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THE BPM ISSUES IN BRAZILIAN PERSPECTIVE

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Rio de Janeiro, RJ – Brasil
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Dedicado à minha família.

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ABSTRACT

Business Process Management (BPM) is a discipline that leads with business process done in the organization, from their identification to their continuous improvement, to achieve consistent results aligned with organization´s goals. The BPM combines knowledge of information technology and management sciences and applies them in business processes that lead to results that is a value for at least one client. In the academic field, research has resulted in a large amount of methods, techniques and tools to support the development, deployment, management and analysis of operational business processes. On the practice field, BPM interest to various groups in an organization, from people responsible for the company to process participants that perform their activities on a daily basis.

This mutual interest in BPM by researchers and professionals who agree that there is an increase in complexity and scope of processes in organizations, gives rise to the need for knowledge of the current state of the art and practice from a Brazilian perspective. There are a few internationally research that perform a consolidated analysis of the state-of-art, either from the state-of-practice in BPM. At the best knowledge, however, no work performs an analysis or even a proposal to research the state-of-art or state-of-practice of BPM under Brazilian perspective.

Thus, following in the footsteps of some internationally relevant research that contributed to condense the evolution of knowledge in the BPM area in the state of the art and the state of practice, this research develops a multi-methodological approach in order to assess the current state of the art and practice of BPM from a Brazilian perspective.

In addition of presenting the results of the evaluation of the state of the art and the state of the practice in BPM under the Brazilian perspective, this research also contributes by the development and presentation of a methodology that can be conducted for future researches, and new comparable evaluations can be made.

Keywords: Business Process Management, state-of-art, state-of-practice.

RESUMO

Gestão de Processos de Negócio (BPM) é uma disciplina que lida com os processos de negócio de uma organização, da identificação deles até a sua melhoria contínua, para alcançar resultados consistentes, alinhados com os objetivos da organização. BPM combina conhecimentos da tecnologia da informação e das ciências da administração e as aplica em processos de negócios que levam, por sua vez, a um resultado que é um valor para pelo menos um cliente. No campo acadêmico, a pesquisa nesta área resultou numa ampla quantidade de métodos, técnicas e ferramentas para apoiar o desenvolvimento, implantação, gerenciamento e análise de processos de negócios operacionais. No campo da prática, a BPM interessa a diversos grupos numa organização, desde pessoas responsáveis pela empresa até os participantes do processo que executam suas atividades no dia a dia.

Esse interesse mútuo em BPM por pesquisadores e profissionais, que concordam que há um aumento de complexidade e de escopo dos processos nas organizações, enseja a necessidade do conhecimento do estado atual da arte e da prática na perspectiva brasileira. Existem alguns poucos trabalhos em nível internacional que realizam essa análise consolidada seja do estado da arte, seja do estado da prática em BPM. Até onde foi pesquisado, nenhum trabalho, no entanto, realiza uma análise ou sequer uma proposta do estado da arte ou da prática em BPM sob a perspectiva brasileira.

Assim, seguindo os passos de algumas pesquisas internacionalmente relevantes que contribuíram para condensar a evolução do conhecimento na área de BPM no estado da arte e no estado da prática, a presente pesquisa desenvolve uma metodologia de múltipla abordagem com o objetivo de avaliar o atual estado da arte e da prática em BPM no Brasil.

Além de apresentar os resultados dessa avaliação do estado da arte e da prática em BPM sob a perspectiva brasileira, esta pesquisa contribui também com o desenvolvimento e apresentação de uma metodologia para que futuras pesquisas possam ser realizadas e novas avaliações possam ser feitas tanto em relação ao estado da arte quanto ao estado da prática.

Palavras-chave: Gestão de Processos de Negócio, estado da arte, estado da prática.

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Chapter 1 - Introduction

This chapter presents the main aspects of this research, including its motivation, the problem characterization, the hypothesis to be investigated and a solution proposal. In addition, the research methodology and the document structure are presented.

1.1 Motivation and Problem Characterization

Business Process Management (BPM) is "the art and science of overseeing how work is performed in an organization to ensure consistent outcomes and to take advantage of improvement opportunities" [1]. BPM combines information technology and management sciences and applies this to operational business processes [2] [3]. Research in this field has resulted in a large amount of methods, techniques and tools to support the development, deployment, management and analysis of operational business processes [2].

Processes are everywhere in organizations and BPM concerns to various groups in an organization, from people in charge of the company affair to people that are part of the processes and responsible for the activities execution. Business Process is a set of inter-related events, activities and decisions points with actors and objects that lead to a result with value for at least one client [1].

Since academy and organizations have a mutual interest in BPM, researchers recognize the practical challenges and agree with the increasing of the complexity and the scope of the processes in organizations [2] [4] [5] [6] [7]. Recker presents important evidences of the organizations concerns [8]. First, BPM is a challenge for expert managers [9]; second, in 2009, WinterGreen predicted that BPM market would triplicate in 2009-2014 over US$ 6.2 billion dollars [10]; finally, organizations deal with initial and trivial stages like discover and document their business process. [11].

Some initiatives contribute to condense the evolution of the knowledge in the BPM field. From an international and academic perspective, Aalst discussed this evolu-

tion in the context of the International Conference in BPM from 2003 to 2012 [12]. In this work, he presents a key concern and a use case classification and the evaluation of all the 289 papers presented in the editions of that conference. According to Aalst, "*use cases refer to the creation of process models and their usage to improve, enact, and manage processes*" [12]. Related to key concern, Aalst remarks that they "*highlight important research areas within the BPM discipline"* [12].

Similarly, in Brazil, the BPM has been studied in the field of Information Systems, which has, as its main national conference, the Brazilian Symposium of Information System (SBSI). Within this Symposium was conducted the Business Process Management Workshop (WBPM) that was, after its eight edition, in 2015, moved to a Special Track inside the 11th SBSI [13] [14] [15] [16] [17] [18] [19] [20] [21].

From the practice perspective, first restrict to Australian scenario and then from an international perspective, three researches investigate the issues in BPM by a multi-methodological approach [22] [23] [24]. In Brazil, we can also mention works on a practical level [25] [26]. However, at best knowledge, there is no consolidated view of BPM scenario in Brazil, in the state of the art and practice. Without this vision is difficulty, for example, to understand the challenges that organizations face or how they can position themselves to the international market and how academy community could merge efforts towards local or international research collaboration.

Hence, some facts motivate this current research. The first is that there are recognized importance of Business Process Management by both the industry and the academy. The second is that there are baselines so that comparisons can be made both on the state of the art [12], and in relation to the state of practice [22] [23] [24]. Moreover, particular to the state-of-art, there is a national conference that could provide subsidies for a consolidated analysis. And finally, the fact of the existence of this gap that there is no consolidator work to allow both start a discussion of the evolutionary point of view as a comparative discussion, is the academic point of view and from a practical point of view.

This work addresses this lack of consolidated analysis of the state-of-art and the state-of-practice in BPM from Brazilian perspective. Moreover, it aims to provide a methodological approach that could be update in the future aiming the evaluation of the evolution of this field.

1.2 Research Goals

To address the lack of consolidated analysis of the state-of-art and the state-of-practice in BPM from the Brazilian perspective the goals of this research is to contribute with the following three research question:

i) "What are the major key concerns in Brazilian academy?"

ii) "What are the major use cases in BPM presented in Brazilian academy?"

iii) "What are the practical issues from the Brazilian´s perspective?"

Moreover, to provide future comparisons and evaluation of the field, another goal is to develop a methodological approach regarding the inherent methodological challenges of balance issues like repeatability, generalizability, explorability and complexity.

1.3 Methodological Approach

Whereas a research is carried out to determine how the research is conducted, this research was conducted regarding the references phases presented by Recker [27]: exploration; rationalization and validation. The exploratory phase aimed at building an understanding of the phenomenon of interest. The rationalization phase aims to give sense to things that involve the problem of interest and the validation phase's aims to ensure that the theory or assumption passed through rigorous evaluations.

The main nature of the research question is exploratory but it aims also to be repeatable. However, the methodological exploratory approaches has its advantages and disadvantages [27]. Hence, this research was designed to follow the steps bellow in a multi-methodological research approach:

- First, a paper collect phase towards strong references that consolidates the state-of-art or the state-of-practice in the BPM scenario. Strong means that the collected papers was a paper that, for example, reach the community by a great number of citations, or because it was published by a relevant member or community team;
- Second, a state-of-art research, regarding the Brazilian academy conference under the light of the references collected in the first step.
- Third, a state-of-practice qualitative research, regarding the Brazilian professionals and/or organizations.

- Fourth, a state-of-practice quantitative research or evaluation of an existent one, under the light of the qualitative research conducted at the third step.

1.4 Organization of the Text

The remaining of this work is structured as follows: Chapter 2 presents theoretical background, focusing in the presentations of BPM key concerns and Use Cases. Chapter 3 analyzes related work. Chapter 4 details the proposed methodological approach and shows an example execution. Chapter 5 presents in more details the research conduction, the findings, and discusses the Brazilian state-of-art. Chapter 6 presents in more details the research conduction, the findings, and discusses the Brazilian state-of-practice. Chapter 7 concludes this research with final considerations about its contributions, validity issues and future works.

Chapter 2 - Theoretical Background

This chapter presents the theoretical background. First, the fundamentals of business process management are introduced. Then, the key issues in business process management are presented and this chapter finishes with the presentation of Aalst´s proposed Business Process Management Use Cases.

2.1 Business Process Management

Business Process Management (BPM) is defined by Dumas et al [1] as "the art and science of overseeing how work is performed in an organization to ensure consistent outcomes and to take advantage of improvement opportunities". For Aalst et al [2] [3], BPM "combines knowledge from information technology and knowledge from management sciences and applies this to operational business processes".

Processes are everywhere in organizations and BPM concerns to various groups in an organization, from people in charge of the company affair (CEO[1], COO[2], CPO[3], CIO[4], CFO[5], and HR[6]) to people that are part of the processes and responsible for the activities execution. Business process, as defined by Dumas et al [1], is a set of inter-related events, activities and decisions points with actors and objects that lead to a result with value for at least one client. Figure 2.1 presents the core Business Process elements and their relationship.

[1] Chief Executive Officer
[2] Chief Operating Officer
[3] Chief Purchasing Officer
[4] Chief Information Officer
[5] Chief Financial Officer
[6] Human Resources

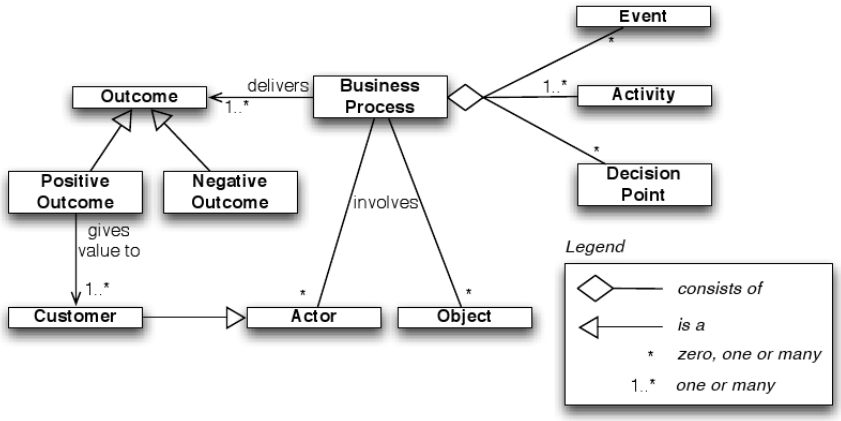

Figure 2.1: The BPM elements and its relationship [1].

Research in this field resulted in a lot of methods, techniques and tools to support the BPM lifecycle and its phases like design, enactment, management and analysis of operational business process. As example of BPM lifecycle, we can present a three-phase lifecycle [12], Figure 2.2, or a more detailed lifecycle, as presented in Figure 2.3.

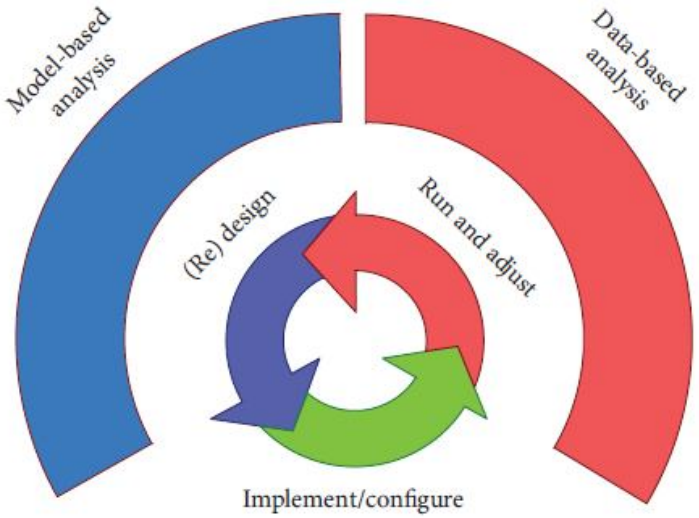

Figure 2.2: The BPM lifecycle with three phases [12].

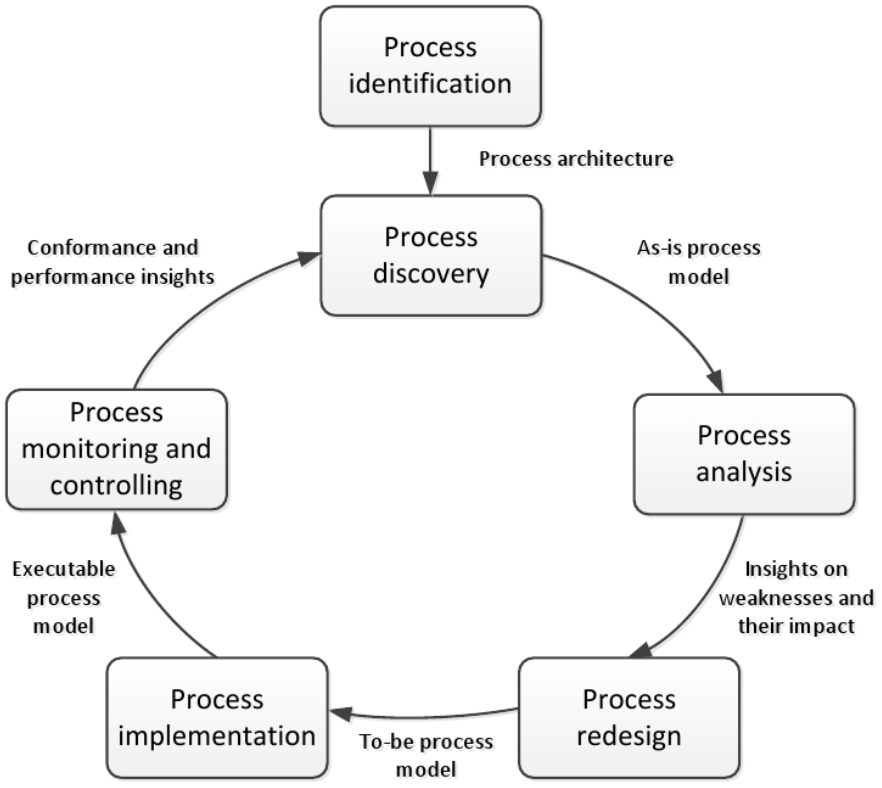

Figure 2.3: The BPM lifecycle by Dumas et Al [1].

The Lifecycle defined by Aalst [12] has, first, the (re)design phase which is the phase to produce or update the process model. Afterwards, the model is implemented or configured to be enacted and adjusted in the Run and Adjust phase.

Those Lifecycle is not far from the Lifecycle presented by Dumas et Al [1]. In the first phase, Process identification, the important processes are identified, delimited and related one with each other. The result is a new process or the update of the Process architecture. In the Process discovery phase the process is documented resulting in an *as-is* process model. Then, in the Process analysis phase, issues related to the *as-is* process are documented and, if possible, quantified by performance indicators. The result of this phase is insights on process weaknesses and their impact, for example, in the performance indicators. In the next phase, the Process redesign, possible changes related to the identified issues are analyzed and compared observing process indicators. In the Process implementation phase, the changes identified in the redesign phase are planned and implemented. The Process implementation covers two aspects: the management of the change in the organization and process automation. The first concerns with the way participants work in process and the second to the development and implementation of information technology systems. Once the redesigned process is running, the Process

monitoring and controlling phase collects relevant data from the process execution to analyze how well the performance of the running process is in relation to the performance measures and goals. Bottlenecks, recurrent errors, deviations are identified and corrected. New issues may arise and this may require that the whole cycle may be repeated.

2.2 BPM Key Concerns

In 2013, Aalst [12] [28] presented six key concerns related to the BPM discipline. Using these key concerns it was possible to analyze past BPM conferences and understand the trends in this discipline.

The six key concerns are: *process modeling language*, *process enactment infrastructure*, *process model analysis*, *process mining*, *process flexibility* and *process reuse* [12] *apud* [28]. We remark that Aalst considers other three potentially missing concerns: *process integration*, *patterns* and *collaboration.*

2.2.1 Process Modeling Language

This concern is about the process modeling language to be used. A plethora of notations and extensions of the existing ones have been proposed for modeling workflows and business process. There are a lot of papers published to evaluate these notations. Their requirements are competitive, e.g., a modeling language should be expressive and simple [28] *apud* [29].

However the intention of the modelling language is quite different. Languages that aim to automate a process execution (e.g., BPEL) may be different from languages that aim to be used for documentation (e.g., EPC). There are also languages that are adapted for verification (e.g., WF-nets) or process mining (e.g., C-Nets or hidden Markov Chains). Since the modeling and analysis of process are a central concern in BPM, "*therefore, the language to represent an organization´s processes is essential*." [12].

2.2.2 Process Enactment Infrastructure

The process enactment infrastructure is a concern about the creation of an infrastructure to execute, support and monitor processes. Aalst gives examples like workflow engines, service-oriented computing, interoperability, cloud computing, enterprise application integration, and work distribution systems [28].

The reference model proposed by the Workflow Management Coalition (WfMC) in the early 1990 [30] [31] for outdate standards and technologies is still adequate to the expected functionality of a WFM/BPM system. Figure 2.4 presents a BPM reference architecture. The remarkable difference from the WfMC reference model is the detailment of the data sets and the lists of roles of the various stakeholders. The designer uses design tools to create models and organizational structure. The worker(s) performs the tasks offered by the enactment service. The managers can monitoring the flow of work by the feedback from the management tools. The enactment services, driven by the models and by the organizational data, may launch various kinds of applications to support the execution of the tasks [12].

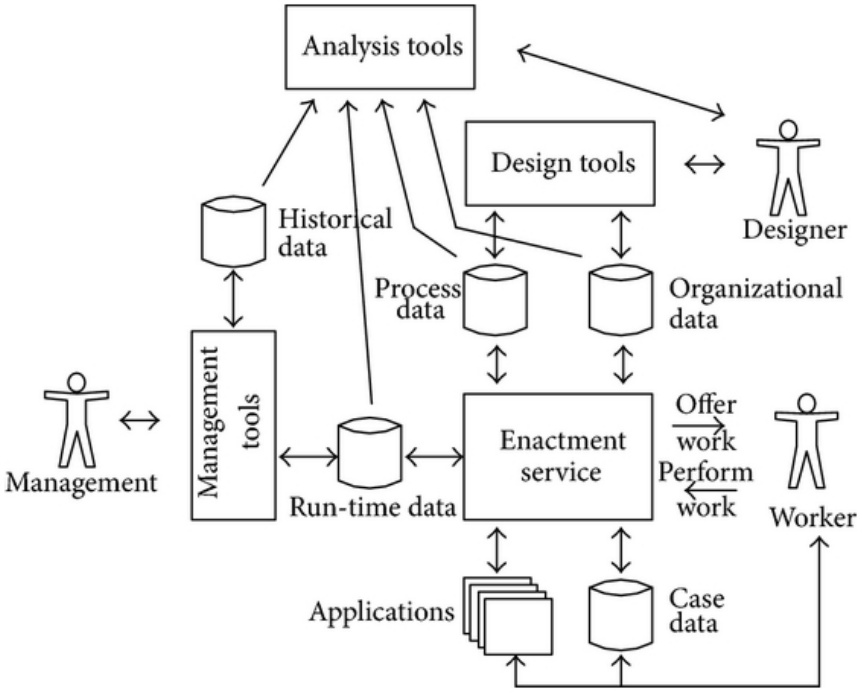

Figure 2.4: The BPM reference architecture [12].

Another important technology in process enactment infrastructure is the Service-Oriented Computing (SOC). The service orientation is an approach where the key idea is to subcontract work to specialized service in a loosely coupled fashion. While SOC encapsulates business funcionalities in business applications inside web services, that can be invoked by applications, in Service-Oriented Architecture (SOA) services interact by exchanging messages, for example.

Functional and nonfunctionals requirements need to be considered when implementing a process-aware information system. Workflow patterns [29] can help the

designers to elicit functional requirements. Cloud computing and technologies like SaaS[7], PaaS[8], and Iaas[9] are available to help researchers and practioners with perfomance issues. However, it implies in new challenges related to *security* concerns.

2.2.3 Process Model Analysis

The process model analysis concern refers to the analysis of processes based on models without using event data. Examples of papers that address this concern are the ones which deals with soundness verification, simulation, and model checking [28].

Verification and perfomance analysis are the mainstream approaches. While verification confirms the correctness of a system or a process, perfomance analysis measures flow times, waiting times, utilization and service levels [12].

Three dimensions of performance are most common: *time*, *cost*, and *quality*. Different *Key Performance Indicators* (KPIs) can be defined for each dimension. *Simulation* is a tecnhique, for example, to "optimize" a model. Through simulation, it is possible to evaluate the behavior of the performance indicators during the process model design phase or redesign phase, i.e., before the process enactment [12].

Finally, Aalst [12] remarks that verification and performance analysis relies on the availability of high-quality models. The model-based analysis make sense when the models and reality are aligned. It´s the problem of *lack of aligment between handmade models and reality.*

2.2.4 Process Mining

The Process mining refers to analysis techniques that are driven by event data. Process discovery techniques that construct a model based on those event data, conformance checking, extension [28] *apud* [32] are examples of subjects of this concern.

Aalst [28] remarks that conformance checking can be used to check if reality, wich is recorded in the event log, conforms to the model and vice versa. Hence, conformance checking is an example of how these concerns can help to address the problem of the *lack of alighnment between handmade models and reality.*

The main objective of *process mining* is to use event data recorded by system in general to extract process-related information. Discover a process model by observing

[7] Software as a Service
[8] Platform as a Service
[9] Infrastructure as a Service

the event log and check conformance of a given model by comparing it with the reality expressed by the event log are examples of *process mining* [12].

Figure 2.5 shows a *process mining framework* [12] *apud* [32]. Event data can be classified as "premortem" and "postmortem" event logs. "*Postmortem*" is the event data with information of completed cases. "*Premortem*" is the event data of cases that have not yet completed. In "alive" cases it is possible to explore the case information to ensure the correct or efficient handling of the case.

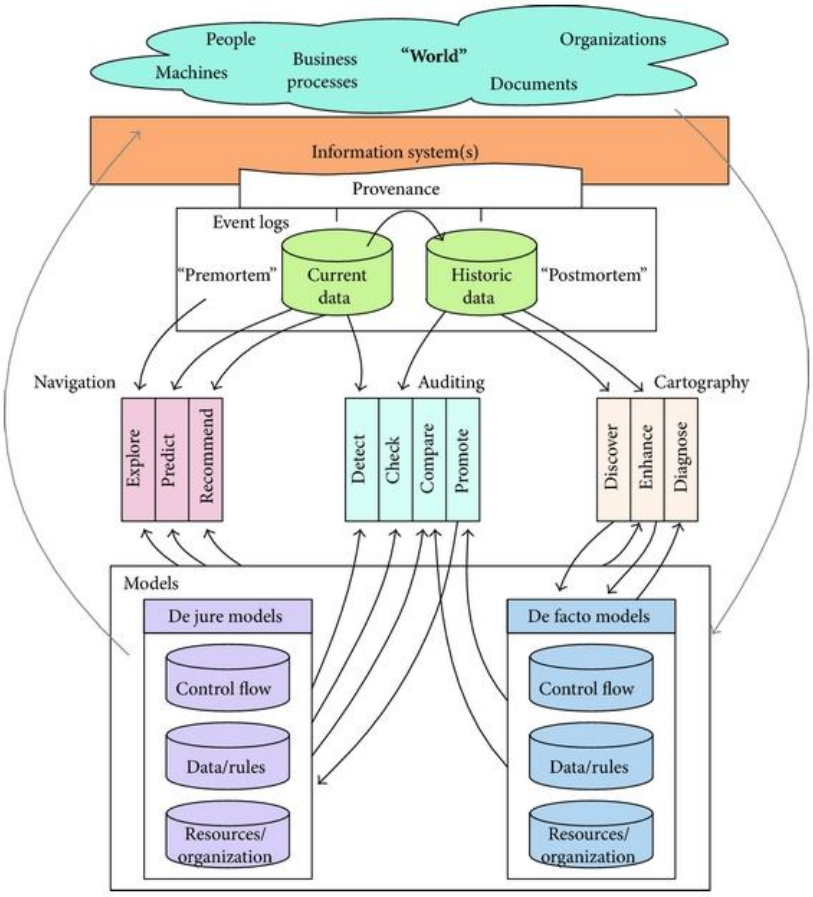

Figure 2.5: Overview of the process mining spectrum [12].

Postmortem event data are most relevant for tasks related with discovery, enhancement or diagnostic of a process. *Premortem* event data are most relevant for tasks related with exploration, prediction or recommendation. A mixture of premortem and posmortem data are most relevant to auditing tasks, where the information of both "*de jure models"* and "*de facto models"* is necessary. *De jure models* is normative, i.e., "*it specifies how things should be done"* [12]. *De facto models* is descriptive and aims to capture reality.

Therefore, process mining is not only about process discovery. Process mining can promote analysis through a large spectrum of model analysis tasks and has the event log as its fundamental part.

2.2.5 Process Flexibility

This concern leads to the problem of a WFM/BPM system beeing inflexible [28]. Flexibility, in the process context, is the *ability to deal with both foreseen and unforeseen changes, by varying or adapting those part of the business process that are affected by them, while retaining the essential format of those parts that are not impacted by the variation* [28] *apud* [33]. Case handling [34], adaptive workflows [35], late-binding [33], declarative languages [36] are examples of flexibility papers.

Flexibility can be classified in four types: flexibility by *definition*, flexibility by *deviation*, flexibility by *underspecifictions*, and flexibility by *change* [12] apud [33]. Flexibility by *definition*, in design time, is the ability of incorporating an alternative execution path given a process definition, i.e., the most appropriate executuion path can be made at runtime for each process instance. Aalst affirms that all BPM systems support this type of flexibility but declarative language make it easier to defer choices to runtime.

In flexibility by *deviation*, a process instance deviates, at runtime, from the execution path prescribed by the original process without altering the process definition itself. To deal with a model that does not contain sufficient information to allow it to be executed to its completion, the ability necessary is the flexibility by *underspecification*. Finally, when it´s necessary to modify the process definition at run time and bring one or all currently executing process instance to the new process definition, we use the ability definied by flexibility by *change*.

2.2.6 Process Reuse

The last concern refers *to the problem that (parts of) processes are often* "reinvented" *rather than reused* [28]. Aalst [12] describes the actual scenario as composed by organization that has hundreds or thousands of process models and deals with problems of maintaining these models. Outdate models, duplicated parts, different models for similar processes or even identical processes are examples of such problems.

However, this is a concern that is gaining more attention by researchers [37]. To deal with this concern, it is necessary process model repositories and tools that allows easy storage and retrieval of these process models.

The features that should be provided are related to analysis, management and usage of this large set of process models storaged in process model repository. Figure 2.6, shows the main activities related to the management of large process model collections.

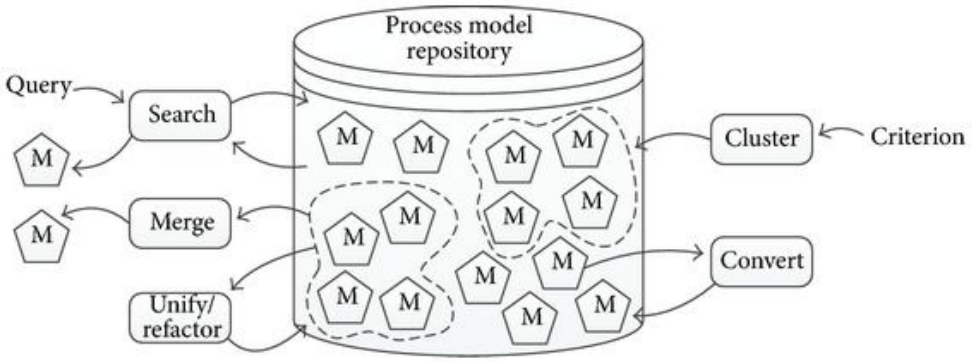

Figure 2.6: Overview of the main activities related to the management of large model collections [12].

Search is the activity where, given a query, a set of models is returned. In merge activity a set of models is combined into a single model where the behavior of the original models is preserved (in large). Cluster is the activity responsible to identify a set of related process models and may be used as input for merging. Unify/Refactor is an activity that given a set of models as input provides an improvement by aligning them, removing redundancies and applying conventions. Finally, the activity convert, is related to the various mapping from one notation to another notation.

2.3 BPM Use Cases

Aalst [12] recognizes that use cases and key concerns classification provide a survey of the state-of-the-art in BPM research and the analysis of past BPM conferences help to understand the trends in this discipline. The use cases perspective can show "how, where and when" the BPM techniques can be used, thus providing a structure for the BPM discipline. In his first work, Aalst identified twenty BPM use cases before the tagging task [28]. Later, in a more recent paper, Aalst classified the twenty use cases in

six categories: *use cases to obtain models; use cases involving configurable models; use cases related to process execution; use cases involving model-based analysis; use case extracting diagnostics from event data; use cases producing new models based on diagnostics or event data* [12]. In this section, we present a summary of Aalst definition for each category, showing their respective use cases.

2.3.1 Use Cases to Obtain Models

The use cases in the obtain models category produce a process model. Figure 2.7 shows these use cases. The pentagons marked with the letter "M" are the representation of the models. It can be a descriptive (D), normative (N), and/or executable (E) model. Descriptive models brings undesirable behavior. Normative models describe only the desirable behavior. The workflow software can interpret executable model unambiguously. The symbol "|" means "or". For example, "D|N|E" means descriptive, normative, or executable. The disc symbol marked with the letter "E" represents event data.

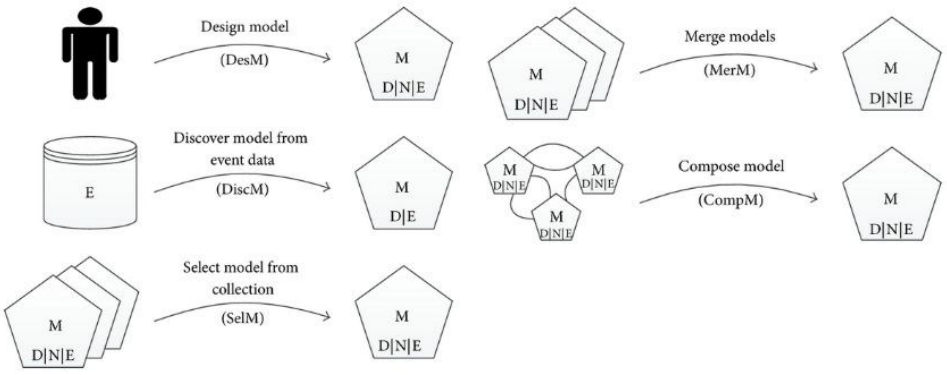

Figure 2.7: Use Cases to Obtain Model. Adpated from [12].

The use case *Design Model* (DesM) refers to the creation of a process model from scratch by a human. According to Aalst, this is the most common way to create models and the model created can be descriptive, normative, or executable.

In the use case *Discover Model from Event Data* (DiscM) process mining techniques are used to generate a process model automatically. The main object of process mining is to use event data recorded by system in general to extract process-related information [32].

In the use case *Select Model from Collection* (SelM), existing process models are retrieved from a process model repository based on keywords or process structures. One example of a problem addressed is how large organizations that have hundreds of pro-

cess models with many variations or versions of the same model manage those process models. Reuse of process is the main concern in this use case.

In *Merge Model* (MerM) different parts of different models are combined into one model, new or existing. The parts may be indistinguishable, i.e., it cannot be related to the original model.

Compose Model (CompM) is different from *Merge Model* (MerM) because in CompM different models are also combined into a large model but, unlikely of MerM, the parts can be related to the original models used in the composition.

2.3.2 Use Cases Involving Configurable Models

According to Aalst [12], "*configurable process models represent a family of process models, that is, a model that through configuration can be customized for a particular setting"*. He exemplifies by mentioning the hiding or the blocking of certain fragments of a configurable process model. It´s important to mention that there are two viewpoints of the generic BPM software and the ERP. Figure 2.8 shows these use cases. The new element is the pentagon with letters "CM". This pentagon represents a configurable model that could also be descriptive, normative or executable.

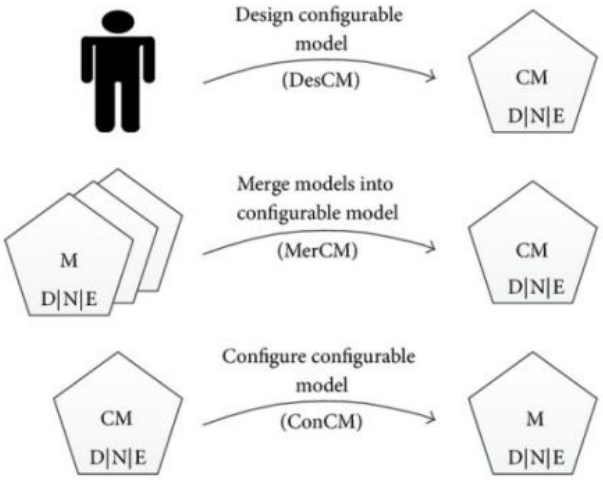

Figure 2.8: Use Cases Involving Configurable Models. Adpated from [12].

