Towards an Easy Transition for Legacy Systems Evolution with the Extension for BPTrends Methodology

Gabriel Bolson Dalla Favera[1], Vinicius Maran[1], Jonas Bulegon Gassen[1,2], Tamires Marques Sum Giffoni[3] and Alencar Machado[1]

[1]*Universidade Federal de Santa Maria, Santa Maria, Brazil*

[2]*Antonio Meneghetti Faculdade, Restinga Sêca, Brazil*

[3]*Sicredi Região Centro RS/MG, Santa Maria, Brazil*

Keywords: BPM, Software Automatization, Methodology, Legacy Systems.

Abstract: With the growing demand for producs and services, organizations are considering ways to better manage their processes. Being the business process management (BPM) the most widely used approach in this context. However, traditional methodologies of BPM do not encopass all different needs yet. Some stages of the BPM lifecycle do not present the information needed to meet the requirements of some organizations. Some of those still use legacy systems that not directly support business process management systems (BPMS). Therefore, for instance, it is dificult to mesure performance or to update processes. In this paper we present an extension based on the BPTrends methodology. It intends to approach problems such as the aforementioned ones, which are not preditected by traditional methodologies. To evaluate the extension, tests were carried out in a real scenario. Furthermore, it was possible to observe, e.g., that the extension allowed BPM to be adopted with ease compared with traditional metodologies, that do not have the possibility to model a legacy system and need to wait organizations to invest on systems compatible with a BPMS.

1 INTRODUCTION

With the growing demand of products and services in organizations, business process management (BPM) teams have emerged (Leopold et al., 2014). BPM allows organizations to present multiple and different viewpoints of its processes, aside of managing activities, events and decisions (Weske, 2012). As well as adding value to organizations and their customers. However, current methodologies do not support some aspects of real world scenarios, such as process redesign in the context of organizations that had a rapid growth and still use legacy systems.

For instance, in various cases, it is difficult to define the risks associated with processes due the diversity of collaborators participating in its execution. Also, computer systems, essential for the functioning of the organization, have become outdated (Nascimento et al., 2009). These legacy systems present problems that generate a huge demand of effort for the collaborators, besides causing difficulties to newcomers to understand its operation. Additionally, some organizations do not make use of business process management systems (BPMS). Since the acquisition of a BPMS can be an arduous process, involving the acquisition, adaptation and implantation. Thus, there has been a need to provide consistent information about running processes (monitoring stage), taking into account the lack of a BPMS (Mejri and Ghanouchi, 2015). In a BPMS, such information should be easily acquired.

Taking into account the presented paradigms, the objective of this paper is to extend the BPTrends methodology. This extension can be applied in different business environments that present a rapid growth and did not consider BPM beforehand. For the construction of the methodology extension, tests were carried out in a real scenario. In which there was a high growth in the demand of work related to the BPM lifecycle. Meaning that many processes were identified and continued the cycle. Besides, the execution of those processes requires many efforts as they run in different systems, including legacy systems.

This paper is organized as follows. Section 2 presents the background, which involves BPM and its technologies. In Section 3 the related work is presented, followed by Section 4 which presents the ex-

Favera, G., Maran, V., Gassen, J., Giffoni, T. and Machado, A.
Towards an Easy Transition for Legacy Systems Evolution with the Extension for BPTrends Methodology.
DOI: 10.5220/0007758906660673
In *Proceedings of the 21st International Conference on Enterprise Information Systems (ICEIS 2019)*, pages 666-673
ISBN: 978-989-758-372-8

tension of the methodology. Section 5 presents the evaluations and discussions. Finally, conclusions and future work are presented.

2 BACKGROUND

The present section was divided in two. Firstly, is explained about the BPM and its lifecycle. In sequence, is presented about BPMS and legacy systems.

2.1 BPM

BPM is an approach that shows how work is performed in an organization, allowing to ensure consistent outcomes and to take advantages that improve the organization (Dumas et al., 2018). BPM intends to bring out important informations about the executed processes , improving decision making (vom Brocke and Rosemann, 2015).

