Towards a Business Process Automation Office Model: Action Research in Higher Education Institution

Maurício F. Galimberti[1], Jean R. Hauck[1], José Eduardo De Lucca[1], Sérgio Peters[1]

[1]Dpto. de Informática e Estatística – Universidade Federal de Santa Catarina (UFSC)
Caixa Postal 476 – 88.040-900 – Florianópolis – SC – Brazil

{m.f.galimberti, jean.hauck, jose.lucca, jose.peters}@ufsc.br

Abstract. *The main objective of this paper is to propose and apply a Business Process Automation Office Model to public institutions. A preliminary model is developed and improved through its application in a public Higher Education Institution. This research uses a multi-method scientific approach. A Systematic Literature Mapping is applied to identify the state of the art about Centers of Excellence involved in the automation of business processes. After that, the proposed model is then refined in three cycles of an Action Research. The main contributions are to offer a processes office model focused in process automation. The preliminary results with BPMS demonstrate greater flexibility to processes updating to public institutions.*

1. Introduction

The maturity of organizations in business processes has influence on the acceptance and adoption of Business Process Management (BPM) services. More advanced services such as governance and process automation are offered in BPM center of excellence initiatives, and adherence to them depends on the organization's experience and maturity in BPM [Rosemann, 2015]. This could be seen in higher education organizations, which typically have numerous BPM initiatives but frequently lack automation and process orchestration with BPM Systems (BPMS). The purpose of this paper is to present a business process automation office model with a focus on automation services, specifically for Higher Education Institutions (HEIs).

This maturation of the BPM area led to the creation of initial BPM nuclei for organizations managed by processes. The constitution of this BPM nucleus was named BPM Center of Excellence (CoE), or BPM Office [Rosemann, 2015]. This concept deals with process management services for organizations, providing the necessary standards and organizing what would be the “process management process” [Kirchmer, 2015]. In [Jesus et al., 2010] cases applied in Brazil are presented, in which CoE is referred as Processes Office. In [Hronza and SPeta, 2013], the structuring of a CoE in a HEI in the Czech Republic is presented. Process management has been identified as an appropriate model for Public HEI, which should guide the HEI's information systems through CoE [Carvalho and Sousa, 2017]and [Brodbeck et al., 2013].

Business process improvement services should be offered by a CoE. This includes core services such as process analysis, process modeling and redesign, and change management, as well as more sophisticated and complementary services such as process automation, risk analysis, and competency identification. [Rosemann, 2015] analysed the differences between perceived capacity and perceived demands for processes in organizations. The author found that in 9 of the 15 provided services, the demand for BPM services far exceeds the internal capacity of the companies. The two main services where the demand perception is much higher than the supply perception are Business Process Automation and Process Performance Measurement.

In this context, these concern are in the research question of this work: Q1) Is there feasibility and benefits of selecting a subset of services more related to business

process automation to integrate a specific office for process automation?; and Q2) What are the interfaces to meet the demands of higher education organizations in terms of business process automation?

Therefore, the main objective of this article is to propose a model centred on process automation, such as a Business Process Automation Office (BPAO). In order to meet this objective a Systematic Literature Mapping (SLM) was carried out on BPM CoE Models and process automation services. From this, a preliminary model of an BPAO was developed and an HEI of interest identified to carry out the study. An Action Research (AR) was designed to test and improve the proposed model in a HEI.

As specific objectives of the AR for the validation of the BPAO Model (BPAO-m) are considered: to define the necessary interfaces with an organization's CoE, in this case an HEI; implement or adapt software for the selected BPMS that allows secure storage of information from academic collections; improve the BPAO's service offering model to make it an institutional core for business process automation.

This article is organized as follows: in the next section, the choice of the research methods is explained to justify the proposed approach. The main concepts and theoretical foundations are presented in Section 3. Section 4 is devoted to describing the three cycles of AR used to refine the proposed model for HEI. Limitations and conclusions end this article in Section 5.

2. Research Method

The research method used in this work consists of a SLM and an AR, with the proposed model being adjusted along the AR. The SLM followed the process defined by [Petersen et al., 2008] and aimed to analyze and synthesize scientific production regarding process offices and the automation of business processes. The SLM stage deepened the search in relation to the state of the art in terms of implementing CoE, regardless of the sector of activity. SLM also sought to find out if there were proposals for models like the one developed in the present work.