Like the DesM, the use case *Design Configurable Model* (DesCM) refers to the creation of a process model from scratch by a human. However, the result of the use case design configurable model (DesCM) is a configurable process model. Challenges

in this use case are related to lead with behavioral anomalies from the configuration activities (e.g., hiding or blocking a fragment).

The result of the use case *Merge Models into Configurable Model* (MerCM) is a configurable model. Unlikely the DesCM, it´s not obtained by scratch but from other process models of a family of process models.

The use case *Configure Configurable Model* (ConCM) *"creates a concrete model from some configurable process model by selecting a concrete variant"* [12].

2.3.3 Use Cases Related to Process Execution

This category of use cases is related with the enactment of a process based on executable process model. Issues of this category are related with automation. However, these issues are not only related with the implementation of a process model in an automated system but also with management, analysis and improvement of business processes [12]. Figure 2.9 shows these use cases. New elements used are the square with rounded corners marked with the letter "S" that denotes information systems used to support processes at runtime and the star shape with the letter "D" that represents diagnostic information obtained from the running process.

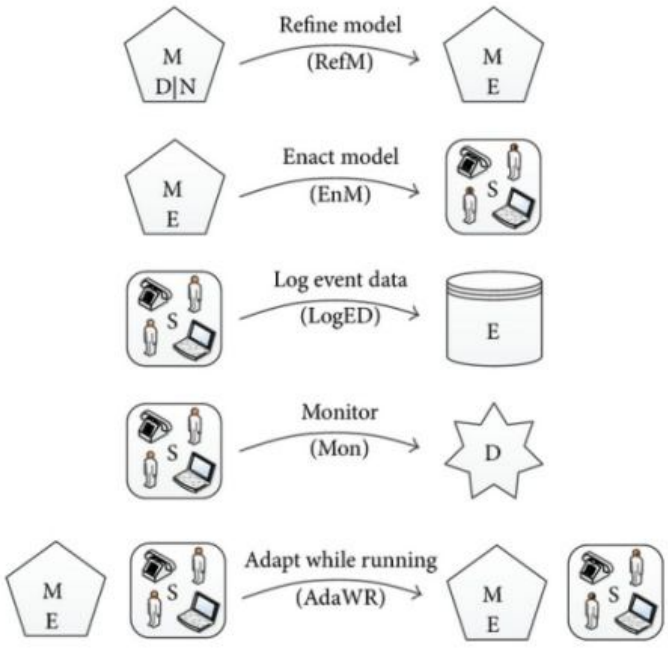

Figure 2.9. Use Cases Related to Process Execution, adaptade from [12].

The use case *Refine Model* (RefM) produces an executable process model from a descriptive or normative process model, i.e., *"a descriptive or normative model is re-*

fined into a model that is also executable" [12]. Executable models need to be free from ambiguities and should be much more detailed than a designed model.

The last use case, RefM, provides an executable model and only this type can be enacted. The use case *Enact Model* (EnM) uses this executable process model as an input to produces a running system [12]. As important issues for this use case, Aalst mentioned reliability, usability, performance, exception handling, scalability and ergonomics.

The use case *Log Event Data* (LogED) refers to "*the recording of event data, often referred to as event log*" [12]. This event data is produced by the information system where the process instance is executed. Not only BPM or WFM systems produces this event data but also other Process Aware Information System (PAIS). The event logs are used for process mining techniques.

"The use case Monitor (Mon) *refers to all measurements done at runtime without actively creating or using a model"* [12]. Aalst exemplifies some indicators as costs, responsiveness, and quality.

Adapt While Running is a use case that leads with model adaptation at runtime. It´s related with the key concern process flexibility.

2.3.4 Use Cases Involving Model-Based Analysis

This category includes use cases where analysis are done based on the process models [12]. Figure 4 shows these use cases. New elements used in the Figure 2.10 are the star shape with the letters "PD" that represents process-related diagnostic information and the star shape with the letters "CD" that represents conformance-related diagnostic information.

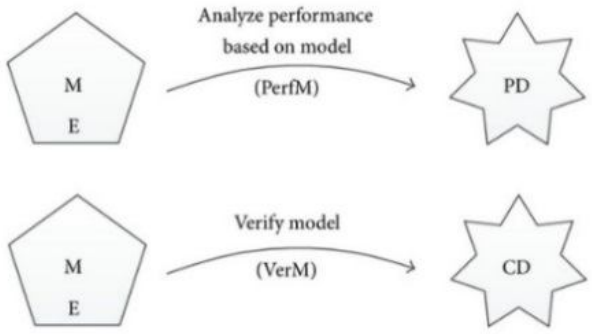

Figure 2.10. Use Cases involving model-based analysis, from [12].

The use case *Analyze Performance Based on Model* (PerfM) is related to analysis of the process model in terms of performance indicators. Aalst exemplifies: response times, waiting times, flow times, utilization or costs. Simulations [38], queueing networks [39] or Markov chains [39] are example of analysis technique in BPM.

The use case *Verify Model* (VerM) is related to model checking issues that aims to assure it´s correctness. One example mentioned by Aalst is the notion of soundness [40] [41]. A process model is "*sound if cases cannot get stuck before reaching the end or (termination is always possible) and all parts of the process can be activated (no dead segment)*" [12].

2.3.5 Use Cases Extracting Diagnostics from Event Data

Use cases that use both model and event data to produce diagnostic information are classified in this category [12]. Figure 2.11 shows these use cases.

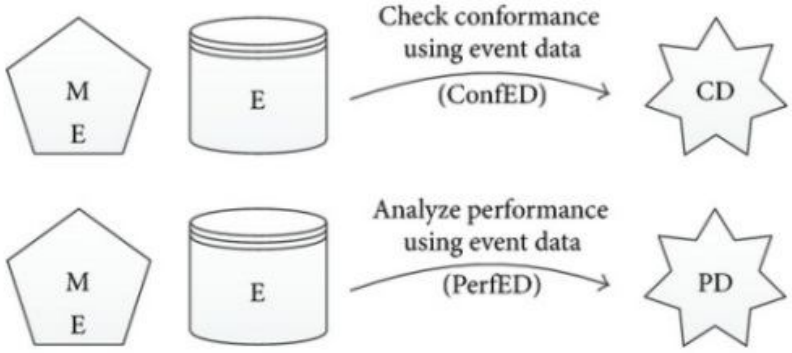

Figure 2.11. Use Cases extracting diagnostics from Event Data, from [12].

The use case *Check Conformance Using Event Data* (ConfED) refers to analysis focused in identify discrepancies between the modeled and observed behaviors. As an example of a practical issue, Aalst mentioned auditing a model to uncover fraud or malpractices.

Analyze Performance Using Event Data (PerfED) refers to the combined use of models and timed event data [12]. A time analysis can help with issues like bottlenecks analysis or prediction analysis.

2.3.6 Use Cases Producing New Models Based on Diagnostics or Event Data

Use cases that are used to repair, extend, or improve models based on the diagnostic information plus the event data are classified in this category [12]. (Figure 2.12).

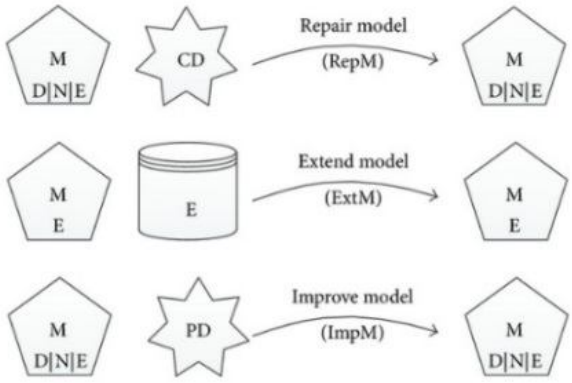

Figure 2.12. Use Cases producing new models based on Diagnostics or Event Data, from [12].

Since the use ConfED identifies reality deviations from the expected model, it´s results is an input for the use case *Repair Model* (RepM). Repair model issue is adapt the model to match the reality [42]. Aalst mentioned that the challenge of this use case is to balance if the resulting model should be closer to the observed behavior than closer to the original model or vice versa.

Extend Model (ExtM) use case uses additional information provided by the event log like data elements to enrich the process model [12]. As an example, resource information collected in the event log can be used to attach roles to activities in the model.

Improve Model (ImpM) use cases use information obtained, for example, by the use case PerfED to help to improve the process by suggesting alternative process models. Aalst alerts that the focus is not repair the model (RepM) but improve it [12].

We remark that use cases can be composed. Not only on a combination of two use cases can be done but even more use cases can be combined. In his work Aalst exemplifies some scenarios. One example is a conventional simulation study. In this scenario the use case *design model* (DesM) is used to create a model and the *analyze performance based on model* (PerfM) is used to obtain performance indicators.

Chapter 3 - Related Work

This chapter focuses on presenting works that proposed to research about the state-of-art and the state-of-practice of BPM.

3.1 Related Work – State of Art

Business Process Management is a well-researched area. Therefore, some papers are remarkable, because they condense those researches and provide an overview of the whole area. In a seminal paper, in 2003, Aalst, Hofstede and Weske published a paper with these characteristics. They historically contextualized the rise of business processes management systems (BPMS) from Workflow Management Systems, presented the fundamentals concepts of the BPM lifecycle, discussed about methodology and modelling, and the rising technology [2]. It´s possible to look at this paper and perceive the origins of the key concerns. The survey presented issues about modelling languages, process modelling, process enactment infrastructure, process mining. Process flexibility could be inferred once (e.g., *"flexible and case-based workflow was (and is being) conducted, both in academia and in industry"*) and only the key concern process reuse is not presented.

Almost ten years later, in 2012 and 2013, Aalst published two papers [12] [28]. The first [28] one is shorter but presents the whole categorization in the both perspective mentioned in Chapter 2: use cases and key concern categorization. The, second paper [12], is the comprehensive survey that starts with the presentation of historical aspects again and then presents a classification schema of BPM research in two viewpoints: use cases perspective and key concerns. He classified in these two viewpoints all the papers of BPM International Conference from 2003 to 2012 and the edited book *Business Process Management: Models, Techniques, and Empirical Studies* [43]. Then the paper discuss the results looking backward based on the relative frequency (also called by Aalst as relative importance) of each classification and points to the forwards [12].

The 289 papers were analyzed and tagged accordingly to the use cases and to the key concerns presented in Chapter 2. Sometimes more than one tag was used. A total of

367 tags for use cases and 342 tags for key concerns were assigned to the 289 papers. Using an example mentioned by Aalst, the paper "Instantaneous soundness checking of industrial business process models" presented at BPM 2009 is an examples of the use case *Verify Model* (VerM).

The relative frequency is reached by counting the number of tags per use case and year is counted. Using the example presented for use case, in BPM 2009 four papers were tagged with use case *discover model from event data* (DiscM) and 30 tags were the total assigned to the 23 papers. *"Hence, the relative frequency of DiscM is 4/30 = 0.133."*.

Observing the research findings, for an overview, Figure 3.1 and Figure 3.2 presents the average relative importance of use cases and key concerns. Through the years, Figure 3.3 and Figure 3.4 shows changes of relative frequency over the time for use cases and key concerns, respectively.

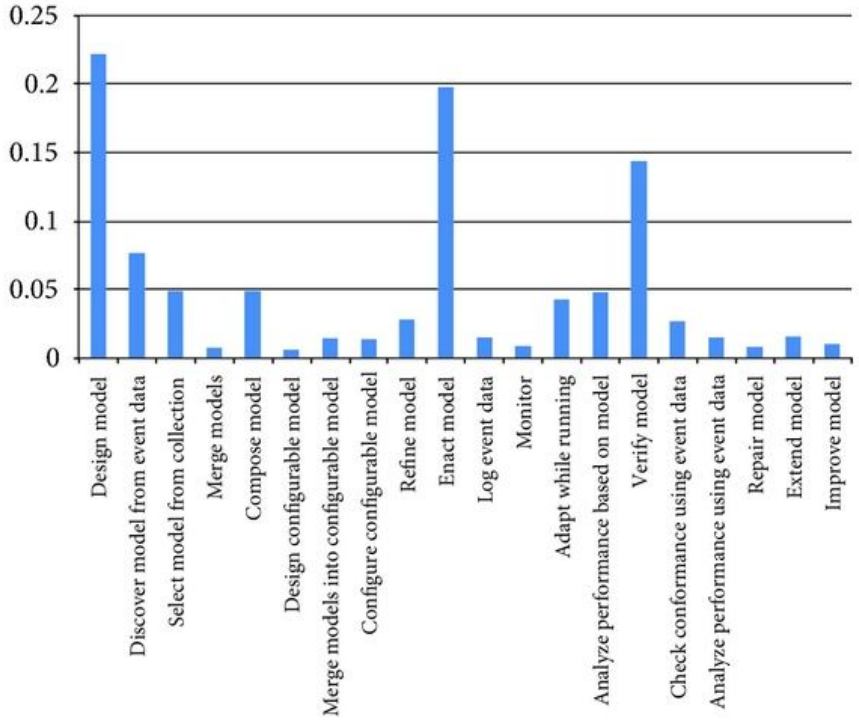

Figure 3.1: Average relative importance of Use Cases in BPM International Conference, from [12].

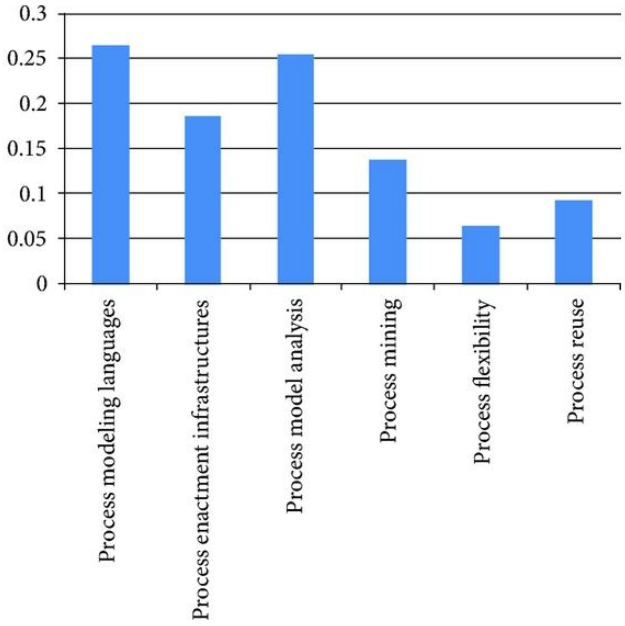

Figure 3.2: Average relative importance of Key Concerns in BPM International Conference, from [12].

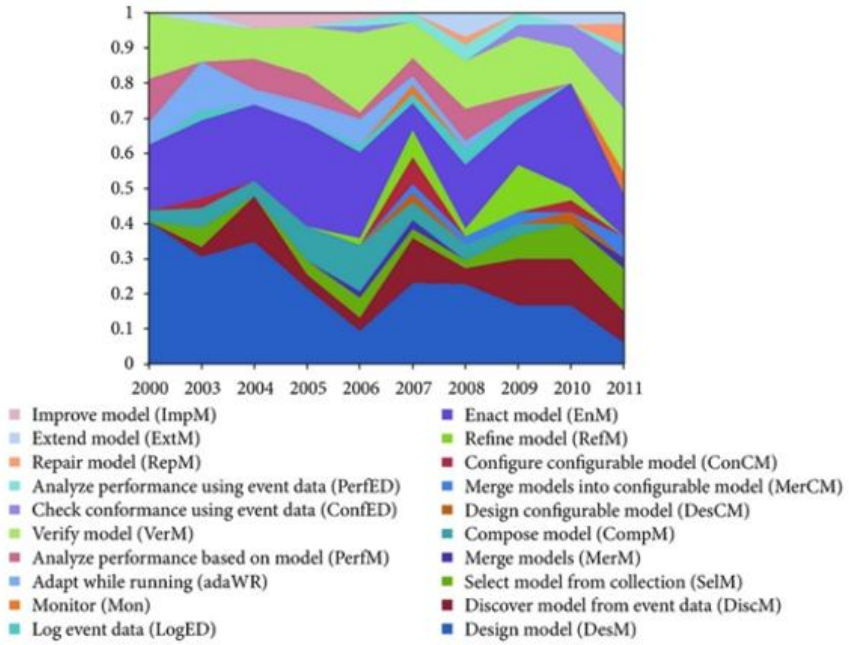

Figure 3.3: Relative importance of Use Cases over time in BPM International Conference, from [12].

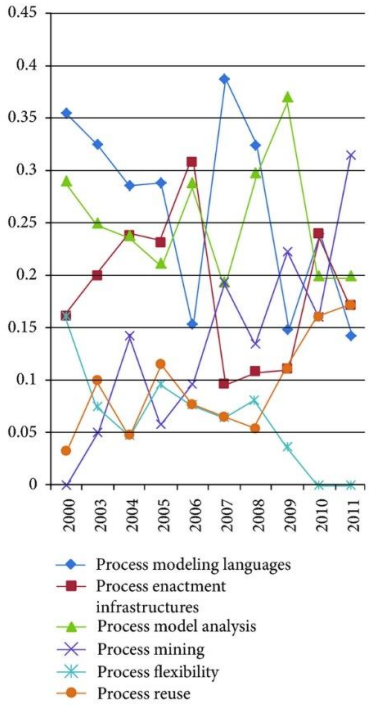

Figure 3.4: Relative importance of Key Concerns over time in BPM International Conference, from [12].

Aalst concludes that the *"BPM discipline has developed at an amazing speed"*. Aalst, remarks that: i) the use cases present "how, where, and when" to use BPM techniques; and ii) the key concerns highlight the research areas within the BPM discipline.

He also points some weaknesses: i) there papers that introduce new modeling languages but in an unclear manner and never used after the publication; ii) some authors focus on originality rather than relevance; iii) many papers include case studies, but they appear to be artificial and with vague core contributions; iv) papers that presents software or prototypes *"simply disappear after the publication"*.

Based on these weaknesses the paper recommend the support of the use cases and key concerns classification because *"such structuring would results in collections of benchmarks problems, comparable to the datasets used in data mining and model checking competitions*". The paper finishes mentioning that it´s an *"attempt to guide BPM research towards the real key challenges"* in the field.

From a Brazilian perspective, to our best knowledge, the first publication with an academic overview in BPM was the key concern analysis that was presented in 2015 [44]. The publication is a result of the research presented in this master dissertation. Hence the findings will be presented in the Chapter 5.

3.2 Related Work – State of Practice

Indulska et al started their research on BPM´s issues using a focus group approach [22] . The aim of the paper, according to the authors, is to identify the major roadblocks that were being experienced by Australian organizations. Hence, the paper research question was: *"What are the major issues and challenges related to the adoption of Business Process Management in Australian organizations"*.

To answer the research question, the research proposed a multi-method approach. Figure 3.5 presents this multi-method approach composed by a first research through a Focus Group Study, presented in the same paper. Then, two researchs to investigate vendors and experts through interviews and, finally, a survey based on the Deplhi approach.

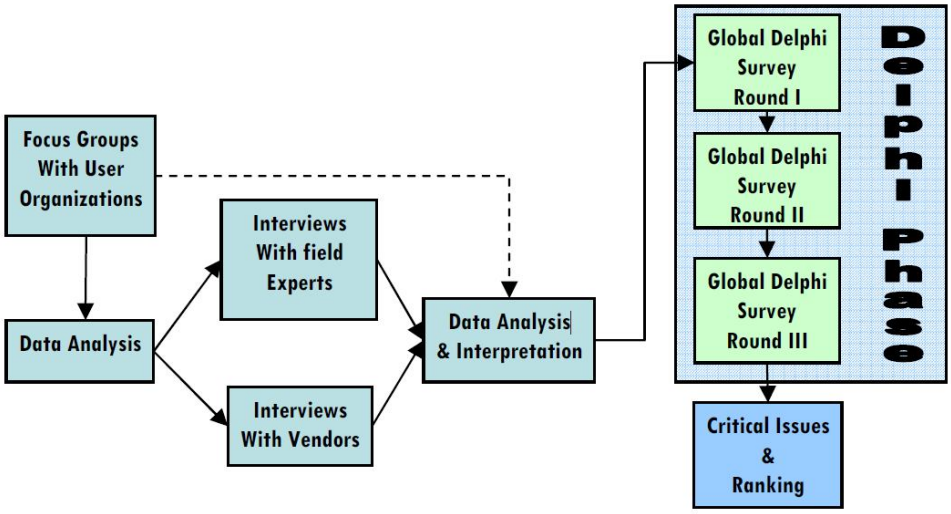

Figure 3.5: Multi-method-research approach, from [22].

In the first paper, Indulska et al [22] conducted four focus group selecting 27 individuals from 21 organizations from Perth, Brisbane and Sidney, states of Australia, to discuss and comment about BPM. There were representants from differents sectors, e.g., Governement, Finance, Bannking, Resource, Utilities. Table 3.1 presents Indulska et al organizations demographics.

Table 3.1: Participating Organizations Demographics, from [22].

Industry Sector	Perth	Brisbane	Sydney	Totals
Government	0	1	0	**1**
Finance, Banking & Insurance	1	1	1	**3**
Resources	4	1	0	**5**
Utilities	0	2	1	**3**
Consulting	3	1	2	**6**
Other (e.g., ICT)	3	0	0	**3**
Totals	**11**	**6**	**4**	**21**

The authors developed an interview protocol prior to the focus group session. Table 3.2 presents the summary of the protocol applied in sessions that least approximately 2 hours. To present the findings Indulska et al distributed the issues perceived by Australian organizations against typical organizational levels, i.e., strategic, tactical, and operational level issues. Table 3.3 presents the distributed issues.

Table 3.2: Focus Group Protocol, from [22]

Agenda Item	Allocated time (minutes)
Welcome and Introductions	05
Motivation and Importance of the Study	10
Brief Presentation on BPM	10
Data Collection Session	
Q1. What is the role of BPM in your organization?	10
Q2. What are the main BPM issues you face?	30
Issues Categorization	15
Q3. Which of the issues are the most critical?	30
Wrap up	05
TOTAL Time	~ 2 hours

Table 3.3: Research findings based on Focus Group interviews, from [22]

Strategic	Tactical	Operational
Change Management	Lack of expertise	Lack of tools for holistic BPM
Lack of Governance	Lack of measurable returns	Lack of technology capability
Lack of top Management Support	Lack of coordination	Lack of process monitoring Lack of integration
Lack of nurture for process owner	Lack of standardization	
	Lack of BPM understanding	
	Lack of visibility	
	Lack of performance measures	
	Lack of progress in process maturity	
	Lack of clear starting point	
	Lack of linkage with customers	

Indulska et al argues that the research is a step toward alignment of BPM research with industry considering the lack os empirical evidence of BPM issues experienced by industry. According to the authors, this kind of study and findings helps BPM research and practicing communities to target their research and work force on BPM topics identified as areas that need attention. However, the context of the research is limited to Australian industry.

Originally planned in [22], Bandara et al conducts a second research [23]. The method was based on interview with BPM experts. The fourteen global BPM experts were selected from the both fields, Tecnhical and Business. The selection was based on factors like years of experience, best selling BPM book publications, research publications, invitation to key note speaches at BPM events. The interviews were conducted in a six-month period and each expert was interviewed face-to-face or by telephone by two researchers interviewers. The format of interviews were semi-structued. The researchers used pilot tested protocol and the duration varied from 45 minutes to 1 hour. Table 3.4 presents the summary of the sample interviewed. And Table 3.5 presents the questions in the expert interview protocol.

Table 3.4: Summary details of sample interviewed, from [23].

Expert ID	Interview Conduct	Expert's primary BPM Background
Expert 1	Telephone	Technical
Expert 2	Face-to-face	Technical
Expert 3	Face-to-face	Technical
Expert 4	Telephone	Technical
Expert 5	Telephone	Technical
Expert 6	Telephone	Technical
Expert 7	Face-to-face	Technical
Expert 8	Face-to-face	Technical
Expert 9	Telephone	Technical
Expert 10	Face-to-face	Technical
Expert 11	Face-to-face	Business
Expert 12	Face-to-face	Business
Expert 13	Face-to-face	Business
Expert 14	Face-to-face	Business

Table 3.5: Expert interview Protocol, from [23].

Q 1: Please describe your role in relation to your BPM experience
Q 2: How would you define the term 'BPM' and, in your own opinion what role(s) do BPM currently play in businesses?
Q 3: What do you perceive as the major issues in Business Process Management?
- What recommendations can you give in addressing some of these issues that you identified …

Q 4: What do you perceive as the major issues in *Business Process Management supporting Technologies*?
- What recommendations can you give in addressing some of these issues that you

Bandara et al again presents the research finding against the three organizational levels, i.e., strategic, tactical and operational levels. The autors argue again that the findings are expected to benefit to both the BPM research and the practicing communities but, at this time, the perspective is the issues as perceived by BPM experts. Table 3.6 presents the issues at different organizational levels, as noted by BPM experts.

Table 3.6: Research findings based on Expert interviews, from [23].

Strategic	**Tactical**	**Operational**
Lack of Governance	Lack of standards	Lack of tool support for process visualization
Lack of employee buy-in	Weakness in process specification	
Lack of common mind share of BPM	Lack of BPM education	Perceived gaps between process design and process execution
Broken link between BPM efforts and organizational strategy	Lack of methodology	Miscommunication of tool capabilities

Also originally planned in [22], Sadiq et al conduct a third research [24]. The method was also based on interview but, at this time, with BPM vendors. The eight global BPM vendors. The vendors were identified and selected based on the Gartner´s Magic Quadrant reports[10]. The interviews were conducted in a six-month period and each vendor was interviewed face-to-face or by telephone by two researchers interviewers. Like the interview with the experts, the format of interviews were semi-structued; the researchers used pilot tested protocol; and the duration varied from 45 minutes to 1 hour. Table 3.7 presents the summary of the sample interviewed and also presents the type of solution the vendor provides and the interview mode (i.e, face-to-face or phone). The authors did not provided access to the questionnaire protocol, but they presented that the Question 1 was *"posed to clarify the vendor´s perspective on*

[10] http://www.gartner.com/technology/research/methodologies/research_mq.jsp

what BPM" and to "*identify their view on what BPM can do within orgnaziational contexts"*. Question 2 and 3 were about BPM products and customer base. Question 4 and 5, the main part, aimed to identify the major issues and potential recommendations. Table 3.8, presents the reserch findings against the three organization levels.

Table 3.7: Summary details of sample interviewed, from [24].

	Head Quarters	*Type of Solution Provider*	Interview Mode
1	USA	BPM Software & Systems Provider	Face-to-face
2	USA	BPM Software & Systems Provider	Phone
3	USA	BPM Software & Systems Provider	Phone
4	Europe	BPM Software &| Systems Provider	Face-to-face
5	Europe	BPM Software & Systems Provider	Face-to-face
6	USA	BPM Trainer/ Consultant	Face-to-face
7	Australia	BPM Software & Systems Provider	Phone
8	USA	BPM Trainer/ Consultant	Face-to-face

Table 3.8: Research Findings based on Sadiq et al [24].

Strategic	**Tactical**	**Operational**
Lack of understanding on process orientation	Lack of flow between strategic and operational directives	Difficulties in integration
Lack of common mindset	Lack of standard methodology	Difficulties in use of product functionality
Customer resistance	Lack of lifecycle management	
Lack of governance	Difficulties in identification of processes	
	Lack of standard language	

From a Brazilian´s perspective, Santos et al [25] presents a exploratory empirical research with a qualitative approach to investigate the BPM iniciatives in four public brazilian organizations [25]. They proposed three question in the research: What are the goals of the BPM initiative? What are the methodologicals approach that are being used? What are the results and the benefits that have been obtained by BPM initiatives?

The research findings for the first question resulted in five goals: standartzation, transparence, monitoring, process automation and strategic alignment. From the second question raises three type of methodologies: i) one based on industry standards (e.g., ITIL, ISO, PMBok, Zachaman´s Framework); ii) one supported by external consultants and processes office; iii) one that has the predominance of the proprietary tools (e.g., Aris Toolset, P3Tech). Finally, the third question gets evidence of a set of results (good or bad results) and benefits like: customer satisfaction survey, process weakness identification, practical results are not perceived and so on.

The authors conclude that the BPM iniciatives are immature. Another conclusion is that, since the research was applied on government organizations, is that the issues like rigidity of regulations, political interference, and strong hierarchical strutcture brings roadblocks to the BPM iniciatives.

In 2014, a new exploratory research in Brazilian´s context, with the same three questions is presented but now the authors investigate three private organizations [26]. The pre-requisite for the organizations to be included in the exploratory study was having process under improvement.

Now the goals identified by the first question were process control, task integration, and processes automation. The second question concludes that the methodology approach was based on BPMN[11] using proprietary tools like Bizagi[12] and Microsoft Visio[13]. Moreover, the organizations only maps the process, without any monitoring of process indicators. The last question shows the follow results of the BPM iniciative in private organizations: customer satisfaction survey, process weakness identification, improvement on the process monitoring, greater interaction between the organization´s sectors, and improvement in employee training.

Again, the authors conclude that the BPM iniciatives are immature because the perceived results are subjectives and limited to the studied processes. Another conclusion is that, since the research was applied on private organizations, the support of the top management is a facilitator but they also find strong hierarchical strutcture which brings challenges to the BPM iniciatives.

[11] http://www.bpmn.org/
[12] http://www.bizagi.com/
[13] https://products.office.com/pt-br/Visio/flowchart-software

Chapter 4 – Methodological Approach Toward State-of-Art and State-of-Practice in BPM from a Brazilian perspective

This chapter presents one of the main contributions of this work, which is a method to evaluate the state of art and the state of practice on Business Process Management in Brazil.

4.1 Method Overview

The methodological approach regards the references phases presented by Recker [27]: exploration; rationalization and validation. The exploratory phase aimed at building an understanding of the phenomenon of interest. The rationalization phase aims to give sense to things that involve the problem of interest and the validation phase aims to ensure that the theory or assumption passed through rigorous evaluations.

The main nature of this research is exploratory; nevertheless it is also important to be repeatable. However, methodological exploratory approaches have advantages and disadvantages [27]. Hence, this research was designed to follow the steps bellow in a multi-methodological research approach:

- The first step, it is a paper collect phase towards strong references that consolidates the state-of-art or the state-of-practice BPM scenario. Strong means that the collected papers t, for example, reach the community by a great number of citations, or because it was published by a relevant member or community team;
- Second, a state-of-art research, regarding the Brazilian academy conference under the light of the references collected in the first step.
- Third, a state-of-practice qualitative research, regarding the Brazilian professionals and/or organizations.
- Fourth, a state-of-practice quantitative research or evaluation of an existent one, under the light of the qualitative research conducted at the third step.

Therefore, this chapter is presented as follow. Section 4.1 presents the methodological approach to evaluate the Brazilian state-of-art scenario; Section 4.2, presents the qualitative approach to evaluate the state-of-practice scenario; Section 4.3, presents the

evaluation of a quantitative survey conducted by a Brazilian BPM Association in the context of the state-of-practice scenario; and Section 4.4, discuss the contribution of the methodological approach and possible future improvements.

4.2 Methodological Approach to Brazilian State-of-Art Evaluation

Business Process Management is an area that presents high level research. Therefore, some papers are remarkable, because they condense those research works and provide an overview of the whole area. Hence, this first step of the methodological approach relies in verifying the existence of this kind of research where important researchers provide their insights about the field evolution.

In 2012 and 2013, Aalst published two papers with this attributes [12] [28]. The first [28] one is shorter but presents two kinds of categorization the state-of-art issues: use cases and key concern categorization. The second paper [12] is a more comprehensive survey that starts with the presentation of historical aspects again and then presents a classification schema of BPM research in two viewpoints: use cases perspective and key concerns.

The state-of-art evaluation done by one high productive researcher was based on the classification in these two viewpoints of all the papers of BPM International Conference from 2003 to 2012 and the edited book *Business Process Management: Models, Techniques, and Empirical Studies* [43]. Then the paper discusses the results looking backward based on the relative frequency (also called by Aalst as relative importance) of each classification and points to the forwards [12].

These researches were important for the definition of the methodological approach because they bring two requirements: a categorization schema for evaluation and a repeatable method. Hence, the methodological approach choice to evaluate the Brazilian state-of-art scenario was to follow Aalst research's methodological aspects.

Other important aspect related to this choice is that, as the international scenario, in Brazil there is a national conference, the Business Process Management Workshop (WBPM). After its 8th edition in 2015, it moved to a Special Track of the 11th SBSI [13] [14] [15] [16] [17] [18] [19] [20] [45].

Considering this aspects, the same approach was follow. Generally, the methodology was analyzed and tagged each Conference paper on use cases and to the key concerns, presented in Chapter 2. More than one tag was used. For example, as mentioned

by Aalst, the paper "Instantaneous soundness checking of industrial business process models" presented at BPM 2009 is an examples of the use case *Verify Model* (VerM).