The BPM lifecycle helps to understand all the technologies involved, their processes, and steps in order to be adopted in any business environment (Weske, 2012). It is defined in six steps, shown in Figure 1 (Dumas et al., 2018). Since BPM concerns process improvement, it is possible to define each of its stages, approaching from the process identification to the implementation and monitoring stages. Therefore, the BPM lifecycle values continuous process improvement, aiming at some goal such as to reduce costs and improve performance (Panagacos, 2012).

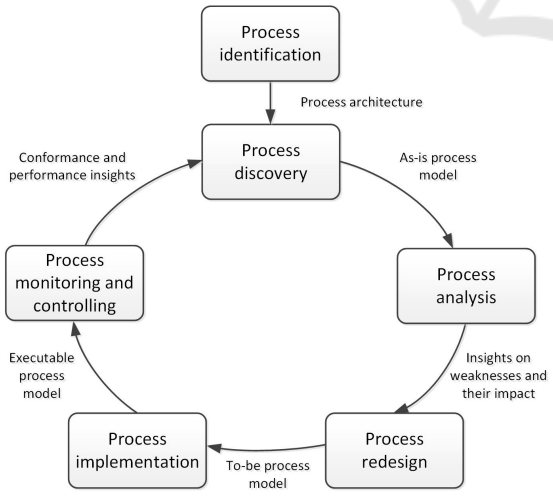

Figure 1: BPM Lifecycle.

Modeling is important during various stages of the BPM lifecycle. Therefore, the BPM has a notation for business process modeling (BPMN) that contains a series of standard icons for drawing (Dumas et al., 2018). Enabling a better understanding of the business. However, before starts modeling a process it is important understand what is your motivation.

The models produced may be different depending on the reason for which they are constructed. BPMN's main objectives are to understand the process itself and share its understanding with the people involved (vom Brocke and Rosemann, 2015). Frequently, process participants perform very specific tasks and are rarely confronted with the process as a whole (vom Brocke and Rosemann, 2015). Therefore, modeling as well as providing a better understanding of the process also helps to identify and prevent possible problems.

Actualy the BPMN notation has more than a hundred symbols (Dumas et al., 2018). However, only a few of them are actually used, less common symbols can be aggregated according to the company's need in more complex projects. In BPMN modeling there are four groups of elements, being them, Flow Objects, Connecting Objects, Swimlanes e Artifacts.

2.2 BPMS and Legacy Systems

BPM provides a set of systems for the automation of the business process management (Dumas et al., 2018). These BPMS include the ability to perform point-to-point business process mapping, as well as enable electronic forms, workflow definition, real-time monitoring of activities and alerts (Aguirre-Mayorga et al., 2012). They are facilitators of the knowledge management related to the processes, being used to obtain, distribute and analyze data.

Also, some organizations have a computer system that, although old, still essential for its operation (Fürnweger et al., 2016). This legacy systems are usually difficult to maintain due to their degree of complexity and costs for modernization. Whereas, lack of documentation and the departure of technical staff involved in the development, legacy systems can present some problems such as code structuring errors, outdated or obsolete programming styles and obsolete development tools (Seacord et al., 2003).

In the following section the related works are presented. The weaknesses of literary methodologies are also shown.

3 RELATED WORK

Harmon (2014) presents a methodology for process redesign. It is incorporated, including, in the process the stages of implamentation and process transition.

The methodology is defined in five stages, being: understand project, analyze business process, redesign business process, implement redesigned business process and roll out redesigned business process (Figure 2). Different from the methodology presented by Rosemann, which shows a focus on processes modeling, a greater focus is given in evaluations involving process redesign. And also is adopted an environment for performing the process redesign.

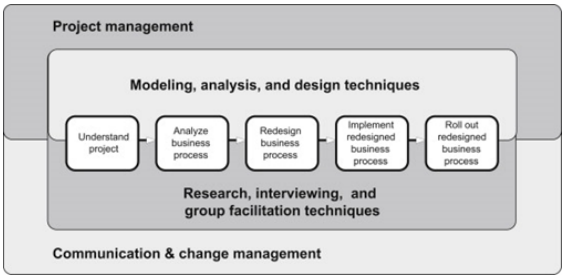

Figure 2: BPTrends Methodology.

