmonization of multiple models. Moreover, most of them have been designed to give support to the harmonization of software models, and although some proposals do support a wider range of models, such as ITIL and COBIT, these are currently proposals within a formal method and validation. Taking that into account, in this article we provide the definition of a harmonization strategy obtained from the execution of a harmonization process. This is composed of three techniques or processes: homogenization, comparison and integration, which have made it possible to carry out: (i) An in-depth analysis of the models involved, (ii) Comparison and identification of relationships and differences between them and (iii) Integration and definition of an IT governance model for banking. The latest versions of models and standards such as COBIT [6], ITIL [12], RISK IT [4], VAL IT [5], ISO 27002 [13] (ISO 17799), and BASEL II [14] were used. These techniques have also been used in other harmonization projects that we have carried out (homogenizations of ISO 9001:2000, CMMI ISO/IEC 12207, CMMI-ACQ VI.2, COMPETISOFT, COBIT 4.0 and PMBOK [15] and comparisons of ISO 9001 and CMMI [16], CMMI-ACQ and ISO/IEC 12207:2008 [17], and between CMMI-ACQ and ISO/IEC 15504 [18]).

A detailed summary of the strategy followed to harmonize the models involved is presented in the next Section.

### 3 Configuration of the Harmonization Strategy

The management of the harmonization of models involved was supported by means of the execution of a *harmonization process*. This process provides a guideline that makes it easier to manage the tasks related to the definition and configuration of a suitable *harmonization strategy* for carrying out the harmonization of multiple models (see Figure 1). The goal is also to ensure the generation of a standard format for the documentation obtained. The harmonization strategy is made up of *techniques and/or methods*, which are configured according to the particular objectives and needs of the organization. Both the harmonization process and the harmonization strategy are elements of the *Harmonization Framework* defined to support the harmonization of multiple models. These and other elements that make up the Framework, together with their application in real case studies, are presented in [19]. A more detailed version of the harmonization process using SPEM 2.0 and edited with the EPF Composer can be seen in [20].

A harmonization strategy was obtained as the main work product of the execution of the harmonization process. It is made up of three techniques, which are part of the Harmonization Framework:

- (i) Homogenization, to provide the tools which are suitable for setting in harmony the models involved, adding their information by means of a Common Schema or Common Structure of Process Entities (CSPE).
- (ii) Comparison, to carry out the identification of differences and similarities between multiple models.
- (iii) Integration, to give necessary support for combining and/or unifying the best practices of multiple models.

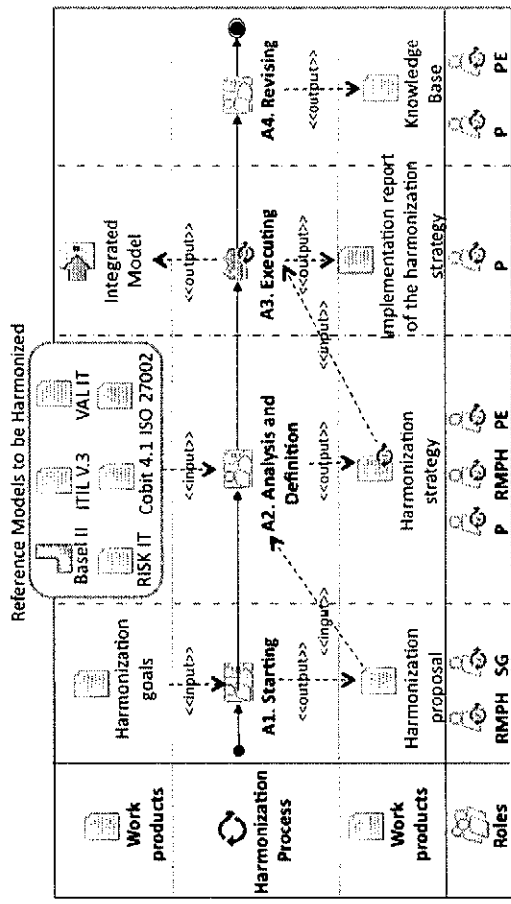


Fig. 1. Activity diagram of the harmonization process followed to obtain the harmonization strategy