After the data collection, i.e., selecting and collecting the papers of a Conference and the data classification, the relative frequency of each categorization is the indicator used by Aalst to verify the relative importance of a category over the years. This relative frequency is reached by counting the number of tags per use case and year is counted. Using the example presented for use case, in BPM 2009 four papers were tagged with use case *discover model from event data* (DiscM) and 30 tags were the total assigned to the 23 papers. *"Hence, the relative frequency of DiscM is 4/30 = 0.133."*

The application of Aalst approaches provides not only the evaluation of Brazilian state-of-art scenario but also the capacity of comparison of the Brazilian scenario under the light of the International scenario. Moreover, it demonstrates that it can be a repeatable approach for future evaluations of the state-of-art scenario.

4.3 Qualitative Analysis for a State-of-Practice Evaluation

Like the state-of-art analysis, the first step of the methodological approach was the verification of the existence of this kind of research but at this time related to the state-of-practice and from a comprehensive BPM perspective. From the practice perspective, first restricted to Australian practice scenario, and then from an international perspective, three researches investigate the issues in BPM by a multi-methodological approach [22] [23] [24]. In Brazil, we can also mention works on a practical level [20] [26].

However, to evaluate the state-of-practice, it is important to mention the importance of starting with a qualitative analysis like the one mentioned before. There are two types of research's questions. "What", "Who" and "Where" that tend to explore and describe a topic where there is little knowledge; and "How" and "Why" are explanatory questions and search for answers of a particular phenomenon [27].

Our research aims to diagnose issues of the state-of-practice in the BPM scenario. It is exploratory regarding the "What", "Who" and "Where" about the "BPM phenomena". Hence, the best design decision for a research with an exploratory goal is the Qualitative side of the research design continuum [27] [46].

The research and the expected outcome are descriptive. Related to the amplitude of the issues in the BPM field, it is a complex goal because involves people, organiza-

tions, business challenge and it is dynamic in time. Hence, research requirements like controllability, deductibility, repeatability and generalizability are almost unreachable at this time. Therefore, to analyze the state-of-practice, the first step is choosing a qualitative strategy. Table 4.1 shows the differences in research strategies.

Table 4.1: Differences in research strategies, from Recker [27] (Based on [47])

Requirement	Qualitative	Quantitative	Design Science
Controllability	Low	Medium to high	High
Deductibility	Low	Medium to high	Very low
Repeatability	Low	Medium to high	High
Generalizability	Low	Medium to high	Low to very low
Explorability	High	Medium to low	Medium to low
Complexity	High	Medium to low	Medium to high

Moreover, the "*Qualitative methods are designed to assist researchers in understanding phenomena in context*" [27]. The qualitative research uses empiric investigation for understand a phenomenon in a real life context instead of measure a particular aspect. They can capture in a text what someone (or a group) has said, believed, done, or researched about a phenomenon, an event or a subject.

In particular, the selected qualitative approach was the focus group study. This kind of qualitative approach is conducted by researchers selecting and gathering the participants based, for example, in his personal experience to discuss and comment the topic that is the subject of the study [48] [22]. Morgan [49] defines focus group as "*a research technique that collects data through group interactions on a topic determined by the researcher*".

The focus group research findings can be used as a starting point for the development of a survey instrument or to analyze critically a quantitative instrument [50] [51] [52]. Another useful issue of this method is its capability of the exploration of a consensus on a given topic [50] . However, the weakness inherent to qualitative, like low generalizability due the small numbers of participants, exists. Within the qualitative research spectrum, in comparison with other qualitative instruments like interviews or observations, the focus groups research has two strengths: i) the capacity to gaining larger and richer information in a short period; ii) the capability of discovering new insights by the interactive nature of the group setting. Hence, new insights and issues, which might not have been planned by the researchers, can emerge [52].

Finally, the use of focus group under the light of previous research provides the same advantages explained in the sate-of-art approach under the light of Aalst approach. I.e., it was not only possible to do a comparison between the Brazilian 2015's scenario and the Australian 2007's scenario but also it demonstrates that it can be a repeatable approach for future evaluations of the state-of-practice scenario.

4.4 Evaluation of a Quantitative Survey of Brazilian State-of-Practice

The exploratory perspective was important to start the research about the state-of-practice. A next step is starting to design and applying a quantitative research under the light of the qualitative findings. From a quantitative perspective, after the qualitative research, it is possible to start the movement towards the other end of continuum of the research spectrum, e.g., while the qualitative research has low generalizability, the quantitative research has medium to high generalizability [27] [46].

The quantitative research strategy can contribute to increase researches characteristics like controllability, deductibility, repeatability and generalizability to a level of medium to high [27]. Hence, after the focus group qualitative research, many options to deeply analyze the raising issues were possible.

At the research design phase, it was expected to conduct a quantitative research phase. However, in a comprehensive context, in Brazil, there is an association (ABPM[14]) that already conducts a survey to evaluate the BPM state-of-practice scenario in Brazil. Hence, once this analysis exists, the methodological approach focused in use the qualitative focus group research to evaluate this quantitative research and give insights to new questions or perspectives that could be evaluated.

4.5 Contribution of the multi-methodological research approach and Future Improvement

The methodological approach developed at this part of research is expected to be one of the contributions of this research. Search previous researches that investigate the BPM field; follow its methods; and results in comparable findings also contribute with evidences that the previous research has some repeatable characteristics, even the qualitative ones.

[14] www.abpmp-br.org

This multi-methodological approach based on previous research regards to threaten comparability and repeatability research´s issues. It is one of the main contributions of this research, besides the research questions, because one of the multi-methodological goals of this research is to provide an approach that could be improved in further research. This capacity is important for a continuous evaluation of the state-of-art and state-of-practice is desirable.

This concern of the multi-method approach on decrease the impact of inherent problems of a single method approach was observed during the method development. For example, it was expected that after the qualitative phase the finding could not be generalized. Hence, a quantitative phase must be predict. Another example, a state-of-art evaluation without a categorization schema like the key concerns and use cases could result in a plethora of findings that could not be compared one with each other and the repeatability and generalization characteristics of the research and its findings would be negatively impacted.

The successful application of the multi-methodological approach is observed, during the report of each phase of the research, in the follow chapters. The validity issues, strengths and weakness are reported and, besides these inherent challenges to lead with a research option, the methodological approach remains constant and conducted as it was planned.

Even when the current research could not reach some part of the solution space due some restriction, it was possible to perceive, extrapolating, if the restriction could be removed the method will support. For example, a reported validity issue to the state-of-art is the positioning of the BPM field. The *spectrum* of its position is from the business field to technology field. In Brazil, three fields leads with BPM: Production Engineering, System Information and Administration. The evaluation using only the System Information field could threaten the validity of the findings. However, regarding these limitations, the methodological approach is open to insert the research from this field. Moreover, this capability was demonstrate by updating the eight Workshops of BPM (2007-2014) evaluation with 2015 BPM Special Track.

Finally, related to future improvement, this multi-methodological approach could be conducted not more as a research method but as a tool. A tool that could provide the capacity to measure the state-of-art and the state-of-practice, reducing the subjectivity by improving the repeatability and the controllability. Probable, towards these new characteristics, the research aspect will have to move from the classical approaches

of the natural science to the epistemological paradigm of the *Design Science* [53], the science of the artificial.

Once the current research works on an exploratory and descriptive perspective, a common perspective of the classical research used in the natural sciences, the multi-method approach serves well to provide the scientific rigor. However, the future improvement proposed here move the research question from the exploration of the BPM scenario to finding "what is this scenario" to another question that is related to "how to measure it the best way possible".

This new perspective, that the finding is in the field of prescription, can help to provide an approach even better than this current one. However, the focus of the research development would move from the phenomenon itself to the "*conception of an artifact that performs a goal"*, and the goal is the evaluation of the state-of-art and the state-of-practice. Ultimately, this kind of research is conducted by the *Design Science Research* that is the method that leads with the *Design Science* [53].

Chapter 5 – Brazilian State of the Art

This chapter explains the results obtained by the application of the proposed method on Brazilian academic Conference. The main goal is to demonstrate that the applicability of the Aalst categorization gives an overview about the BPM research in academy and insights to the future.

5.1 Introduction to State of the Art research

Some initiatives contribute to condense the evolution of the knowledge in the BPM field. From an international and academic perspective, Aalst´s related work presented on Chapter 3 discussed this evolution in the BPM International Conference from 2003 to 2012 [12]. He presents a key concern classification and the evaluation of all the 289 papers presented in the editions of that conference.

In Brazil, BPM is generally associated with the Information Systems area. Similar to the BPM International Conference, from 2007 to 2014, Brazil also had its national a premier Conference in a Workshop format in conjunction with the Brazilian´s Information Systems Symposium (SBSI), the Workshop in Business Process Management (WBPM) [13] [14] [15] [16] [17] [18] [19] [20]. The Symposium, in 2015, is in its 11th edition [45] and at this time, after the 8th edition of the WBPM, BPM was incorporated as a Special Track inside the 11th edition of the SBSI. Given the similarity, this part of the present research intend to answer two questions:

i) "What are the major key concerns in Brazilian academy?"

ii) "What are the major use cases in BPM presented in Brazilian academy?"

Therefore, this research started studying the key concerns and use cases classifications proposed by Aalst [12] [28]. Then, papers were collected and tagged in key concerns and use cases categorization all the 66 papers from the WBPM. Moreover, part of this research was published [44] and, after that, WPBM has been incorporated as Special Track inside the SBSI. Hence, this research was updated with more five papers from the 2015 SBSI's BPM Special Track.

This chapter has two main parts, one to present the results and discussion of the academy evaluation related to the key concerns and another related to the use cases. The

evaluation comprises the comparison with the BPM International Conference and, finally, we remark some validity issues accordingly to Brazilian´s context.

5.2 State-of-art of Key Concerns in Brazilian Conference

Following Aalst's work [12], first we collected all the papers published in the WBPM from 2007 to 2014 [13] [14] [15] [16] [17] [18] [19] [20]. There were 66 papers published. Then, to evaluate the relative importance of the key concerns, we tagged all the papers. Most papers were tagged with one dominant key concern, but in some cases, more tags were used. In the International Conference, Aalst used 342 tags to evaluate the key concerns of the 289 papers published, a 1.18 tag per paper on average. Our evaluation used 79 tags for the 66 papers published WBPM, 1.19 tags per paper on average. We remark that the proximity of the average was a coincidence, noticed after tagged all the papers.

As an example of paper that can be tagged with more than a dominant key concern, we mention the [54]. In fact, this paper presents and discusses the requirements of a tool that could support workflow activity patterns. In this sense, this paper can be tagged as *process enactment infrastructure*. However, to implement this proposal, it was necessary a statistic repository of activity patterns. Hence, it also can be tagged as process reuse, because it deals with a repository where process models are storage and retrieved. It´s not impossible to argue that this paper can be also tagged with *process modeling language*, because it has a discussion about BPMN 1.2 and UML 2.0 as well as *process mining* since they have "*implemented a process model mining tool to be used for identifying the activity patterns co-occurrences*".

The relative frequency is considered in this research as an indicative of the relative importance of a key concern. It´s important to remark that this research considered also, based on Aalst´s work [12], that the concept of relative importance is not only related to the relative frequency of a key concern in papers of the BPM International Conference, but also to the fact of this conference represents "the premier conference in the field". Since this research also considers that WBPM is the premier Brazilian´s research conference in the field, when term relative importance is used, as Aalst´s work, these two points are considered.

The relative frequency can be calculated by simply counting the number of tags per key concern and year. For example, for WBPM 2009 four papers were tagged with

the key concern *process enactment infrastructure*. The total number of tags was 17 for the 13 papers published. Therefore, the key concern *process enactment infrastructure* has a relative frequency of 4/17 = 0.235. Table 5.1 shows all relative frequencies of key concerns per year. The last row is the average relative frequency of each key concern over all eight WBPM editions. All rows add up 1. Figure 5.1 graphically presents the total average.

Table 5.1: Relative importance of key concern in eight years of WBPM [44].

Year	Process Modeling Language	Process Enactment Infrastructure	Process Model Analy-sis	Process Mining	Process Flexibility	Process Reuse
2007	0.07	0.33	0.27	0.13	0.13	0.07
2008	0.40	0.00	0.30	0.30	0.00	0.00
2009	0.24	0.24	0.29	0.00	0.12	0.12
2010	0.00	0.25	0.63	0.00	0.00	0.13
2011	0.00	0.20	0.30	0.20	0.00	0.30
2012	0.25	0.00	0.75	0.00	0.00	0.00
2013	0.20	0.00	0.40	0.20	0.20	0.00
2014	0.30	0.30	0.30	0.00	0.10	0.00
Average	0.18	0.20	0.35	0.10	0.08	0.09

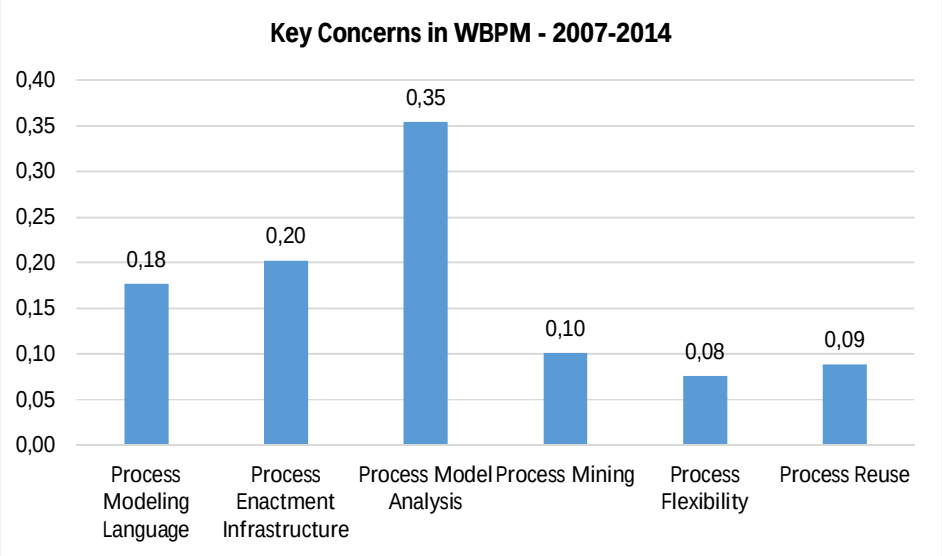

Figure 5.1. Average relative importance of key concerns in WBPM [44].

In Aalst´s research [12] it was noticed that the tagging of key concerns is highly subjective. He mentioned, "*It is unlikely that two BPM experts would use precisely the*

same tags for all papers". Moreover, this researched had the same difficult with broad papers. For, example, what is the key concern classification of a paper based on this research? To evaluate this subjectivity, yet in rough manner, before the final tagging, the author and the advisor of this research made a blind tagging, i.e. each one classified the papers without see the other's classification. Moreover, the advisor, the most expert, tagged the papers based only in its title. Nevertheless, in the large, the raw results lead to same concerns. The classification of the author prevailed, because, as mentioned, the advisor classification was based only in the title. Figure 5.2 shows the raw results of this title classification.

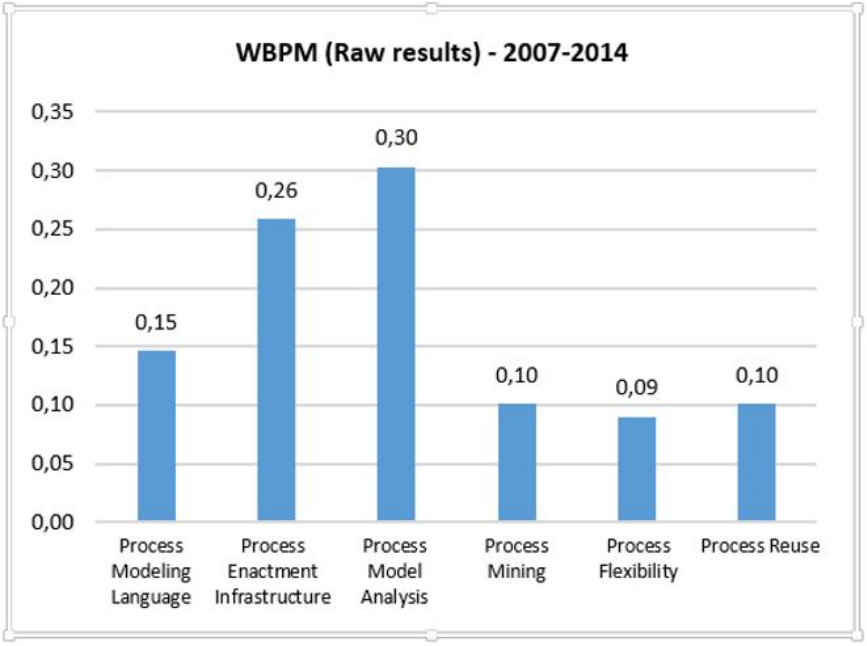

Figure 5.2. Raw results with the average relative importance verify the subjective component of the classification [44].

The analysis of key concerns in WBPM shows that the first three key concerns are the most frequent. In comparison, the BPM International Conference has also these three key concerns in the top concerns as shown in Figure 5.3. It was also noticed that they represent more than 70% of the relative importance in both scenarios, WBPM and BPM International Conference. However, the distribution between the three concerns is quite different. In BPM International Conference, they represent almost one third each

one, but in WBPM the *process model analysis* represents almost the half.

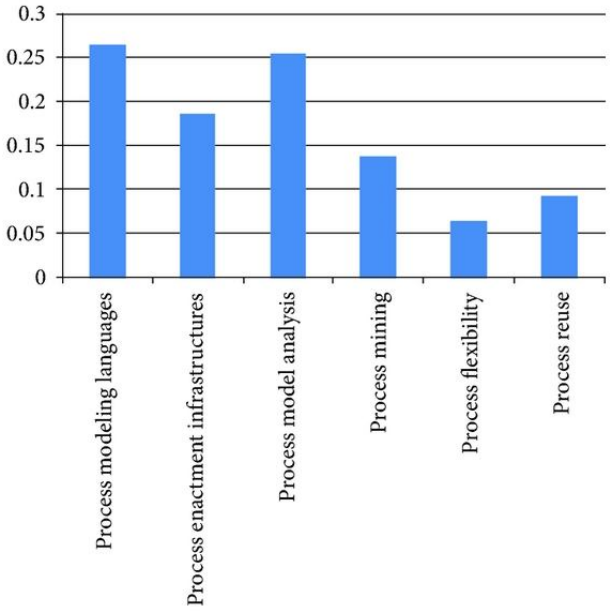

Figure 5.3: Average relative importance of Key Concerns in BPM International Conference [12].

It´s important to highlight that in the comparison related to time distribution, it´s possible to observe a two-year shift, since Aalst analysis didn´t address 2012, 2013 and 2014 editions of the Internationals Conference. Moreover, Aalst deals with ten years and WBPM had only eight editions. Therefore, this research, now, analyze the distribution over the years.

Aalst's results indicate the concerns *process mining* and *process reuse* have been gaining importance. In the other hand, the relative frequency of the concern *process flexibility* is decreasing. Table 5.2 shows the relative importance of concerns over the years in BPM International Conference and Figure 5.4 shows the importance of each concern plotted over the time.

Table 5.2: Relative importance of key concern in BPM International Conference [12].

Year	Process Modeling Language	Process Enactment Infrastructure	Process Model Analysis	Process Mining	Process Flexibility	Process Reuse
2000	0.355	0.161	0.290	0.000	0.161	0.032
2003	0.325	0.200	0.250	0.050	0.075	0.100
2004	0.286	0.238	0.238	0.143	0.048	0.048
2005	0.288	0.231	0.212	0.058	0.096	0.115
2006	0.154	0.308	0.288	0.096	0.077	0.077
2007	0.387	0.097	0.194	0.194	0.065	0.065
2008	0.324	0.108	0.297	0.135	0.081	0.054
2009	0.148	0.111	0.370	0.222	0.037	0.111
2010	0.240	0.240	0.200	0.160	0.000	0.160
2011	0.143	0.171	0.200	0.314	0.000	0.171
Average	0.265	0.187	0.254	0.137	0.064	0.093

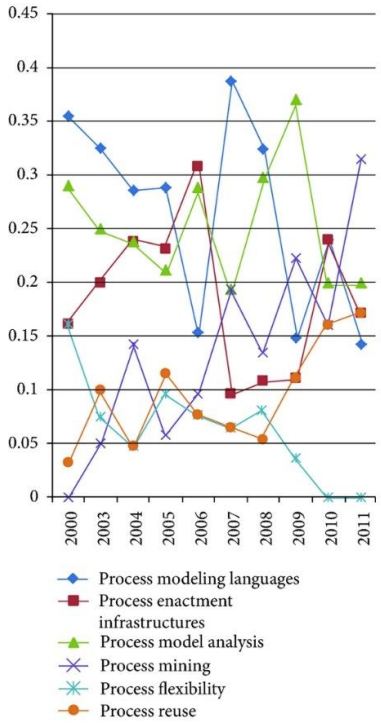

Figure 5.4: Importance of each concern plotted over the time in BPM International Conference [12].

Analyzing the results, they did not indicate a consistent trend in the sense of a key concern gaining importance and other loosing. Over the years, it is remarkable that *process reuse* disappeared in the last three years and the *process model analysis* has

always remained. Table 5.1, shown earlier, presents the relative importance of concerns over the years in WBPM. Figure 5.5 shows the relative importance of each concern plotted over the time.

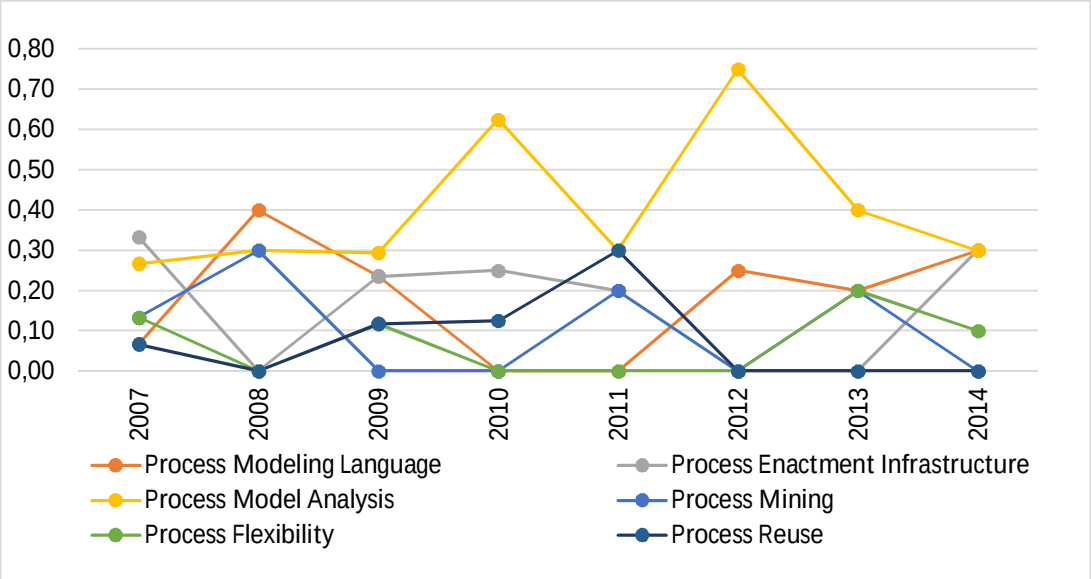

Figure 5.5: Relative importance of each concern plotted over the time in WBPM [44].

Grouping the concepts, the three most relevant in one hand (*process modeling language, process enactment infrastructure, process model analysis*) and the three others in another (*process mining, process flexibility and process reuse*) indicated in Figure 5.3, we can also perceived that they almost represent 70% of the relative importance in all years. The year 2011 is an outlier with 50% relative importance for each group and 2012 is another outlier, since the first three concerns represent 100% of the relative importance.

We are especially interested in this assembly because, according to Aalst [12], *process mining, process flexibility* and *process reuse* are concerns that are more recent, so let´s call it *modern group*. In other hand, there are the *process modeling language, process enactment infrastructure* and *process model analysis* concerns, which are more mature concerns; hence we will call it *mature group*.

Our analysis indicates that those groups in Brazilian research are not in the same direction of the BPM International Conference. Table 5.3 shows the sum of the relative frequencies in each group per year and Conference. Figure 5.6 graphically represents this difference. Comparing the earlier years of each conference with the last years, we observe that differently from the level change in BPM International Conference, which is clear, this change in the WBPM is not easily noticed.

Table 5.3: Relative importance of group of Mature Concern and Modern Concern over the years for each Conference [44].

Year	Mature Concerns International Conference	Modern Concerns International Conference	Mature Concerns WBPM	Modern Concerns WBPM
2000	0.80	0.20		
2003	0.78	0.23		
2004	0.76	0.24		
2005	0.73	0.27		
2006	0.75	0.25		
2007	0.50	0.50	0.67	0.33
2008	0.73	0.27	0.70	0.30
2009	0.63	0.37	0.76	0.24
2010	0.68	0.32	0.88	0.13
2011	0.51	0.49	1.00	0.00
2012			1.00	0.00
2013			0.60	0.40
2014			0.90	0.10

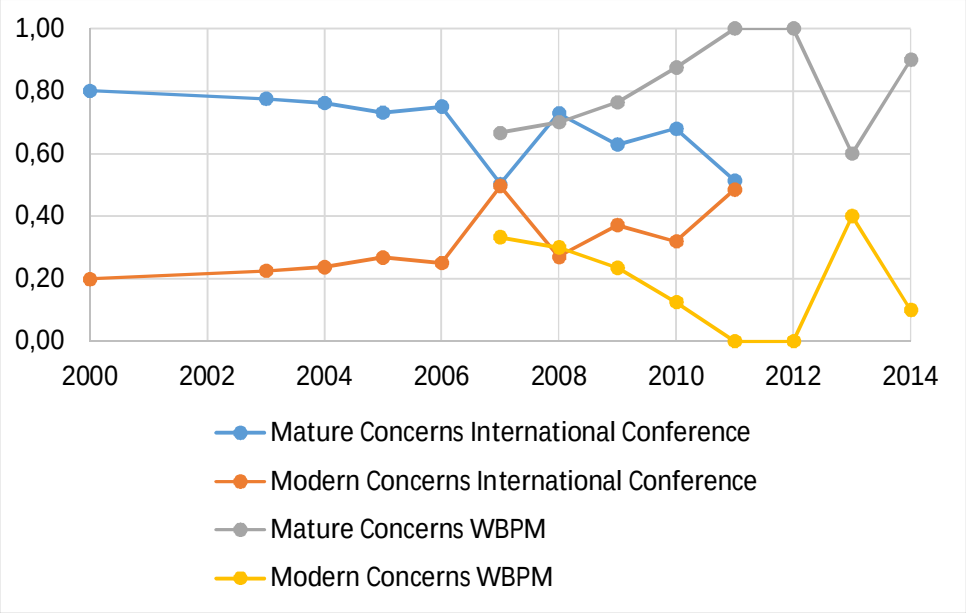

Figure 5.6: Relative importance of each group plotted over the time.

Once the first phase of the research was ready, it´s possible to update the research with the 11th SBSI [45], in 2015. The decision to present first the research with-

out the current year then the updated result is related to proof the concept of the methodology to evaluate the state-of-art. Table 5.4, Table 5.5, Figure 5.7, Figure 5.8, Figure 5.9 show the previous results updated with the 5 new papers of the 11th SBSI BPM Special Track.

Table 5.4: Relative importance of key concern in eight years of WBPM updated with the 11th SBSI BPM Special Track.

Year	Process Modeling Language	Process Enactment Infrastructure	Process Model Analysis	Process Mining	Process Flexibility	Process Reuse
2007	0.067	0.333	0.267	0.133	0.133	0.067
2008	0.400	0.000	0.300	0.300	0.000	0.000
2009	0.235	0.235	0.294	0.000	0.118	0.118
2010	0.00	0.250	0.625	0.000	0.000	0.125
2011	0.000	0.200	0.300	0.200	0.000	0.3000
2012	0.250	0.000	0.750	0.00	0.00	0.000
2013	0.200	0.000	0.400	0.200	0.200	0.000
2014	0.300	0.300	0.300	0.000	0.100	0.000
2015	0.000	0.000	0.600	0.200	0.200	0.000
Average	0.167	0.190	0.369	0.107	0.083	0.083

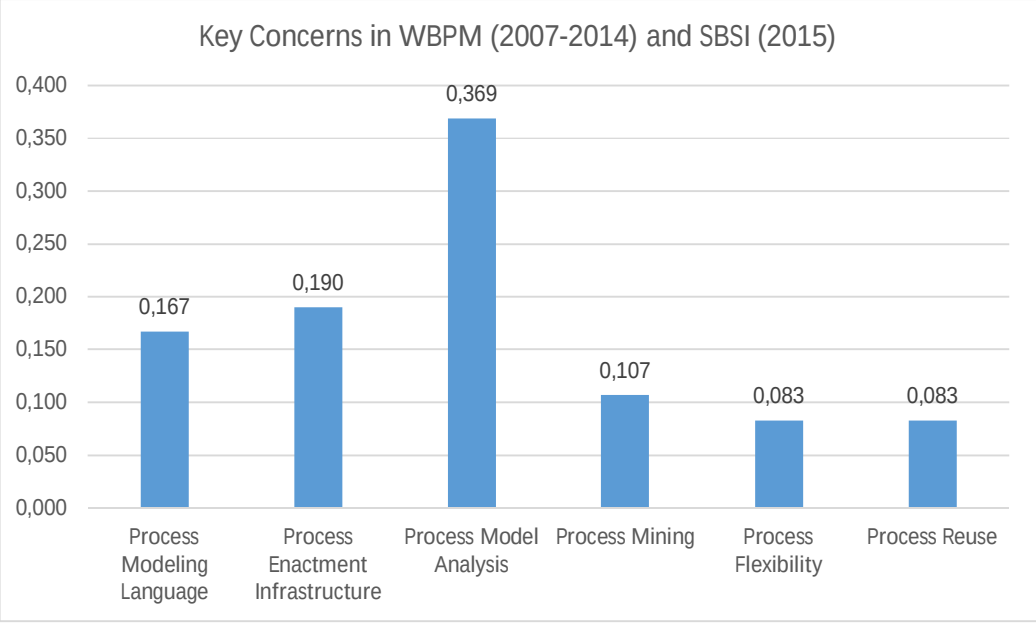

Figure 5.7. Average relative importance of key concerns of WBPM updated with the 11th SBSI BPM Special Track.

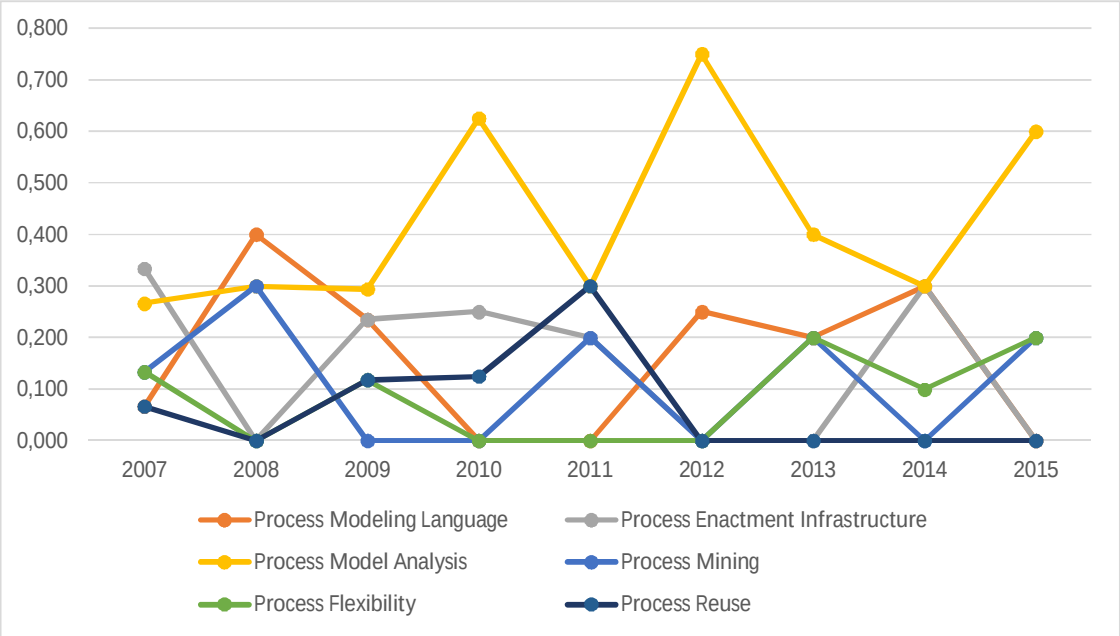

Figure 5.8: Importance of each concern plotted over the time of WBPM updated with the 11th SBSI BPM Special Track.

Table 5.5: Relative importance of group of Mature Concern and Modern Concern over the years for each Conference, updated with the 11th SBSI BPM Special Track.