During the application of the BPTrends methodology (Section 4), some steps could not be faithfully applied. Thus, it was necessary to apply changes to achieve the expected results for the organization. At the identification stage, risk identification was not applied due to lack of knowledge of the process as a whole by those involved. In addition, the processes to be mapped were already defined by the organization.

In the process analysis stage, there was a need to model the execution flow of legacy systems. The modeling should allow a better understanding of the flow executed in the systems, besides providing information for the redesign and for the involved collaborators. There was a need to define the risks of each process modeled in the current environment and in the improvement. Finally, due to the lack of a system for the management of the business process and the time needed to acquire. Functionalities have been developed to monitor the processes during the monitoring stage.

Rosemann (2017) present a methodology for the rapid process redesing. It was defined by the author that the process redesign would be divided into four stages. (i) navigate, (ii) expand, (iii) strengthen and (iv) tune/takeoff). It is defined by the author, including, the ideal environment to realize the processes mapping. It is used a room where it is possible to place the models AS-IS and TO-BE arranged on opposing walls (Figure 3). Also are used two opposite walls to show the process resources and the policies and procedures.

The NESTT methodology has its main feature focused on the best use of a dedicated space for modeling process (Rosemann, 2017). However, this

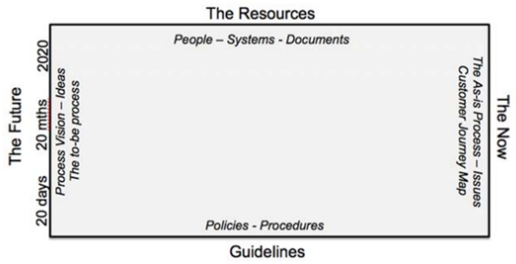

Figure 3: NESTT Environment.

methodology is focused only on the modeling and redesign of the processes, in order to prepare for to takeoff. The stages of identification, implementation and monitoring are not addressed, and it is the criterion of each company to carry out. In the methodology presented by (Harmon, 2014) are included all the stages of the BPM lifecycle. Focusing on continuous process improvement. However, the steps do not provide specific instructions for the tasks preparation.

Due to the difficulty of applying a literary methodology in a business environment, emerged the need to construct a extention methodology based on BPTrends. The papers presented in this section and the applications made in a real scenario (Section 5) were essential in order to achieve positive results for the company. The following is the methodology applied in the company.

4 EXTENDING THE METHODOLOGIES

As presented in Section 3, the current methodologies of BPM do not cover all kind of requirements that the organizations need. Therefore, in this work we discuss a extension methodology based on the BPTrends methodology.

The main problems found for organizations transitioning from non BPM to a BPM approach, having legacy systems, concerns the stages identification, analysis, redesign and monitoring (Table 1). To evaluate the proposed extension, tests were carried out in a credit cooperative, based on the BPTrends methodology.

Based on practice, aspects in different phases were missing. The following sections describe the phases poiting out the missing parts.

4.1 Identification

In the identification phase, the criteria for selecting processes was defined. In order for the processes to be chosen, it is important to hold meetings with the

Table 1: Comparative applying the extension.

Stages	BPTrends Methodology	The NESTT	Extension
Identification	- Show documentation - Mesure costs - Mesure risks		- Show documentation - Mesure costs - Consider risks
Analysis	- Model AS-IS process - Colect data for simulations - Construct documentation	- Prepare the environment for NESTT - Colect all documents - Model AS-IS process	- Model AS-IS process - Colect data for simulations - Construct documentation - Model execution of legacy systems - Mesure risks
Redesign	- Model TO-BE process - Colect data for simulations - Construct documentation	- Colect sugestions for the TO-BE process - Model TO-BE process	- Model TO-BE process - Colect data for simulations - Construct documentation - Model legacy systems - Mesure risks - Formulate precautions
Implementation	- Create a team for the implementation - Train employees		- Create a team for the implementation - Train employees - Pilot the implementation
Monitoring	- Mesure with BPMS		- Create a mesure using the documentations and evaluations

team involved to point out the main focus of BPM being applied for the given organization. Should be presented the process with the description and the degree of complexity and importance (Harmon, 2014).