Using an AR approach, it was intended to put into practice and make adjustments to an office model for process automation in an HEI. According [Avison et al., 2001] AR can be appropriate for this study because it focuses on organizational change, and this study focuses on changing HEI processes.

The AR was conducted in a HEI-type organization using the method proposed by [Baskerville and Wood-Harper, 1996], which contains the following phases: 1-diagnosing; 2-action planning; 3-action taking; 4-evaluating; 5-specifying learning. AR was performed in three internal cycles within the same HEI, except for the single diagnostic phase, which corresponds to the identification of the primary problems that are the underlying causes of the organization’s need for change. AR was also conducted through cooperation agreements, which are composed by control mechanisms [Avison et al., 2001], as Initiation, Authority, and Formalization.

AR was conducted at the public HEI *Universidade Federal de Santa Catarina* (UFSC), specifically in cooperation with *Centro Tecnológico* (CTC), which is one of the University’s 15 academic units. The characterization of the HEI, as well as the respective control mechanisms in which the research method was used, are detailed in Section 4.

3. State of the Art and Practice

With organizations deepening actions in BPM in the first decade of the 2000s, efforts were also made to develop BPM-related maturity models, such as [Bruin and Doebeli, 2010] and [Harmon, 2004], that defined the Business Process Maturity Model (BPMM). From models like these, publications have appeared referring to the term BPM Center

of Excellence (CoE) [Kirchmer, 2015; Scheer and Brabänder, 2010], also being named as Process Office [Jesus et al., 2010].

Thus, in order to analyze the state of the art and practice on the definition and use of Process Offices, a SLM was carried out. The main objective of this SLM is to analyze and synthesize scientific production regarding the responsibilities of process offices, especially with regard to the automation of business processes.

3.1. Search Protocol

From the main research questions of the research project, two search questions are derived: sQ1-Which studies deal directly or indirectly with Process Offices? And sQ2-Process offices relate to or perform business process automation?

In order to select the primary studies, inclusion/exclusion criteria were defined, and a search string was adapted to each digital library, as shown itens in Table 1.

Table 1: Criteria to select the primay studies

Item	Description
Inclusion criteria	Studies published between 2009 and 2019; studies fully available through the selected scientific databases; studies that present the conceptualization of process offices and use BPM practices; studies that present methods or models that define automation and process office; studies that present an approach for the application of automation assignments in a process office.
Exclusion criteria	Studies that do not address explicitly the process office responsibilities, or studies that do not address the use of process management practices.
Generic search string	("office" OR "center of excellence" OR "centers of excellence" OR "centres of excellence" OR "competency center") AND (("business process management") OR (("automation" OR "automatization" OR "automated") AND ("business process")))

The search strategy involved the use of automated search, which were carried out in following digital libraries, after duplicated articles been removed and reading the titles: IEEExplore (10 results); ACM Digital Library (03); Scopus (96); and Emerald Insight (03). The manual search has also been used [Kitchenham et al., 2015].

The returned studies were filtered through the application of the inclusion and exclusion criteria by reading the abstracts, resulting in 21 papers. After that, the articles were fully read for three persons and the final list had five papers selected, as the others did not meet the inclusion criteria related to automation in process offices. Four other studies were included through manual selection: three from [vom Brocke and Rosemann, 2015], and one industrial case study from [Jesus et al., 2009].

3.2. Data analysis and Discussion

For each of the research questions the data collected are analysed.

sQ1-Which studies deal directly or indirectly with Process Offices?

As a result of the automatic and manual searches, 9 papers were found that deal with Process Office, most of them referring it as Process CoE. The complete list of articles is presented in reverse chronological order in Table 2. No direct references were found to business process automation models in selected studies.

According to [Jesus et al., 2009, pp. 1], a CoE is a governance “mechanism that has been widely adopted by enterprises aiming at institutionalizing BPM initiatives and perpetuating their benefits throughout the organization in a more centralized approach”.

In addition, the work of Michael Rosemann is fundamental to this research. Firstly for the studies in BPMM that are the link with the concept of CoE [Rosemann and De Bruin, 2005]. Then, for presenting the BPM area with handbooks in two volumes [vom Brocke and Rosemann, 2015]. But, mainly, for presenting a portfolio of services to be made available by BPM CoE [Rosemann, 2015].