Year	Mature Concerns International Conference	Modern Concerns International Conference	Mature Concerns WBPM	Modern Concerns WBPM
2000	0.80	0.20		
2003	0.78	0.23		
2004	0.76	0.24		
2005	0.73	0.27		
2006	0.75	0.25		
2007	0.50	0.50	0.67	0.33
2008	0.73	0.27	0.70	0.30
2009	0.63	0.37	0.76	0.24
2010	0.68	0.32	0.88	0.13
2011	0.51	0.49	1.00	0.00
2012			1.00	0.00
2013			0.60	0.40
2014			0.90	0.10
2015			0.60	0.40

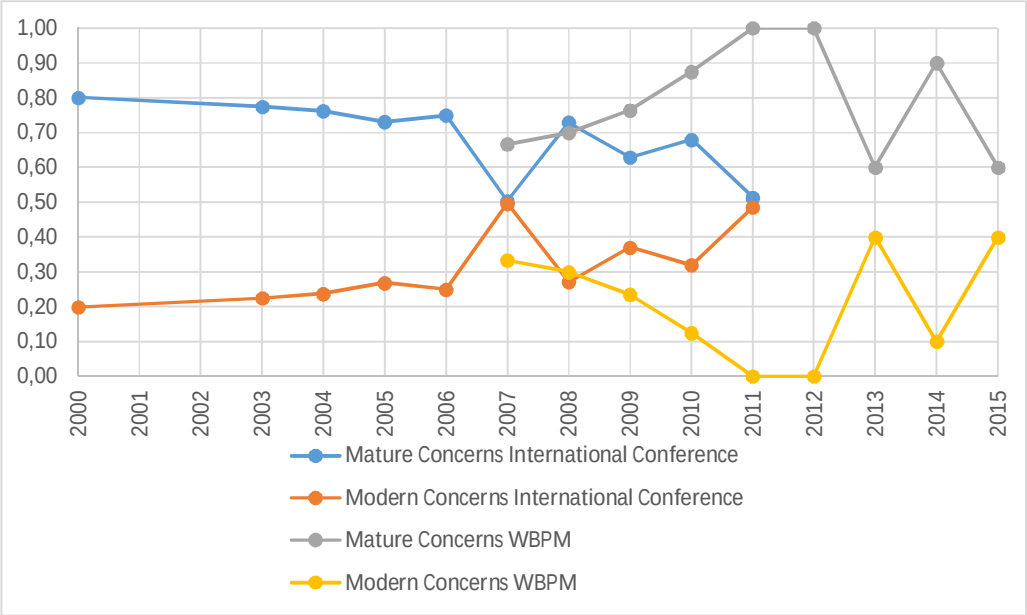

Figure 5.9: Relative importance of each group plotted over, updated with the 11th SBSI BPM Special Track.

The remarks about the updates is, first, the blind evaluation of the author and the advisor result in only one different tag. The second remark is that the paper that present the partial result of this research, [44], was excluded from the evaluation. Finally, overall evaluation did not change at all.

5.3 State-of-art of Use Cases in Brazilian Conference

After the first part of the research about key concerns [44], the next step is tag the papers according to the use cases classification. Most papers were tagged with one dominant use case, but in some cases, more tags were used. Follow de chronological order, as the research finished the tag effort before the 11th SBSI BPM Special Track, like the last session, 5.1, the results will be presented first with the WBPM evaluation and then updated with the 11th SBSI BPM Special Track.

In the BPM International Conference, Aalst used 367 tags to evaluate the key concerns of the 289 papers published, a 1.27 tag per paper on average [12]. This research started the evaluation using 105 tags for the 66 papers published in WBPM, 1.59 tags per paper on average.

For this research, the relative frequency is as an indicative of the relative importance of a use case. It´s important to remark that this research considered also, based

on Aalst´s work [12], that the concept of relative importance is not only related to the relative frequency of a use case in papers of the BPM International Conference, but also to the fact that this conference represents "the premier conference in the field". Since this research also considers that WBPM is the premier Brazilian´s research conference in the field, when term relative importance is used, as Aalst´s work, these two points, i.e. relative frequency and premier regional research conference, are considered.

The relative frequency can be calculated by simply counting the number of tags per use case and year. For example, for WBPM 2009 five papers were tagged with the use case *design model* (DesM). The total number of tags was 21 for the 13 papers published. Therefore, the use case design model has a relative frequency of 5/21 = 0.238. Table 5.6 shows all relative frequencies of use cases per year. The last row is the average relative frequency of each use case over all eight WBPM editions. All rows add up 1 (discarding the thousandths because of rounding).

Table 5.6. Relative importance of use cases in eight years of WBPM.

Year	Design Model	Discover Model From Event Data	Select Model From Collection	Merge Models	Refine Model	Enact Model	Log Event Data	Monitor	Adapt While Running	Analyze Performance Based on Model	Verify Model	Check Conformance Using Event Data	Analyze Performance Using Event data	Improve Model
2007	0.188	0.000	0.000	0.000	0.063	0.313	0.000	0.000	0.188	0.000	0.063	0.063	0.063	0.063
2008	0.455	0.182	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.182	0.091	0.091	0.000
2009	0.238	0.000	0.000	0.000	0.095	0.190	0.000	0.048	0.095	0.143	0.143	0.000	0.000	0.048
2010	0.125	0.000	0.063	0.063	0.063	0.125	0.000	0.125	0.063	0.188	0.000	0.000	0.000	0.188
2011	0.188	0.125	0.188	0.125	0.125	0.125	0.000	0.063	0.063	0.000	0.000	0.000	0.000	0.000
2012	0.500	0.000	0.000	0.000	0.167	0.167	0.000	0.000	0.000	0.000	0.167	0.000	0.000	0.000
2013	0.500	0.167	0.000	0.000	0.000	0.00	0.167	0.000	0.167	0.000	0.000	0.000	0.000	0.000
2014	0.385	0.000	0.000	0.000	0.077	0.308	0.000	0.077	0.154	0.000	0.000	0.000	0.000	0.000
Average	0.276	0.048	0.038	0.029	0.076	0.171	0.010	0.048	0.095	0.057	0.067	0.019	0.019	0.048

All use cases could be used in the classification task. However no papers were classified in the follow use cases: *compose model*, *design configurable model*, *merge models into configurable model*, *configure configurable model*, *repair model*, *extend model*. The table shows only the ones that appeared after the classification task: the relative frequency of each use case over all eight WBPM editions. Figure 5.10 graphically presents the total average.

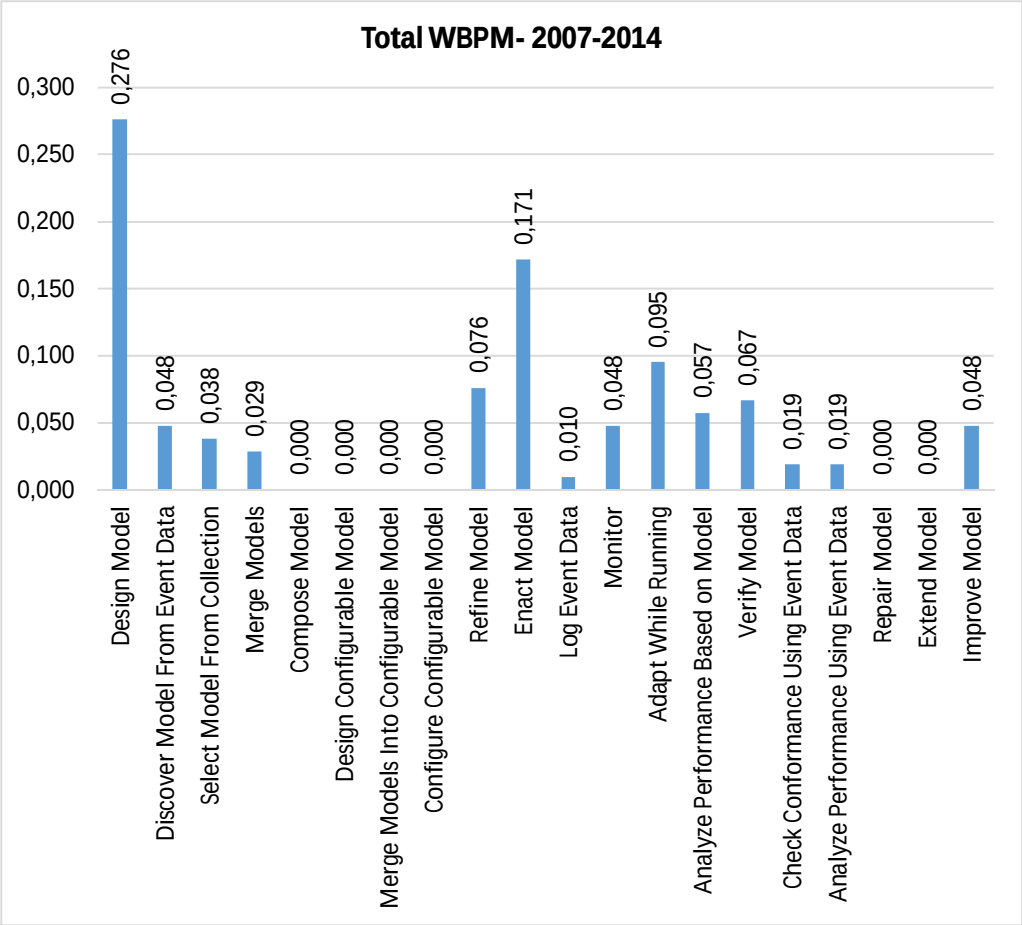

Figure 5.10. Average relative importance of use cases in WBPM.

In Aalst´s research [12] it was noticed that the tagging of use cases is highly subjective. He mentioned, "*It is unlikely that two BPM experts would use precisely the same tags for all papers*". Moreover, this researched had the same difficult with broad papers. For, example, what is the key concern classification of a paper based on this research? To evaluate this subjectivity, yet in rough manner, before the final tagging, the author and the advisor of this research made a blind tagging, i.e. each one classified the papers without see the other's classification. Moreover, the advisor, the most expert, tagged the papers based only in its title. Nevertheless, in the large, the raw results lead to same concerns. The classification of the author prevailed, because, as mentioned, the advisor classification was based only in the title. Figure 5.11 shows the raw results of this use case classification based on title.

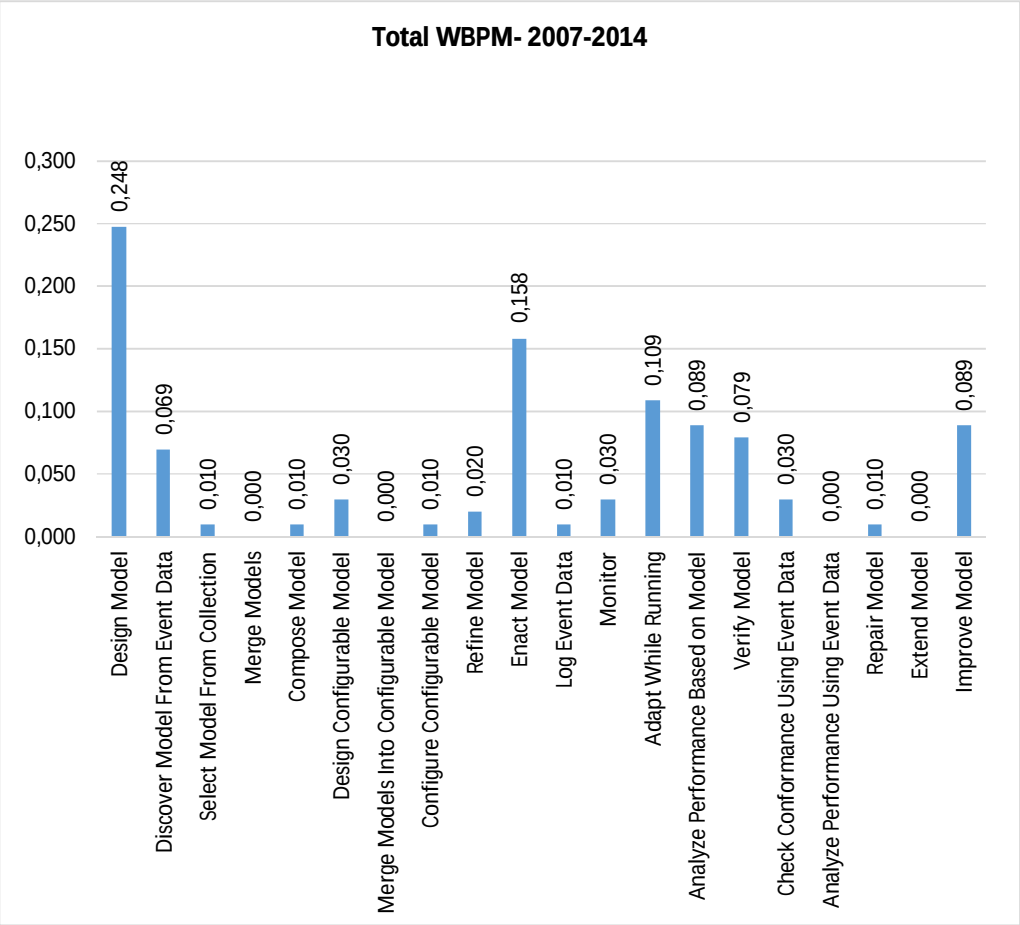

Figure 5.11. Raw results with the average relative importance verify the subjective component of the classification.

The analysis of use cases in WBPM shows that *design model* (DesM) and *enact model* (EnM) are the most frequent. In comparison, the BPM International Conference (Figure 5.12) presented also these two use cases as the most frequent. Moreover they are almost in the same interval of relevance, i.e., *design model* is in the interval from 20% to 30% and the *enact model* is in the interval from 10% to 20%.

An interesting result is that the use case *verify model* is the third more frequent in the BPM International Conference and, for Aalst, it´s "more surprising" than the first and the second place. He concludes: "*In this context it is remarkable that the use case monitor (Mon) and analyze performance using event data (PerfED) have a much lower relative frequency*". In the WBPM, it´s possible to notice that the use case *analyze performance using event data* is more frequent than the *verify model*. Even the use case *monitor* (Mon) is more frequent in WBPM than in the BPM International Conference. Maybe the result observed in the WBPM is more aligned with Aalst expectation as he

mentioned about the results of the use case analysis in the BPM International Conference: Given the practical needs of BPM one would expect more papers presenting techniques to diagnose and improve performance of business processes.

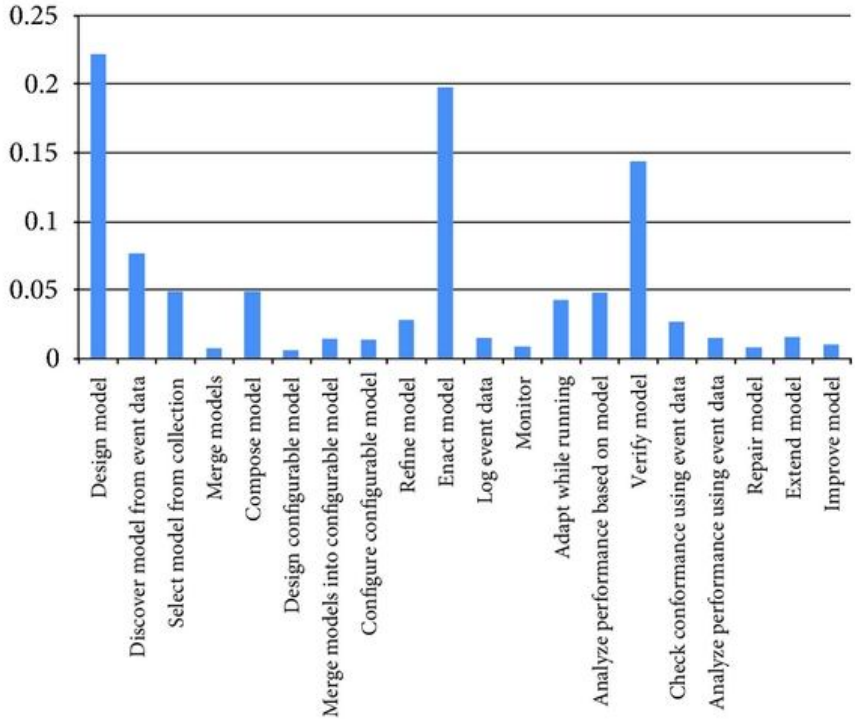

Figure 5.12. Average relative importance of use cases in the BPM International Conference [12].

Over time, Aalst's declared that the use cases analysis of the BPM International Conference shows that the process-mining-related topics are increasing. Differently from the BPM International Conference use case analysis, no clear trends are visible in WBPM. The cause for this stated in Aalst´s research, i.e., many use cases and small number of years and papers per year, seems to present a bigger impact in WBPM. While Aalst´s has a universe of 289 papers, WBPM has only 66 papers. Table 5.7 shows the relative importance of each use case over the years in the BPM International Conference and Figure 5.13 shows the importance of each use case plotted over the time. Figure 5.14 shows the importance of each use case in WBPM.

Table 5.7. Relative importance of key concerns in International BPM Conference [12].

Year	Design model	Discover model from event data	Select model from collection	Merge models	Compose model	Design configurable model	Merge models into configurable model	Configure configurable model	Refine model	Enact model	Log event data	Monitor	Adapt while running	Analyze performance based on model	Verify model	Check conformance using event data	Analyze performance using event data	Repair model	Extend model	Improve model
	DesM	DiscM	SelM	MerM	CompM	DesCM	MerCM	ConCM	RefM	EnM	LogED	Mon	AdaWR	PerfM	VerM	ConfED	PerfED	RepM	ExtM	ImpM
2000	0.406	0.000	0.000	0.000	0.031	0.000	0.000	0.000	0.000	0.188	0.000	0.000	0.063	0.125	0.188	0.000	0.000	0.000	0.000	0.000
2003	0.306	0.028	0.056	0.000	0.056	0.000	0.000	0.028	0.000	0.222	0.028	0.000	0.139	0.000	0.111	0.000	0.000	0.000	0.028	0.000
2004	0.348	0.130	0.000	0.000	0.043	0.000	0.000	0.000	0.000	0.217	0.000	0.000	0.043	0.087	0.087	0.000	0.000	0.000	0.000	0.043
2005	0.216	0.039	0.039	0.000	0.098	0.000	0.000	0.000	0.000	0.294	0.000	0.000	0.059	0.078	0.137	0.000	0.000	0.000	0.000	0.039
2006	0.094	0.038	0.057	0.019	0.132	0.000	0.000	0.000	0.019	0.245	0.019	0.000	0.075	0.019	0.226	0.019	0.019	0.000	0.000	0.019
2007	0.231	0.128	0.026	0.026	0.051	0.026	0.026	0.077	0.077	0.077	0.026	0.026	0.026	0.051	0.103	0.000	0.026	0.000	0.000	0.000
2008	0.227	0.045	0.023	0.000	0.045	0.000	0.023	0.000	0.023	0.182	0.045	0.000	0.023	0.091	0.136	0.000	0.045	0.023	0.068	0.000
2009	0.167	0.133	0.067	0.000	0.033	0.000	0.033	0.000	0.133	0.133	0.033	0.000	0.000	0.033	0.167	0.033	0.033	0.000	0.000	0.000
2010	0.167	0.133	0.100	0.000	0.000	0.033	0.000	0.033	0.033	0.300	0.000	0.000	0.000	0.000	0.100	0.067	0.000	0.000	0.033	0.000
2011	0.061	0.091	0.121	0.030	0.000	0.000	0.061	0.000	0.000	0.121	0.000	0.061	0.000	0.000	0.182	0.152	0.030	0.061	0.030	0.000
Average	0.222	0.077	0.049	0.007	0.049	0.006	0.014	0.014	0.029	0.198	0.015	0.009	0.043	0.048	0.144	0.027	0.015	0.008	0.016	0.010

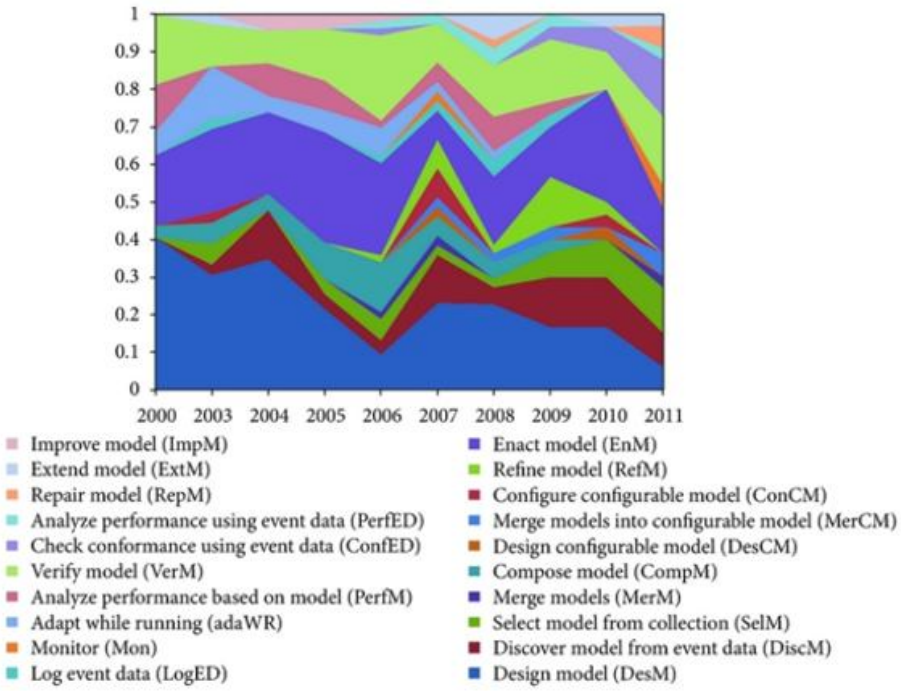

Figure 5.13. Importance of each use case plotted over the time in the BPM International Conference [12].

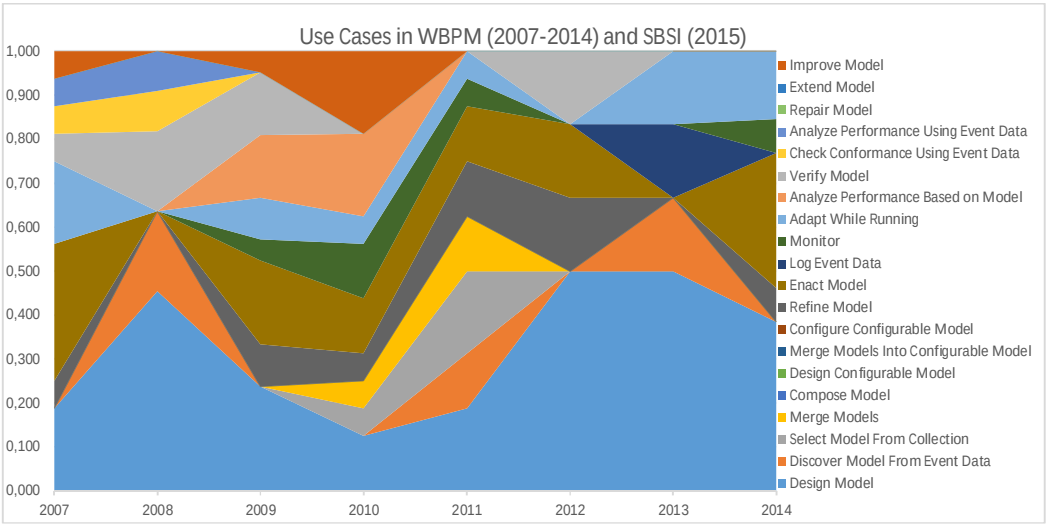

Figure 5.14. Importance of each use case plotted over the time in WBPM.

Now also with the use cases categorization, once the first phase of the research was ready, it´s possible to update the research with the 11th SBSI [21], in 2015. Again, the decision to present first the research without the current year then the updated result is related to proof the concept of the methodology to evaluate the state-of-art. Table 5.8, Figure 5.15, Figure 5.16 show the previous results updated with the 5 new papers of the 11th SBSI BPM Special Track.

Table 5.8: Relative importance of use cases in eight years of WBPM updated with the 11th SBSI BPM Special Track.

Year	Design Model	Discover Model From Event Data	Select Model From Collection	Merge Models	Refine Model	Enact Model	Log Event Data	Monitor	Adapt While Running	Analyze Performance Based on Model	Verify Model	Check Conformance Using Event Data	Analyze Performance Using Event data	Repair Model	Extend Model	Improve Model
2007	0.188	0.000	0.000	0.000	0.063	0.313	0.000	0.000	0.188	0.000	0.063	0.063	0.063	0.000	0.000	0.063
2008	0.455	0.182	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.182	0.091	0.091	0.000	0.000	0.000
2009	0.238	0.000	0.000	0.000	0.095	0.190	0.000	0.048	0.095	0.143	0.143	0.000	0.000	0.000	0.000	0.048
2010	0.125	0.000	0.063	0.063	0.063	0.125	0.000	0.125	0.063	0.188	0.000	0.000	0.000	0.000	0.000	0.188
2011	0.188	0.125	0.188	0.125	0.125	0.125	0.000	0.063	0.063	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2012	0.500	0.000	0.000	0.000	0.167	0.167	0.000	0.000	0.000	0.000	0.167	0.000	0.000	0.000	0.000	0.000
2013	0.500	0.167	0.000	0.000	0.000	0.00	0.167	0.000	0.167	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2014	0.385	0.000	0.000	0.000	0.077	0.308	0.000	0.077	0.154	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2015	0.500	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.125	0.000	0.000	0.125	0.125	0.125	0.125	0.125
Average	0.292	0.044	0.035	0.027	0.071	0.159	0.009	0.044	0.097	0.053	0.062	0.018	0.018	0.009	0.009	0.053

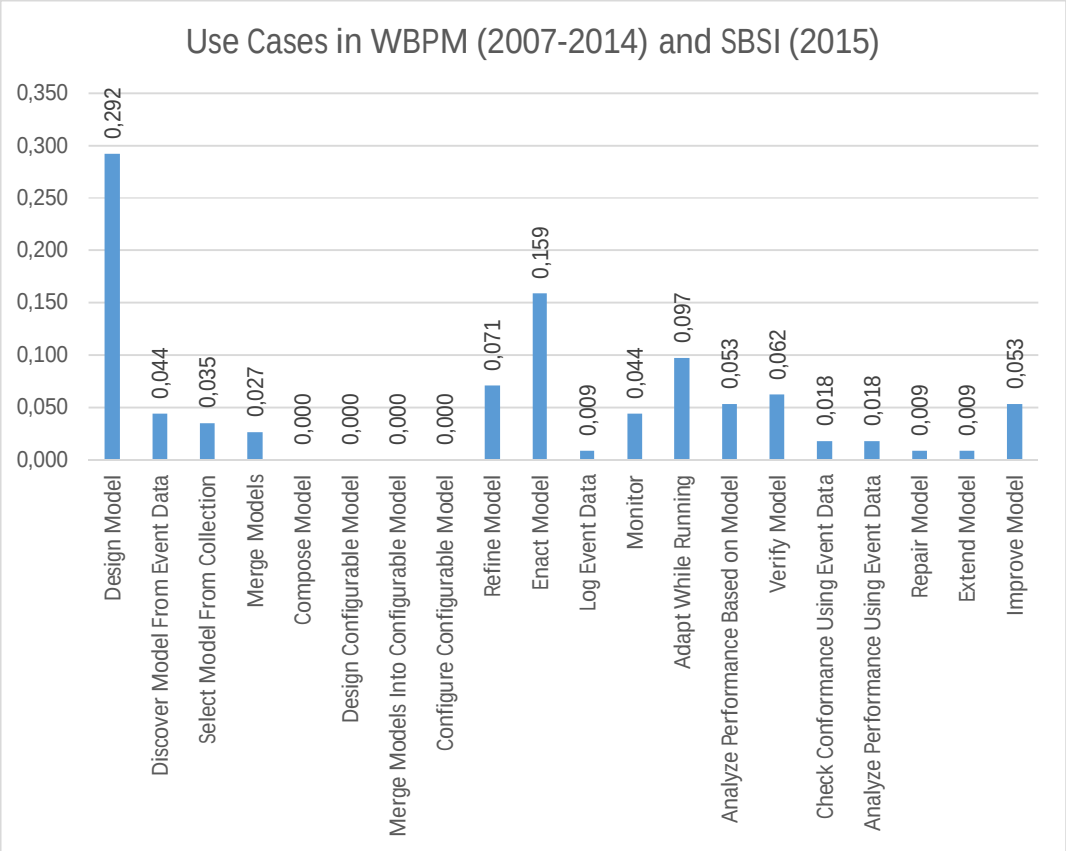

Figure 5.15. Average relative importance of key concerns of WBPM updated with the 11th SBSI BPM Special Track.

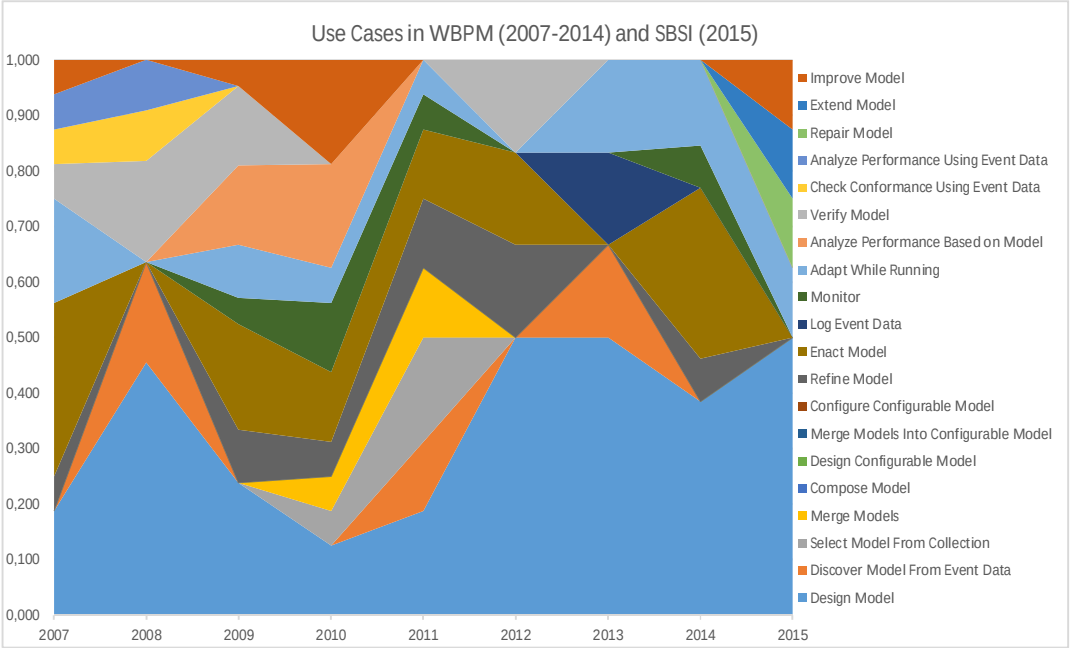

Figure 5.16: Importance of each concern plotted over the time of WBPM updated with the 11th SBSI BPM Special Track.

The remarks are, first, the paper that presents the partial result of this research, [44], was excluded from the evaluation. The second remark is that the update results in two use cases that was not presented in any year before: the use case *repair model* (RepM) and the use case *extend model* (ExtM). Finally, overall evaluation did not change at all, i.e., the use case *design model* (DesM) and the use case *enact model* (EnM) still the most important use cases but, it´s remarkable that, in 2015, the use case *enact model* (EnM) was not present in any research published.

5.4 An Outlook through Brazilian State-of-Art (Discussion)

Aalst analysis recognizes the “amazing speed” of the development of the BPM discipline [12]. However, he also discusses some weaknesses. Hence, in this subsection we will look at the WBPM and the 11th SBSI BPM Special Track papers remarking the aspects as pointed by Aalst.

Aalst´s research [12] first point is that many papers presents a new modeling language, but the need for such languages is often unclear besides they are never used again. In WBPM, we noticed that the first phenomenon occurs not with languages, but with the key concern *process modelling analysis*. There are many papers proposing new methods, approaches or techniques, including use cases, but we did not notice the evo-

lution or evaluation of those proposals in subsequent years. However, despite this trend, some papers reflect research continuity [55] [56] [57] [25] [26].

A second point recognized by Aalst [12] is the distance between research and real-life. Aalst believes some authors seem to focus on originality rather than relevance. A third point is about implementation. Despite the efforts, the non-availability of the software is frequent or the prototypes simply "disappear" after the publication. The result is a discontinuity of the research. Finally, in a fourthly point, he noticed that many papers include case studies, which could be good, but instead they appear to be artificial and, often, the core contribution is not really evaluated or the case study is deliberately kept vague.

Unlike the BPM International Conference, in WBPM there are few papers presenting implementations. New software is not common in WBPM. However, papers tagged with the key concern *process enactment infrastructure* and use cases like *refine model* (RefM) or *enact* model (EnM) often presents a new method, technique or approach and, like noticed by Aalst but in WBPM, once the proposal is published there is no new publication evaluating or discussing the evolution of the proposal.

In this context, one can argue that this analysis results, lack of continuity, will occur because the natural evolution of a research, after a national publication, would be an international one. Nevertheless, we understand it is important to warn about that, because it will help to future evaluations for national conferences, publications and communities.

Concerning specifically to the use cases, Aalst noticed that many papers cannot be linked to one of the twenty use cases and various use cases are neglected by both BPM researchers and BPM software [12]. He exemplifies this use case issue with use cases related to improve the performance of processes and remarks that there aren´t tools that provides suggesting for redesigning processes. In WBPM we observe this phenomenon also occurs in use cases related to model configuration.

Although we noticed the same weakness that Aalst remarks in BPM International Conference, we also noticed that national research is not distant from BPM International Conference issues. Aalst recognizes that the BPM discipline has developed at a great speed and, besides that speed, in WBPM there are papers that deals with all the key concerns, the mature ones or the modern one since early editions. I.e., we observe that in the earliest editions we already found papers about *process enactment infrastructure* and *process mining*.

Another comment is that Aalst proposed that key concern categorization could consider other ones, like collaboration. In WBPM, since earlier editions, it´s possible to identify research in this categorization topic *collaboration* [55] [56] [57].

Before finishing this outlook and discussion, it´s important to notice that the update with the papers published in the 11th SBSI at the BPM Special Track did not impact the overall evaluation. Finally, since the partial results of this research was published in the Symposium, it´s expected a reflection about this concerns that results in a movement towards the BPM International Conference, i.e., towards the modern concepts.

5.5 Conclusion of the State-of-Art evaluation and Final Remarks

In this part of the research, is expected to answer two research questions:

i) "What are the major key concerns in Brazilian academy?"

ii) "What are the major use cases in BPM presented in Brazilian academy?"