In BPTrends it is necessary to measure the risks presented in each process. These risks provide data that help in making the decision about which processes to apply BPM for. However, identifying those risks was difficult due the diversity of people involved in some processes. Additionaly, the risk should be considered differently from aspects such as costs. The risk might change in the TO-BE model, increasing or decreasing. However it depends on the company appetite for risks. Thus, the risk should be considered, but carefully in the identification phase.

The risks could be measured after mapping the processes that are executed in the current environment (AS-IS) and in the improvements (TO-BE). This information is used to leverage metrics for monitoring. Additionally, some processes can be defined from the top, as organization priorities.

4.2 Analysis

After defining the main processes, meetings were held in order to build their models. It is necessary that all the activities described during the meetings match the processes modeled, thus accurately representing how processes occur in the current environment. In some cases, depending on the complexity of each process, follow-up meetings should be held where the collaborator performs the process in practice, and is accompanied by the modeling team. Once the process is modeled, a document containing the description of the processes must be created and the company must be handed over to the understanding of the modeling process. Must be collected also run-time data in order to perform simulations.

When the process is documented, the risk of the AS-IS process must be evaluated. This risks should be predicted for each modeled process. The company should predict the risks and the main impacts that are presented for itself and its clients. It also can be used to create improvements in the TO-BE process.

It was also identified, the need to perform the modeling of the execution of the legacy systems. This modeling provides more information for the redesign process and for the implementation processes as well.

For the modeling of the legacy systems can be made using the BPMN notation. As in business process modeling, it should contain start and end event. And the tasks are simple and can be represented by the same verb-object structure. If there is a need, intermediate events and gateways can be used. Intermediate events can represent, for example, the need for a system to wait for some message, signal or some time, since the gateways represent the deviations of the execution flow. In addition, the use of sub-processes can be made to improve the visualization of processes. The swimlanes are also used in modeling the processes of legacy systems. Pools continue to represent the company to which the software belongs and the Lanes will represent the persons or roles that perform these systems.

The modeling of these systems provides subsidies for building an upgraded system, as well as containing documentation for possible future improvement. In the next stage process improvement will begin, and all documents built will be essential.

4.3 Redesign

During the improvement stage, meetings or workshops are held with the purpose of analyzing the AS-IS model and presenting solutions for process improvement. This step involves not only the follow-up of the collaborator but also that of his superiors, being responsible for providing suggestions within the availability of company. Also, the documentation must be created, so that the company can evaluate. It is also required collect stipulated run-time data for the purpose of being simulated and measured before its implementation.

As an adiction for the BPTrends methodology, when constructing the TO-BE process the AS-IS process should be used as a comparison. The two models must be visible, arranged side by side, as a basis for their construction. Also the modeled process of the execution of the legacy system can be used as a basis to create an automation or a new system. However, this should be described in the TO-BE process.

As in the previous step, the risks that the redesigned process presents should be described, together with the precautions. In this way, it will be possible to generate precautions when some risk occurs.

4.4 Implementation

The implementation stage can be applied in different ways. In some cases, the modeling team may be in charge of refining TO-BE processes. In other situations the development team should provide support for the implementation of the changes that occurred in the process. Software implementation can also be done, as well as training for users.

In this step, the legacy system flow previously modeled in the analysis phase can be used. It provides information to implement new systems and to modify the task flow of the current systems.

4.5 Monitoring

In the BPTrends methodology, during the monitoring stage, BPMS are used. These systems can provide detailed information of average time in the process execution flow, in addition to distributing and defining tasks. However, acquiring a BPMS can be a complex task and requires a greater time demand.

In order for the processes to be measured, comparisons were made between the simulations of the processes. The data for which the processes were simulated were collected in the analysis and redesign stages. Thus, the average execution time can be compared taking into account the types of tasks, for example, the significant decrease of the time due to an automation.

The risks presented by both AS-IS and TO-BE processes were compared. The amount of risk that each process presented or comes to present is indicative of the performance in the process flow. Preventions, in addition to reducing costs for the organization are also indicative of improvements in the process.

Besides the analysis of the simulations and risks, forms were filled out by those involved in their respective processes. The form seeks to measure the level of satisfaction of each collaborator and client, regarding the level of stress for their tasks, average time of execution, customer waiting time informed by the collaborator and difficulties of adaptation with changes in the process. Other metrics can be defined according to the needs of each organization, usually applied when presenting specific tasks.

