ERP Projects in Organizations with Low Maturity in BPM: A Collaborative Approach to Understanding Changes to Come

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Abstract: ERP projects are constantly involved with profound changes in organizations that directly impact business processes and their stakeholders. Therefore, process understanding is an essential step in such projects. However, in companies with low maturity levels in BPM, the processes are informal and unstructured; there are no previous models or outdated. Thus, the primary source of information about processes is the people involved in their execution. But, how to engage ERP project stakeholders in the changes resulting from the new system by understanding current processes and future changes? This study proposes a framework called "Meet2Map" to answer this question. This approach promotes identifying, discovering, and modeling processes involving participants based on collaborative interactions and human-centered design principles. Through a case study, the results showed the adequacy of the Meet2Map framework in supporting the process analyst in As-Is process modeling as an essential step in the implantation of ERP systems.

1 INTRODUCTION

Organizations typically face challenges when trying to implement initiatives to change their business processes. A typical example of this scenario is implementing business management systems, better known as ERP (Enterprise Resource Planning). These systems are responsible for any company's key activities, usually implying changes in critical processes in sectors such as production, services, HR, finance, logistics, distribution, among others, and, therefore, involving all employees who make the company, from operational to a strategic level (Taube and Gargeya, 2005), (Sedera, Gable and Chan, 2003).

Many ERP projects have been renewed recently, mainly due to cloud computing and big data technologies, aiming at service-based platforms to reduce costs and increase business efficiency through greater integration between the company and its value chain (Schmitt, 2015; Seethamraju, 2014). Thus, ERP solutions are constantly evolving, demanding the implementation of new ERP projects (Lechesa, Seymour, Schuler, 2012; Johansson and Ruivo, 2013). In this scenario, the sophistication of the new ERP systems causes profound transformations in organizations, directly impacting all employees' activities, at all levels, conducted for years in the same way and with the same people. These changes often demand new skills, differentiated roles, much less operational and more managerial functions, involving a change in organizational culture and personal mindset that organizations are not always prepared to face.

It is not new that ERP projects have suffered failures. According to Santos, Santana and Elihimas (2018), one of the reasons is poor administration regarding identifying and managing implementation risks, in general, associated with critical factors of project success. Among these factors, the human factor is predominant such as the support of top management, the presence of key users, the competence of the project team (which includes managers, users, and IT professionals), education & training, communication, and the management of expectations (Bhatti, 2005; Prata and Santos, 2019). In this context, it is evident how essential the involvement of the interested people is in organizational changes and how these changes need

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to be understood effectively, not only with messages and presentations, which are almost always unidirectional. At this point, BPM can be used as a strategy for engaging employees with future changes, based on the exposure of their current processes and, together with them, understanding the changes that these processes will undergo with the implementation of the new ERP.

The initial activities of an ERP project coincide with the initial stages of the BPM life cycle, which include the identification, discovery, and analysis of business processes, according to Dumas (2013). In general, process analysts carried out these steps to identify business processes, detail their tasks, and produce process models that clarify how to work procedures are performed (As-Is models) and how they can be improved (To-Be models). However, many organizations, particularly those with low BPM maturity, suffer from a lack of information from outdated, inconsistent, or non-existent process documentation (Jeston and Nelis, 2006). In these organizations, the primary source of information about processes is the people involved in their execution through the domain experts (users, owners, managers) representing the main stakeholders in the ERP projects (Persson, 2001).

According to Luebbe and Weske (2012), raising processes through interactions between process analysts and domain experts is not easy. Traditionally, process analysts interact with domain experts, collect information, and translate it into process models. However, domain experts (like users, owners, managers) are generally unfamiliar with process thinking and notations, failing to provide meaningful feedback. Another common problem during process modeling is that the process analysts could misinterpret information because they are not familiar with the process, generating an incomplete or wrong model. Finally, failures during a process modeling cause rework, costs and compromise stakeholder confidence.

In this context, a central question motives this study: "*How to engage ERP project stakeholders in the changes resulting from the new system by an understanding of current processes and their future changes?*". To answer the central question, this study describes a proposal to identify, discover and model business processes from interactions of people involved in those processes, called the "Meet-to-Map" Framework ("Meet2Map", in short). Based on collaborative interactions and human-centered design principles, this approach might foster new ways of process modeling by engaging participants. For this, the Meet2Map framework comprises an application process, a design tool, and artifacts to guide the process analyst in modeling the As-Is processes together with domain experts. Although similar proposals are found in the literature (Adamides and Karacapilidis, 2006; Luebbe and Weske, 2010; Cereja et al., 2017), there are no reference guides focused on a collaborative process modeling able to support the analyst in this task.

As main contributions, it is possible to highlight: a detailed step-by-step procedure on how to perform the As-Is modeling stage of the BPM life-cycle; and a collaborative approach supported by a tool based on design principles. Also, a case study is described, showing the viability of this proposal.