To answer it, it was developed a research taking the same path used by Aalst [12] to evaluate the last decade of world´s research in BPM, i.e., verifying the frequency of a concern or a use case in the premier BPM International Conference.

To Brazilian Academy scenario it was used the papers published at WBPM. The papers were tagged with key concerns and use cases proposed by Aalst. Moreover, since it was used the same categorization proposed in Aalst research, it is possible to compare the results of each Brazilian key concern´s and use cases' research with the BPM International scenario.

For the first question, the results indicate that Brazilian academy has the key concern *process model analysis* as its major issue and, through the eight years investigated, it has not changed at all even when the update with the 11th SBSI BPM Special Track. Evidencing the possibility of comparison, this concern together with the other two most relevant concerns, *process enactment infrastructure* and *process modelling language* composes the same set of the BPM International Conference.

However, through the years, the research in the BPM International Conference has moved to other concepts like *process mining* and *process reuse*. In Brazilian scenario, there was no movement through this direction. Possible it´s related not only to academy issues but also to the industry scenario. That reflection is one of reflections that justifies the next step of this research, presented in the chapter about state-of-practice analysis.

Moreover, related to the first question, these results give insights to verify two categories to confirm the stability of the concerns in WBPM over the time: mature concepts and modern concepts. This category comparison made possible to conclude that the BPM International Conference is moving from the mature concepts to the modern concepts while WBPM is not.

To answer the second question, the use case analysis showed that the most frequent use case is the *design model*, followed by the use case *enact model*. It is not a surprise if the key concern analysis result is observed. Through the year, there was not a clear trend to Brazilian scenario.

Thinking about the possibility of classification in mature and modern concepts, this kind of analysis is more complicated or not trustful since a single use cases can be related to a mature key concern or to a modern key concern. For example, Aalst related the use case *design model* with the mature concern *process modelling language* and strongly related it with the modern concern *process reuse* [12].

To recognize other state of art aspects, a possibly evolution of this part of the research is through other potentially concerns proposed by Aalst: *process integration*, *patterns*, and *collaboration* [12]. Another possible evolution is to update this research for a broader geographical perspective. For example, to whole Latin America. This research proved this, partially, updating a result already published [44].

Treating the validity, this part of research has some limitations related to the positioning of the BPM field. BPM initiatives can be found in a *spectrum* from business to technology. In Brazil, it was verified that BPM research have been conducted in fields like Production Engineering, System Information and Administration research fields. The evaluation using only the System Information field could threaten the validity of the findings.

Another limitation is that in research scenario in Brazil is under the evaluation of the Capes (in English, Higher Education Personnel Improvement Coordination)[15]. This public foundation, in Brazil, provides a quality evaluation of the national and international conferences and journals, called Qualis[16]. The implication of that evaluation is that Brazilian researchers try to publish first in better-evaluated conferences and journal, most of them international and this research focused at Brazilian Conferences.

[15] http://www.capes.gov.br/

[16] https://sucupira.capes.gov.br/sucupira/public/consultas/coleta/veiculoPublicacaoQualis/listaConsultaGeralPeriodicos.jsf

Nevertheless, regarding these limitations, the methodological approach is open to insert this new research. The methodological approach provides the capability of update the state-of-art analysis regarding other fields or focusing not in conferences but in the Brazilian researchers. A concept proof updating the eight Workshops of BPM (2007-2014) evaluation with 2015 BPM special track was also presented in this part of the research.

Finally, to conclude, observing only this part of the research, it aims to contribute in the same manner of the original, the BPM International one [12]. As the author writes, it is a "*modest attempt to guide BPM research towards the real key challenges in our field*". It´s expected that this part of the research will help to highlight the Brazilian research trajectory and will contribute with new research questions, e.g., Why are we in this trajectory? Which trajectory would be better? Maybe researches like that could be a baseline to move this trajectory to another one and, in the future, this movement can be perceived by a constant actualization of this research. It´s also expected that this research would influence the practitioners, and vice-versa, i.e., the practitioners with these new insights could bring new experiences and challenges to the academy.

Chapter 6 - Brazilian State of the Practice

This chapter presents the results obtained by the application of the proposed method on four Focus Groups with Brazilian practitioners. The main goal is to demonstrate the applicability of the Focus Group research to obtain qualitatively the Brazilian practice issues like Queensland research. Moreover, the results will give insights to evaluate a quantitative research developed by a BPM National organizational.

6.1 Introduction to State of the Practice research

In this part of the research, the focus is the analysis of the state of the practice from a Brazilian´s perspective. Therefore, this part of the main research question is: *"What are the practical issues from the Brazilian´s perspective?"*

To explore this research question, a qualitative analysis first conducted a focus group research with Brazilian´s practitioners. Moreover, aiming a research that could have an internationally comparison, our research followed the one presented by Indulska et al [22].

6.2 Qualitative Analysis – Focus Group research

6.2.1 Methodology justification – Why Focus Group?

There two types of research's questions. "What", "Who" and "Where" tend to explore and describe a topic where there is little knowledge. "How" and "Why" question are explanatory question and search for answers of a particular phenomenon [27]. The definition of the kind of issue is one of the inputs to the research design. Table 6.1 shows elements for taking decisions related to the research design.

Table 6.1: Research design decisions from Recker [27] (adapted from [46])

Spectrum	One End of Continuum		Other End of Continuum
Method	Qualitative	vs.	Quantitative
Aim	Exploratory	vs.	Explanatory
Boundary	Case	vs.	Statistical
Setting	Field	vs.	Laboratory
Timing	Cross-sectional	vs.	Longitudinal
Outcome	Descriptive	vs.	Causal
Ambition	Understanding	vs.	Designing

Our research aims to diagnose issues of the state-of-practice in the BPM scenario. It´s an exploratory research and the expected outcome is descriptive and with a further understanding ambition. It is a complex goal because involves people, organizations, business challenge and it´s dynamic in time. Hence, research requirements like controllability, deductibility, repeatability and generalizability are almost unreachable. Therefore, in this research phase our option is for a qualitative strategy. Table 6.2 shows the differences in research strategies.

Table 6.2: Differences in research strategies, from Recker [27] (Based on [47])

Requirement	Qualitative	Quantitative	Design Science
Controllability	Low	Medium to high	High
Deductibility	Low	Medium to high	Very low
Repeatability	Low	Medium to high	High
Generalizability	Low	Medium to high	Low to very low
Explorability	High	Medium to low	Medium to low
Complexity	High	Medium to low	Medium to high

"*Qualitative methods are designed to assist researchers in understanding phenomena in context*" [27]. The qualitative research uses empiric investigation for understand a phenomenon in a real life context instead of measure a particular aspect. They can capture in a text what someone (or a group) has said, believed, done, or researched about a phenomenon, an event or a subject.

Recker [27] consolidated a number of characteristics of qualitative methods. It has a *natural setting* characteristic because it´s performed in the field, i.e., studied in the context in which it occurs. As a state-of-art analysis, this research was conducted in the context of the BPM practice. Another characteristic is that the *researcher is a key instrument*, often through face-to-face interactions but even through other means like observing behavior, studying documents, or interviewing participants. This is in consonance with the main issue of this research, BPM, which has its efforts mainly carried

out by people. *Multiple sources of data* are another characteristic. The source of this research can be classified, materially, as a text (oral) data. However, since the focus group has participants with different roles in the organization, formally, we have multiple source of information. It is an *inductive analysis* since the "*qualitative methods emphasize a bottom-up analysis of data"*. They *focus on emergent meaning*, to learning the meaning that participants have about a phenomenon. It has an *evolutionary design* characteristic, when the research plan can change in time through the evolution of the research. Often it is *interpretive*, researchers develop interpretations of the data they collect and analyses, hence, the interpretations are subjective. Finally, it has a *holistic and contextual* characteristic because the qualitative methods are designed to help researchers in developing a comprehensive picture of a complex phenomenon. Summarily, all the characteristics presented by Recker [27] are in conformance with this part of research.

Recker [27] also explained the epistemologically difference between the qualitative and the quantitative research. From a qualitative perspective, the best way to study a social reality is through subjective interpretations within the socio-historical context. From a quantitative perspective, the reality is independent of the socio-historical context and can be isolated and studied objectively. Hence, to explore the state-of-art issue, the socio-historical context is important and from also an epistemologically definition the qualitative perspective remains the best choice to this evaluation and justifies this research´s methodological approach.

In particular, the focus group study is conducted by researchers selecting and gathering the participants based, for example, in his personal experience to discuss and comment the topic that is the subject of the study [48] [22]. Morgan [49] defines focus group as "*a research technique that collects data through group interactions on a topic determined by the researcher*".

In this part of the research, we used the focus group research method as an exploratory study [58] aiming that it can be a starting point for the development of a survey instrument or to analyze critically any type of quantitative instrument [50] [51] [52]. Another useful issue of this method is its capability of the exploration of a consensus on a given topic [50] .

As a qualitative research, the focus group has, for example the weakness of the low generalizability due the small numbers of participants. However, in comparison with other qualitative instruments like interviews or observations, it has the strength of

the capability of gaining larger and richer information in a short period. Moreover, it has the capability of discovering new insights by the interactive nature of the group setting. Each participant has a background and reacts during the discussions not only by this background but also by the other´s experience. Hence, new insights and issues can emerge that might not have been planned by the researchers [52].

6.2.2 Designing the Focus Group study – Who, when, where?

To plan and design a qualitative research it is important to observe that, unlikely the quantitative research that relies on random sampling, the qualitative methods relies on purposive sampling, i.e., cases are selected based on particular properties of interest [27]. Moreover, one aspect is the focus group number of participants. Morgan [49] states that should consist of 4-6 participants. However, it can vary from 3 to 12 participants, for example [49] [52]. Smaller groups have a high level of participant involvement and they are good, for example, with emotionally charged topics. Larger groups have low level of involvement and they are good for neutral topics [59] [52].

Indulska et al [22] didn´t identify the number of participants of each of four focus groups but as the total number of participants, the research reached 27 participants. Regarding the purposive sampling properties of qualitative research and aimed to obtain a representative data set, the focus group research carried out by Indulska et al [22], also presented at Chapter 2, were conducted in different states and the participants were selected from a diversity of organizations. Table 6.3 presents Indulska et al demographics of the focus group participant.

Table 6.3: Participating organization demographics [22].

Industry Sector	Perth	Brisbane	Sydney	Totals
Government	0	1	0	**1**
Finance, Banking & Insurance	1	1	1	**3**
Resources	4	1	0	**5**
Utilities	0	2	1	**3**
Consulting	3	1	2	**6**
Other (e.g., ICT)	3	0	0	**3**
Totals	**11**	**6**	**4**	**21**

This part of the research also observed those aspects, i.e., number of participants, sector and region. However, the main difference was the decision to base the research not focusing the organization but focusing at the professionals. As a first research with this approach in Brazil about BPM, at our best knowledge, focusing at the professional instead organizations could provide insights about another BPM practices and comparisons with past situations through the professional experience. Table 6.4 presents the demographics of the focus group participants in this research.

Table 6.4: Participating professional's demographics.

Industry Sector	Rio de Janeiro	São Paulo	Totals
Government	3	1	**4**
Finance, Banking & Insurance	0	3	**3**
Resources	2	0	**2**
Consulting	2	1	**3**
Other (e.g., ICT, Health)	0	1	**1**
Totals	**7**	**6**	**13**

The study was planned regarding the qualitative saturation aspects. First, the focus group literature points that at least two groups should be conducted [60]. Second, the variation through professionals sectors' experience and through region should bring new findings, otherwise, the saturation was reached and the qualitative process could be finished. Saturation is an epistemological instrument that defines when to stop the observations, i.e., new observations cannot provide new properties of the object under investigation [61].

For example, in the from the first focus group session to the second session new properties, i.e., issues were observed. However, from the second focus group session to the third session there was less new issues. Finally, in the fourth focus group session, no new issues were perceived, only the reinforcement of the issues that were already perceived. Table 6.5 presents each focus group composition.

Based on these aspects, four focus group studies were conducted in 2015. Three in July and one in September. Two of them at Rio de Janeiro city and the other two at São Paulo city. Thirteen professionals have taken part at this study. One important remark is that Rio de Janeiro and São Paulo are the cities that have the two largest Gross

Domestic Product (GDP) of Brazil[17]. Another remark is that both the public sector and the private sector should be covered. It was important to observe that, not only because of their inner differences, but also because previous qualitative research [26] [25] mentioned at Chapter 2, bring different findings. Table 6.5 details the participants demographics by sector and region of each focus group conducted.

Table 6.5: Detailing participating professional's demographics by each group.

	Rio de Janeiro	São Paulo	Totals
	15/07 – 17/07	30/07 – XX/09	
Industry Sector	Group 1 - Group 2	Group 3 - Group 4	4 Focus Groups
Government	0 - 3	1 - 0	**4**
Finance, Banking & Insurance	0 - 0	1 - 2	**3**
Resources	2 - 0	0 - 0	**2**
Consulting	1 - 1	1 - 0	**3**
Other (e.g., ICT, Health)	0 - 0	0 - 1	**1**
Totals	**7**	**6**	**13**

6.2.3. Conducting the Focus Group study – How?

Kontio et al [52] presented a summary about the conduction of focus group sessions. Usually it takes 2-3h and has a predefined schedule and structure. The number of issues needs to be limited to allow the participants to comprehend the issues and to have a meaningful discussions and interactions. They recommend, for example, that the session needs to be initiated by an introduction where the goals and rules are explained to participants.

It was observed that Indulska et al [22] research has the characteristics mentioned by Kontio et al [52]. They developed a semi-structured protocol to guide their research with limited issues and they initiated with an introduction. The protocol is presented in Table 6.6. For Indulska et al [22] the semi-structured protocol is also important because when planning multiple focus group sessions the protocol allows the researchers to follow the same structure and format for each focus group session. More-

[17] http://saladeimprensa.ibge.gov.br/noticias?view=noticia&id=1&busca=1&idnoticia=3038

over, it helps to reduce gaps in the understanding of BPM influenced by the wide-ranging backgrounds and foci on the part of the participants.

Table 6.6: Focus Group Protocol, from [22]

Agenda Item	Allocated time (minutes)
Welcome and Introductions	5
Motivation and Importance of the Study	10
Brief Presentation on BPM	10
Data Collection session	
Q1. What is the role of BPM in your organization?	10
Q2. What are the main BPM issues you face?	30
Q3. Which of the issues are most critical?	30
Wrap up	5
Total Time	**~2 hours**

The main difference in the focus groups conducted in the current research is that it was used a professional perspective, not an organizational perspective. Hence, this research also partitioned the focus groups in parts and followed a protocol based in the Indulska et al´s protocol [22], but with adaptations. The sessions also started with welcome, introduction and motivation, but without the "*Brief presentation on BPM*", once the participants were preliminary selected based on their experience with BPM practices. Sessions also finished with a wrap up. The major adaptation, however, is at the main part, the Data Collection. In this research, it was divided in two main questions adapted to the professionals' perspective instead the organization perspective:

Q1. What is your previous and actual experience with BPM?

Q2. What are the main BPM issues you face?

The third question of Indulska et al [22] research could appear during the final part of the focus group session conducted in the presented research. However, the main objective of the third question of Indulska et al [22] research, which is to categorize in most critical issues, was not presented by their research. Hence, we planned the sessions without this question. Table 6.7 presents the planned protocol

Table 6.7: Brazilian Qualitative Analysis Focus Group Protocol

Agenda Item	Allocated time (minutes)
Welcome and Introductions	5
Motivation and Importance of the Study	10
Data Collection session	
Q1. What is your previous and actual experience with BPM?	20
Q2. What are the main BPM issues you face?	40
Wrap up	5
Total Time	**~1,5 hours**

A final remark about the planning ("who, when, where") and the data collection ("how") is that there was a commitment with the participants to not reveal their details or their organization details due to confidentiality and ethical reasons. With that commitment, the participants allowed the audio record of the sessions to further analysis and the moderators could work only in the conduction of the sessions and take notes.

6.2.4. Data Analysis

As the each focus group session was completed, the main findings were summarized. All sessions were transcribed and analyzed using the qualitative data analysis tool NVivo 11.0 Starter version. The data analysis of the focus group sessions was initially planned to use the Grounded Theory approach [62]. The NVivo[18] tool would be used to capture details of each issue.

However, after the initial analysis of the first focus group session it was perceived that almost all the codified issues of the first focus group are present on the research conducted by Indulksa et al [22], Bandara et al [23], and Sadiq et al [24]. It should be remarked that, during the sessions, the mediator did not make any reference to those issues. Due to that perception, the data analysis was first made regarding all the previous codification and, in a second moment, the Brazilian particular issues were codified.

Table 6.8 presents the issues observed in those previous researches and extracts that demonstrate definitions or exemplifies how the issue was reached. As the previous research divides the issues in Strategic (S), Tactical (T), or Operational (O) issues, the issues are presented in the table in that order. Moreover, the similar issues are presented next to each other. The exception of this order of division, i.e., fist the levels (strategic,

[18] http://www.qsrinternational.com/product

tactical and operational) and second the similarity, is the issue *Broken link between BPM efforts and organizational level* because this issue is similar and close to the issue *Lack of flow between strategic and operational directives,* but they were classified in different levels. Finally, to demonstrate that a same issue is part of different researches, the column 'Research' carries the references where the issues are part.

Table 6.8: Excerpts of Qualitative Analysis Focus Group Protocol, from [22]

Issues	Definition excerpts based on previous research	Research
Change Management (S)	*"Change management in organizations relates to devising a plan for introducing changes in the organization that the benefits to be obtained from the change can be maximized.... This situation includes difficulties associated with redefinition of roles and responsibilities, as well as redesign of reward mechanisms (Hammer and Champy, 1993)... Another problem identified within this domain is the fear of change by management due to common assumption that changes may be drastic and may potentially escalate beyond their control."*	[22]
Lack of Governance (S)	*"...Governance in general refers to the use of some form of authority in order to control and coordinate the different facets of operation... a recurring issue is the ownership and control of process across organizational units....Also, fitting into this umbrella is the management of the complexity of business logic"*	[22] [23] [24]
Lack of Top Management Support (S)	*"... changes that can be associated with BPM initiatives require strong support from executive and upper management... Evidently, lack of top management support clearly makes change management significantly more difficult."*	[22]
Lack of Nurture for Process owners (S)	*"Process owners, generally, do not have direct control over people in an organization, hence, they rely on influence and persuasion... need for nurturing process owners so that there is a level of cultural alignment within the organization – i.e. where there is alignment and good communication between people responsible for determining the goals required for the organization to be successful, and people who can deliver on those goals"*	[22]
Lack of employee buy-in (S)	*"Employee buy-in across an organization is negatively impacted by the lack of a common understanding of BPM. One reason for this is lack of awareness of what BPM is. Another reason is the wide range of views that exist of BPM.... This multiple perspective and lack of common consensus often creates confusion and disagreement on the benefits, expectations and deliverables of BPM... Organizational culture also plays a role in levels of employee buy-in...Another identified hurdle to employee buy-in is the common perception that BPM is about minimizing the employee-base... process automation and improvements do, in cases, result in minimization of the workforce. However, the employees' perception that this is commonly the case is due to lack of understanding of BPM benefits overall."*	[23]
Customer resistance (S)	*"Customer resistance was identified from two different angles. ...organizations that had successful BPM projects should make their success more widely known, both within and outside the BPM industry. Secondly, issues were raised regarding impact on organizational work practice and underestimation of change management challenges."*	[24]
Lack of understanding on process orientation (S)	*"Misconceptions on some of the fundamental principles of BPM were identified as a major roadblock in promoting (selling) the technology... Lack of awareness and understanding on process orientation was also associated with lack of education or systematic training regimes that (should) ensue from such technology uptakes...the association between workflow and BPM, and preconceived notions of one or the other and how this contributes to fuzzy understanding."*	[24]
Lack of common mind share of BPM (S)	*"There is a lack of awareness that BPM technologies can help, as well as a lack of consensus that a holistic BPM approach is applicable. One of the major inhibitors for this is the lack of consensus on what BPM is and what it can provide...There should be no gap between the bridge between organizational strategy and BPM efforts..."*	[23]
Lack of common mindset (S)	*"The lack of a common mindset is a lead up to the lack of understanding in process ... More often, customers were said to have a preconceived understanding, and new initiatives were somehow fitted into the existing mind set. A strong recommendation to overcome this problem was to promote a structured methodology."*	[24]
Lack of expertise (T)	*"... Lack of skills and expertise came up across all levels of the organization... some managers simply do not have the necessary training and exposure to possess the thinking of process. Most managers operate and think at the functional level.... Lack of ´technical know-how´ to lead to the lack of skills to implement BPM within organization."*	[22]
Lack of measurable returns (T)	*"The inability to estimate the financial benefit of BPM and the intangible nature of BPM.... Many organizations seem to be too cost-focused in the short term and would invest in IT instead of BPM because the former is more tangible and accountable with executives. ... This is further exasperated when various departments are in competition for funding".*	[22]

Lack of coordination (T)	*"… refers to, specifically, lack of inter-departmental coordination within organizations. The success of any cross-departmental BPM initiative depends on harmony between the involved departments".*	[22]
Lack of standardization (T)	*"Standards are specifications that are sanctioned by standard governing bodies or specifications that are widely accepted and used (de facto standards)… They hence play an important role in maintaining consistency within and across organizations and domains. In the space of BPM, standards support consistency and completeness of BPM solutions, and allow various departments within an organization to better communicate their processes"* [23] *"Lack of standardization of modelling approaches results in difficulties in correlating the processes across functional areas and across the enterprise. Various departments within one organization may be using different process modelling techniques - for example, flow-charting, activity diagrams, and so on."* [22]	[22] [23]
Lack of standard language (T)	*"… there seems to be a lack of well-defined semantics for process-oriented language… the lack of formal semantics has resulted in different interpretations by vendors of even the basic control of flow constructs… Lack of agreement on a standard modelling language is a major factor contributing to the success or failure of the BPM definitional phase… Both the interleaved issues of expressibility as well as notation are being debated."*	[24]
Weaknesses in process specification (T)	*"There is a difference between what could and should be usefully modeled and what modeling languages can actually support - this is a yet to be addressed issue. In light of using process modeling for process specification, organizations also often fall into the pitfall of over specifying their process, losing track of the bigger picture of the intended purpose of modeling…"*	[23]
Lack of BPM understanding (T)	*"Lack of BPM understanding, in particular shared BPM understanding, was repeatedly raised as a major issue in the Australian focus groups. This issue also encompasses problems related to the lack of understanding of BPM benefits, lack of credibility of departments that propose BPM initiatives, as well as the large gaps in understanding of BPM between the employee and the executives at management levels…"*	[22]
Lack of BPM education (T)	*"Past BPM success studies have directly stated the importance of appropriately skilled personnel and BPM education for successful proliferation (Grover et al., 1998; Larsen and Myers, 1998; Murphy and Staples, 1998; Ketinger and Teng, 1997). However, many years after identifying this need, lack of appropriate BPM education is still a topic that is raised as a perennial issue by the experts."*	[23]
Lack of visibility (T)	*"The lack of visibility of BPM within an organization appears to be a factor for the lack of shared understanding of BPM and the lack of understanding of potential benefits. The lack of visibility is particularly observed in organizations where BPM is driven by IT rather than by business. It also seems to be connected to the lack of a designated 'BPM champion' within an organization. In general, one would expect that organizations with low BPM visibility experience a whole range of issues related to difficulties in persuading management about BPM benefits, as well as difficulties in changing the organizational culture."*	[22]
Lack of performance measures (T)	*"Lack of appropriate performance measures, for both processes as well as executives and staff members, and a lack of linkage to organizational strategy are seen as a big issue for organizations wanting to engage in BPM initiatives…"*	[22]
Lack of progress in process maturity (T)	*"…In essence, the question remains whether the proposed maturity models are correct in indicating that an organization can only progress one step at a time – hence a need is highlighted for more illustration of such models."*	[22]
Lack of lifecycle management (T)	*"… any BPM undertaking is a continuous and incremental process that needs to be governed by systematic lifecycle management… Lack of flow between strategic and operational aspects of the organization is linked to this point. Particularly in dynamic environments, the propagation of changing business process models into the executable artefacts of the organization's technology infrastructure is a significant challenge, and often the source of this disconnect."*	[24]
Lack of clear starting point (T)	*"… the lack of understanding of where to start and what to do first in a BPM initiative… Furthermore, even though there are a large number of BPM methodologies available, these seem to exist in isolation and there is no one guiding methodology on how to conduct holistic BPM in the organization… As a result, these tend to be ad-hoc and consequently may not produce the best results."*	[22]
Difficulties in identification of processes (B)	*"… a common cause of difficulty when implementing the software involves management's understanding of its own business process (Keller and Detering 1996)… "as many companies get ready to implement standard software, they encounter the problem of how to simplify and model the enormous complexity of their business processes" (Keller and Detering 1996)… difficulty in identifying firstly what the key processes are (see also lack of flow between strategic and operational directives) and secondly articulation of end-to-end processes…"*	[24]
Lack of linkage with external business partners (T)	*"Balancing the 'inside-out' view of process management within an organization, together with an 'outside-in' view is considered to be an important, yet risky activity. Essentially, the customer-driven view of process management should be balanced with the "business, financial, cost reduction" inside-out approach to process improvement…"*	[22]
Lack of methodology (T)	*"…that there is no reliable holistic methodology that guides the BPM projects end-to-end… there is a need for an overall encompassing methodology that addresses issues such as BPM project scope management, appropriate tool and technique selection in BPM projects, a way to maintain performance measures and overall project flexibility."*	[23]
Lack of standard	*"Lack of standard methodology within organizational contexts for the uptake of BPM as a management*	[24]

methodology (T)	*approach and subsequently within technology infrastructures, results in substantial 'pain points' and unnecessary 're-inventing-of-the-wheel' situations... The move towards such a standard methodology is a significant challenge due to the diversity of contexts that surround business process design and enactment..."*	
Broken link between BPM efforts and organizational strategy (S)	*"BPM management should be a holistic approach... There should be no gap between the bridge between organizational strategy and BPM efforts; ... I see a lot of bottom up projects but no way to tie that all into an overall business strategy or process strategy of the organization... BPM experts have also expressed a major concern with the problem of policy management, policy match making and service agreement..."*	
Lack of flow between strategic and operational directives (T)	*"A gap was identified between the strategic objectives and operational practices, which was undermining BPM benefits. This lack of flow within the organizational hierarchy can result in inappropriately positioned BPM investment... Solutions where there is a disconnect between the two will only provide limited benefits as strategic objectives determined in process design may not be effectively controlled and monitored through a process enforcement technology."*	[24]
Perceived gaps between process design and process execution (O)	*"In the current market, the tools for BPM are relatively fragmented. Different vendors specialize in different aspects of the BPM lifecycle, and often, due to a lack of standards, activities completed in one phase with one type of tool do not translate to the next steps of the lifecycle (which may use another type of tool). This is in particular visible between the process design (process specification/ requirements engineering phase) and the process execution phase."*	[23]
Lack of tools for holistic BPM (O)	*"... lack of end-to-end tools to manage business process management itself as being a major issue faced by organizations... It is, however, a well-accepted fact that BPM, in order to be successful, requires a holistic approach (Burlton, 2001)... This issue, in terms of lack of methods, also relates to the lack of methodologies or guidance for holistic BPM in organizations, i.e. methodologies that effectively allow organizations to move between strategic, design, execution, and monitoring aspects of BPM."*	[22]
Lack of tool support for process visualization (O)	*"Process visualization is a core element within BPM projects, and this is often achieved with a series of as-is and to-be process modeling tasks. Process modeling is an approach for visually depicting how businesses conduct their operations by defining the entities, activities, enablers and further relationships along control flows (Curtis et al. 1992; Gill 1999). It is widely used to increase awareness and knowledge of business processes, and to deconstruct organizational complexity (Davenport, 1993; Hammer and Champy 1993; Smith and Fingar 2003). The visualization of business processes in the form of process models has increased in popularity and importance, and appropriate tool support is a critical success factor for successful process modeling (Bandara et al, 2005)."*	[23]
Lack of technology capability (O)	*"... an underlying goal of the definitional phase of BPM is to eventually provide process control and monitoring through the organization's technology infrastructure. The issue of technology capability relates mainly to the existence in organizations of legacy systems that need to be incorporated in the BPM initiative... There is evidence of success in this regard from investments in web services technologies... SOA investments are known to be large with little immediate returns. BPM solutions must provide plug and play functionality for both legacy as well as service enabled applications if organizations are to reap the true benefits of BPM..."*	[22]
Miscommunication of tool capabilities (O)	*"It is a common problem that many users are not aware of the full functionality of the tool(s) that they have purchased. Tool vendors and consultants have been scrutinized for providing incomplete details of the software and/or misleading information..."*	[23]
Difficulties in use of product functionality (O)	*"Several vendors also identify incorrect usage as a deterrent in best use of their solutions. This was attributed to lack of training, preconceptions on product functionality or misfit of business requirements."*	[24]
Lack of process monitoring (O)	*"Benefits ensuing from a large and often costly move towards BPM must be clear and evident. However, a lack of process monitoring capability will dampen such benefits and threatens to compromise strategic initiatives towards process orientation. This issue is closely tied up with technology capability to provide process enforcement at the operational level. An essential pre-requisite to process monitoring is the introduction of technological support for process control, so that processes designed at the strategic/tactical levels are aligned with the processes actually enacted at the operational level..."*	[22]
Lack of integration (O)	*"... It encompasses problems with breaking system and departmental silos, a lack of multiplicity of views of processes within the organization, and lack of linkages to other processes... This situation also contributes to a lack of integration of various processes across the organization, for example, financial and cost management processes... At the technical level, lack on integration manifests itself through the difficulty in interoperation between enterprise applications."*	[22]
Difficulties in integration (O)	*"... benefits of BPM are closely connected with process enforcement through controlling and monitoring enterprise applications and service dependencies."*	[24]

6.2.5. Focus Group Research Findings

This session presents the raised issues. First it will be discussed the issues that was not presented. Second, as a matter of comparison, it will be presented the issues

that are cited in this part of the research and are cited in the three previous qualitative researches [22] [23] [24]. In that case, besides the presentation of the issue, as seen in Table 5.8, some participants' quotations will reinforce the presence of the issue in Brazilian state-of-practice scenario. Finally, third, it will be presented the issues that appear only in the Brazilian state-of-practice scenario also with participants' quotation.

6.2.5.1. Issues that are in previous researches that were not perceived in Brazilian State-of-practice in 2015.

Lack of Integration and *Difficulties in integration*

This issue was also identified in Indulska et al research [22] is quite similar to the *Difficulties in integration* identified in Sadiq et al research [24]. However, the second one is closer to technologies issues. It is possible to observe in Table 5.8 that it is reasonable to classify the second issue within the first one.

In the present focus group research, both issues were not perceived as a BPM issue. Moreover, it was possible to collect information that this used to be a problem that is not present anymore. Since the last focus group was the one where the saturation was observed, it was the opportunity to stimulate such verification saying "*at the beginning of system deployments the finance person did not want to give the data for the marketing person.*" Immediately, all the participants agreed when one said "*Today is more integrated*".

Lack of Performance Measures

This issue was also identified in Indulska et al research [22]. In the current focus group research, the issues were not perceived as a BPM issue. Unlikely the *Lack of Integration* and *Difficulties in integration*, it was not necessary to collect information that this is not an issue for the focus group participants through statements that show that the performance measures should be "*obviously"* collected during the BPM practice. For instance, one participant explaining about how they are working today: "*… we are using Lean a lot to understand exactly what we have, where we want to go and how we will. In addition, you have to go based on numbers. You should have metrics about things there. How are you doing this today? How long it takes. How many percent are? What do you want to achieve?*"

Lack of Standard Language

This issue was also identified in Sadiq et al research [24]. This current focus group research, seven years after the Sadiq´s research, it remarkable how BPMN has been removing this issue. In a scenario of choosing a BPM solution one focus group participant remarks "*Can you export directly to BPMN? …no? I disqualify this vendor."*

Miscommunication of tools capabilities

This issue was also identified in Bandara et al research [23]. However, in this research this issue was not perceived. It is remarkable that none of the participants has experience with process mining tools or process reuse tools.

In all focus groups, there was opportunities to verify if the participants have already worked with this kind of tools or even with the concepts. The conclusion is that they only have experience with process modelling and process execution tools. Moreover, in this scenario with only two kind of BPM tools, it was not only perceived that this issue used to be a reality in the past and it is not a problem in 2015 but also that is important to separate BPM concerns from IT concerns. A statement that shows this reality change is like that one "*… and people, I think they bought, or created the false idea that if I buy this software it will work. Silly, does not"*.

Difficulties in use of product functionality

This issue was identified in Sadiq et al research [24]. This research perceived that the product is not an issue for Brazilian´s practitioners. Many tools were cited (e.g., SAP, Business Studio, Bonita, ARIS) and there was not even one complaint about any tool. Moreover, there was evidence at using the tools capacity adequately. For instance, use the SAP to ERP issues or, in a tool evaluation experience, a participant explain, *"Bonita was chosen by its modelling and process engine capacity"*.

Lack of Progress in process maturity

This issue was identified in Indulska et al research [22]. In this previous research this identification was not clear, i.e., they affirm that it is an issue, but at the same time, they say that the focus group participants "*are unsure of the capability of maturity models in general"*. Moreover, contradictory as an identified an issue by the participants, there is a doubt about the issue stated by the authors as *"…the question remains whether*

the proposed maturity models are correct in indicating that an organization can only progress one step at a time".