Both documents can be used to monitor and measure the level of collaborator and customer satisfaction. The results in these analyzes may serve as a future improvement in the process or even until a BPMS system be properly implemented, thus obtaining more precise documentation.

In the following section the related works are presented. The weaknesses of literary methodologies are also presented.

5 EVALUATION AND DISCUSSION

In order to elaborate an extension methodology based on BPTrends, applications were made in a credit cooperative, which did not have defined processes. Thus, the techniques of traditional methodologies were applied, allowing us to identify the main limitations concerning the scenario.

During the first stage, a difficulty was identified in measuring the risks associated with AS-IS processes. The fact behind this was that no collaborator was aware of the process as a whole. Once the AS-IS processes were already modeled, the risk evaluation became easier. The identification stage started with demands from the organization, which had already selected processes by their own means. These processes were defined by the superiors and according with their needs.

Although some processes were already determined, it was verified the need to measure the costs involved. Those costs were used to continue identi-

Table 2: Example result table.

Process	Cost by minute	Cost by instance	Total annual
Consortium - vehicle acquisition	$0.30	$18.00	$900.00

fying process candidates, as well as to measure improvements during the monitoring phase. A table was built based on the method of analysis and problem solving (MASP) in order to calculate the costs involved. The total cost per minute (cm), was calculated using the monthly salary (ms), days worked in the month (dwm) and hours worked in the day (hwd) based on a collaborator (Equation 1).

$$cm = \frac{ms}{dwm \times hwd \times 60} \quad (1)$$

The cost per instance (ci) defines the amount spent for each execution of the process. Total cost per minute was used (cm) plus running minutes spent (rms) (Equation 2).

$$ci = cm \times rms \quad (2)$$

Impact (i) was used to calculate the total annual cost (ta). It was calculated based on process execution frequency per year (fey) plus the number of clients and adjacent affected (caa) 3.

$$i = fey \times caa \quad (3)$$

Finally, the annual total (ta) was calculated with a sum of the cost per instance (ci) and the impact (i).

$$ta = ci \times i \quad (4)$$

Based on the results generated from the equations, it was possible to calculate the cost involved in each process (Table 2). External costs were not evaluated, such as the maintenance of computers, due to the irrelevance presented to the processes. Also, it was possible to define with more severity the priority of the processes.

Once the processes were defined, the AS-IS process modeling was started. During the modeling, several suggestions for improvement were made, making it difficult to model the current process. However, it was possible to perceive a better understanding of the operation of the process by those involved. With the processes modeled, mapping documents were generated using a Bizagi tool. These documents could be analyzed by the directors and stakeholders.

Also, data were collected from the execution of the processes. These data were collected for the purpose of simulations when TO-BE processes were modeled. There was also a need to model the execution flow of the legacy system to be handled in the next steps. The modeling of the system has even allowed a better understanding for its employees and modeling team, which can be based on documentation for the execution of their activities. For the flow modeling of the systems, basic BPMN elements were used (Figure 4), making the process understandable to the involved.

Table 3: Preventions table.

Process	Risk	Prevention
Consortium - vehicle acquisition	Lack of adaptation in the use of the system	- Provide courses of use - Build documentation for use of the software
	Error in automated system	- Construction of a contingency for the carrying out the tasks - Testing in a safe environment

At this point, it became possible to measure the risks of each process, thus setting a standard. This information was essential for the monitoring step as well as to compare with the TO-BE process.

For the construction of the TO-BE model, meetings were held with the team involved, together with process managers. Suggestions were provided by the process team. However, because the team had specific knowledge of some stages of the process, the managers were able to provide an overview, thus contributing to the improvement as a whole.

Once the TO-BE process was modeled, it became possible to measure the risks based on the modeling process. Precautions have also been provided for some situations that may occur with the process (Table 3). Again, data were collected for the purpose of simulations, identifying the improvements achieved. Finally, the TO-BE process documentation was generated. This documentation was passed on to those involved to collect suggestions for improvement.