This paper is organized into six sections. After this introduction, Section 2 describes the primary theoretical references and related works. After that, Section 3 presents the research methodology. The Meet2Map Framework and its components are presented in Section 4, followed by a case study discussed in Section 5. Finally, Section 6 presents the conclusions and future perspectives of this research.

2 THEORETICAL BACKGROUND

Two main fundamentals underlie the Meet2Map framework: the characteristics of the discovery and process modeling step of the BPM cycle, discussed in Section 2.1; the principles of human-centered design, discussed in Section 2.2. Section 2.3 also presents a brief description of the works that inspired this study.

2.1 Business Process Discovering and Modeling

Several authors (Davenport et al., 1997; Jeston and Nelis, 2006; Dumas et al., 2013) agree that the first step in any BPM project is to understand the process and identify its problems, and as so, to model the As-Is process. It is necessary to understand the current process to identify improvement points and avoid repeating past mistakes (Sedera, Gable and Rosemann, 2004). Another essential factor is the acceptance of the model by its participants. The imposition of a new process, not considering the participants' experience, contributes considerably to negative results. Baldan et al. (2007) emphasize the relevance of the following steps on the identification and modeling of the As-Is process: i) *Project planning*, understanding of scope (which process will be modeled, goals, metrics, strategic alignment,

deadlines, deliverables), team composition, schedule, the infrastructure needed, access to documentation related to the process (laws, regulations, references); ii) *Data collection with users* (business experts and facilitators), including interviews (open or structured), the joint definition of activities, information about the process, meeting records; iii) *Process documentation*, building the process model, according to the methodology adopted. Additionally, some information could also be registered, such as publications, references, scope, etc. In this phase, it is expected the use software to support modeling; iv) *Process validation*, evaluating the model in an authentic process instance to check for coherence; v) *Model adjustment*, in which any perceived distortions during validation should be corrected.

These steps grounded the definition of the Meet2Map framework. In addition, we considered other critical factors extracted from the BPM CBOK (2013), which could influence the planning and execution of these steps. The first issue is the communication problem. All the stakeholders must fully understand the externalized knowledge. Thus, it is necessary to establish a clear goal to support defining priorities and needs. It is also required to identify the process at a high level before describing its activities. Going straight to the details can lead to constructing a very large and challenging to understand model. A sequential decomposition approach of "understanding the whole - understanding the parts - choosing one part" assists in the conception and comprehension of the model.

It is also important to manage expectations concerning modeling goals. Process modeling is not an end but a means to achieve a goal. It is fundamental to understand and make clear what is expected of the modeling. It is important to emphasize that the model must also be validated by those who will use it and not only by those who have provided information about it. Finally, it is important not to confuse understanding and standardization. Process modeling does not represent an institutionalization of the process as a standard. These critical factors served as a reference to define the method for the process modeling phase proposed in this paper.

2.2 Design Principles to foster Business Processes Discovering

Although the design thinking approach has been used more frequently in the context of process innovation, some studies suggest that alternatively, organizations could use design principles (Brown, 2009) and practices to address some issues faced by dealing with BPM in a general way, considering these issues are essentially human-centered (Van Looy and Poels, 2019).

In the context of "As-Is" process modeling, three phases can be considered: *identification*, to achieve a full understanding of the process, analyzing it both from a rational and experienced perspective; *discovering*, discussing processes, and proposing potential solutions that represent them; *as-is modeling*, in which a process is designed and evaluated by people involved, in a real scenario, getting feedback from them. As in the design of new product or processes, some principles also need to be adopted in the discovering and modelling of processess, encouraging the participation and engagement of domain analysts, users and other stakeholders. In this context, Brown defines seven design principles (DP) that can be related to processes, as shown in Table 1.

Table 1: Design principles in process modeling.

ID	*Design Principle*	*Process Modeling*
DP1	*Human-centered*	People who participate in the modeling process are the most important resource and should be valued.
DP2	*Collaboration*	Stakeholders should be able to model process collaboratively, making the participants owner of the process.
DP3	*Experimentation*	Look for different ways of modeling processes and breaking down barriers, allowing domain experts to model the process.
DP4	*Reflective*	Observe the process from different perspectives to allow more discussion on the process.
DP5	*Multidisciplinary*	Involve people from different areas and functions related to the process.
DP6	*Process thinking*	Ensure that process stakeholders can analyze their processes, think about the problems faced, and propose possible improvement.
DP7	*New ways of thinking*	In this context, about the processes.

These principles were used in the Meet2Map conception to define its method and guidelines on how to apply it as described in Sections 4 and 5.