In this current research, this issue is apparently not yet perceived in the state-of-practice. Maybe in the future, the perception of the need of a BPM maturity model, step-by-step, to evaluation of the progress could be perceived. This possibility can be noted when a focus group participant thinking a step-by-step BPM and related this to the progress of the BPM initiative: *"… then you have to move two step forward, and nothing move. Because you have to move toward the human dimension, delivery results, move toward costs and people don´t discuss that… they only do diagrams."*

6.2.5.2. Issues that are in previous researches and that were perceived in Brazilian State-of-practice in 2015.

The issues presented in this subsection are presented in Figure 5.1. They are distributed by the fourth focus group (1, 2, 3, and 4) and the vertical is the sum of the references for each codifications. The graphic is ordered by the sum, i.e., the lack of employee buy-in was the most perceived and referenced issue and the weakness in process specification is unless perceived and referenced. As a qualitative research, it is not possible to determine exactly quantities but it is possible to have insights about the importance given to some issue or other issue.

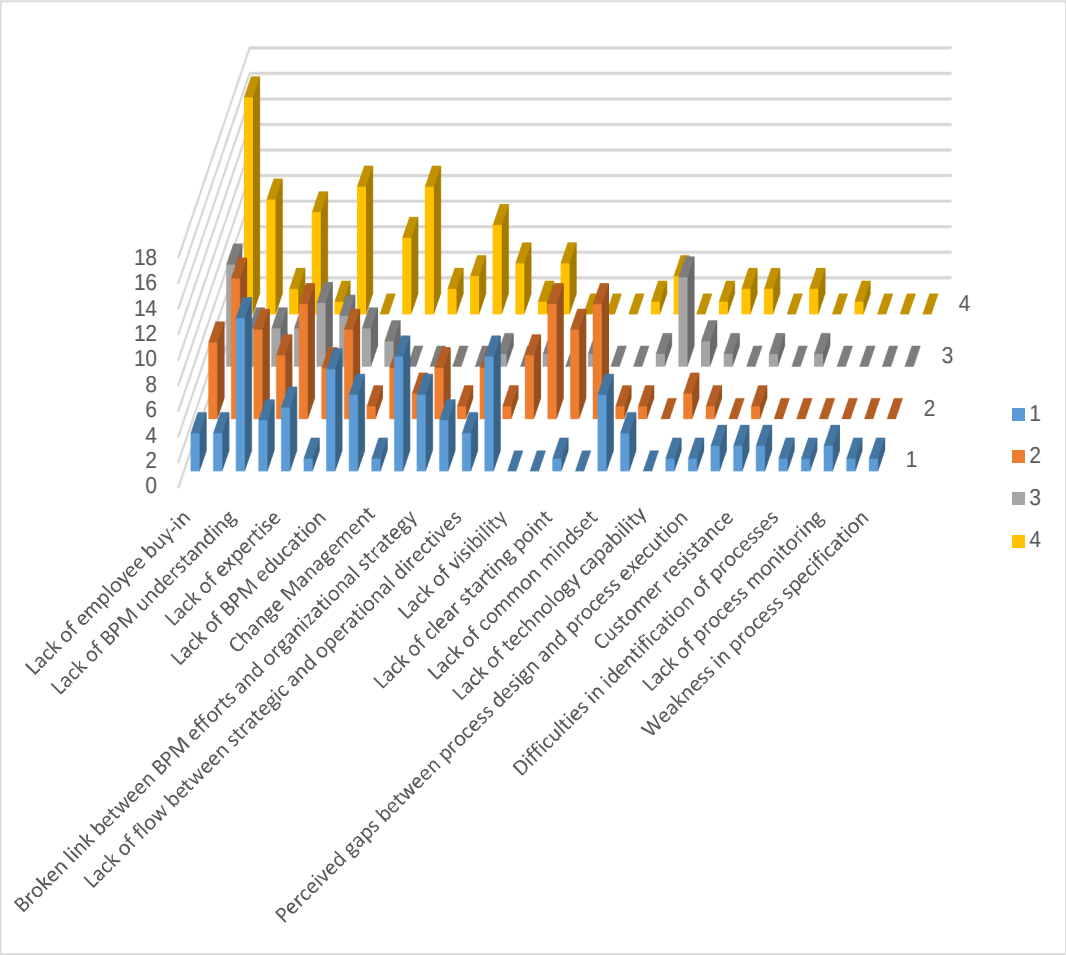

Figure 6.1. Issues that are present in both previous researches and current research distributed by focus group and ordered by the sum of references perceived.

Change Management

This issue was also identified in Indulska et al research [22]. It was perceived in this categorization difficulties associated with redefinition of roles and responsibilities were identified. During one of the focus group session, it was perceived this difficulty occurring in the top management an in the minor functions.

A consultant pointed this difficulty: *"So, I started with the board of administration area. I presented a new organizational chart, with restructuring. They agreed to do and we did an interview with each of the employees to say, "Look, this is the new vision" and "we want you to do this part, you do this." They had people who wanted and had people who did not. So the choice of them was".*

Then, further, in the same focus group session one member of Top Management talked about some managers during a restructuring: *"The manager said 'Oh no, here you cannot move. You cannot change this position in the department because you do not*

move in my department'. So, not only employees. The managers itself also has this resistance".

Moreover, not only in the definition phase or during the enactment but also after the change this issue is identified as a challenge. For instance, to maintain the process or even to improve the process. "*We still have some support issues of this improvement in long term. Sometimes the plan is implemented, the improvements come into operation, but the indicators are accompanied in waves, cycles and, then, the manager stop the measures.*"

Lack of Governance

This issue was identified in the three previous researches [22] [23] [24]. The classified issues in a BPM perspective are related to ownership and control of process across organization. Previous research exemplifies: "*who has influence over the solution and how to best implement it, and who will provide required services. Also fitting into this umbrella of issues is the management of the complexity of business logic".*

This issue was identified with many examples in all the focus groups. For example, the complexity of an organization that is composed by dozen of enterprises: "*but we have more complex projects and our approach is actually over a few months, then the management that involves companies, involves several areas of each company.*"

Another issue was about changes in top management. The lack of governance results in a discontinuity of the process enactment after the change. "*There was a project that we implemented in two areas and in the middle of the project, the manager changed. Then, everything went wrong!"* In public organizations, this kind of problem seems to be amplified: "*…here in Brazil has this issue. When government changes, managers change."*

Moreover, within public organizations, it is possible to observe the lack of governance, i.e., the managers cannot control the team: "*And the difference from private organization to public organization is that the top management, in a public organization, don´t control effectively the team".* However, it´s remarkable that due to that situation it is not abnormal to hear something like that: "*Because the top management, in a public organization, is the one who has the minor comprehension about the strategy of the organization… but is the person, the employee, who is playing the true strategy objectives of the organization".*

Finally, there is also lack of governance about the IT solutions of a national subsidiary within an international organizational. A focus group participant complained about the impact of an IT solution discontinuity decided by the main subsidiary: *"The licenses are global. I don´t buy the licenses here. According to the decisions they take, everything changes. It´s a huge impact. Because then, people think it is just turn the key."*

Lack of Top Management Support

This issue was also identified in Indulska et al research [22]. Indulska et al´s research also perceived a link between this issue and the change management issue. In this current research, this issue was also perceived in all focus group sessions. Moreover, besides this issue, one participant perceived that for super functional organizational based on hierarchy the change management problem related to the lack of top management support is amplified. "*In our organization it´s is more serious, because it´s very functional*".

One participant resumed the symptom: *"Then they will continue delivering nice results, animators, but apart from a very symbolic change…"* A consultant also complained about the bad result in a project without the top management support: "*Look… who was in the top management, buy-in? It worked. Management area pushed, without whose support from who is in the top management? The value chain, lackluster. It was only for showing… we left the organization with people hating us*"

Lack of Nurture for Process Owners

This issue was also identified in Indulska et al research [22]. In this current research, this issue was also perceived in all focus group sessions. Participants recognized the importance of a process owner in the BPM efforts within organizations. "*Because if a manager does not have to face really leading the process improvement, it does not occur"*. However, for some participants the need of nurture of this process owner is a quite new issue and as it was identified in Indulska et al research [22], they have to be trained. *"So it's something we've been discussing more recently, over the last month, it is to seek this training, this support to the manager*".

Lack of motivation, probably related to the lack of a direct link with the organization strategy, was also perceived. "*People do not see, do not treat it, and do not lead*

this process in the search for adequate performance or as the strategic intent of the organization". In Indulksa et al research [22] it was called as *cultural alignment.*

Lack of employee buy-in

This issue was also identified in Bandara et al research [23]. In this current research, this issue was also perceived in all focus group sessions. As mentioned before, inside the change management issue, there is a problem perhaps linked with the lack of BPM understanding that leads to the difficulty stated by the consultant: *"So, I started with the board of administration area. I presented a new organizational chart, with restructuring. They agreed to do and we did an interview with each of the employees to say, "Look, this is the new vision" and "we want you to do this part, you do this." They had people who wanted and had people who did not. So the choice of them was"*.

The participants of Bandara et al research [23] associated this issue also to the middle management. This research finding some evidences related to the lack of the middle management buy in and also related and presented at the change management issue when a member of Top Management talked about some middle managers: *"The manager said 'Oh no, here you cannot move. You cannot change this position in the department because you do not move in my department' So, not only employees. The managers itself also has this resistance"*.

Another sub issue related to the lack of buy in present in Bandara et al research [23] and also perceived in this research was the common perception that BPM is about minimizing the employee-base. "*… this thing is done to lose my job… the guy say that will automate the process… putting a little robot and will do everything I do…"*

One sub issue that was categorized here and does not appear in previous researches was taking care to not minimize the function that someone played for many years. "*And you come and say that what you did in the las ten years is wrong… The person really sees undervalued"*.

Customer resistance

This issue was also identified in the Sadiq et al previous research [24]. For Sadiq et al research [24], there was two different angles. The first one is similar to the visibility issue of the Indulska et al research, i.e., organizations should make their BPM successful projects widely known, inside and outside the organization. The second one is the underestimation of change management challenges.

In this current research, this both angles were also identified. Related to the need to make BPM successful projects widely known, a participant states: *"Sometimes we have to act even like a market operation!"* Another identifies the symptom when this issue is not threated: "*However, they have trauma of things that do not work out…*"

Related to the second sub issue, some participants recognizes this issue, and are somehow addressing it. For instance, some participants talked about lessons learned specific related to internal underestimation the customers of the process when there is a process automation: "*That was our mistake in the development of the project. We should have done, should have done a simulation. At least one screen mockup"*.

Lack of understanding on process orientation

This issue was also identified in the Sadiq et al previous research [24]. This issue is quite similar to the Lack of BPM understanding, Lack of common mind share of BPM and Lack of common mindset. At Sadiq et al research [24], remarks this is "*misconceptions on some of the fundamental principles of BPM"*. Moreover, *"even in implementation initiatives as where organizations were already undertaking BPM, vendor had difficulties in helping them achieve best value from investment"*.

This issue was also identified in this current research. A focus group participant that has the role of BPM consultant views this issues like the vendors in Sadiq et al research [24], i.e., he can´t help their customers and "*there is other BPM´s consultant organizations that even achieve the existence of some fundamentals"*.

It´s remarkable that in this current research, the same phenomenon identified in Sadiq et al research [24] occurs, i.e., *"as a positive outcome of BPM initiatives, it was note that the development of understanding of process orientation, and the discovery the whole process, and particularly the resultant explicit documentation was a significant outcome"*. In this current research, a focus group participant said: "*people become happy because they had never seen the process"*. However, after this statement, the lack of understanding on process orientations raises "*…then this don´t move to any direction. Then you have to achieve another dimensions, human dimensions, cost dimension, positive outcomes"*.

Lack of Common mind share of BPM

This issue was also identified in Bandara et al research [23]. In this current research, this issue was perceived almost in the same manner. At Bandara et al research

they stated that one of the major inhibitors for this is the lack of consensus on what BPM is and what it can provide. In this current research, for example, the question also raised in an extreme term: "*I´ve started to asked myself if BPM exists*".

Lack of common mindset

This issue was also identified in the Sadiq et al previous research [24]. This issue is quite similar to the Lack of understanding on process orientation, Lack of BPM understanding, and Lack of common mind share of BPM. Sadiq et al research [24] did not bring quotations to exemplify the question that brings the problem of new initiatives being fitted into the existing mind set. In this sense, this research capture evidences of this problem, i.e., the BPM initiative has to be adapted or modified to fit in the common mindset. For example, talking about implementation strategies that need to be adapted to the common mindset and the impact of this adaptation: "*it´s complementary to functional perspective and brings a lot of resistance and difficulty to operate. The value delivery is limited if you get restricted to it."*

Lack of expertise

This issue was also identified in the Indulska et al previous research [22]. In this previous research, they identify this lack of expertise across organization levels, including the top management. Managers think and operate at the functional level, inadequate management education, and complications combining BPM and IT, and lack of BPM know-how are sub-issues perceived in the Indulska et al research [22].

In this current research this issue was also perceived in all focus group sessions. Not only the lack of expertise was stated like "*The experience is very bad, being sincerely…*" but also that the organizations did not give the conditions to the manager or even employers: "*… if you think, the routine of the guy within a company, it takes her body. He did get better because before that, on his priority list, he has only 30 things*".

Related to BPM, in particular, some focus groups' participants were selected because they have experience not only in Rio or in São Paulo but also in other parts of the country. This participants identified not only the lack of expertise of the professional but also that there is even anyone to form new professionals. *"… we went to Sergipe… Espírito Santo, we don´t have. They don´t have the capacity. We have to provide education to all the professionals."*

Lack of measurable returns

This issue was also identified in the Indulska et al previous research [22]. In this previous research, they identify this as an inability to estimate the financial benefit of BPM and also the intangible nature of it. Moreover, they also perceived this difficult linked to the initiatives that bring benefits to more than one department.

In this current research, this issue was also identified in all focus groups. Sometimes in a super explicitly manner: "*Than, you start to ask yourself, what the outcome value is?*" The intangible nature also was mentioned: *"… the problem is that many people do not see the returns of that person (a member of the BPM staff)… that´s because the person does not bring the ready product that you can sell.*" It happens even when the professional knows to show the non-simple measurable benefits: "*the efficiency is hard to measure. Also the transparency.*"

Lack of coordination

This issue was also identified in the Indulska et al previous research [22]. In this previous research, they identify this as the lack of inter-departmental coordination within the organization. This current research also identifies this issue in all focus group sessions.

For example, like the lack of governance issue related to normative, sometimes you need the buy-in from an internal normative department: "*how to change the methodology, it was approved by the department.*" The owner of a procedure, for example, does not accept the change. In a hospital experience, a participant talked about the resistance of the director of an operational department that happens based on the lack of coordination, and also change management: "*Who said that the process department could change the procedure here?"*

Lack of Standardization and *Lack of Standards*

This issue was also identified in the Indulska et al [22] and Bandara et al [23] previous researches. In both research, for example, the need of a process modelling standard language are mentioned and BPMN, a new standard in 2007, was mentioned about its potential to help this problem. However, the standards and standardization are major issues itself, i.e., they hold not only the standard language modelling, but also the modelling approach itself, process monitoring, business rules etc.

This current research perceives that during the BPM initiative there is a search to methods that can help the process enactment. This lack of standard is putting the BPM in a negative perspective, i.e., the perspective that not deliveries results: "*…or I have a lean, six sigma, TQC, …, because they clearly delivery"*. Moreover, it was noted that the process model language standard should be differently aligned, for example, with the communication issue. In more than a focus group session the participants discussed about BPMN is good for technicians and they do themselves other solutions to communicate the model when they have to present the BPM issues of the organization from "*Power Points*" to "*… ludic diagrams"*.

Weakness in process specification

This issue was also identified in Bandara et al [23] previous researches. In these research, the issue is presented starting with the importance of a process specification (e.g., to avoid information islands), then addresses the over specification and the experts of the research suggests to model in different abstraction levels.

This current research perceives that this occurs as mentioned in the last issues, lack of standards and standardization. In more than a focus group session the participants discussed about the need to have more than one abstraction level to represent the model "*Power Points*" to "*… ludic diagrams"*. Moreover, to take this conclusion, it´s important to relate it to a context of lack of expertise or lack of BPM education, i.e., is not only a problem of lack of standards or lack of standard language. An over specification sub issue, for example, can be seen as a weakness in process specification like the lack of specification.

Lack of BPM understanding

This issue was also identified in the Indulska et al [22] previous research. In their research this issue is related to problems like lack of understanding of the BPM benefits, lack of credibility of the departments that propose BPM initiatives and gap of understanding of BPM between the employee and the executives at management levels. Moreover, they also related this issue to breakdowns in communication channels, employee´s roles within these processes, and difficulties in identifying what are the actual problems. To finish the presentation they also showed two examples of this confusion such as people considering BPM and Six-sigma the same thing and managers considering having ARIS as having BPM in organization.

In this current research, many of these aspects were also perceived. For example, the viewpoint that BPM is similar, almost the same thing, to quality methodologies like Lean: "*we need to invest in the support of the managers with the Lean practice*". Another example is the lack of understanding of the BPM benefits: "*there is no discussion about demand and capacity in process management*". It was also identified the difficult in identifying the actual problems and employee´s roles within the processes in a context initially good for BPM initiative, i.e., where there is employee buy-in: "*… many time people give good ideas but about things that you already tried to implement four or five years ago. You know, the illusion of "… and if we do that"… you note that the employee don´t have know-how in his domain"*.

Lack of BPM Education

This issue was also identified in the Bandara et al [23] previous research. In their research this issue is related to problems like lack of appropriate BPM education, e.g., a in a MBA education in US, according to the participants, you do not hear 'process'.

In this current research, this issue was even perceived as an entrepreneurial opportunity. "*The market… it is a moment of commercial opportunity to enter and start to former many people in BPM*". As also mentioned, in some regions in Brazil there are even no people able to provide capacitation: "*… there is no capacitation in processes. Neither teachers, neither people that was formed, neither a course, neither a consulting organization selling courses"*. It´s important to mention that the region that the participant used as an example is a metropolitan region with almost 900.000 habitants and with a GNP (gross national product) in 2014 of R$14,8 billion. In dollar, in 2014, this value was around U$6billion.

Lack of visibility

This issue was also identified in the Bandara et al [23] previous research. They discussed this issue as a factor of the lack of understanding of BPM and lack of understanding of potential benefits. They also connected this issue to the lack of a designated 'BPM champion' within an organization. Moreover, low visibility leads to difficulties in the convincement of BPM benefits and in the change of the organizational culture.

In this current research, the focus group participants perceived this issue. To address this issue a group participant commented that they "*sometimes act as being at a*

marketing operation". It is remarkable that even the BPM initiative could start by attacking this issue: "*…what´s the best project that I have to do to BPM explode here?"*

The perspective cited above is from someone that works in a BPM consulting enterprise, i.e., this participant is an external person in the perspective where the BPM initiative is being conducted. However, even from an internal perspective, i.e., participants that are responsible to the BPM initiative in the organization and is an internal employee noted this problem: *"…we are always selling ourselves"*.

Lack of Lifecycle Management

This issue was also identified in the Sadiq et al [24] previous research. They discussed this issue in the context of the process improvement in a systematic, continuous and incremental process, governed by a lifecycle management. They state that this issue is also linked to the lack of flow between strategic and operational aspects of the organization.

In this current research, this issue was also identified as relevant. The participants identified that the lack of the lifecycle management and the non-continuous process brings a "*cycle of achievements and disappointments*". The rupture of the continuous process improvement is a concern for the participants: "*…we have some questions about the support of this improvement, in a long term."* Moreover, the lack of lifecycle management can result in a step backward: "*if you don´t create a culture of review… it begins to get lost in time."*

Lack of Clear Starting Point

This issue was also identified in the Indulska et al [22] previous research. They discuss this issue in the context of a relative immaturity in BPM with doubts like where to start and what to do first in a BPM initiative. The availability of a large number of BPM methodologies and the lack of a guiding methodology are also related to this issue.

In this current research, this issue was also identified. For example, to explore the state of art, it was also invited participants that are starting a BPM initiative and they start by a benchmarking with the conclusion that "*each case started the initiative; one different from the* other". Some experiences related started the initiative with courses to employees, other started by analyzing the company´s accounts, by the value chain- and so on.

Difficulties in identification of processes

This issue was also identified in the Sadiq et al [24] previous research. They discuss this issue from a vendor perspective. From this perspective, the right process identification is important otherwise the software is useless. They related this difficulty with the presence of many legacy systems that evolves with new functions. In this scenario, the organization has difficulties to identify the key process and the end-to-end process.

In this current research, this issue was also identified. However, the perspective was not related to the presence of legacy system, but related to a systemic view itself. The whole picture of the process in the business and organization context: "*…they don´t have a systemic view. The process is systemic. You have to think in the context"*.

Lack of linkage with external business partners

This issue was also identified in the Indulska et al [22] previous research. The researchers related this issue in aspects of 'inside-out' view and 'outside-in' view. They exemplifies by a balance of the customer-driven view and the cost reduction view, i.e., the process improvement should consider the balance of benefits to this more the one perspective.

In this current research, this issue was also perceived. It was already related to the difficult to measure some kind of return due the intangible nature of some of the BPM outcomes: "*the efficiency is hard to measure. Also the transparency.*" To balance this two kind of benefits, also with the intangible nature, issues like lack of coordination and lack of governance contributes to increase this problem, almost a decision problem. At the end, it results in difficulties to justify the investment in new BPM initiatives: "*I have the challenge to have my project approved… it is a strategic project, a global project involving people outside Brazil… I am working more than a year in this project"*. Asked, specifically about what are the challenges to reach the external partners, this participant answered "*I n the organization is the involvement of people*". Again, specifically, it was asked: "*even from the top management?"* and the answer was *"yes"*.

Lack of Methodology and Lack of Standard Methodology

These issues were also identified in the Bandara et al [23] and Sadiq [24] et al previous researches. The researchers related these issues to the lack of a standard methodology or a standard approach for the uptake of BPM within organization in terms of

management and in terms of technology. For both researches, the issues were perceived in a spectrum of an end-to-end approach and a holistic approach. The researches exemplifies as results of the lack of methodology an unnecessary 're-inventing-of-the-wheel' and the use of ad hoc specific methodologies like Lean or Six-sigma.

In the current research these both issues were also perceived. For instance, the use of Lean because of the lack of methodology and an the use of this approach, incorrectly, as an end-to-end BPM approach: *"…we are using Lean a lot to understand exactly what we have, where we want to go and how we will…"*. Moreover, it was already perceived this issue of lack of methodology in the aspect of the use of ad-hoc methodologies in this current research inside the issues lack of standardization and lack of standards: *"or I have a lean, six-sigma, TQC, …, because they clearly delivery"*. Other issues as the lack lifecycle management or as the lack of clear starting point are strong related to the lack of methodologies or standard methodology.

Broken link between BPM efforts and organizational strategy

This issues was also identified in the Bandara et al [23] previous research. They presented this issue related to a perspective of a BPM management as a holistic approach and without gaps between BPM efforts and organizational strategy. A concern with bottom-up approach is mentioned and another major concern with the problem of policy management, policy match-making and service agreement.

In this current research, this issue was also perceived. BPM initiative has difficulties to reach the top management and to verify the organizational strategy. "*It will pass through organization issues that is not present in the autonomy of the process practitioner*". Hence, it leads to an "*a separation between who make the organization strategy and the execution*". However, it is remarkable that it was perceived from participants in an organization with a successful BPM area and initiative that they have to control the work of other departments to avoid this broken link and "*to not work with crumb*".

Lack of Flow Between strategic and Operational Directives

This issue was also identified in the Bandara et al [23]. It is very similar with the last issue, the broken link between BPM efforts and organizational strategy. Although the link exists, the efforts do not reach the operation level. It was presented as research challenges like the use of tools in the strategic level, pitfalls of over analysis, and a lack

of effective pipeline between the process definitional phase and the process enactment phase.

In the current research this issue was also perceived. From many perspectives the flow do not occur. *"… it pass through do not communicate adequately the strategic vision, make it clears, stablish the goals… engaging and simultaneously charge the contribution of each unit to the results."* Moreover, many other issues already presented like lack of governance, lack of coordination, lack of expertise, lack of employee buy-in contribute to break or reduce this flow.

Perceived gaps between process design and process execution

This issue was also identified in the Sadiq et al [24]. One of the perspectives presented is the relative fragmentation of BPM tools in different aspects of the BPM lifecycle, particular between the process design phase and the process execution phase. Another aspect is that this fragmentation leads to a large amount of rework and even loss of information.

This issue was also perceived in this research. However, the perspective is strongly related to reach the execution, the enactment, by the employees and the departments. In this perspective, other issues like lack of expertise, lack of employee buy-in, lack of coordination contribute to keep this gap between process design and process execution.

Particularly related to the information technology perspective, like Sadiq et al research [24], it was perceived to sub issues that contribute to keep this gap. The first is the cost of the license and the difficult to justify the investment (lack of measurable returns). A participant, explaining the result after the decision of purchase a specific BPM System, exposes the reaction of the manager: *"Are you crazy, this license is a fortune!"*

The second one is the difficult of integration with other IT solutions, legacies. In the process design phase, much integration is desired. However, during the process automation phase you have challenges like technologies used by different systems (e.g. *"it was two different worlds, one in the mainframe, another using an integration layer in the middle…"*) or even with the lack or hard specification of these legacy systems (e.g. *"we have systems that do this query in four hundred different ways"*).

Finally, the third one is related to a kind of lack of discontinuity. This sub issue was perceived in more than one focus group and is related to the fact of some organizations that bought tools and that were paying for the software support but never used the

those tools that could help the BPM initiative. It was not possible to identify the root cause, i.e., if it was a purchase and discontinuity of an IT initiative or a BPM initiative.

Lack of tools for holistic BPM

This issue was also identified in the Indulska et al [22]. The perspective of this issue for the previous research is the lack of end-to-end tools to manage business process management itself. From this perspective, to the researchers, this issue is related also to a lack of methodologies or guidance for a holistic BPM approach, i.e., to allow the BPM initiative to move between strategic level, design, execution, and monitoring perspectives of BPM.

In this research, this kind of issue was also perceived. Although the process modelling aspect of BPM tools is well accepted for start a BPM initiative, the lack of a link between this kind of tool and a strategic view is perceived. It was also perceived that the tools and their semantics are fair enough to IT people, however, to the managers the lack of a strategic perspective is a problem: "*… the guy does not know how to read the flow… for someone from IT, it´s fine. However, to the management, they complaint a lot about the flows"*. Moreover, as reported in the previous research of Indulska et al [22] this issue is related also to lack of methodologies or guidance for a holistic BPM approach.

Lack of tools support for process visualization

This issue was also identified in the Bandara et al [23]. It is partially similar to the last issue, the lack of tools for holistic BPM. However, this is issue is specifically about the perspective of modelling, i.e., to help to describe the operations, increase the awareness and knowledge of the business process, and to reduce the complexity. The researchers presents issues about the visualization of process models that are too big, "monster diagrams". It is also mentioned the tools that try to reduce the complexity by breaking down the process, but it introduces new complexities, related to technology and process integration. The participants mentioned that the notations like BPMN, Petri Net and EPC do not delivery the promise of work in all abstraction levels.

In this current research, this issue was also perceived. Through the experience of a participant is possible to reach the user experience with BPM modelling languages: "*it has much complaint, especially in management areas. BPMN is bad."*

In the previous research a participant mentioned the visualization issue in that way: "*…It´s good for technicians and it´s good up to the process analyst but when you go into the business world then people don´t think in boxes and narrows"*. In this current research, it is the same sense of the speech of one of the focus group participant, also presented in the lack of tools for holistic BPM issue: "*… the guy does not know how to read the flow… for someone from IT, it´s fine. However, to the management, the complaint a lot about the flows"*.

Lack of technology capability

This issue was also identified in the Indulska et al [22]. The researchers relate this issue to the challenge of providing process control and monitoring through the organization´s technology infrastructure. Mainly, the authors relate this issue to the existence of legacy systems that need to be incorporated in BPM initiative. Moreover, they mentioned the importance of service-oriented architecture (SOA) to achieve loose coupling between the applications that could provide the connective of the activities that constitute the business processes.

In this current research, this issue was also perceived. Although the technology capacity of tools increased, it was perceived that this is still an issue in Brazilian scenario. For example, after the implementation of a system, the responsible for the initiative "*spend a good time seeing what people have missed*". In this scenario, they discover that customers "*moved to an Excel"*. This occurs not only because missing of capacities but also because "*the functionalities that we want assemble in the system took a lot of time or not happens"*.

For a participant, specifically, that had previous experience of being an owner of an application development company this problem is related to the "*production of technology in Brazil is very expensive"*. Moreover, the good developer "*he will work out, in another country"*.

Lack of process monitoring

This issue was also identified in the Indulska et al [22]. This issue relates the lack of process monitoring to impacts negatively the benefits of BPM like the strategic initiatives towards the process orientation. In this issue, they identified the need of technology support to verify the alignment between the designed process and the process in

run time; absence of adequately control of the monitoring, and the need of empower the process users to response in real-time to changing conditions.

In this current research, this issue is perceived as a need of empowering the process owner and the need to pay attention to indicators. Related to the technology capacity to provide process-monitoring solution, the focus group participants did not mentioned this need. Probably it is because, in majority, the Brazil scenario is yet related to the definition phase. Even the participants selected by their experience in the enactment phase also with automation, seems to present more challenges in the definitional phase then in the enactment phase.

6.2.5.3. Issues that are not in previous researches and that were perceived in Brazilian State-of-practice in 2015.

Dysfunctions of Bureaucracy and Culture in the public sector

An issue not identified in the three studies mentioned before [22] [23] [24] but is mentioned in a Brazilian qualitative study from 2011, [63] , is the bureaucracy and the culture in the public sector. It is strongly related to the public sector but it can be perceived also in the private sector. In this previous Brazilian research, although they collect a correct issue, i.e., the participants of their qualitative research presents a challenge that is in the right context, the categorization should be corrected because the problem is related to dysfunctions of bureaucracy, not to the bureaucracy.

The participants mentioned that "*although, people want to work, the "thing" works very slow because of the bureaucracies. It demands a lot of meetings, bidding…*" and the authors related it to bureaucracy. However, bureaucracy is a term developed by Max Weber who use the bureaucracy definition to develop the adoption of modes of authority rational-legal [64]. Simplifying the theme, one of the important goal of the bureaucracy was to stimulate the proceeding manner *sine ira et studio*, i.e., without the influence of personal reasons and sentimental reasons. In other hand, there are theories about the bureaucracy dysfunctions, where the bureaucracy is studied as irrational. Now, simplifying the theories about bureaucracy dysfunctions, this analyze cases of radicalization and decontextualization of bureaucratic goals and procedures, which become goals in themselves, regardless of their purpose, thus reducing the adaptability of organizations, generating high level of organizational inefficiency [64].

Anyway, in this current research, this issue remains a challenge. For example, the excess of norms and legislation results in that, even in similar organization activities (e.g., collect a tribute), it´s not possible to have an effective reuse of efforts from a benchmark perspective. *"This is a challenge because I can´t compare, I can´t put others idea inside my process… each state, organization, has it owns law… the process should be aligned with the laws".*

A main difference from the previous study is that it is perceived a paradigm change. Instead complain and accept the restriction as one participant stated (e.g. *"but if it is not in the legislation, I can´t do it")*, other participants shows that they try some initiatives to reach the top management aiming to change the law or the norm itself and while something it is not possible they look for improvement possibilities. "*Well, so let´s do an improvement in the law project… change an internal resolution*."

International Outsourcing

At our better knowledge this is the first time it issues appear in a qualitative research that aims to provide a perspective in BPM state-of-art scenario. During one of the session, a participant talk about the outsourcing initiative related to process automation and integration. They were in touch with not only developers but also with business analysts. More than the language, because the outsourcing is a phenomenon that reaches countries that can provide workforce cheaper (e.g. *"one problem is the language… a non-American English …)*; the problem is that how to explain things that is characteristic from Brazil: "*there are things that are only ours. Only from Brazil*". After this issue was, exposed participants talk about some examples in the financial sector like how to explain a specific tribute that was extinct but can return so a "*flag*" is necessary.

6.3 Evaluation of a Brazilian Quantitative Survey in BPM

6.3.1 Introduction to the Evaluation

To plan and design a qualitative research it is important to observe as mentioned before, that there are two types of research's questions. "What", "Who" and "Where" tend to explore and describe a topic where there is little knowledge. "How" and "Why" questions are explanatory question and search for answers of a particular phenomenon [27]. Moreover we presented, in Table 5.1, the elements presented by Recker [27] to take decisions related to research design.

The exploratory perspective was important to use a qualitative focus group approach to start the research about the state-of-practice. A common next step is start from this qualitative exploratory research and contributes to formulate a quantitative approach to analyze deeply the state-of-the practice. As presented in Table 5.1, from a new perspective, after the qualitative research, it´s possible to start new verification that leads to the other end of continuum, i.e., an explanatory research that could have a statistical boundary, even with a laboratory setting with causal outcomes.

Also mentioned in Section 5.2.1, an exploratory research has as an expected descriptive outcome and with a further understanding ambition. However, as presented in Table 5.2, it has low controllability, deductibility, repeatability and generalizability.

In the other hand, the quantitative research strategy can contributes to increase these low characteristics to a level of medium to high [27]. Moreover, as also mentioned in the Section 5.2.1, the epistemologically difference between the qualitative and the quantitative research is that, from a qualitative perspective, the best way to study a social reality is through subjective interpretations within the socio-historical context and from a quantitative perspective, the reality is independent of the socio-historical context and can be isolated and studied objectively.