The process carried out to perform the harmonization between COBIT, ITIL, RISK IT, VAL IT, ISO 27002, and BASEL II is described in the following lines. The purpose of this process was to provide a suitable harmonization strategy (or guideline) from the union and coupling of the three different techniques, aiming to guarantee the reliability of results obtained between them. Incorporating these techniques allowed us to carry out the step-by-step harmonization of the models involved. In order to organize and manage the people and activities throughout the strategy, this process establishes two roles: the performers and the reviewers, along with three stages:

- *Stage 1. Homogenization.* This stage involved the tasks: (i) acquisition of knowledge about the models involved, (ii) structure analysis and terminology, (iii) identification of requirements and (iv) correspondence.
- *Stage 2. Comparison.* This stage involved the tasks: (i) designing the mapping, (ii) carrying out the mapping, (iii) presenting the outcomes of the mapping and (iv) analyzing the results of the mapping.
- *Stage 3. Integration.* (i) designing the integration, (ii) establishing an integration criteria, (iii) carrying out the integration, (iv) analyzing the results of the integration and (v) presenting the integrated model.

Homogenization, comparison and integration are harmonization techniques which make up the Harmonization Framework. A detailed summary of these techniques can be seen in [12] and [19], respectively.

Figure 1 shows the activity diagram of the harmonization strategy described previously, which uses SPEM 2.0 notation and includes the main activities, tasks, roles and work products.

Table 1. Homogenization of the POI process defined in COBIT 4.1

Homogenization of POI: Define a strategic IT plan	
Domain	Plan and organize
Process	POI
<b>Name</b>	Defines a strategic IT plan
<b>Purpose</b>	To manage and drive all the IT resources in accordance with the particular strategy and priorities of the business.
<b>Objective</b>	To improve the understanding of the main stakeholders as regards the opportunities and limitations of IT. In addition, to assess present performance and identify the capacity and requirements of human resources, as well as to clarify the level of research needed.
	<b>Activities</b>

**POI.1 IT Value Management:** Work with the business, to guarantee that the IT investment portfolio of the firm contains programs with solid business cases. The task of accounting of profits and of cost-control is clearly assigned and monitored.

**POI.2 Business-IT Alignment:** Ensure that the goal of the business to which the IT is being applied is well understood. The business and IT strategies should be integrated, thereby creating a relationship between the goals of each, recognizing the opportunities, as well as the limitations in the present capacity. Broad-based communication should take place.

**POI.3 Assessment of Current Capability and Performance:** Assess the performance of the existing plans and of the information systems in terms of their contribution to the business objectives, their functionality, stability, complexity and costs, as well as their strengths and weaknesses.

**POI.4 IT Strategic Plan:** Create a strategic plan which, in cooperation with the relevant stakeholders, defines how IT will contribute to the firm's strategic objectives (goals), while also setting out costs and related risks. The strategic plan of the IT should include an estimate of the investment/operation, the sources of funding, the strategy to obtain as well as the legal and regulatory requirements.

**POI.5 IT Tactical Plans:** Produce a portfolio of tactical IT plans which are a by-product of the IT strategic plan. These tactical plans should describe the initiatives and requirements of resources demanded by the IT, as well as how the use of resources will be monitored, along with the profits gained.

**POI.6 IT Portfolio Management:** Actively administer, in conjunction with the business, the portfolio of IT investment programmes which is needed in order to achieve business goals.

#### 4.2 Comparing the Models

Since the homogenization allowed us to harmonize the models at the level of their structures and PEs, the *performer*, along with the *reviewer*, carried out the comparison of the models at the level of two PEs: *processes and activities*. This stage also followed an iterative and incremental approach. We say "iterative and incremental", because the comparison was carried out completely on one BASEL principle and COBIT processes, and then on the other BASEL principles. The result of this comparison was taken as a basis for carrying out the comparisons with the processes of other models involved. In each iteration, the comparisons of the descriptions of each PE were performed through a *semantic analysis*. Semantic analysis allowed us to identify the common features, differences and relationships at a low level of abstraction between the compared PEs. This consisted of studying the relationships between the descriptions of PEs that were being