2.3 Related Work

According to Forster et al. (2012), since various domain experts and engineers are involved in collaboratively creating of process models, the frontier between elicitation and representation is blurred. The authors argue that the distinction between those two phases disappears and is replaced by an iterative process of performing them. So, despite the most traditional method for process discovery and modeling be the structured interview (Davis et al., 2006; Dumas et al., 2013), some research on collaborative process modeling has been proposed. In this sense, Adamides and Karacapilidis (2006) presented a framework for collaborative business process modeling, in which during a collaborative modeling session, a group participates in four interrelated activities: construction, presentation and understanding, critique, and intervention on the model. Furthermore, Antunes et al. (2013) developed a modeling approach and a collaborative tool to support end-users in modeling business process based on a composition of scenes that form storyboards. None of these proposals provide a structured method for the modeling phase of business processes.

On the other hand, although some companies are already starting to use design thinking in BPM (e.g. SAP1), and this approach is mentioned in white papers from consulting groups (e.g., Recker, 2012), the academic literature has not explored this topic in depth yet. Based on design science and action research, Rittgen (2010) proposes a six-step method to guide groups in workshops and a software to support applying this method, also advocating the use of collaborative methods for process modeling (Rittgen, 2009). This work is focused on the dynamics of the workshop itself. Cereja et al. (2017) described the use of design within the BPM cycle. A real case in a company has motivated that work when a traditional method of requirements elicitation was not successful in a specific project, and moreover, the users did not perceive the process that the system should support. So, a consulting company was hired to apply design thinking. They did not focus on the modeling phase and neither used a collaborative application to support the approach, as the framework presented here. Besides, Miron et al. (2019) described the DIGITRANS Project, which is intended for an automated transformation of haptic storyboards into diagrammatic models. They are focused on the development of an app that delivers a design-based method and a set of tools to support the digital transformation process of Small and Medium Enterprises.

Luebbe and Weske (2010) proposed a tool to support business process modeling called TBPM (Tangible Business Process Modeling). They aim to model the process during the discovering phase, so the domain specialist is no longer only interviewed, but he/she models together with the analyst. This proposal is based on design principles. The tool comprises a set of acrylic artifacts based on BPMN notation (task, event, gateway, and data object), which can be handled by the team to create the model. According to the authors, the semantics associated with the artifacts impel participants to use the concept of control flow, data flow, and resources. Thus, participants can create, delete, organize and rearrange objects. Luebbe and Weske (2010) pointed out the benefits of the tool: people talk and think more about their processes; people review their processes more often and also apply more corrections during the discovery session; more fun and new insights during process modeling; active creation involves the participants and increases the engagement to complete the task. In view of these results, we propose this work as the initial stage of our research methodology, as described in the next section.

3 RESEARCH METHODOLOGY

This study is characterized as qualitative research, with an emphasis on Action-research. According to Patton (2002), research is said qualitative when aims to investigate what people do, know, think, and feel through data collection techniques such as observation, interviews, questionnaires, document analysis, among others. According to Merriam & Tisdell (2015), action research is intended to solve a problem in practice, contributing to the research process itself, addressing a specific problem in a real environment such as an organization. This research was conducted in three stages: 1) Research delimitation; 2) Action-research cycles; and 3) consolidation of results. Figure 1 shows an overview of the research methodology.

In the first stage, a literature review was carried out, which supported the construction of the theoretical background on the themes related to BPM, process modeling, and benefits of Design principles (described in Section “Theoretical Background”). Moreover, as an ICT manager of a company in the electric sector, the first author of this study observed many problems with business process management concerns an ERP project in his organization,

particularly concerning adherence between processes and systems. In the second stage, we specified the problem, central question, research questions (described in the section Case Study) and planned the 2 case studies. To guarantee the reliability of the results, we defined a protocol for each one, which described the procedures of data collection, selection of the participants, analysis methods, and documents used.

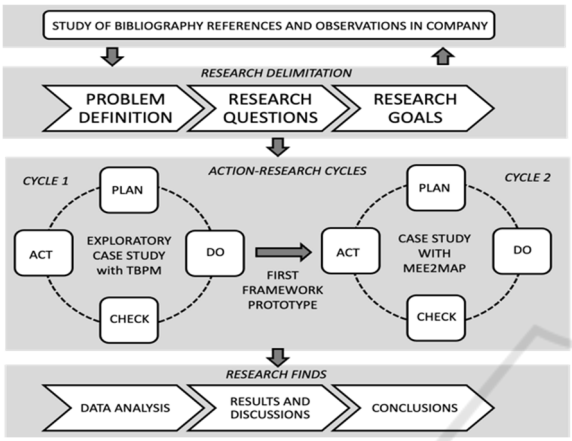

Figure 1: Research methodology.