After the focus group qualitative research many options to deeply analyze the raising issues were possible. In a comprehensive context, in Brazil, there is an association (ABPM) that already conducts a survey to evaluate the BPM scenario in Brazil. Once this analysis exists, the qualitative focus group research makes possible to evaluate this quantitative research and give insights to new questions or perspectives that could be evaluated [65] [66].

Hence, this session will present and analyze this quantitative research under the light of the qualitative research already conduct. The expected result is to, eventually, perceive that some issue could be generalized and give insights towards the improvement of this Brazilian comprehensive quantitative research.

6.3.2 The ABPMP Quantitative Research

The Association of Business Process Management Professionals, ABPMP is an international association of BPM professionals, "*non-profit, vendor independent dedi-*

cated to the advanced of business process management concepts and its practices"[19].In Brazil this association is an active organization that participate in many BPM initiatives.

Their mission, in an international perspective, is to engage in activities that advance the practice of business, process management, promote and evolve a Body of Knowledge, development and advance the skill of the professionals and validate the professional qualification. In Brazil[20], as one of their vision point, is to promote the practice of BPM and recognize those one that contributes to the BPM discipline. One initiative align with this mission is the support of the BPM Global Trends that is a "*seminar held by ABPMP which aims to bring to Brazil consecrated cases, best practices and innovations in Business Process Management around the world."*[21] This initiative has it owns publications in a journal format that promotes articles about success cases and reflections of the BPM professionals.

The BPM Global Trends publication in its fifth edition, in 2013 [65], and in its tenth edition, in 2015 [66] , two editions brings a National Survey in Business Process Management, conducted by ABPMP Brazil. The survey was answered by 385 professionals answered, in 2013, and 641 professionals answered the second survey, in 2015.

To present the survey results, first the characteristics of the respondents will be described. Second, the results that can be related and discussed under the light of the qualitative research will be presented. This section will be finished by presenting the results not strongly related to the qualitative research but relevant to the evaluation of Brazilian state-of-practice.

6.3.2.1. Characteristics of the Respondents.

Figure 6.2 combines in one graph the distribution of the organizations of professionals that answered the survey per Brazilian federative unity of the both survey, 2013 and 2015. A remark is that once the first survey did not bring the quantity distribution but only the frequency, to reach the quantity it was used the percent presented applied on the total quantity of the participants. As and result the total sum is different in three (3), i.e., it was 385 respondents but if the quantities of respondents is summed using the graphics the result is 388.

[19] www.abpmp.org
[20] www.abpmp-br.org/
[21] http://www.bpmglobaltrends.com.br/

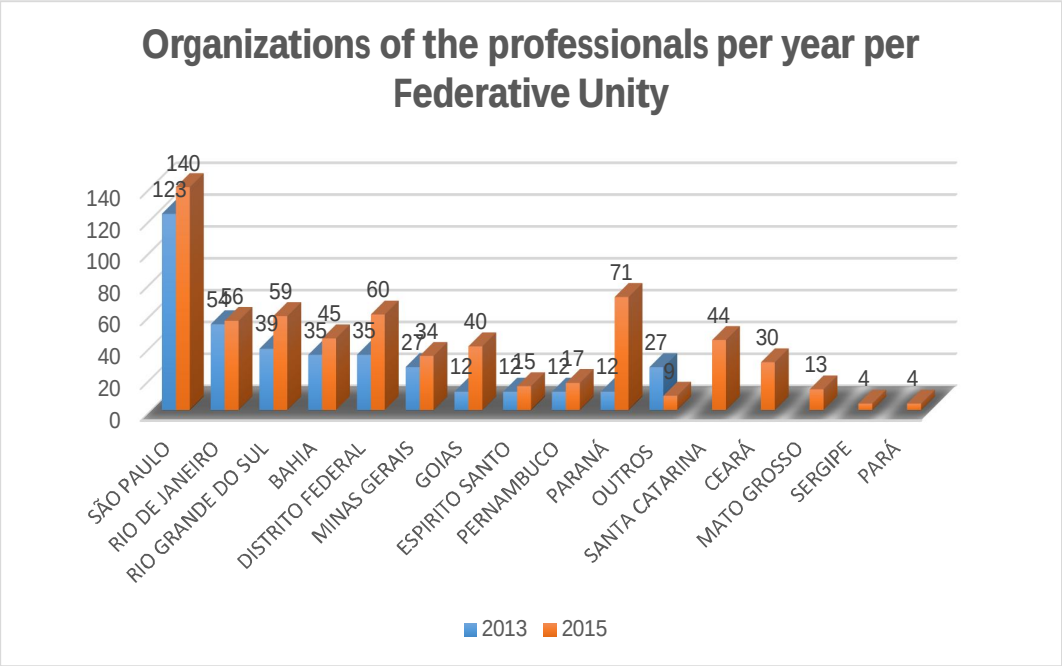

Figure 6.2. Distribution per year and per Federative Unity. Adapted from [65] [66].

Figure 6.3 presents the distribution by the market sector organizations. Mixed organizations in Brazil are those that has a part of the command by the public and a part by the private. Non-Governmental Organizations are non-profits social groups characterized by social actions. Civil Society Organization of Public Interest are one particular kind of NGOs that are organized in the private sector but has to observe some requirements, specially some requirements related to norms of administrative transparency.

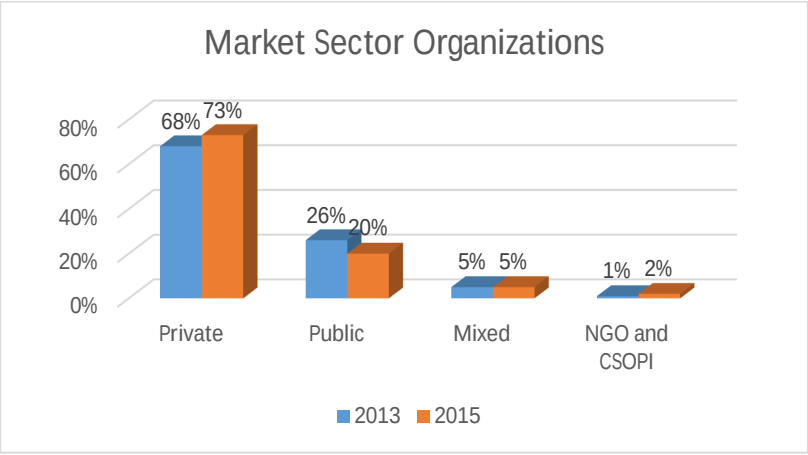

Figure 6.3. Market Sector Organizations. Adapted from [65] [66].

Figure 6.4 presents the distribution of the organizations based in the quantity of employees. One remark is that there was a range difference between the 2013 survey and the 2015 survey. The 2015 presents to ranges from 0-100 employees, one from 0-50

and another from 50-100. Since the 2013 survey did not separate this range, the ranges presented in the 2015 survey were grouped.

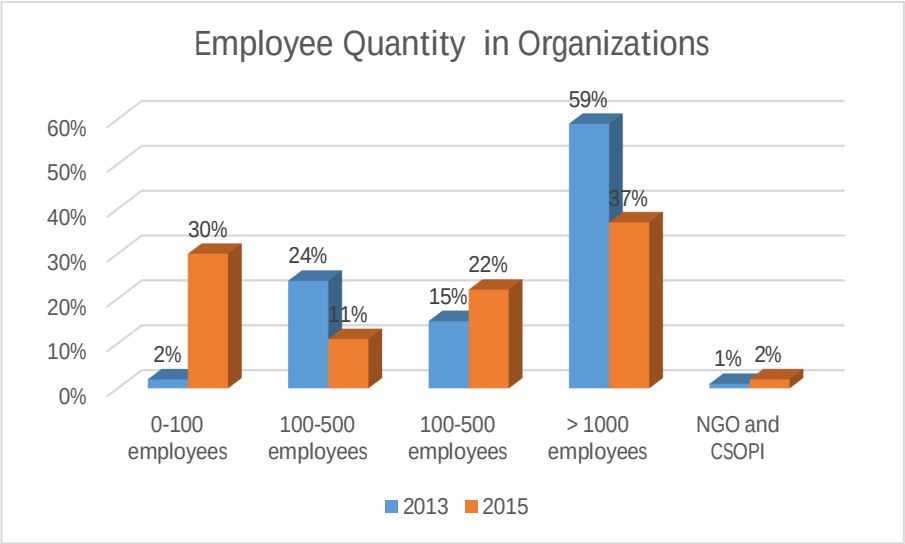

Figure 6.4. Employee Quantity in Organizations. Adapted from [65] [66].

Figure 6.5 presents the distribution by revenues of the organization. At this point of the current research, it was not possible to use the results of the 2013 survey due some noticed inconsistency. For example, in the distribution by revenues it was excluded the range of 0-20 million of revenue and the quantity excluded were not cited. Hence, only the result of the organizations that participates on the 2015 is presented.

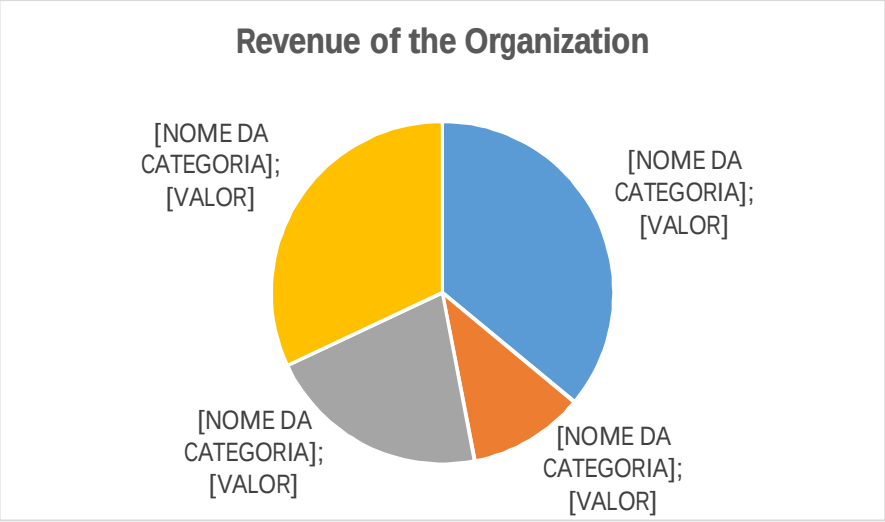

Figure 6.5. Market Sector Organizations. Adapted from [65] [66].

Figure 6.6 presents the frequency distribution by activity sector in the 2015 survey. The 2013 survey did not have this information. Figure 6.7 presents the distribution

of the respondents in organizations accordingly to their professional role. It was possible to compare the 2013 and the 2015 configuration.

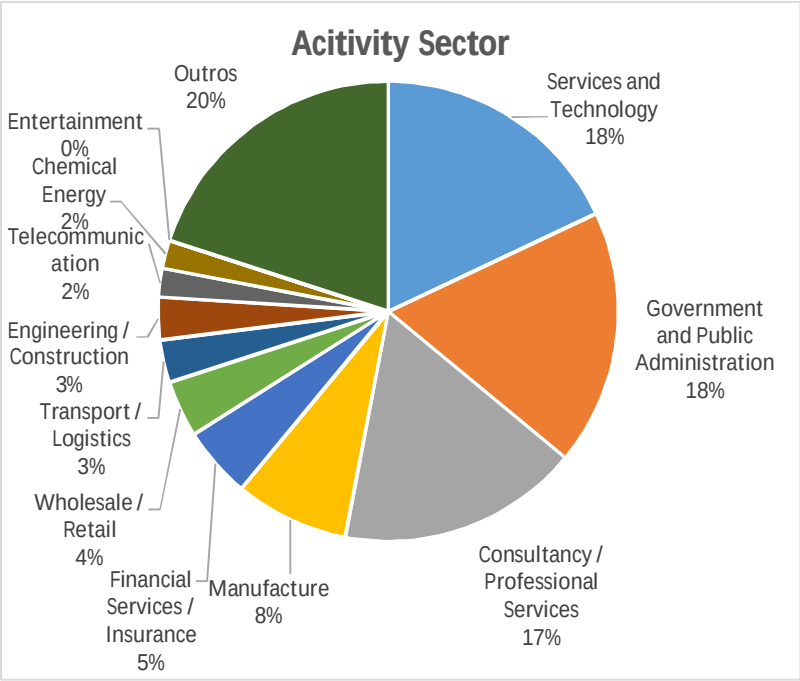

Figure 6.6. Activity Sector of the Organizations. Adapted from [65] [66].

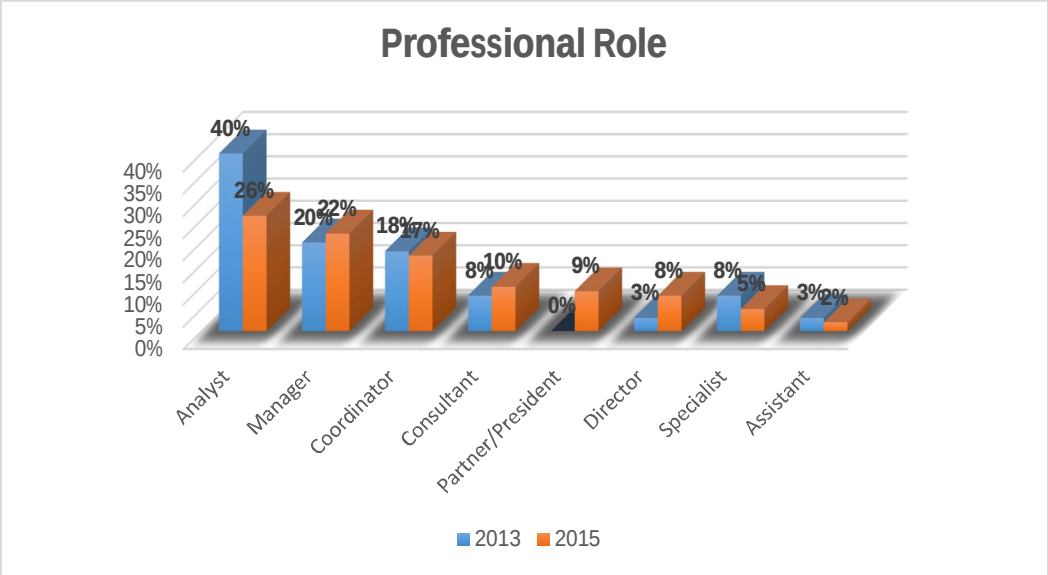

Figure 6.7. Professional Role of the respondents. Adapted from [65] [66].

The last information related to the characteristics of respondents is about the time of adoption of BPM by the organization. Figure 6.8 present results from 2013 and 2015. The distribution did not change very much.

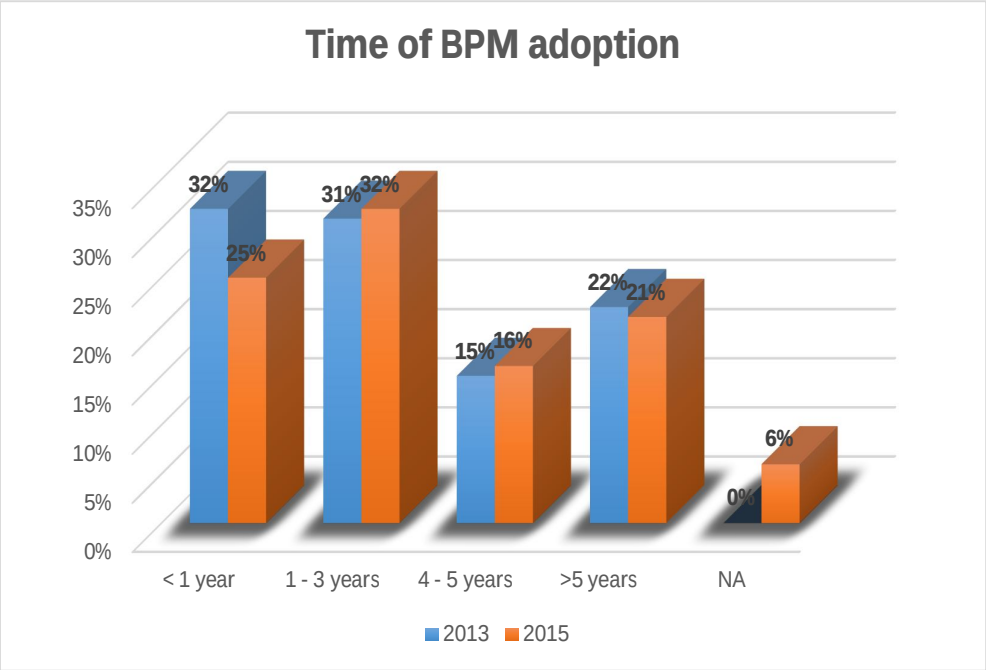

Figure 6.8. Time of BPM adoption. Adapted from [65] [66].

A final remark is that the original survey presents other characteristics of the respondents. However, they are almost related to the existence of a process area and the crossing of the process areas result with the main characteristics presented here. Due the qualitative research did not reveal important aspect or necessity of have or no a process area or office, that quantitative section do not report the findings of the ABPMP survey related to this existence.

6.3.2.1. Results of the Quantitative Survey related to the Qualitative Survey.

The strongly related result of the quantitative survey related to the qualitative survey presented in the section 6.2 is the results to the question presented in the 2015 survey [66]: "*What is the main difficulty (ies) faced by the team to the evolution of business process management?"* To answer that question the respondents had eight choices where more than one could be marked, one choice to mark "none", and an open text if the respondent mark "other". Table 6.9 present the similar structure of the question. Figure 6.9 present the results.

Table 6.9. Structure of the question, from [65] [66].

What is the main difficulty (ies) faced by the team to the evolution of business process management?	
Training of professionals in the office processes	☐
Professional training of the business areas involved in BPM initiatives	☐
Adequacy to internal standards and procedures	☐
Adequacy for legal/regulatory aspects	☐
Communication with sponsors and other stakeholders	☐
Resistance to change and/or unfavorable organizational culture	☐
Difficulty in standardizing the process models generated during the analysis and design processes	☐
Choose the most suitable BPM software to reality, size and organization culture	☐
None	☐
Others (specify) : _____	

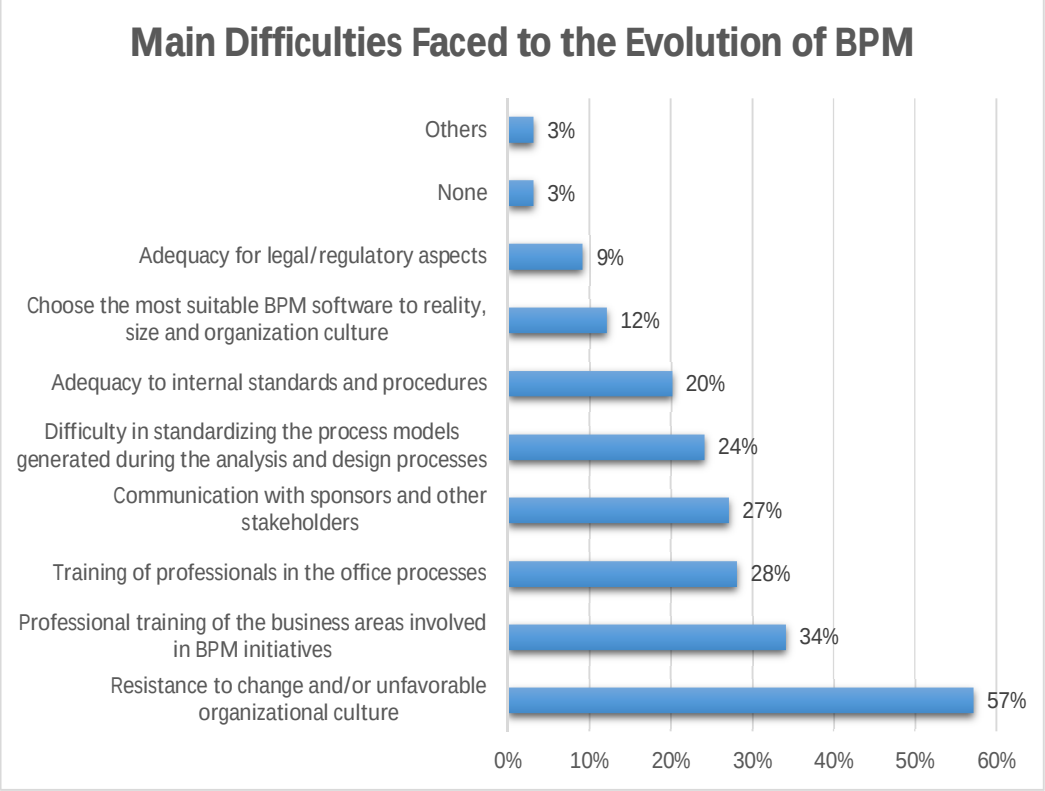

Figure 6.9. Difficulties Faced to the evolution of the BPM initiative in 2015. Adapted from [66].

A similar question was presented in the 2013 survey. The question was: "*What is the main restriction to the evolution of the BPM in your organization?*" The focus is the organization instead, the team and the 2015 presents the word difficulty instead the word restriction. Since the questionnaires was not available and the report only present the results not the methodology, probably the answers were pre-defined. Although the question is similar the answers is much more different from the 2015 survey. Even though it is possible to establish a correlation, in this research the option was to present the result as it was presented in the original survey, in 2013, in Figure 6.10.

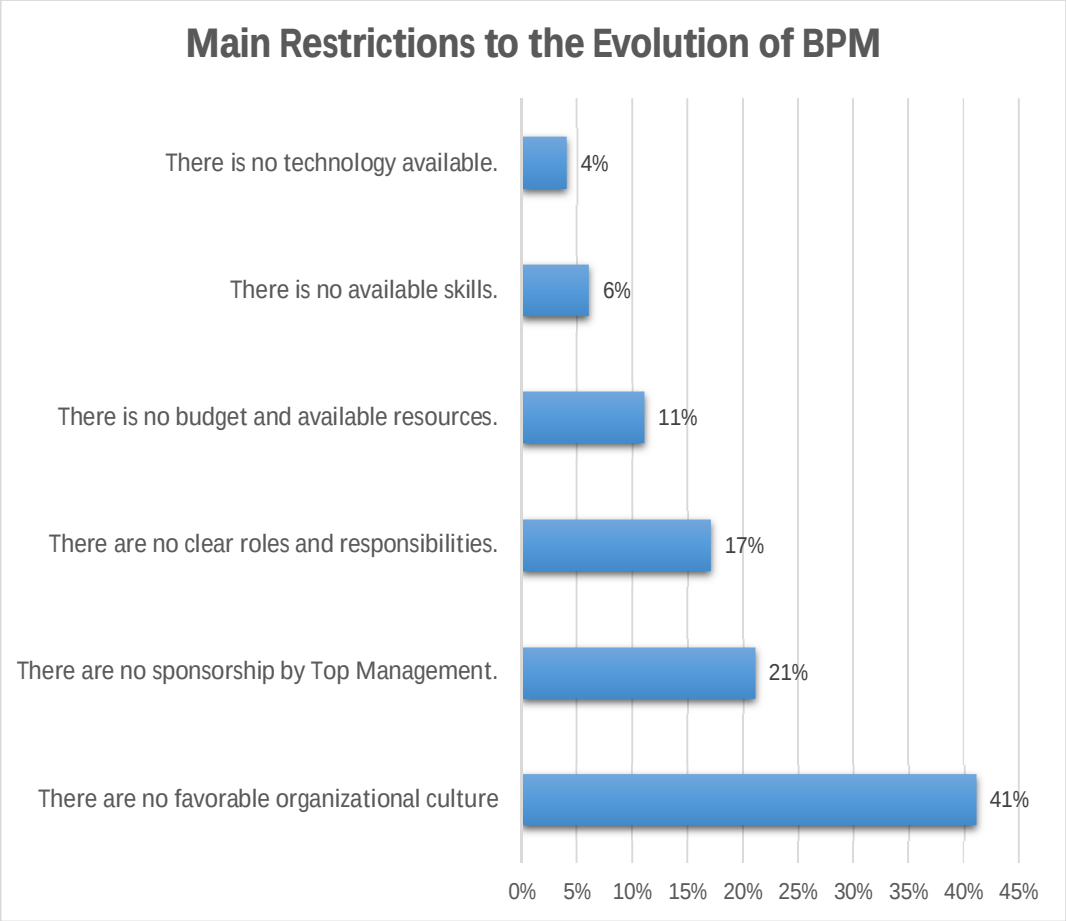

Figure 6.10. Main restriction faced to the evolution of the BPM initiative in 2013. Adapted from [65].

6.3.2.1. Results of the quantitative survey not strongly related to the qualitative research but important to the evaluation of Brazilian state-of-practice.

This subsection presents results that are not strongly related to the quantitative research. However, the results presented in the quantitative research of the ABPMP contributes to the state-of-practice and, even with the strongly relation, is possible to provide insights to evolve the quantitative research.

For example, the presence of two questions like “What is (are) the platform(s) of BPMS adopted by the organization to automatize the process execution?” and “What is (are) the graphical tool(s) adopted by the organization to model the processes?” associated to the absence of a question related to tools for mining process provides evidences that there is an alignment between the results of the qualitative research and the quantitative research, i.e., at the qualitative research, business intelligence issues and experiences were not perceived and, hence, the survey will lead to a question with the a possible non conclusive answer and this is not a good practice in quantitative survey, a long questionnaire.

Starting the presentation of the quantitative results by the questions above, Figure 6.11 presents the results of BPMS used by professionals related to the automation phase. This question was also presented in the 2013 survey and both results are combined in a single figure. A remark is that the exact values were not presented in the 2015 survey result. It was evaluated by the distance to the marks available in a bar chart. For example, the marks available were 0, 0.25 and 0.5. If the bar presented in the bar chart of the original survey [66] is between 0.25 and 0.5, then it was used the value 0.375.

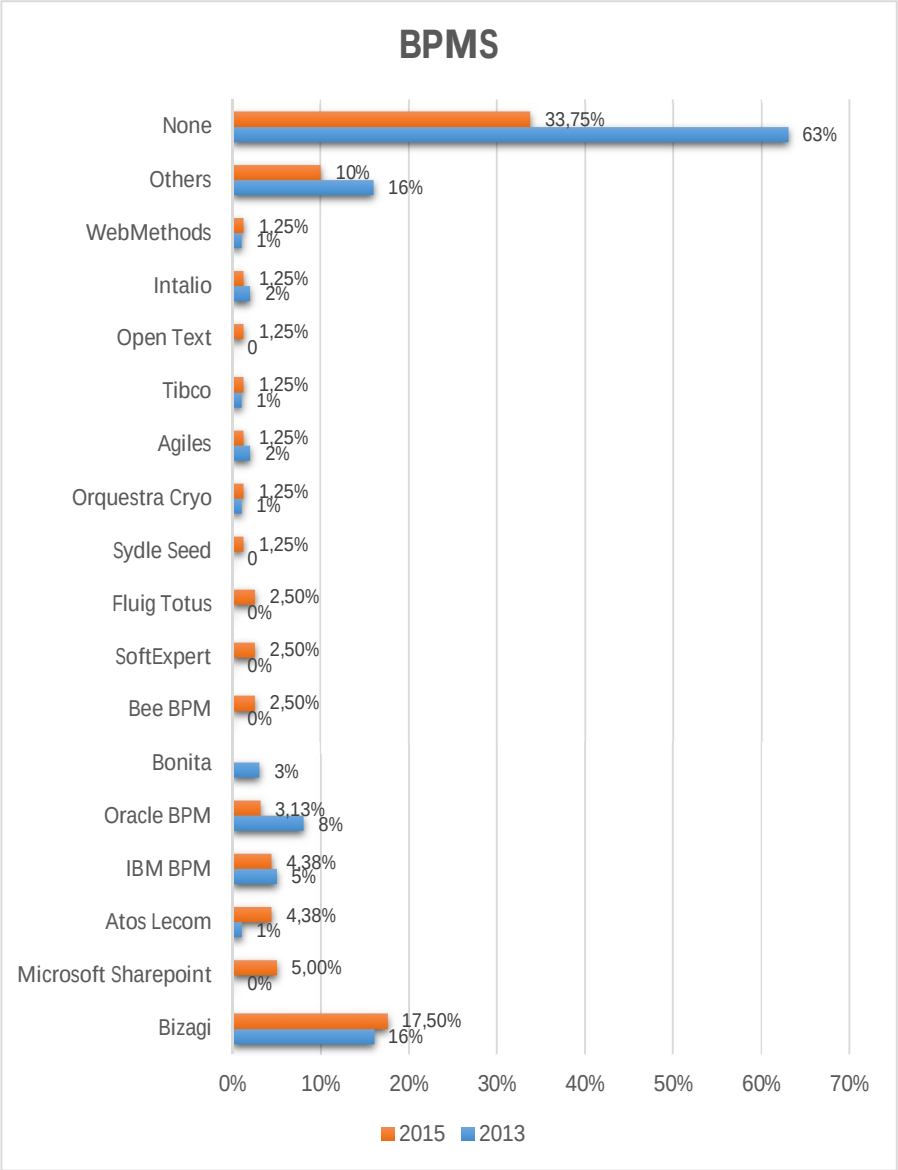

Figure 6.11. BPMS used by the respondents [65] [66] .

Figure 6.12 and Figure 6.13 presents, respectively, the results to BPM model language and BPM model tools used by professionals related to the automation phase. These questions were presented 2015 and in the 2013 survey and the both figures combines the results each one in a single figure.

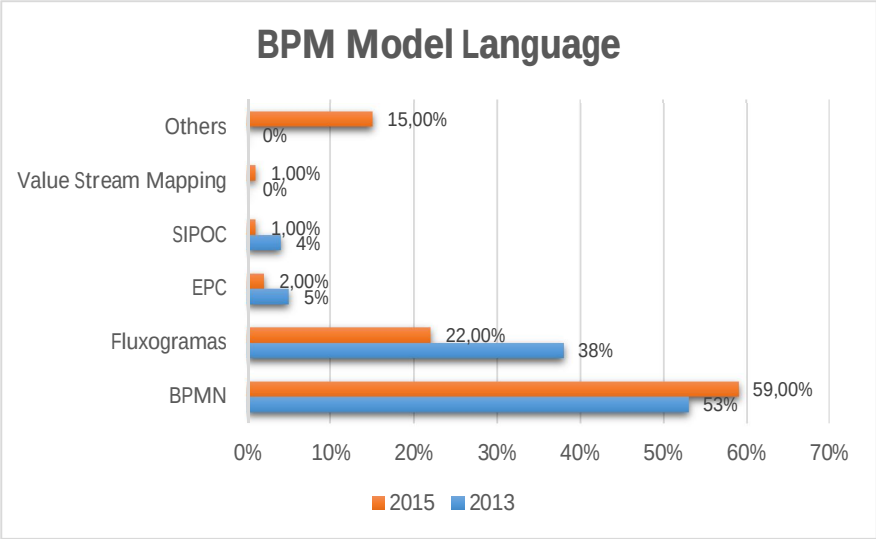

Figure 6.12. BPM Model Language used by the respondents [65] [66].

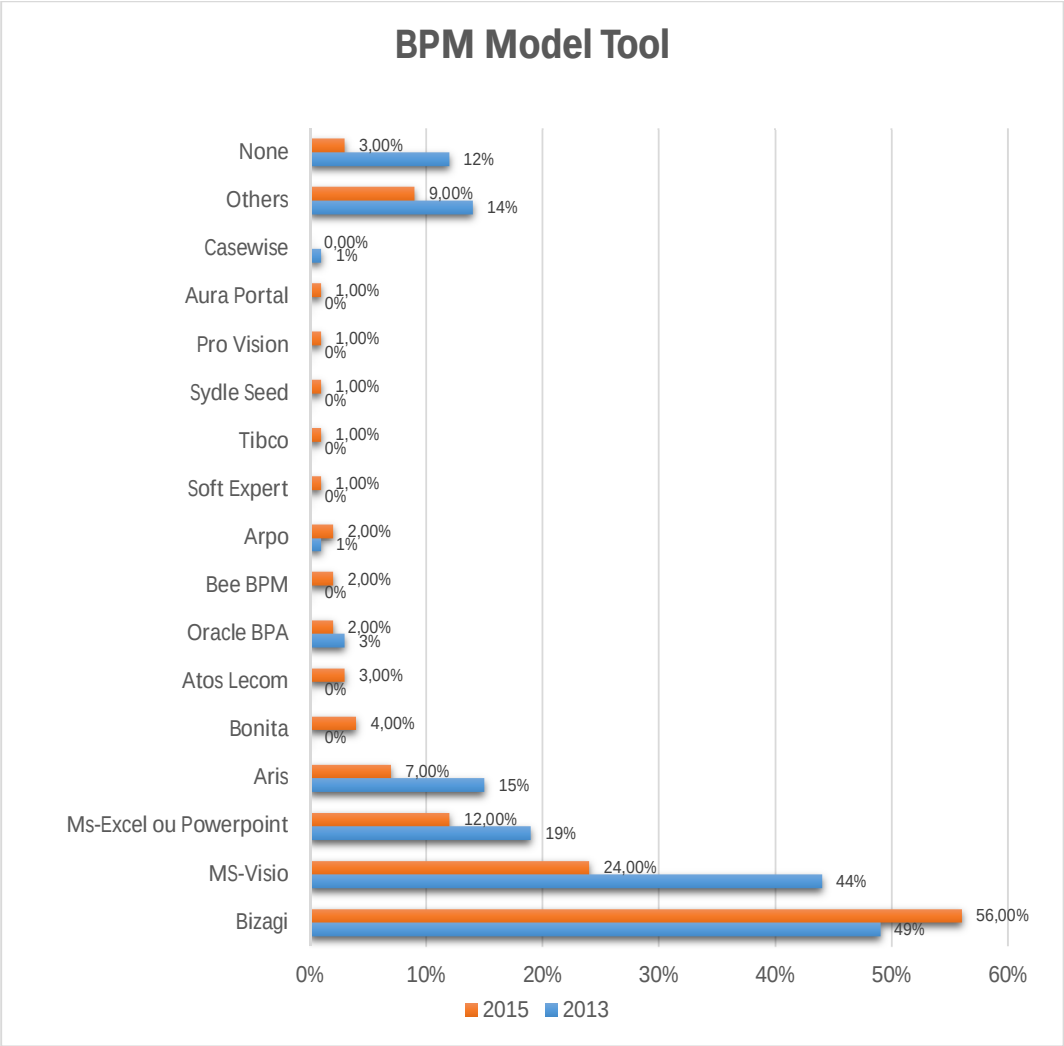

Figure 6.13. BPM Model tool used by the respondents [65] [66] .