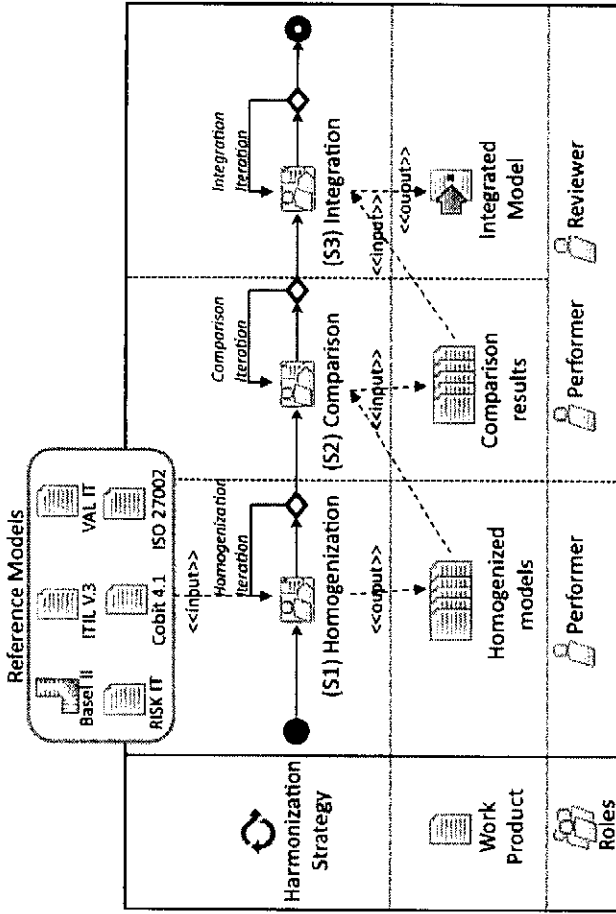


Fig. 2. Activity diagram of the harmonization strategy defined

### 4 Execution of the Harmonization Strategy

#### 4.1 Homogenizing the Models

Before carrying out the execution of the harmonization strategy, an analysis of each model was performed with respect to some of their elements and/or attributes, e.g. approach, size (number of pages), organization developer and processes or practices that make up the models and obtain the reference document. Since each reference model defines its own structure of PEs, the *performer* carried out the homogenization of his/her structures through a CSEP template, which is defined and executed through a homogenization technique (see [15]). Homogenization of the models' structures made it easier to compare them, due to the fact that they were structured under the same PEs during the execution of the comparison stage. We have performed the homogenization by means of an iterative and incremental procedure, in order to identify which specific practices of each model are supported by the CSEP template. This iterative and incremental approach has allowed us to manage the complexity where PEs of low-level abstraction are involved.

The homogenization of the PEs of each model allowed to prepare the models for the next stage. It also made it possible to carry out an initial comparison of the models at a high level of abstraction. This initial comparison permitted us to know if a model defines similar process entities or not, taking the entities process described in the CSEP as a basis. Table 1 shows an example of the CSEP and the homogenization of the POI process, which describes the best practices related to defining a strategic IT plan according to COBIT 4.1.

compared. Figure 3 shows the tasks diagram of the comparison iterations, displaying the comparison iterations, work products, outcomes, role, directionality of the comparisons and quantity of relationships identified.

From a first comparison between BASEL II and COBIT 4.1, 44 relationships (or 18 related processes of COBIT) were found; these relationships were compared with the other models involved. The results found in each comparison iteration can be summarized as follows:

- 44 relationships (or 18 processes) found between: BASEL II (10 principles) and COBIT (34 processes),
- 35 relationships found between: COBIT (18 processes) and VAL IT (34 processes),
- 33 relationships found between: COBIT (18 processes) and RISK IT (9 processes),
- 108 relationships found between: COBIT (18 processes) and ISO 27002 (39 processes),
- and 112 relationships found between: COBIT (18 processes) and ITIL V3 (37 processes).

Given the space limits, it is not possible to show all comparisons performed; a detailed summary of the relationships found during the comparison between Basel II and COBIT 4.1 is set out in Annex 1.

#### 4.3 Integrating the Models

On the basis of the results obtained in the comparison stage, the work group, comprised of the *performer* and *reviewer*, carried out the integration of relationships found between BASEL II and COBIT and after that, the integration of the relationships found in the other comparison iterations. That being so, the integrated model is based on the integration of the set of comparisons of the models involved; its process entities structure is comprised of 44 COBIT processes related to the operational risk principles defined in BASEL II. The integration of relationships (or related processes) found was carried out by (i) analyzing the results obtained in the comparison iterations and (ii) analyzing and identifying the activities needed to fulfill each purpose described in the 44 processes.

In each iteration, the integration was performed at the level of the PEs compared (processes and activities) in them. In addition, this stage followed an iterative and incremental approach. That made it possible to carry out the systematic management of the PEs involved and reduce the complexity coming from the integration of the descriptions of each model. Figure 4 shows the tasks diagram of the integration iterations performed.