The first case study had an exploratory nature, aiming to come up with the main challenges related to process modeling with the usage of TBPM (Luebbe and Weske, 2010). The results of this exploratory study provided an additional basis for the design of the Meet2Map Framework, which will be described in the next section. The data collected allowed the identification of the problems related to the process elicitation and modeling phase as well as the use of the collaborative tool. The problems were categorized into 10 types of Failures: F1. Lack of experience of the analyst in the application of the modeling tool; F2. Lack of a clear introduction on business process concepts and process model in BPMN; F3. Lack of an interview script; F4. Lack of key participants in the modeling team; F5. Lack of proper introduction on tool use; F6. Homogeneity of participants; F7. Inadequate or partial preparation of the modeling tool; F8. Unclear or poorly defined activity proposal; F9. Impulsive conclusion of the analyst; F10. Excessive interference by the analyst for direct modeling of the process. These failures were associated with 9 different types of Consequences arising from them: C1. Increasing the time of the modeling task; C2. Lack of confidence in the use of the tool; C3. Lost of focus in the modeling task; C4. Process model not well-defined; C5. Unbalanced participation; C6. Low performance of the team; C7. Participant demotivation; C8. Resistance of the participants; C9. Lapse of relevant information. The categorization of failures and consequences allowed the proposition of four critical success factors for discovering and modeling activity, using the collaborative modeling tool:

- CSF1. Experienced and prepared analyst related to failures (F1, F2, F5, and F9; C1 to C4);
- CSF2. Detailed definition of the methodology using the collaborative modeling tool (F2, F3, F5, F7, and F10; C1 to C7);
- CSF3. Choice of suitable participants for the process (F4 and F6; C4 to C7);
- CSF4. Clear and well-defined mission (F8; C3, C4, C8, and C9).

The goal of the second case study was to evaluate the application of the Framework. Section "Case Study" describes that case study in detail, as its results and discussions that are related to the third stage (research finds).

4 Meet2Map FRAMEWORK

This section presents the framework proposed to support the analyst in conducting the discovery and modeling phases collaboratively. The framework is composed of a collaborative modeling method, a tool for collaborative modeling processes, and group of artifacts, as shown in Figure 2.

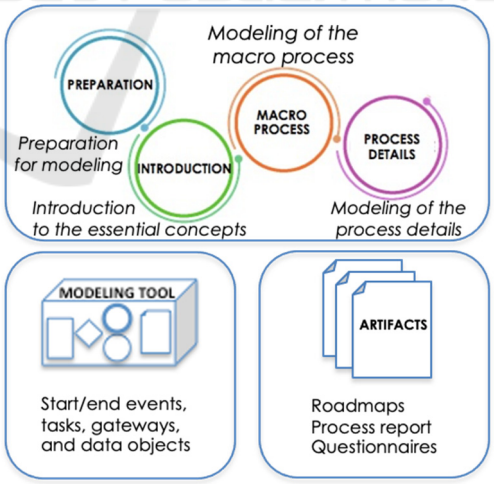

Figure 2: Components of Meet2Map Framework.

4.1 Modeling Tool

The goal of the Collaborative Modeling Tool is to foster interaction among participants according to the design principles. So, we took the TBPM tool as a

starting point. However, despite the benefits presented, the use of the tool in the exploratory case (commented in section "Research Methodology") pointed out some problems related to its design: building the acrylic pieces demands specific tools for the appropriate cutting and craftsmanship for the finishing of the pieces; and, applying the TBPM on a horizontal surface, preferably of glass, is required to allow the design of the swimlanes and flows. But since modeling activities usually take place at the customer's location, getting an environment with this type of table is not so simple. Thus, the solution was to replace the original material used in TBPM with the paper since it is low cost and accessible to everyone, as illustrated in Figure 3.

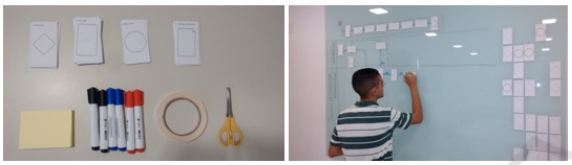

Figure 3: Collaborative Modeling Tool.

To ensure a tactile experience, some resistance to handling and good appearance, various types of paper were tested (Dutra, 2015). The BPMN elements are start events, end events, tasks, gateways, and data objects. Hence, the template cards could be printed and easily cut for the preparation of the pieces. Moreover, there is another benefit of this design: with the application of a double-sided tape on the opposite side of the printed face, the tool can be easily used in whiteboards that are easy to acquire and commonly used. To facilitate use during the modeling activity, blank pieces were fixed on the board within reach of the participant.

4.2 Collaborative Modeling Process

The main goal of the Method for Collaborative Modeling Processes is to involve all participants in the joint effort of modeling the process supported by a collaborative tool. Thus, it is necessary that the analyst to promote the participant's active collaboration to extract as much as possible relevant information and insights about the process. The result expected is not the final version As-Is process model, but the identification of details that allow adequate final modeling. The method is composed of four steps.

The first step is the Preparation for modeling. This step is very important since the team needs an appropriate environment. These are the instructions for this step: Select the environment: it is important to select a place free of distractions, favoring the attention of all involved; Guarantee full availability of participants: it is important to ensure that all key stakeholders are fully engaged in the activity during the proposed period, considering the human-centered, collaborative and multi-disciplinary characteristics of the design principles (DP1, DP2, and DP5 as shown in Table 1); Prepare the modeling tool: it is important to prepare the modeling tool so that it is ready for use and available for participants during the modeling activity encouraging experimentation (DP3).