Table 2: Complete list of selected studies

Refers	Title
[Nqampoyi *et al.*, 2016]	Effective business process management centres of excellence
[Rosemann, 2015]	The service portfolio of a BPM center of excellence
[Rosemann and Vom Brocke, 2015]	The six core elements of business process management
[Van Looy and De Backer, 2013]	On the importance of organisational culture and structure in business process maturity
[Hronza and SPeta, 2013]	Business process center of excellence at the faculty of electrical engineering at the Czech Technical University in Prague
[Ganesan, 2011]	Composite enterprise process modeling (CEPROM) framework: Setting up a process modeling center of excellence using CEProM framework
[Jesus *et al.*, 2010]	BPM center of excellence: The case of a Brazilian company
[Patel and Andrews, 2010]	Seven key steps to establishing a center of excellence
[Jesus *et al.*, 2009]	A Framework for a BPM Center of Excellence

sQ2-Process offices relate to or perform business process automation?

[Rosemann, 2015] presents the results of a survey with large Australian organizations in which they offer a view of the elements common to all of them. The author presents 15 services identified from the view of the investigated companies with regard to the perceived capacity and the perceived internal demand by companies to offer such services. [Rosemann, 2015] found that in 9 out of 15 services the demand far exceeds the internal capacity of companies to provide BPM services. Attention is drawn to the distance between the expected process automation service and what can actually be found in terms of BPM in organizations.

The definitions of BPM CoE, as well as the services offered according to [Rosemann, 2015], are referenced by almost all the articles found in the SLM, that is, in [Hronza and SPeta, 2013], [Ganesan, 2011], [Nqampoyi et al., 2016], and [Van Looy and De Backer, 2013], in addition to the work entered manually in SLM [Jesus et al., 2010], as well as others already mentioned included in the Handbooks of [vom Brocke and Rosemann, 2015]. However, even those five articles resulting from SLM do not mention BPM CoE models with a focus on process automation. Anyway, they are important because of the governance and services offered by the BPM CoE models.

In [Nqampoyi et al., 2016], authors seek to answer research questions that allow characterizing an effective BPM CoE, as well as the respective factors supporting this effectiveness. [Ganesan, 2011] also bases on the 15 services defined in [Rosemann, 2015] and its research objective is to prescribe a generic framework for enterprise process modeling. The study presented by [Van Looy and De Backer, 2013] addresses the maturity of the organization in processes from cultural and structural aspects. They say that the program management office is responsible to coordinate all process-related activities and projects within the organisation. [Hronza and SPeta, 2013] addresses the experience of implementing BPM at the Faculty of Electrical Engineering at the Czech Technical University in Prague (FEE CTU), towards a BPM CoE. [Patel and Andrews, 2010] proposes that the CoE's objective is to provide guidance and direction for the BPM technology and process automation needs for all areas of the company.

About BPMS, [Patig and Stolz, 2013] point out that most companies that adopt BPM use process descriptions with little rigor, with automations performed in information systems, leaving BPMS relegated to a secondary role. Therefore, process-oriented approaches, such as Process-Aware Information System (PAIS) [Dumas et al., 2005], should also use technology for process automation and orchestration as a BPMS. In this research BPMS are analysed and selected according to analysis criteria, corroborated by [Delgado et al., 2015; Sousa et al., 2018].

4. Action Research (AR) in HEI

Prior to AR, the SLM pointed out that BPM initiatives within organizations, in general, have not implemented automation and process orchestration actions with BPMS. Then, internally at HEI that became a research partner, possible reasons for that scenario were identified, which characterizes the start of the first phase of AR as presented below.

Diagnosing phase: the HEI partner in AR, UFSC, is characterized as a public federal university, composed by 15 academic units. The CTC is one of these units, with 384 academic staff and 115 administrative and technical staff, serving approximately 5,600 undergraduate and 2,400 graduate students. Each academic unit has treated separately processes that are common to the other units.

In addition to the CTC initiative, other BPM-like actions were observed in other academic units but were restricted to modeling processes for documentation purposes. In situations where they were referred for automation, this was done under the traditional view of developing functional systems, or at most by a PAIS view. Recently, the new Institutional Development Plan (UFSC PDI 2020-2024) defines at least three strategic initiatives to encourage the automation of the processes and routines of its units. Thus, the initial concern is about an HEI internal office that may concentrate services for automation and process orchestration through the approach of a BPMS.