Continuing the presentation related to tools, Figure 6.14 presents the results to the question "*What are the relevant requirements to choose the tool?"* Two interesting questions where made in the 2015 survey, about the level of satisfaction and the number of the processes that were automated. However, the report did not show the legend with the correct ranges.

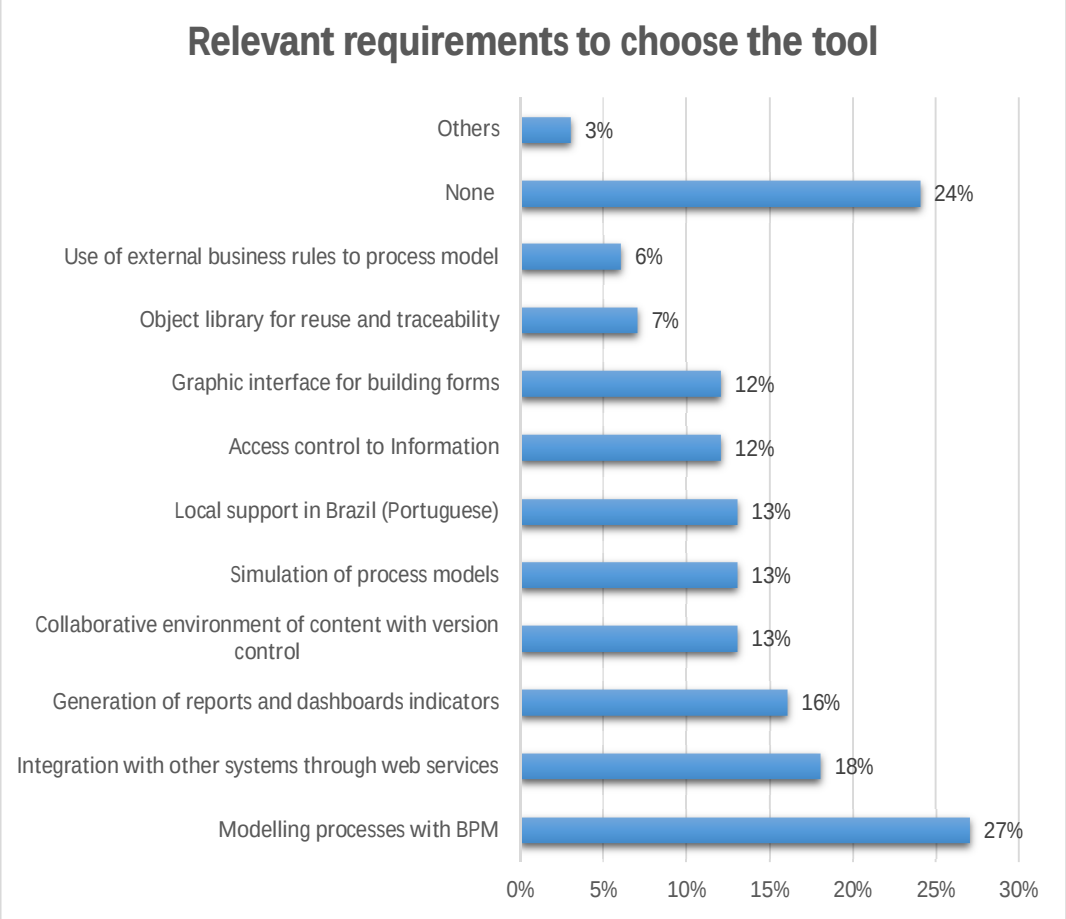

Figure 6.14. Relevant requirements to choose a BPM tool [66] .

Finally, to end this subsection there are three questions interesting to the state-of-practice. Figure 6.15 presents the results for the question about the motivation to introduce the BPM in the organization. To combine the results of the both surveys, some adaptations were necessary. For example, in the 2015 survey, one of the options to the respondent was *"Implantation of excellence model in management (PNQ, ISO9000)"* and in the 2013 survey the option was only *"ISO 9000, ISO 9001"*. Figure 6.16 combines the two questions of the 2015 survey in the same graphic: "*What were the main results reached by the organization in the year 2014 with BPM?"* and *"What are the main results expected by the organization at the end of the year 2015 with BPM?"*

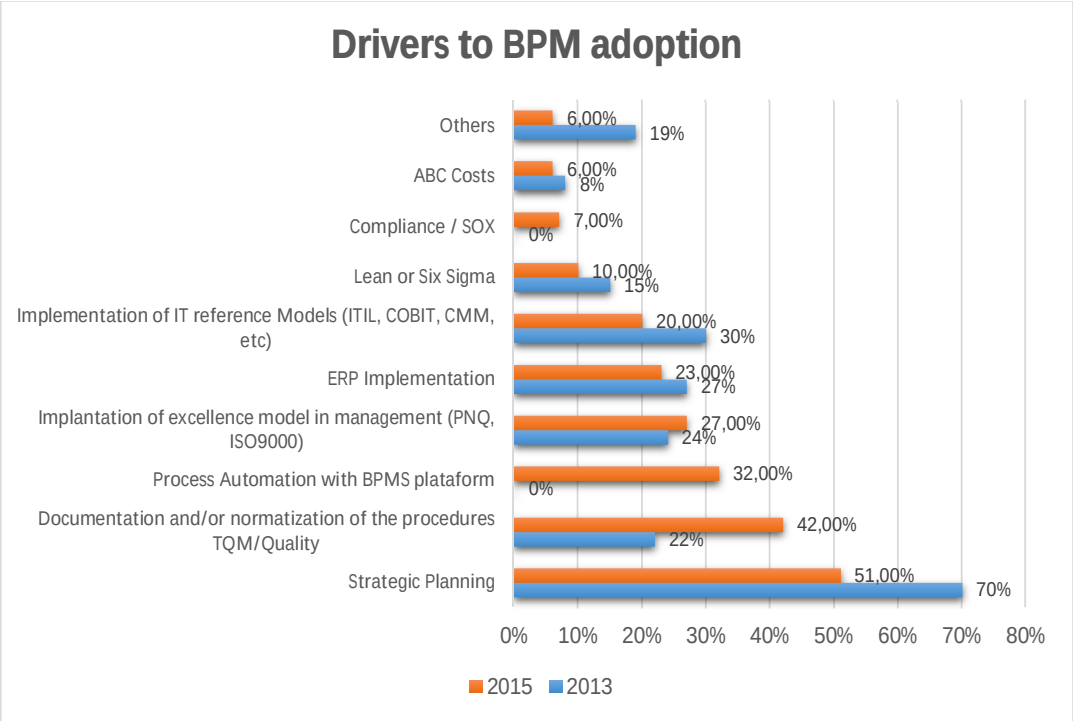

Figure 6.15. Drivers to BPM adoption [65] [66] .

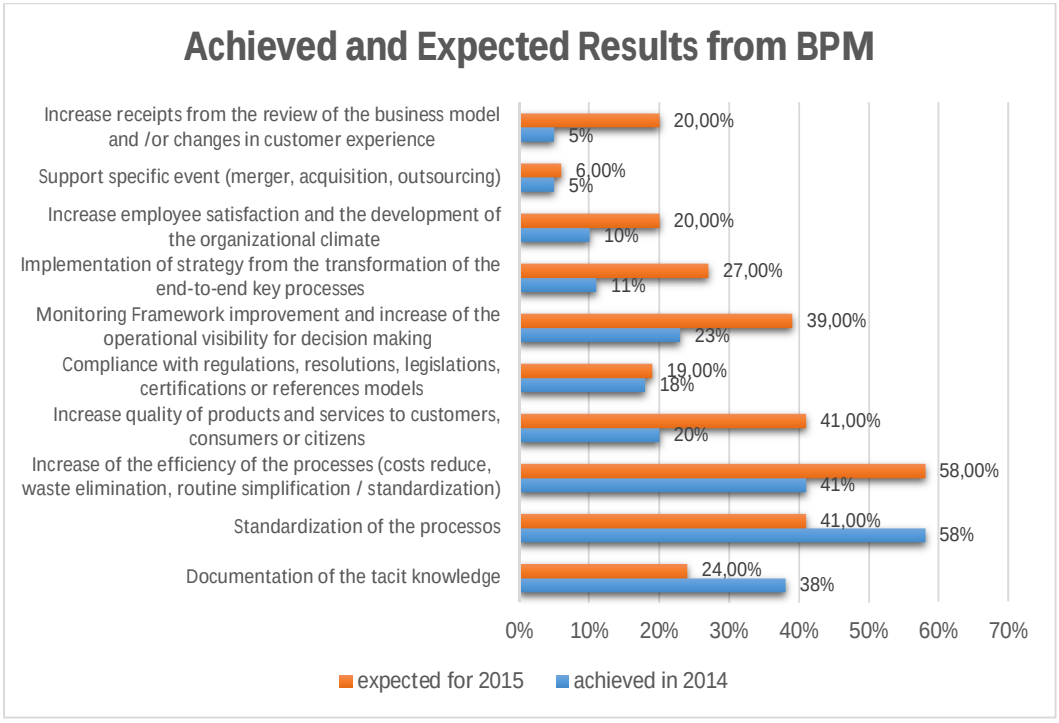

Figure 6.16. Achieved and Expected Results from BPM [65] [66] .

6.3.3 The Evaluation of ABPMP Quantitative Research

This section evaluates the ABPMP quantitative research towards insights provided by the qualitative. According to Recker [27] *"surveys are non-experimental research methods that do not involve controlling or manipulating independent variables (that is, they do not contain a "treatment")*. Moreover, the survey aims "*to gathering information about the characteristics, actions, perceptions, attitudes, or opinions of a large group of units of observation"*, the population.

Three are the purposes of the survey: exploration, description, or explanation. [27]. The exploration aims to become familiar with a phenomenon or topic of interest; the description aims to "*find out about the situations, events, attitudes, opinions, processes, or behavior that are occurring in a population"*; and explanation aims to test a theory and hypothetical causal relations. The ABPMP quantitative research is a kind of description survey.

Finally, the use of a survey has advantages and disadvantages. Table 6.10 presents some strengths and weakness of this kind of research.

Table 6.10: Advantages and Disadvantages of survey [27].

Advantages	Disadvantages
Surveys are easy to administer and simples to score and code	Surveys are just a snapshot of behavior at one place and time
Surveys determine the values and relations of variables and constructs	One must be careful about assuming they are valid in different contexts. In particular, different cultures may produce different results
Responses can be generalized to other members of population studied and often to other similar populations.	Surveys do not provide as rich or 'thick' description of a situation as a case study
Surveys can be reused easily, and provide an objective way of comparing responses over different groups, times, and places	Surveys do not provide as strong evidence for causality between surveyed constructs as a well-designed experiment
Surveys can be used to predict behavior	Surveys are often susceptible to low response rates, which can diminish the generalizability of the results
Specific theoretical propositions can be tested in an objective fashion	
Surveys can help confirm and quantify the findings of qualitative research	

6.3.3.1. General evaluation of the survey

Recker [27] presents suggestion to produce a quality survey. The guidelines recommended are: (I) report the approach used to randomize or select samples; (II) report a profile of the sample frame; (III) report the characteristics of the respondents; (

IV) append the whole or part of the questionnaire; (V) establish the validity and reliability of the survey instrument; (VI) perform an instrument pre-test; (VII) report on response rate.

Evaluating the 2015 version of ABPMP research, under the light of the Recker´s suggestions [27], only some items are perceived. The items (I), (II), (V), (VI) are completely missed. The suggestion (III) is present. The item (IV) is partially presented at the published report. The questions are available but the options to answer are not. The suggestion (VII) is also partially present because it is informed the number of the respondents but not the number of people that were asked to participate.

The general recommendation is that the survey increases rigor. Comparing the 2013 version with the 2015, there was no evolution aligned with Recker´s suggestions [27]. The evolution occurs punctually more related to the adaptations of pre-existent questions.

6.3.3.2. Evaluation of the survey regarding the qualitative results

The most relevant result of the survey regarding the research question is the one related to the difficulties faced to the evolution of the BPM. It is possible to observe that in both surveys, 2013 and 2015, this question was present but the possible answers changes from the first to the second edition.

Under this perspective, the qualitative research provides insights to evaluate the possible choices that the survey presents to the respondents. For example, is it adequate that the quantitative research asks about restrictions to the evolution of BPM and give as a possible choice the "*resistance to change and/or unfavorable organizational culture"*? Under the perspective of the collected issues of the qualitative research, the answer is yes when it is in accordance with the perceived issues like "*lack of employee buy-in"* that results in a perceived resistance to change. Table X.XX evaluates each possible choice available at the 2015, indicating if it is adequate, partially adequate or not adequate, and relating this indicator to a previous issue identified at the qualitative phase.

Table 6.11: Evaluation of the options available in the 2015 survey question about the difficulties faced in the evolution of BPM initiatives.

Question Options	Adequately?	Qualitative related Issues	Evaluation
Resistance to change and/or unfavorable organizational culture	Partially	Lack of employee buy in; lack of coordination; lack of nurture for process owners	The choice could be separated in new choices or the questionnaire could be improved dedicating a specific question with the qualitative related issue as options. The finding of the quantitative survey resulting in a big value, i.e., 57% could be perceived also as an outlier.
Professional training of the business areas involved in BPM initiatives	Yes	Lack of BPM education; Lack of common mindshare of BPM; Lack of expertise	There were also focus group sessions where the participants were in doubt if the business areas should be involved. Moreover, the discussion about if the top management of this business areas should be involved in this BPM education of the business area issue also happened.
Training of professionals in the office processes	Partially	Lack of BPM education; Lack of common mindshare of BPM; Lack of expertise	In all focus group session, the lack of expertise has appeared as an issue. The partially evaluation is because this issue relates the training to the office processes, not to the professionals. A review is of the questionnaire could, perhaps, merge this option and the last option (professional training of business area involved in BPM initiatives) in one question with the options of "who" should be trained.
Communication with sponsors and the stakeholders	Yes	lack of coordination; lack of governance; lack of visibility; lack of top management support	Even being adequately, future research could review the questionnaire and investigate if the issue is the communication or other difficulties. The difficulty in communication with sponsors and stakeholders could be a symptom of the issues identified in the qualitative research.
Difficulty in standardizing the process models generated during the analysis and design processes	No	Lack of standard language; Miscommunication of tools capabilities; Difficulties in use of product functionality; Lack of tool support for process visualization; lack of tools for holistic BPM; Weakness in process specification	This option was not clearly defined by its text. Hence, many issues perceived in the qualitative research can be associated to this option. Again, it is like a symptom and could be better explored if new choices appear or a new specific question appears.
Adequacy to internal standards and procedures	Yes	Lack of Governance; lack of coordination; Lack of linkage with external business partners; Dysfunctions of Bureaucracy and Culture in the public sector	Even being adequately, future research could review the questionnaire and investigate if the issue is the adequacy to internal stands and procedures or other difficulties. It is hard to accept it as a difficult if one of the BPM deliveries is standards and procedures.
Choose the most suitable BPM software to reality, size and organization culture	Yes	Lack of tools for holistic BPM; Lack of technology capability; Lack of clear starting point; Lack of expertise; Lack of BPM understanding; Lack of BPM education	Even being adequately, future research could review the questionnaire and investigate if the issue is the tool choose process or difficulties. Moreover, this difficulty, perhaps, is a symptom of the related issues identified in the qualitative research.
Adequacy for legal/regulatory aspects	Yes	Lack of Governance; lack of coordination; Lack of linkage with external business partners; Dysfunctions of Bureaucracy and Culture in the public sector	The evaluation is similar to the evaluation of the "adequacy to internal standards and procedures.

A main result of the evaluation of this question is that the quantitative research related to the difficulties provides some evidences that maybe some qualitative issues could be easily generalize with a quantitative research. Another perception is that the options has an ‘inside-out’ BPM adoption bias about the difficulties.

For example, the professionals of the area responsible by the process office should be trained or the adequacy to standards or procedures being a difficulty to the BPM adoption can be viewed more related to the deficiency of the overall BPM expertise of the implementers. The ‘inside-out’ bias is in the same set of the ‘outside-in’ participants when the role in the organization of the respondents is presented. This is a structural mistake of the survey design.

Not strongly related like this question, another three questions could be improved by the qualitative results insights. The question about the drivers to BPM adoption and the two questions about the achieved and the expected results from BPM. Table 6.12 suggests the relationship between the options available by the questions and the issues perceived by the qualitative research. The marks where subjective done and they should be understand as wide opportunities of improvement or, even, insights to new research that aims to move from the exploratory spectrum to the explanatory spectrum.

Table 6.12: Evaluation of the options available in the 2015 survey question about the difficulties.

Achieved and Expected Results / Drivers	Documentation of the tacit knowledge	Standardization of the processes	Increase of the efficiency of the processes (costs reduce, waste elimination, routine simplification / standardization)	Increase quality of products and services to customers, consumers or citizens	Compliance with regulations, resolutions, legislations, certifications or references models	Monitoring Framework improvement and increase of the operational visibility for decision making	Implementation of strategy from the transformation of the end-to-end key processes	Increase employee satisfaction and the development of the organizational climate	Support specific event (merger, acquisition, outsourcing)	Increase receipts from the review of the business model and /or changes in customer experience	Productivity improvement and/or quality in the custommer view	Strategic Planning	Documentation and/or normatization of the procedures TQM/Quality	Process Automation with BPMS plataform	Implantation of excellence model in managements (PNQ, ISO9000)	ERP Implementation	Implementation of IT reference Models (ITIL, COBIT, CMM, etc)	Lean or Six Sigma	Compliance / SOX	ABC Costs
Qualitative Issues																				
Lack of employee buy-in								x		x	x									
Lack of Governance	x		x		x	x	x	x	x			x	x		x		x		x	
Lack of BPM understanding		x											x				x	x	x	x
Lack of top Management Suport						x	x					x								
Lack of expertise	x		x						x				x	x				x		x
Lack of coordination		x	x				x	x	x			x	x			x				
Lack of BPM education		x			x								x		x		x	x	x	x
Lack of nurture for process owners		x											x							
Change Management		x	x		x				x	x	x	x	x		x		x		x	
Lack of common mind share of BPM							x													
Broken link between BPM efforts and organizational strategy				x		x	x	x		x	x	x								
Lack of lifecycle management		x	x			x							x							
Lack of flow between strategic and operational directives				x		x	x	x		x	x	x		x	x		x		x	
Lack of understanding on process orientation		x											x			x				
Lack of visibility	x							x					x							
Lack of tools for holistic BPM		x				x	x					x	x	x	x		x		x	
Lack of clear starting point																x		x		x
Lack of tool support for process visualization	x	x										x	x							
Lack of common mindset		x	x										x					x		x
Lack of measurable returns			x	x						x	x									
Lack of technology capability							x							x						
Lack of linkage with external business partners			x		x		x			x	x				x	x	x		x	
Perceived gaps between process design and process execution		x				x		x		x	x	x	x	x						
Lack of standard methodology		x											x			x		x		x
Customer resistance			x	x				x		x	x		x							
Lack of methodology		x											x					x		x
Difficulties in identification of processes	x	x							x				x							
Lack of standards	x	x											x					x		x
Lack of process monitoring		x	x		x	x				x	x		x		x		x		x	
Lack of standardization	x	x											x					x		x
Weakness in process specification	x									x	x		x							
Dysfunctions of Bureaucracy and Culture in the public sector			x		x			x		x	x				x		x		x	
International Outsourcing									x	x										

Finally, about the other questions present in the survey, they are either related to the characteristics of the respondents, or related to the presence and absence of a processes office, or related to tools. From the perspective of qualitative focus group sessions reported results, the questions about the tools and the characteristics questions are

aligned to the reality. It means, for example, that the participants of the focus group research are in align with the roles or the evaluate tools are from the BPM phases that are most common in the participants experiences, i.e., there are not experiences with process mining or process reuse but there are experience of model and automation, hence, there is no sense asking about this kind of tools in a quantitative research if there is no experience.

6.4 An Outlook through Brazilian State-of-Practice

Related to the state-of-art, Aalst analysis recognizes the "amazing speed" of the development of the BPM discipline [12]. However, he also discusses some weaknesses. The state-of-art analysis of the Brazilian scenario also, however, bring some evidences that this scenario is, regarding the BPM lifecycle, in the analysis and design phase with few implementation, monitoring or reuse experiences.

The data collected from the state-of-practice analysis provides evidences that also the state-of-practice is concentrate in the same phases of the state-of-art, i.e., with more emphasis at the analysis and design, few issues related to automation phase and the absence of issues related to monitoring, reuse and flexibility experiences.

This current research also provides evidence that it is possible that Brazilian scenario is quite similar to the Australian scenario in 2007. The evidences are that almost all issues that are perceived in Australian researchers [22] [23] [24] were perceived in the focus group qualitative research. Remarkable is that probably the issues that were not perceived is related to the advent of the BPMN model language (e.g. lack of standard language).

Related to the evaluation of a quantitative analysis that is already conducted by Brazilian ABPMP, there are also others interesting findings. Although a qualitative and methodological analysis reveals some methodological problems and non-alignment or biased questions, the survey findings provide some insights to the perspective of the state-of-practice in Brazil. For example, the qualitative perceived issue *lack of employee buy-in* could be inside the most selected difficulty of the survey with BPM professional, the "*resistance to change and/or unfavorable organizational culture"*.

The research reached more than 600 professionals and provides evidence that the BPM is in practice around all over the country, in public and private organizations, from several activities, within little and big organizations, and affecting in many roles within

the organization. Moreover, the quantitative survey shows what are in vogue in terms of model notation language, the process model tools, and process automation tools.

Finally, in addition, and as mentioned before, the survey confirms the qualitative evidence that in Brazilian state-of-practice there is an absence of discussing tools and concepts related to process monitoring, reuse and flexibility.

6.5 Conclusion of the State-of-Practice evaluation and Final Remarks

This part of the research is expected to answer the follow research question: *"What are the practical issues from the Brazilian´s perspective?"*

To answer it, it was developed a research taking the path of other researches that evaluates the state-of-practice issues. Two phases were planned, a qualitative phase and a quantitative phase. In the first phase, it was analyzed qualitative researches regarding reproducibility and comparison aspects. Two Brazilian´s researches [26] [25] and three International´s previous research [22] [23] [24] were identified and used as references.

Regarding the references and based on scientific methodologies aspects [27], it was conducted a focus group research [51] [67] [52] [58] [50] [59]. A remarkable conclusion is that that the focus group research option and the qualitative analysis reusing the codification available in the previous research provides results that can be comparable and, at minimum, maintains the expected scientific methodological rigors from previous research. Another remark is that before the decision of the code reuse, other methods of qualitative data analysis were also investigated (e.g. Grounded Theory [62], Discourse Analysis and Content Analysis [68]).

In a second moment, the quantitative phase, it was analyzed if in Brazil scenario there is any professional report or academic paper that conducted recent quantitative analysis. It was verified that there were conducted two recent surveys by the ABPMP, a professional and international association of BPM practitioners that is also presented in Brazil. Since there is already a survey, the approach was to evaluate this quantitative survey and provide insights under the light of the qualitative analysis.

This current research state-of-practice phase concludes that there is evidences that the state-of-practice is in alignment with the state-of-art, i.e., the professional community is concentrating their efforts in both initial phase of the BPM lifecycle: the analysis and the design phase. Moreover, it was possible to compare this results finding of Brazilian scenario in 2015 with the Australian scenario in 2007. Almost all the issues

were the same and it was also perceived that maybe the issues that were not perceives has a relationship with advent of BPMN model language (e.g., lack of standard language).

Yet related to the findings, the support of the pre-existent quantitative survey provides evidences that reinforce the almost absence of discussion at the other phases of the BPM lifecycle, like process monitoring, reuse or flexibility, in the professional community. Moreover, aiming the improvement of this quantitative survey, the survey was analyzed and criticized under the light of the qualitative research and scientific methodological aspects.

In this current BPM state-of-practice perspective a multi-methodological approach was applied to reduce the inherent validity of qualitative and quantitative research. For example, the generalization of the findings of focus group research is low.

However, besides the inherent limitations, another limitation is that only one researcher could analyze the qualitative data. To try to reduce this limitation, all issues were presented with a focus group participant citation and, if necessary, with the context explained. Another limitation is, due the confidentiality commitment, the transcription could not be presented for other researchers evaluated the conclusions of the current research.

Finally, to conclude, observing only this state-of-practice part of the research, it aims to contribute is also a "*modest attempt to guide BPM research towards the real key challenges in our field*" [12]. It is expected that this part of the research will help to highlight the Brazilian state-of-practice trajectory and contribute with new insights to the evolution of the BPM application at organization. It is also expected this part of research would influence the researches providing new insights, maybe explanatory ones, which could help the BPM professional with the challenge of the initial BPM lifecycle phases and move it towards the other BPM lifecycle phases and to have a complete BPM experience and its benefits.

Chapter 7 – Conclusion

This chapter presents the main findings from this research and points its contributions, limitations and possibilities of future work for research continuity.

Business Process Management (BPM) is defined by Dumas et al [1] as "the art and science of overseeing how work is performed in an organization to ensure consistent outcomes and to take advantage of improvement opportunities". From an academic perspective, research in this field resulted in a lot of methods, techniques and tools to support the BPM lifecycle and its phases like design, enactment, management and analysis of operational business process, i.e., it results "*in a plethora of methods, techniques and tools to support the design, enactment, management and analysis of operational business process* [2]*.*"

From a practice perspective, processes are everywhere in organizations and BPM concerns to various groups in an organization, from people in charge of the company affair (CEO[22], COO[23], CPO[24], CIO[25], CFO[26], and HR[27]) to people that are part of the processes and responsible for the activities execution [1]. Recker presents important evidences of the organizations concerns [8]. First, BPM is a challenge for expert managers [9]; [9]; second, in 2009, Wintergreen predicted that BPM market would triplicate in 2009-2014 over US$ 6.2 billion dollars [10]; finally, organizations deal with initial and trivial stages like discover and document their business process [22].

Some initiatives contribute to condense the evolution of the knowledge in the BPM field. From an international and academic perspective, Aalst´s related work pre-

[22] Chief Executive Officer
[23] Chief Operating Officer
[24] Chief Purchasing Officer
[25] Chief Information Officer
[26] Chief Financial Officer
[27] Human Resources

sented on discussed this evolution in the BPM International Conference from 2003 to 2012 [12], resulting an evaluation of the research scenario within a key concern and a use case categorization of 289 papers in this period.

There are also publications related to the state of the practice. Induska et al [22] multi-method research approach, complemented with Bandara et [23] and Sadiq et al [24] researches, provide an overview of the BPM scenario from an Australia perspective and International perspective almost ten years ago, in 2007. From a Brazilian´s perspective, three publications also investigates the state of the practice using a qualitative approach and, with a bigger amplitude, the ABPMP conducts two surveys, one in 2013 and the other in 2015.

Regarding that academy and organizations have a mutual interest in BPM [2] [4] [5] [6] [7], this research also recognizes the relevance of a consolidation of the both, the state-of-art and the state-of-practice scenario proposing the following research question:

i) "What are the major key concerns in Brazilian academy?"

ii) "What are the major use cases in BPM presented in Brazilian academy?"

iii) "What are the practical issues from the Brazilian´s perspective?"

Related to the state-of-art and to the first two questions, this research provides evidences that the key concern *process modelling analysis* is the dominant concern in the Brasilizan academy. It is followed by the concerns *process enactment infrastructure* and *process modelling language*. However, while in the international conference the research is moving from these three concerns to the other three concerns, *(*i.e., process reuse, process monitoring, and process flexibility), in the national conference, this movement was not perceived. Related to the use cases, the *Design Model* use case is the most frequent, followed by the *Enactment Model*. It´s not a surprise since these use cases are strongly related to the two key concerns *process modelling analysis* and *process enactment infrastructure*.

Related to the state-of-practice, and to the last question, this research perceived that the main issues are related to the first BPM lifecycle phases, i.e. the analysis and design phase. It is in line with the state-of-art conclusions. Moreover, from the practical perspective, there is almost an absence of experience in BPM monitoring phase.

7.1 Contributions

The main contribution of this work is a first outlook overview about the whole state-of-art and state-of-practice scenario in Brazil by the data collection, analysis and discussion of findings that aimed answering the research questions. It is expected that this main contribution will help to highlight the Brazilian research trajectory and contribute with new research questions, e.g. in state-of-art, Why are Brazilian researching scenario is, at major, concentrate in the analysis and design BPM lifecycle phase? Why the research scenario is towards the process mining? Why process modelling language is returning as a relevant issue?

With this main contribution, it is also expected that this research would influence the practitioners, and vice-versa, i.e., the practitioners with these new insights could bring new experiences and challenges to the academy. State-of-practice associated to state-of-art insights, could help the BPM professional with the challenge of move towards other BPM lifecycle phases and to have a complete BPM experience and its benefits.

Moreover, another main contribution is a methodological approach that follows previous researches from the both perspectives regarding the comparability, repeatability and future improvement. The observation of a qualitative phase, a quantitative phase and previous research could became a tool that could help future state-of-art and state-of-practice analysis that could help the researchers to move their goals and the state-of-practice to stay in touch with the more recent academy findings.

In addition to this dissertation, for expanding the body of knowledge, this research have already provide a scientific paper, presented in the Brazilian Symposium of Information Systems [44] and two more reports are being prepared to be presented at the academy. Moreover, the results will be sent to the professionals BPM associations aiming the improvement of the quantitative national survey in the field.

7.2 Implication for practice

The results of this research could have strong implications for practice. The news about the Brazilian state-of-practice scenario and the state-of-art scenario and the relationship of this scenario with other international scenario can help users with insights to new start points in their BPM initiatives.

Moreover, the categorization of the BPM knowledge in key concerns and use cases can help to organize and to prioritize the BPM initiatives. In the future, the methodological approach could be redone to evaluate new directions and to evaluate new situation of the state-of-art and the state-of-practice.

7.3 Limitations

From the state-of-art, there are limitations related to the positioning of the BPM field. BPM initiatives can be found in a *spectrum* from business to technology. In Brazil, it was verified that BPM research have been conducted in fields like Production Engineering, System Information and Administration research fields. The evaluation using only the System Information field could threaten the validity of the findings.

Continuing at the state-of-art, another limitation presented is the research scenario in Brazil is under the evaluation of the Capes (in English, Higher Education Personnel Improvement Coordination)[28]. This public foundation, in Brazil, provides a quality evaluation of the national and international conferences and journals, called Qualis[29]. The implication of that evaluation is that Brazilian researchers try to publish first in better-evaluated conferences and journal, most of them international. This research focused at Brazilian Conferences, an exclusive BPM one.

The focus in a specific conference, the WBPM, brings these kind of limitations. However, other options like investigate thesis, dissertations would provide other kind of limitation, e.g. completeness, because not all the universities provides a thesis repository and this option would not provide a comparability with the international scenario.

Nevertheless, regarding these limitations, the methodological approach is open to insert this new research. The methodological approach provides the capability of update the state-of-art analysis regarding other fields or focusing not in conferences but in the Brazilian researchers. A concept proof updating the eight Workshops of BPM (2007-2014) evaluation with 2015 BPM special track was also presented in this current research.

From the state-of-practice perspective, the multi-methodological approach tries to reduce the inherent validity of qualitative and quantitative research. For example, the

[28] http://www.capes.gov.br/

[29] https://sucupira.capes.gov.br/sucupira/public/consultas/coleta/veiculoPublicacaoQualis/listaConsultaGeralPeriodicos.jsf

generalization of the findings of focus group research is low. This limitation was already known during the design phase of this research and was presented, for example, in the methodology justification of focus group. Some limitations could be threaten but others not.

For example, to reduce the limitation of only one researcher could analyze the qualitative data, all issues were presented with a focus group participant citation and, if necessary, with the context explained. However, due to the confidentiality commitment, the transcription could not be presented for other investigators evaluated the conclusions.

7.4 Future Work

For future work, there are some perspectives. First, to update the state-of-art analysis with new research. It could be done towards the Brazilian researchers or towards another knowledge field. It´s also possible to use the same state-of-art methodological approach to have a region overview, e.g., analyzing the Latin America state-of-art scenario. Other possibilities is to investigate new possibilities of categorization, not only the six key concern but also other concerns, as already presented by Aalst like collaboration, process integration and patterns [12], or to elaborate challenges for the field like Business Process Intelligence Challenge [69] or the Big Challenges on Computing research in Brazil [70].

Another perspective is to improve the state-of-practice analysis. The multi-methodological approach could help to reduce some inherent problems of the both kind of research, the qualitative and the quantitative. However, as the nature of a state-of-art or practice evaluation, it is desirable the repeatability in order to follow the evaluation and to make comparisons. In other words, this kind of research could be comparable to a measure tool. To advance towards this repeatability and due to the complexity of this issue, perhaps a design science [53] approach could be followed. It means that the methodological approach could move from this exploratory and explanation classical research approach to a prescriptive approach or, in a new research question, “what is the best manner to measure the BPM state-of-art or state-of-practice?”

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