The second step is the Introduction to essential concepts. The process analyst starts the workshop by introducing the team to the essential concepts to perform the task as listed below, stimulating process thinking (DP6): Understand the goals of the organization with the accomplishment of the task; Discuss the methodology that will be used for modeling; Introduce the basics of BPM, process modeling, and BPMN notation; Present the collaborative process modeling tool.

The third step is Modeling the macro-process. The main characteristics and macro tasks of the process must be identified (identification phase). It is recommended that the analyst conduct a semi-structured interview, driven by questions that help to understand the overall scope of the process. A proposal of questions is presented in the section "Artifacts".

After the questions for macro tasks identification have been answered, providing new ways of thinking about the process (DP7), the participant should summarize the understanding of the macro process and its main activities, taking the time to do it (DP4).

Finally, the last step is *Modeling of the process details*. At this point, the macro tasks are already identified and, it is time to learn the details, such as responsibilities, interactions, transitions, rules, and events. First, it is necessary to present the modeling elements of the tool, recalling the basic concepts of BPMN.

To demonstrate the use of the tool to the participants, the analyst can represent the macro tasks at the top of the whiteboard. That way, while he demonstrates the use of the tool, he creates a reference guide. Additionally, the analyst can also draw the pool of the process with the swimlane of the first participant-role identified, and then place the start event. After this, participants should be encouraged to detail each macro task, according to the discovery phase.

The top-down design technique can aid in the discovery of more details about the macro task, so each task is examined until the desired level of detail

is reached. This human-centered activity (DP1) promotes reflexive thinking, process thinking, and new ways of thinking about the problem (DP4, DP6, and DP7).

The process analyst can intervene by asking questions about the process to guarantee the correct use of the modeling concepts. But it is important that he/she does not interfere by drawing conclusions about activities, since this may decrease the participation of business experts and make them mere observers. Moreover, whenever necessary, the analyst can also introduce a more specific BPMN element to further enrich the process model. To do this, he/she must adapt the base element (e.g., transforming a basic task into a user task or manual task) by drawing the symbol corresponding to the most specialized task. However, the concept must always be presented to the participant, and his understanding must be confirmed, so that knowledge could be replicated in another situation by him. Additionally, throughout this step, critical points of the process and points of failure must be identified and pointed out in the model; however, it is very important that process improvements are not addressed yet to prevent the participant from contaminating the as-is process model with insights of improvements that do not correspond to the actual process performed.

Once the process has been detailed, the analyst must validate it, corresponding to the as-is modeling phase (sketch of the model). Therefore, the process analyst should request participants to verbally summarize the process model from the start to the end to observe if any part of the process has not been represented. It is also important to check if the modeling goals were met.

4.3 Artifacts

To facilitate the application of Meet2Map, a script was defined with reference to the experiment designed by Luebbe & Weske (2012), in which the following steps are defined: Step 1) Apply the preliminary evaluation questionnaire; Step 2) Conduct the interview to identify, discover and model the processes; Step 3) Apply the step evaluation questionnaire.

About Step 1, the preliminary evaluation questionnaire is composed of four questions:

1. Have you participated in a business process mapping activity before?
2. Do you have any previous knowledge about business process management, by articles, books, or daily tasks?
3. Do you have knowledge of BPMN notation? Have you used this notation?
4. Do you have experience with any process or activity modeling language?

That questionnaire must be sent to the participant by email and must be completed before the discovery and modeling activity.

Considering Step 2, a roadmap is proposed, according to the following activities:

- *Activity 1* – Start the mapping session with a presentation to introduce main concepts to the team: Introducing the basic concepts of process methodology; What is the business process management and what is it for? What are primary, managerial, and support processes? What is an As-Is process? To present the basic concepts of BPMN notation, the objectives of the organization for mapping processes, the methodology that will be used for the mapping activity, and the mapping tool and collaborative modeling.
- *Activity 2* – After preparing the team, begin the interview for mapping the macro process as-is, following a script with pre-defined questions: What is the objective of the process? Why is the process important to the organization? Who is the client of the process? What is the customer's expectation of the process? Who are the suppliers of the process? How/when does the process start? How/when does the process end? What are the overall scope of the process and the most important activities?
- *Activity 3* – To demonstrate the modeling technique and summarize the understanding of the macro process and demonstrate the use of the modeling tool, the process analyst should model the macro process using the modeling tool.
- *Activity 4* – Start mapping to detail the process using the collaborative modeling tool. Conduct the participants in the as-is process model construction and perform questions to identify the parts of the process.
- *Activity 5* – Once the process is modeled, ask participants to flag existing problems in the current process. Signalize problems directly in the process using sticky notes that point to the point of the problem that the process has.
- *Activity 6* – Finally, the modeled process needs to be validated by participants. For this, the

process analyst must: Ask the participant to verbally summarize the understanding of the modeled as-is process; Review whether the model made meets the reasons initially defined for mapping the as-is process; Question if there is any other information about the process that the participant would like to share.