In this diagnosing phase, agreements were established with CTC managers and processes to be automated were prioritized. With support from the CTC, meetings were being held in pro-rectories in order to demonstrate the idea of the project.

The central aspect of those meetings were to confirm the interest in the research due to the limitation of HEI in carrying out design and automation of processes with the BPMS approach. Second was to confirm of the benefits for HEI with the possible implementation of a BPAO. Thus, the AR was conducted according to the control mechanisms and terminology defined by [Avison et al., 2001]:

- Initiation: AR was started by researcher with a research project. This project was approved by CTC council. Initiation can be considered as ‘Researcher’ or ‘Collaborative’.
- Authority: the type of Authority is ‘Staged’, as CTC, and Pro-Rectory of Administration (PROAD), specifically the responsibility of the Department of Projects and Agreements (*Dpto. de Projetos e Convênios* - DPC), whoever has the process owners and respective sponsors, are responsible for authorizing automated processes to go into production, while the research group is responsible for the automation.
- Formalization: all AR cycles started with signed cooperation terms. In the end, the BPAO creation was approved by CTC and UFSC councils, bringing it to the formal organizational structure. The type of Formalization is ‘Formal’.

The next four phases of the AR were performed in three consecutive cycles. For clarity they will be presented in a single sequence.

Action planning phase: this phase begins with the existence of a preliminary model for the BPAO, in which types of services that would be offered in the final model of the BPAO were absent, except for the Automation service, as shown in Figure 1. The main automation services that integrated the model and the specification of the respective necessary infrastructure were identified. They are discussed further from Figure 2.

The following criteria were defined for mapping and selecting processes: in cycle #1, they should preferably be primary processes for the CTC sponsor, especially those that are common to other academic units at HEI; cycle #2 should be shorter, in order to adjust the BPAO model; in cycle #3, the BPAO lifecycle method of process

automation should be reapplied to other institutional instance.

The CTC was the sponsor of the project in the first two cycles. The third cycle was extended to an instance of a rectory of HEI, in this case PROAD/DPC as process owner. The main goals to be achieved were to map, model, redesign and automate the processes. At each cycle, this planning was revised based on data from the processes.

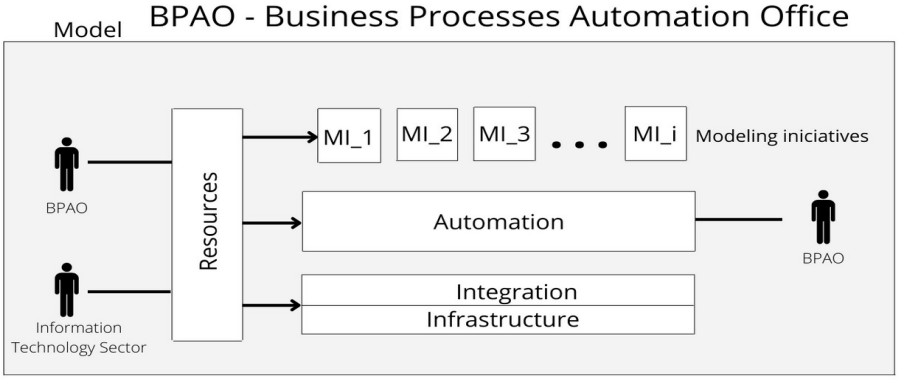

Figure 1: Preliminary Model for BPAO

Action taking phase: this phase was characterized by the implementation of the IT infrastructure that would also be adjusted over the three cycles. BPMS Bonita Community Edition [Bonitasoft, 2022] was customized and selected according to the criteria of making the process automation resources of a BPMS engine available and be open source software, also supported in the works of [Delgado et al., 2015] and [Sousa et al., 2018].

Cycle #1 of the AR was conducted throughout the end of 2018 and the first semester of 2019. It was the period when the main mechanisms of the BPAO model were adjusted, in particular the BPMS Bonita and the process automation lifecycle method, which was refined over three years of numerous iterations using the undergraduate course as a laboratory. Two process owners were chosen, being Administrative Secretaries of the CTC Directorate.