During the implementation phase, teams were created to carry out the construction of software or automation, implement and provide process training. Based on the modeling processes of the legacy systems, information was obtained that facilitated the automation and construction of the software. Functional and non-functional requirements of the systems were defined, as well as diagrams using the unified modeling language. The documents generated were delivered to the organization in order to update when necessary. Trainings also provided for the use of software and to adapt to the new modeled processes.

Finally, during the monitoring phase, it was verified the absence of a system for managing business processes (BPMS). However, acquiring a system that meets the needs of the company can be a lengthy process. In this way, it were developed ways of measuring the performance of processes without the use of software.

Initially, the simulations were used, seeking to identify the execution time. Some issues are taken

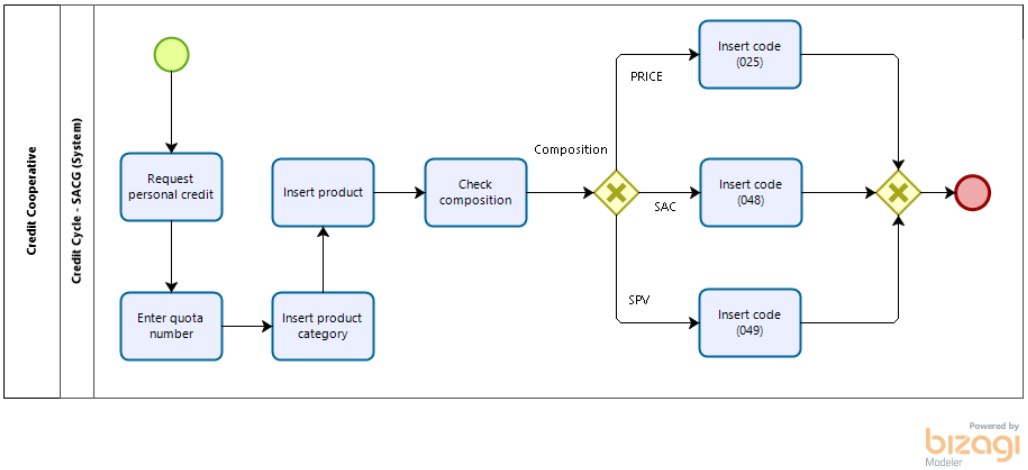

Figure 4: Part of the process of launching into the system the release of personal credit.

into account, such as the automated tasks and the reduction of employees' tasks. Comparisons of the AS-IS and TO-BE processes. The risks were compared with the AS-IS and TO-BE processes. Thus, it is up to each organization to define the risk it wishes to assume.

During the application of the methodology extension it was possible to perceive an easy adaptation from the company side. Concerning the modeling phase and processes involving the legacy systems, more time was required than in the application of the traditional methodologies. However, during the implementation phase, which involved the development of an application, a significant decrease in time was observed.

It was also observed that the lack of a BPMS did not prevented the evaluation of the process performance. The evaluations provided satisfactory information to the organization. However, a greater time demand was required for the data collection in order to perform the monitoring phase.

In the next section, conclusions and future work are presented.

6 CONCLUSIONS

This paper presented an extension based on the BP-Trends methodology. Which was tested in a real world scenario, concerning a organization which had high growth in work demand. The organization made use of legacy systems, which required a greater time for the execution of tasks. It was also identified the lack of a BPMS in the organization, thus it was difficult to measure processes performance.

Based on the presented results, it is possible to affirm that the use of the methodology extension can provide essential information regarding process models documentation for comprehension and implementation. Facilitating the adoption of BPM on the organization.

The modeling of tasks execution in legacy systems provide essential information to build new software. In addition to provide information of its operation to other employees. In this way, it was also possible to avoid that knowledge for the execution of the system remained with only one collaborator.

Regarding the BPMS, the extension provides techniques to gather process performance metrics. This can avoid downtime since acquiring a BPMS can involve a lot of time, and the organization can not stop in the meantime. In addition, the definition of risks and preventions in the analysis and redesign stages provides information, allowing a comparative analysis in the monitoring stage.

For future work, we envision the development of a tool that allows the modeling of legacy systems tasks. The tool can provide more information about the legacy systems for modelers and organizations that wish to use it.

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