In an effort to make the integration of descriptions between PEs easier, a set of rules or integration criteria was defined. It allowed us to know how to merge the descriptions in certain situations, e.g. (i) when the description of the process/activity which has less detail is supported and contained within the description of the procedure/activity that has greater detail and (ii) when the description of the procedure/activity with greater or less detail is not contained in the other process/activity. To apply these suitably, previous knowledge of the models involved and experience in the supervision of the banking sector of the *performer* were fundamental.

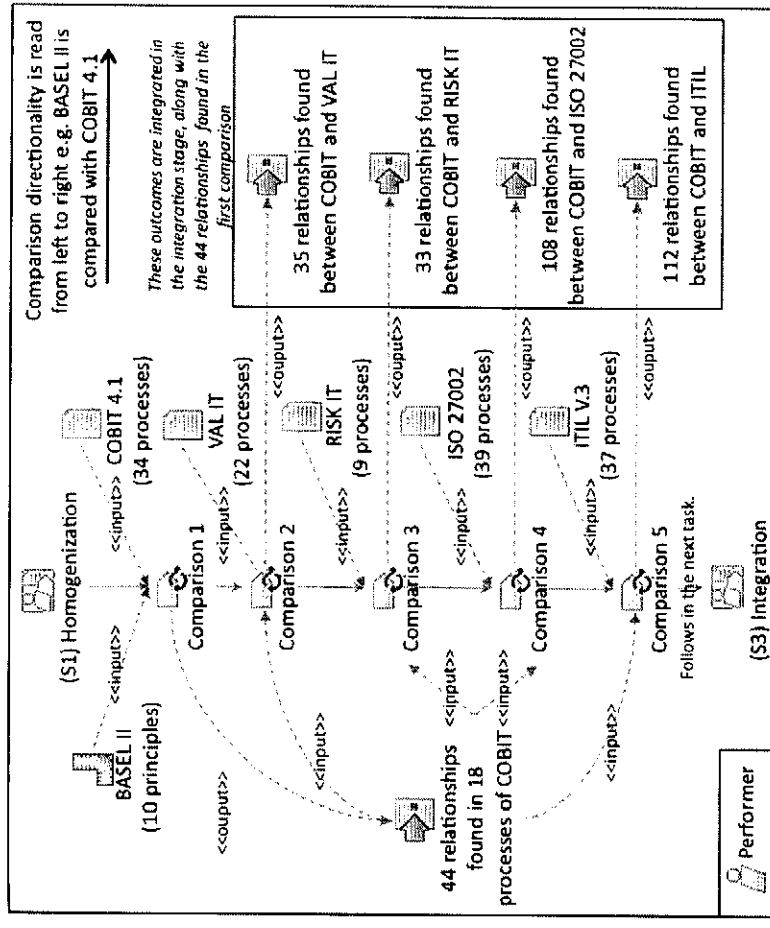


Fig. 3. Activity diagram of the comparison iterations

As a result of the execution of the harmonization strategy presented, a unified IT Governance Model for Banking, called ITGSM, has been obtained. It complies with operational risk principles established by BASEL II. In this way, ITGSM also consolidates the governance model proposed from the perspectives of: (i) Investment management IT - VAL IT, (ii) IT Risk Management - IT RISK, (iii) Management of information security - ISO 27002 and (iv) Life cycle management services - ITIL V3. Figure 5 shows the approaches, models and relationships that make up ITGSM. ITGSM defines 22 processes initially, which support the various approaches unified. We cannot show the unified model in its complete form here, due to limits on space. In Table 2, however, we present an extract, giving an overview of the structure of ITGSM. A detailed summary of ITGSM is presented in [21].

Although ITGSM's structure is oriented in one direction or another, according to the particular approach of each model, that itself makes it easy to maintain it if inter-national bodies provide new versions of the integrated models. It will also be easy to adopt its practices and reflect the changes in the organizations' processes.