Cycle #2 had as main objective to put into practice the model adjustments, related to new procedures for collecting requirements and tests. For this, a process was chosen that the BPAO itself would demand, that is, a help desk process that allows for process owners to report problems and demand adjustments in automated processes. The supervisor of the *Laboratório de Sistemas de Conhecimento* (LSC) served as client to elicit process requirements, which was carried out entirely by BPAO scholarship holders.

Cycle #3 started with a demand from PROAD/DPC and another one from Pro-rectory of Undergraduate Studies (PROGRAD). Then, these demands were modeled in BPAO, reviewed and automated, resulting in 2 automated processes: the Registration process for Access to SIASG (internal information system) and the Syllabus and Programme of Study Management process.

Evaluating phase: this stage identified the effects of process automation with the process owners involved. We sought to assess the impact from the proposed view, analyzing problems encountered and adjusting the model for the next two cycles of AR.

At the end of the three cycles, a total of eight business processes were automated and put into production: four primary processes (2018-19); one support process (2019); and finally another primary process with the PROAD/DPC (2019), and two primary processes with PROGRAD (2021-22).

The evaluation of cycle #1 and cycle #2 allows us to conclude that it served to put the adjustments in the BPAO-m into practice. This occurred specifically with tasks

for collecting process requirements and automated process tests. It was satisfactory, especially for guiding scholarship holders in carrying out the tasks and because it determined the successful final application of the model in cycle #3. It was possible to evaluate that the adjusted BPAO-m was assumed by the BPAO team after review, and the PROAD/DPC named SIASG process was redesigned, automated and implemented without requiring further changes in the process lifecycle model. This process, after being automated and put into production, can be started by practically the entire academic community of UFSC, potentially reaching 40,000 people.

Specifying learning phase: the realization of AR in three cycles allowed the improvement of the BPAO-m, especially in two aspects: i) adjustments of the process lifecycle method, previously restricted to academic practices; and ii) better identification of the three types of interfaces that must be maintained internally at HEI. Both aspects will be presented in subsection 4.1 to deal with the proposed BPAO-m.

The BPAO-m had its lifecycle method followed for redesign and process publishing services, and for automation with process redesign. After the implementation of the BPAO, the impact on the organizational environment can be estimated by the products/services that were delivered to UFSC/CTC, as follows:

- BPAO team trained in BPM and process automation for BPMS Bonita;
- Customized BPAO production environment in BPMS Bonita;
- Six processes implemented and in production;
- Automated processes published on the institution's intranet for convenience information and reference by its employees, and can be accessed at https://documentacao.processos.ufsc.br/;
- The BPAO recommended to UFSC the publication of the documentation for each process, as Technical Report, in the Digital Repository of the UFSC Central Library;
- Infrastructure planned for the BPAO made possible, with a process execution portal at https://processos.ufsc.br/bonita/apps/eapnPortal and a Wiki for the process automation guide to facilitate the entry of new fellows and collaborators in the BPAO.

In the first half of 2020, the institutionalization of BPAO as a CTC Nucleus was requested and approved. However, the impact on the organization can be amplified, and throughout the AR, the experience of process automation was enthusiastically received in meetings with pro-rectories.

4.1. Resulting Model for an BPAO (BPAO-m)

The analysis of the services of [Rosemann, 2015] was the starting point for the selection of the services that would compose the Business Process Automation Office Model (BPAO-m) in Figure 2. The following model values BPAO's collaborative work with HEI's BPM initiatives and with IT sectors. The first aspect to be presented is regarding the structure and relationships proposed by the BPAO-m.

Therefore, the BPAO is envisaged as a nucleus interacting with other instances of the HEI. Its model provides interfaces for CoE or other partial BPM service initiatives. Analogously to the work of [Ganesan, 2011], whose proposed framework is focused on the process modeling service, BPAO's scope is to provide business process automation and orchestration services.

The BPAO-m, after being applied and adjusted in the AR, presents BPAO with three main types of interfaces: Itf-1, with applicants for process automation from Process Modeling Initiatives (MI_1, MI_2, etc.); Itf-2, with users, processes owners or other demand for modeling initiatives; Itf-3, with the organization's IT Sector,

especially for orchestration with legacy systems and web services.