Regarding Step 3, questionnaires were defined with the proposal to evaluate three main aspects: the information provided; the modeling activity; and the collaboration tool. These questions will be discussed in the results section of the case study. It is important to emphasize that the questionnaire was sent to the participant by email, right after the modeling activity was finished.

5 CASE STUDY

The case study was conducted within a company that provides services to the electric sector. This company had just acquired a new Enterprise Resource Planning (ERP) system and needed to start modeling and analyzing the current processes to align with the new system. The scope of the project encompassed the following areas of the company: Electrical Management; Accounting (tax and patrimony); Financial; Payroll and Point (Human Resources); Purchasing and Inventory (Supplies); Logistics. In total, 25 processes needed an analysis of conformance to the new system. It was necessary to map in detail how the processes were executed, observing activities supported by the legacy software, manual activities, rework due to the deficiency of the legacy software, and business rules related to the processes. In this context, the internal analyst (first author of this paper) proposed to use the Meet2Map. It was selected four processes to be modeled following the proposed framework: Contract Billing (Electrical and Financial Management); Employee recruitment (HR); Maintenance of fleets (Logistics and Finance) and; Purchasing (Supplies and Finance).

The selection of the participants was made in two steps. The first selection was based on the departments involved in the processes to seek the support of the managers to identify all the key participants in the processes. The second one corresponded to the stage of identification of the participants for the modeling activities (Preparation for modeling). The identified participants were involved in the modeling activities of the selected processes, which were conducted by the researcher in the role of the process analyst. The number of participants for each process was: Kick-off Workshop (6); Process 1 (3); Process 2 (2); Process 3 (2); Process 4 (3). 80% of them had some coordination or management function; which benefits the modeling activity, considering their experience in the business. Regarding the participants' experience time, 90% had more than 2 years of experience in the area, with only one participant with less than one year in the company, who then participated in the modeling of the Employee recruitment process as a listener. None of the participants had performed process modeling before, and only 40% of the participants had participated as a collaborator in traditional modeling activities based on interviews. It is worth noting that a large part of the participants (80%) knew basic concepts of business process management but had never used these concepts in practice. This aspect reinforces the importance of an introduction to the theme for leveling the knowledge and the proposal. Finally, 90% of the participants already knew some language for control flow modeling and 40% of them had already used this technique to model processes, although none of the participants had previously used BPMN.

The study was conducted as follows: 1) two processes were modeled in a traditional way, without the support of a collaborative modeling tool; 2) two other processes were modeled using the tool.

5.1 Collaborative Modeling Process

The case study started with a kick-off meeting, for which all the 6 leaders from the areas involved and the project sponsor were invited. During this meeting, the list of elected processes was presented together with the organization's reasons for choosing them, the methodology of work, and the structure of a form to identify roles and participants. Finally, the deadlines for returning the form and the agenda of the workshop were defined. After the kick-off, an email was sent to each leader, attaching the form, the presentation, and the preliminary calendar of the mapping activities. As far as the forms were being returned, the map of areas, functions, and participants had been defined. The next steps were the workshops for modeling each process. To exemplify how they were conducted, we will comment on two: first, using the traditional method and; second, using the Meet2Map Framework.

The Contract Billing process was the first one to be modeled in a traditional method. The goal of this workshop was to identify the process, starting from contract measurement, billing approval by the contractor, registering in the Accounts Payable system, receiving of payment, and conciliation. The activity was performed as planned: all participants

have actively provided information about their activities (2 leaders of the Electrical area, 1 supervisor of the Accounts Payable and Receivable area, all of them with 3-4 years of work in the company). The workshop spent 2:34 hours. As main reports, the participants declared that they were unaware of the internal procedures of the other sector for the implementation of the process and the participants showed interest in knowing the work carried out by the other area of the company. Clearly, some weaknesses were evident in the first workshop: the dependence on an interview script, which needs to be detailed and precise to obtain quality answers; the low motivation in answering questions that require more dialogue; the difficulty in explaining processes from memories and experiences; the lack of interactivity between participants, which stimulates participation and reasoning through information sharing. At the end of each mapping workshop, a questionnaire was sent out to evaluate the respective stage. These results will be discussed in Section 5.3.

The second process mapped was the Purchasing process (one of the most complex), following Meet2Map Framework. The team identified all phases of the process, from the demand to purchase, quotation, approval, payment to delivery. The workshop spent 3:41 hours. All participants (2 leaders of the Supplies area, one supervisor of the Accounts Payable and Receivable site, all of them with 2-4 years of work in the company) interacted actively providing information about their activities, this time generating an initial process design, as illustrated in Figure 4. A clear picture of this process is available in (Dutra, 2015).