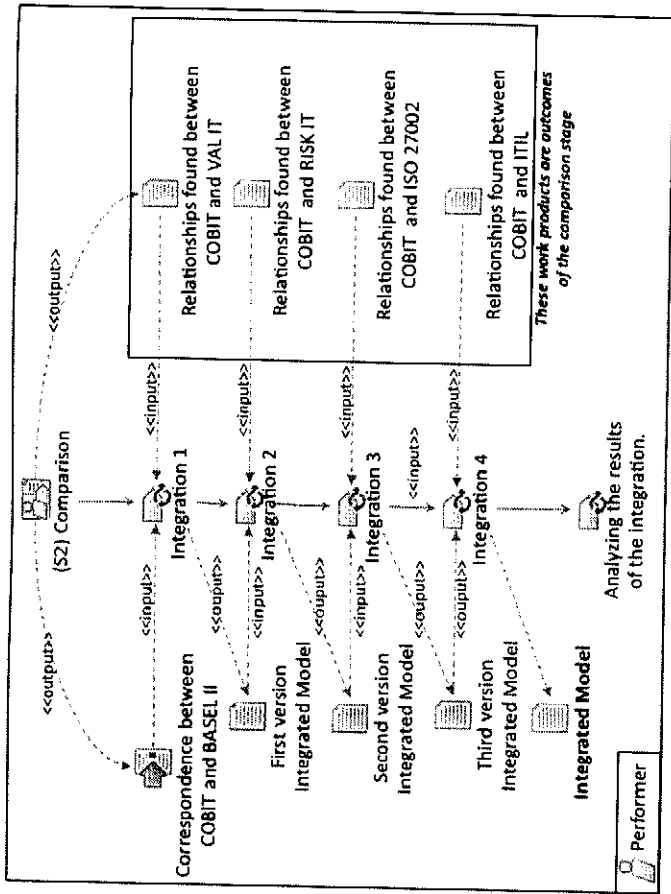


Fig. 4. Activity diagram of the integration iterations

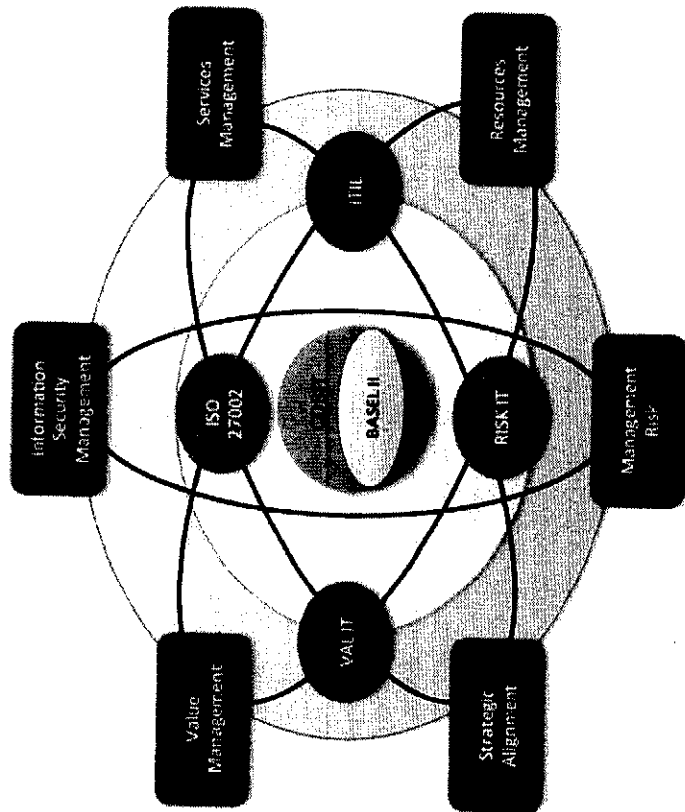


Fig. 5. IT Governance Model for Banking - ITGSM

### 5 Discussion and Conclusions

This paper has presented the harmonization strategy which has been designed to define an IT Governance Model for Banking, called ITGSM. The harmonization strategy has helped to organize and manage the work performed to obtain ITGSM through the configuration of three techniques: homogenization, comparison and integration, which have been joined in such a way as to take into account the harmonization objectives and specific needs of this research project. The systematic configuration of these techniques has allowed us to know "what to do", as well as "how to harmonize" BASEL II, VAL IT, RISK IT, ISO 27002, ITIL V3 and COBIT 4.1. To increase the reliability of results, this harmonization strategy used a reviewer who was present in each stage, who also helped to validate the results obtained and to resolve disagreements with the performer. The harmonization strategy has also made it possible to overcome some issues which arise when multiple models are integrated; these are:

- (i) *There are different structures.* Since a harmonization strategy described a homogenization stage, it was possible to harmonize the structural differences between the integrated models and prepare them for the execution of other stages or techniques, in this case, to run comparison and integration techniques. Having the same structure of PEs between models involved has allowed us to carry out the comparisons and integrations between similar process entities. It has not been necessary to define rules of comparison to address the issues concerning structural differences.