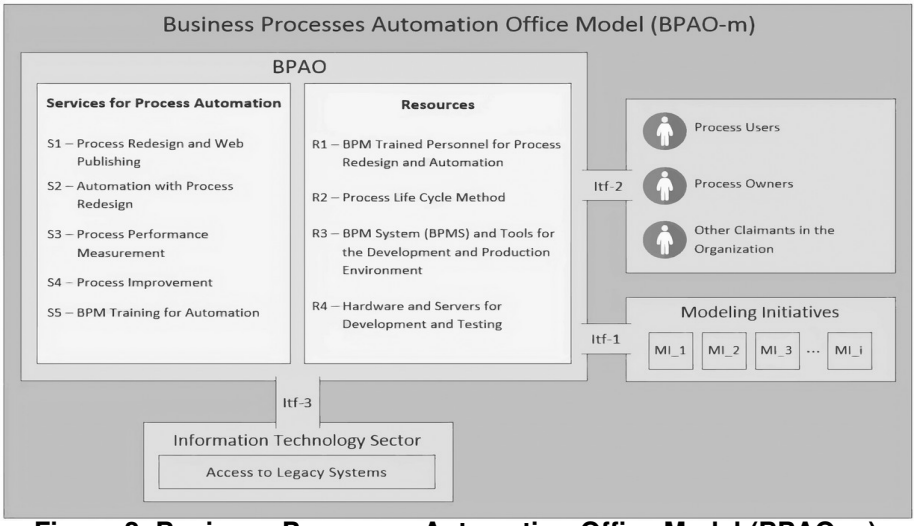

Figure 2: Business Processes Automation Office Model (BPAO-m)

The BPAO-m presents its services for process automation in the homonyms box in Figure 2, as follows: S1) Process Redesign and Web Publishing; S2) Automation with Process Redesign; S3) Process Performance Measurement; S4) Process Improvement; S5) Training in BPM for Automation. Unlike services S1 to S4, which were already part of the preliminary BPAO model, the S5 service becomes part of BPAO-m only at the end of AR. Internally at BPAO, mapping and modeling of processes are also carried out in the case of no external modeling being provided.

The operational viability of BPAO is possible with the following resources, in the respective box in Figure 2: R1) BPM Trained Personnel for Process Redesign and Automation; R2) Process Lifecycle Method with recommendations for deliveries in process automation; R3) Open source BPMS and tools for the development and production environment; R4) Hardware and Servers for Development and Testing. The R2 is characterized by the lifecycle method for process automation, consisting of 12 stages, documented as an internal guide in BPAO. The R3 is the BPMS, which was customized to HEI UFSC with Bonitasoft.

4.2. Discussion

As predicted by BPMM, the level of maturity of the organization directly influences the structuring of a BPM CoE [Rosemann, 2015]. In organizations with low maturity levels in processes, one of the possible benefits of the proposed BPAO-m is to help mitigate such influence, when it comes to automated solutions under a processes view. In this way, BPAO-m proposes to make automation and orchestration of processes with BPMS throughout the maturation of organizational processes. In terms of benefits, solutions with BPMS demonstrate greater flexibility to update processes and this approach can contribute to maturity and organizational culture in processes.

The three cycles of AR enabled an incremental development of the BPAO-m and delivered a properly validated BPM CoE approach with exclusive focus on process automation. The first results indicate that the model can be adapted to other public HEIs. The BPAO-m provides interfaces not only with the organization's CoE but extends it to numerous and dispersed BPM initiatives that usually exist in an HEI.

The BPMS Bonita distribution offers an open source license with a sufficient set of features for process automation. However, adapting and putting a BPMS into production, in correct communication with IT department, required almost a year of work, before the first automation. A multidisciplinary team was trained and was able to

customize the BPMS facilitating the development of interfaces for communication with HEI legacy systems. This was achieved efficiently and characterize an important item that more easily makes BPAO feasible both at UFSC and other HEIs.

The third specific objective was related to the service model provided for the BPAO. The research project was born with a focus on automation and process improvement services. Inspired by [Rosemann, 2015], it was planned to monitor indicators to improve processes. The model was designed with those services separated in S1 to S4. Subsequently, S5 was added to its services portfolio.

Possibly due to the multidisciplinary nature of BPM, in academy, it is common to have bias in the application of BPM according to the domain of the knowledge of those who apply it. For example, there are initiative adopting BPM tools through functional silos, without interaction with different sectors. In other cases, the processes are treated as a set of documents whose flows are defined by the process participants themselves. This increases the occurrence of errors, delays, and rework.