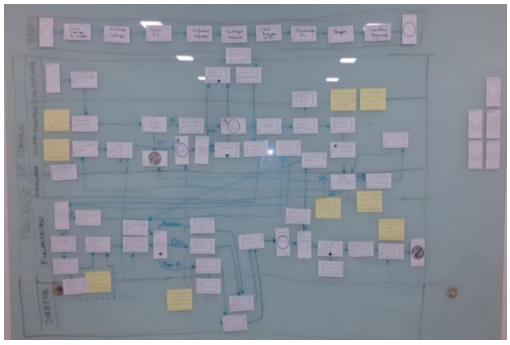

Figure 4: Purchase process model.

All participants described the activities of their department, as well as their activities. Despite the longer duration, none of the participants felt unmotivated or disinterested. Before each modeling workshop, the researcher sent the team an email, attaching the preliminary questionnaire link.

5.2 Collaborative Modeling Process

A questionnaire composed of open and closed questions was used to collect data on the participants' perceptions about the framework application, organized into three groups: G1) information provided, G2) modeling activity, and G3) collaborative tool. Online questionnaires were applied to all participants in anonymous mode and, preserving the anonymity of the participants. It is important to point out that the same questionnaire was used for both situations, the processes modeled using the collaborative modeling tool and the traditional modeling through structured interviews.

The analysis approach was based on two ways of organizing results: Unified evaluation, in which all answers to the same question were grouped and evaluated uniquely; Distinct evaluation, in which the answers were separated into two groups, referring to collaborative modeling and traditional modeling. The goal was to assess if there is significant variation between the techniques. Additionally, the data is qualitative but uses a quantitative value scale to analyze the data obtained from the closed questions of the questionnaire. The closed questions verified the degree of influence of the factors involved in the modeling activity through the Likert scale. Thus, quantitative responses replaced the qualitative scale: I totally disagree (1), I partially disagree (2), Neither agree nor disagree (3), I partially agree (4) and, I totally agree (5). The Mean Ranking Index (MRI) was used to analyze the items answered in each question. MRI calculated the weighted average for each item, based on the frequency of responses as presented in the formula:

Mean Ranking Index (MRI) = WA / (NS), where WA (Weighted Average) = Σ(fi.Vi); fi = Observed frequency of each response for each item; Vi = Value of each answer; NS = Number of subjects

5.3 Results and Discussion

The main goal of the Method for Collaborative Modeling Processes is to involve all participants in the joint effort of modeling the process supported by a collaborative tool. Thus, it is necessary that the
We received the answers from 10 participants. Tables 2, 3, and 4 present the MRI for the questions of each group. For the first group (G1), as shown in Table 2, the results were considered positive, emphasizing the need for efficient communication proposed by the framework. The value of question Q1a (4.9) confirms that the information presented by the analyst was enough to guide the participants. That information

consisted of the activity goals, introduction to BPM and BPMN. This reinforces the importance of the framework, which proposes the alignment of knowledge and goals as a way to ensure the success of the modeling. The values of questions Q1b (5.0) and Q1c (4,8) emphasize the ability of the analyst to inform the concepts.

Table 2: MRI for Group of Questions 1.

ID	*Question*	*MRI*
Q1a	The information was sufficient to carry out the activity.	4.9
Q1b	The information was presented in a clear way.	5.0
Q1c	The information was presented objectively.	4.8

The results in Table 3 compare the responses between the traditional (TM) and collaborative modeling (CM) teams, separately.

Table 3: MRI for Group of Questions 2.

ID	*Question*	*MRI CM*	*MRI TM*
Q2a	I felt motivated during the activity.	5.0	4.0
Q2b	I would participate in the activity again for modeling another process.	5.0	5.0
Q2c	This activity helped me to better understand the process.	4.6	4.8
Q2d	This activity can really help me improve the current process.	4.8	4.8
Q2e	The activity was engaging.	4.8	4.0

The second group of questions corresponds to the perception of the participants about the modeling activity. The results indirectly reflect the benefits of the framework in providing a good roadmap according to the following analysis. The values of questions Q2a (5.0 / 4.0) and Q2e (4.8 / 4.0) reinforce the benefits of the collaborative modeling tool since there is a significant difference between the values for the traditional and the collaborative modeling. This result is in line with the proposal of the tool and design principles. The values of questions Q2b (5.0 / 5.0), Q2c (4.6 / 4.8), and Q2d (4.8 / 4.8) support the perception that the activity was performed properly, showing that the participants in both cases were motivated and willing to participate in more activities of the type. The difference in the values of the Q2d was not significant, and thus, it is not possible to compare them.

The third group of questions (G3) corresponds to the perception of the participants about usability and utility aspects of the technique used for modeling, as shown in Table 4.

Table 4: MRI for Group of Questions 3.