Table 2. Structure of ITGSM (Extract)

PR	Process	IT governance	Management the IT investment	Activities		Management the service lifecycle
				Specific risk management IT	Management of information security	
P1	PO4.2, PO4.3	PO4.2, PO4.3	VG1.4, VG1.5, PM1	RG2.1	Clauses 5.1, 6.1, 6.2, 8.1.1, 8.2.1, 15.1, 15.2	SD2.4.2, SS6.1, SO3.2.4
	PO9.1, PO9.2	PO9.1, PO9.2	IM1.2	RG1.5, RG1.7, RG1.8, RG3.3, RG3.4, REI.1, REI.3, RR3.4	Clauses 4.1, 5.1, 13.1, 14.1.1	SS9.5
P3	ME4.2	ME4.2	VG1, VG2.1, VG5	RG1, RG2	Clauses 5.1, 6.1.2, 10.1	SD3.10
	ME2.1, ME3.2	ME2.1, ME3.2	--NA--	RG1, RE2, RRI.2, RRI.3	Clauses 5.1, 6.1.8, 15.2, 15.3	--NA--
P5	ME3.1, ME3.3	ME3.1, ME3.3	--NA--	--NA--	Clause 15.1	--NA--
	PO1.2, PO1.4	PO1.2, PO1.4	VG1.5, VG2.1, VG4, PM1, PM6	RG1, RG2	--NA--	SS2.1, SS2.3, SS3.3, SS4.1, SS4.2, SS4.4, SS5.5
P7	PO4.1, PO4.8	PO4.1, PO4.8	VG2.4, VG2.6	RG1.2, RG2.4, REI.1, RE3.1	Clauses 6.1, 6.2.1, 7.2, 8.1, 8.2, 8.3, 9.1, 9.2, 10.1.2	SS2.6, ST4, SO4
	COBIT 4.1		VAL IT	RISK IT	ISO 27002	ITIL V3

(1) BASEL II: PR= Principle, (2) COBIT 4.1: PO= Plan and Organize, ME= Monitor and Evaluate, DS= Deliver and Support, (3) VAL IT: PM= Portfolio Management, IM= Investment Management, VG= Value Governance. (4) RISK IT: RG= Risk Governance, RE= Risk Evaluation, RR= Risk Response, (5) ITIL V3: SD= Service Design, SS= Service Assess, SO= Service Operations, CSI=Continual Service Improvement, ST=Service Transition, (6) NA= Not Applicable

(ii). *The confusion caused by many-to-many comparisons.* The comparison technique used has allowed us to make the correspondences and identify the relationships clearly and concisely. We adjust the mapping template of [18] to establish the comparisons performed to define the integrated model.

(iii). *Complexity of harmonization.* Since six models at a low level of abstraction had to be integrated, using an iterative and incremental approach has made it possible to: (i) manage and reduce the complexity and scope iterations of each stage of the harmonization strategy that has been designed, (ii) carry out supervision by the reviewer in each iteration, (iii) obtain feedback quickly, (iv) measure the progress in short periods of time and (v) integrate the results obtained in each iteration continuously. The total effort spent during the execution of the harmonization strategy was 9880 minutes. This effort was expended between the performer and reviewers.

This work intends to support and guide organizations in homogenizing, comparing and integrating multiple models. Currently, we are working on the definition of a widespread harmonization strategy (WHS), which will offer companies a generic strategy to harmonize multiple models, regardless of their approach. It will be defined from the harmonization strategy presented in this article. It will likewise be implemented in other case studies, to validate its generality and adaptation according to needs in other contexts.

As a result of the execution of the harmonization strategy defined, ITGSM currently defines 22 processes and gives support to five different approaches: (i) IT Governance, (ii) investment management IT, (iii) IT risk Management, (iv) management of information security and (v) life cycle management services. In that sense, IGTSM can be useful for organizations which are planning to adopt practices concerning IT Management, IT Governance and Information Security Management, even if the organization does not have a BASEL certification. In the future, we will evaluate this model empirically in a case study, in an attempt to confirm its efficiency and assess the way in which information technology supports business and operational risk management.

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