These problems are common and have an impact on HEI's daily processes, requiring transit of personnel and documents. This can be solved by the BPAO-m and its respective BPMS tool. This becomes more urgent in times of intense remote work, such as the pandemic situation caused by Covid-19, in which several HEI processes, and countless tasks, must be addressed quickly. A process management approach, with adequate automation, using a BPMS, can make a HEI more agile and more efficient. The presented BPAO-m seeks to contribute in this sense.

5. Limitations and Conclusion

The conclusion of the AR bring a validated and adjusted BPAO-m that can contribute to the solution of organizational problems with adequate automation. This can continue to be done internally at the current BPAO, or its technology and know-how can be transferred to IT teams in order to effectively transfer the model to HEI.

Information technologie departments may be addressing demands with the traditional view of developing new systems. BPAO-m identifies the interfaces with BPM initiatives, but also with IT departments, in order to redesign and automate business processes modeled in the organization. In the case of UFSC, the PDI 2015-2019 mentioned concern with its processes. More recently, the PDI 2020-2024 defines strategic initiatives aligned with processes automation, which need direct actions in IT. Because of this, the present article is concerned that BPM is addressed with all its managerial potential but also with appropriate automation.

The term Business Process Automation (BPA) has been found since 2004, when it was already associated with tools for what would be consolidated as BPMS. BPMS have evolved and are more robust, and recently Robotic Process Automation (RPA) has been referred to as the process automation revolution. Apparently, this revolution should eliminate some kinds jobs and give rise to new jobs with greater relevance for an office focused on automation of business processes.

This paper have several limitations and possibilities for future work. A limitation of this work is that it was carried out in just one organization, in the higher education sector. Second, the model proposes two services that have not yet been validated, and one more that was added to the model at the end of the AR. It is justified that there was no validation of the services that depend on the volume of data from the automated processes that are in production. For this, we are implementing and customizing a dashboard that enables a Business Activity Monitoring, as they are not available in the license of BPMS Bonita. On the other hand , it is possible that there are aspects in the BPAO-m that would not be justified in organizations in other sectors, then new process automation projects for companies can be implemented with new AR initiatives.

Finally, we must to include in the research agendas in BPM the study of the impact of process automation in the allocation and deallocation of personnel. It is vital for BPM's own automation approach to seek alternatives for maintenance and improvement of working conditions for process workforce. If, on the one hand, there are demands for improvements that can be achieved with automation, there must also be a concern in the organizational culture to involve its employees in automated processes, or in training for new challenges in the new processes. Thus, employees can be allocated to more relevant tasks in which they can fully exercise their potential, offering more and better benefits to themselves and the organization itself.

Acknowledgements

This study was partially funded by *Fundação de Amparo à Pesquisa e Inovação do Estado de Santa Catarina* – FAPESC, and *Universidade Federal de Santa Catarina* – UFSC, specifically CTC, Bridge Laboratory, and Prograd, and developed within the scope of a cooperation agreement with the BonitaSoft Company.

References

Avison, D., Baskerville, R. and Myers, M. (2001), "Controlling action research projects", Information Technology & People, MCB UP, Vol. 14 No. 1, pp. 28–45.

Baskerville, R.L. and Wood-Harper, A.T. (1996), "A critical perspective on action research as a method for information systems research", Journal of Information Technology, Vol. 11 No. 3, pp. 235–246.

Bonitasoft. (2022), "BPMS Bonita", available at: https://www.bonitasoft.com/.

vom Brocke, J. and Rosemann, M. (2015), Handbook on Business Process Management 2: Strategic Alignment, Governance, People and Culture, Second Edition, Springer Berlin Heidelberg.

Brodbeck, Â.F., Musse, J., Viegas, M. and Zimmermann, A. (2013), "Implementação de Escritório de Processos Em Organizações Governamentais: o caso de uma Instituição de Ensino Superior". Workshop de TIC das IFES, João Pessoa.

Bruin, T. and Doebeli, G. (2010), "An Organizational Approach to BPM: The Experience of an Australian Transport Provider", Handbook on Business Process Management 2, Springer Berlin Heidelberg, pp. 559–577.