ID	*Question*	*MRI CM*	*MRI TM*
Q3a	In my opinion, this technique is fully adequate for process modeling.	5.0	4.4
Q3b	I felt confident in using the technique.	4.0	4.8
Q3c	I agree that most people would learn to use this technique without problems.	5.0	5.0
Q3d	The notation adopted is adequate for modeling processes.	5.0	5.0
Q3e	The notation used is very complicated to use.	1.2	1.2
Q3f	I need the support of a technician to be able to use the technique.	2.6	2.6
Q3g	The technique does not encourage the contribution of important observations.	1.0	1.2
Q3h	I was enthusiastic about the technique used for process modeling.	4.8	4.6
Q3i	This technique aided to extract my knowledge about the process.	5.0	4.8

The value of Q3a (5.0/4.4) presents the most significant result for this group, since it indicates, even with only a small difference, the participants' perception that the modeling technique with the collaborative modeling tool is better when compared with the traditional one. Although the value of Q3c (5.0/5.0) presents an equal result, it shows that all the participants agreed that people would learn to use the technique without problems. It was also a consensus that the BPMN notation is suitable for process modeling, this statement can be interpreted from the values of questions Q3d (5,0/5,0) and Q3e (1,2/1,2). The value of question Q3f (2.6/2.6) expresses those participants agreed that the presence of an experienced process analyst is required to perform the mapping activity. The values of questions Q3g (1,0/1,2), Q3h (4,8/4,6) and Q3i (5,0/4,8) underpin the importance of the technique, and although they present better values for the collaborative modeling technique, the difference was very small, therefore.

This study confirmed the importance of preparing the execution of the modeling task, allowing the identification of critical success factors that the process analyst must know. In addition, strategies to

promote the team's engagement during the activity helped the improvement of the collaborative modeling tool that transforms the domain analyst into the agent responsible for modeling the process.

5.4 Research Threats and Limitations

This study has limitations and threats common to all qualitative research: dependence on the application context and lack of repeatability. In addition, although action research has many advantages because it is applied, empowering, collaborative and democratic, it also has its flaws, especially in three important aspects: the subjectivity of the researcher, who may be over-involved or interpret results only under his perception; the influence of power or lack of it on the part of the researcher in the organizational hierarchy, who in the role of subordinate or leader may impact the results; and the time-consuming process, considering an authentic ERP project and its complexity.

To mitigate these limitations and threats, this study first sought to define the research in two cycles. The first cycle sought to understand the problem better and define the research objectives based on actual experimentation with an existing proposal. In the second experiment, the multidisciplinary nature of the ERP project reduced the biases. As an IT manager, the researcher has a position that facilitates the articulation between other business area managers, but without power influence. Still, the survey involved several data collection tools, such as questionnaires and interviews, preserving the original data to avoid biased interpretations. To evaluate results, the proposal to use a qualitative questionnaire with the numerical value scale (Likert scale) sought to attenuate the subjectivity of the analysis. In addition, the collaborative process modeling included review and corroboration steps for all involved, avoiding misunderstandings and new biases. Finally, this work has some limitations that prevent an in-depth analysis of the framework's benefits. Nevertheless, even with these limitations, Meet2Map contributed to real-word ERP projects.

6 CONCLUSIONS

With the advancement of technologies in organizations, the renewal of business management systems, better known as ERPs, becomes frequent. However, ERP projects are constantly challenged by their characteristics and impacts on an organization's business processes, transforming the activities and tasks of its employees who are not always prepared for the changes from the system. In this context, BPM can be used to identify current processes and understand future changes. However, in an organization with low BPM maturity, where few or no processes are documented and standardized, process mapping becomes a significant challenge. As a result, human capital becomes the primary source of information about business processes and, therefore, fundamental agents in ERP projects.

Thus, this paper proposes a framework that presents clear recommendations on how to perform the identification, discovery, and modeling phases of the process life cycle, including support to the data collection and detailing how to apply a collaborative modeling tool to build the process model. In addition, the definition of strategies to engage the team in ERP projects showed up to be adequate for the case study discussed: modeling the process with process analyst together stakeholders allowed a detailed view of the process, promoting the discussion and the emergence of insights, which, traditionally, would be very difficult to occur. The main contribution of this research is a prescriptive solution for process modeling in the context of ERP projects, which includes: a process for discovery and modeling of As-Is processes; an easy-to-use tool that carried out this activity collaboratively, engaging its participants and; that enables the management of this activity, supporting its planning, execution, and follow-up. From the scientific perspective, the research advances in solutions for human-centered process modeling, encouraging that the As-Is modeling activity could be carried out with stakeholders involved in the process (users, owners, and process managers), not only by the analyst of the process. From the practical perspective, we expect that the application of the framework might improve the task of modeling processes as a strategy to prepare the stakeholders for future changes, achieving better inputs for the next stage of the BPM life-cycle and ERP Project life-cycle.

As future work, we intend to conduct case studies in different organizations and projects.

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