Carvalho, K. A. de and Sousa, J.C. (2017), "Gestão por Processos: Novo Modelo de Gestão para as Instituições Públicas de Ensino Superior", Revista Administração Em Diálogo - RAD, Portal de Revistas PUC SP, Vol. 19 No. 2, p. 1.

Delgado, A., Calegari, D., Milanese, P., Falcon, R. and García, E. (2015), "IFIP International Federation for Information A Systematic Approach for Evaluating BPM Systems: Case Studies on Open Source and Proprietary Tools", pp. 81–90.

Dumas, M., Aalst, W. van der. and Ter Hofstede, A. (2005), Process-Aware Information Systems: Bridging People and Software through Process Technology, Wiley.

Ganesan, E. (2011), "Composite enterprise process modeling (CEPROM) framework: Setting up a process modeling center of excellence using CEProM framework", ICEIS 2011 - Proceedings of the 13th International Conference on Enterprise Information Systems, Vol. 4 SAIC, pp. 378–383.

Harmon. (2004), "Evaluating an organization's business process maturity", Business Process Trendes, 2, available at: http://www.bptrends.com/publication%0D %0Afiles/03-04 NL Eval BP Maturity - Harmon.pdf.

Hronza, R. and SPeta, M. (2013), "Business process center of excellence at the faculty

of electrical engineering at the Czech technical university in Prague", Proceedings - 2013 IEEE International CBI, IEEE Computer Society, pp. 346–349.

Jesus, L., Macieira, A., Karrer, D. and Caulliraux, H. (2010), "BPM Center of Excellence: The Case of a Brazilian Company", Handbook on Business Process Management 2, Springer Berlin Heidelberg, pp. 285–306.

Jesus, L., Macieira, A., Karrer, D. and Rosemann, M. (2009), "A Framework for a BPM Center of Excellence", available at: www.bptrends.com.

Kirchmer, M. (2015), "Management of process excellence", Handbook on Business Process Management 2: Strategic Alignment, Governance, People and Culture, Second Edition, Springer Berlin Heidelberg, pp. 79–100.

Kitchenham, B., Budgen, D. and Brereton, P. (2015), "Evidence-Based Software Engineering and Systematic Reviews", CRC Press.

Van Looy, A. and De Backer, M. (2013), "On the importance of organisational culture and structure in business process maturity", ICIS 2013: Reshaping Society Through Information Systems Design, Vol. 3, pp. 2732–2747.

Nqampoyi, V., Seymour, L.F. and Laar, D.S. (2016), "Effective business process management centres of excellence", Lecture Notes in Business Information Processing, Vol. 268, Springer Verlag, pp. 207–222.

Patel, J., Andrews, L. (2010). "Seven Key steps to establishing a center of excellence", Infonomics; Jan/Feb 2010 Vol. 24 Issue 1, p.40-44, ISSN: 1544-3647.

Patig, S. and Stolz,M. (2013), "A pattern-based approach for the verification of business process descriptions", Information and Software Technology, Vol. 55, pp. 58–87.

Petersen, K., Feldt, R., Mujtaba, S. and Mattsson, M. (2008), "Systematic Mapping Studies in Software Engineering", Proceedings of the 12th International Conference on Evaluation and Assessment in Software Engineering, Swindon, GBR, pp. 68–77.

Rosemann, M. (2015), "The service portfolio of a BPM center of excellence", Handbook on Business Process Management 2: Strategic Alignment, Governance, People and Culture, Second Edition, Springer Berlin Heidelberg, pp. 381–398.

Rosemann, M. and Vom Brocke, J. (2015), "The six core elements of business process management", Handbook on Business Process Management 1: Introduction, Methods, and Information Systems, Springer Berlin Heidelberg, pp. 105–122.

Rosemann, M. and De Bruin, T. (2005), "Towards a business process mangement maturity model", Proceedings of the 13th European Conference on Information Systems, Information Systems in a Rapidly Changing Economy, ECIS 2005.

Scheer, A. and Brabänder, E. (2010), "The Process of Business Process Management", Handbook on Business Process Management 2, Springer Berlin, pp. 239–265.

Sousa, M., Lopes, N., Ribeiro, O. and Silva, J. (2018), "Evaluation of BPM tools open source/freeware", CISTI, Vol. 2018–June, IEEE Computer Society, pp. 1–6.