

An application of business process management in a dental clinic

Bruna da Silva Garcia¹, Universidade Estadual Paulista Júlio de Mesquita Filho

Renato de Campos², Universidade Estadual Paulista Júlio de Mesquita Filho

ABSTRACT

Micro and small businesses are of great importance to the national environment of a country, due to their participation in economic growth. However, such businesses are characterized as poorly-managed, informal working environments, lacking both process organization and operational and strategic planning, and hence face difficulties in maintaining their position in the marketplace. In this context, the objective of this research was to analyze the case of a dental clinic located in a city from the interior of the state of Sao Paulo, Brazil, to understand and define the critical client service and stock management processes, through an application of the Business Process Management (BPM) model. The results show that BPM can be adapted for use with micro and small businesses, offering improvements and standardization for their most important processes.

Keywords: *Business Process Management; BPM; Modeling of Processes; Standardization/ Improvements; Dental Clinic.*

Editor Responsável: Prof.
Dr. Hermes Moretti Ribeiro da
Silva

1.Av. Eng. Luiz Edmundo C. Coube 14-01 - Vargem Limpa, Bauru, SP, Brasil, CEP 17033-360, bruna.garcia@unesp.br; 2. renato.campos@unesp.br.

GARCIA, B. S.; CAMPOS, R. *An application of business process management in a dental clinic*. **GEPROS. Gestão da Produção, Operações e Sistemas**, v. 15, n. 3, p. 102 - 116, 2020.

DOI: 10.15675/gepros.v15i3.2733

1. INTRODUCTION

Micro and small business have a relevant part to play in the economic growth of their country. According to estimates from the Micro and Small Businesses Counseling Service (SEBRAE), Brazil will have approximately 17.7 million small businesses by 2022, that is, more than one million new businesses per year. Furthermore, the fact that small businesses account for 98.5% of the country's companies and are responsible for the generation of 70% of the income of Brazilians working in the private sector, highlights the irrefutable proof of the importance of this sector for the economy. The majority of these businesses operate under the "Simple National" system, which reduces tax burdens and bureaucracy, thereby stimulating their development and growth and enabling them to compete in the marketplace (AGÊNCIA SEBRAE DE NOTÍCIAS, 2017).

In view of the importance of micro and small businesses, and considering that they habitually form part of the poorly-managed, informal work environment, one which lacks organizational processes and strategic and operational planning, Business Process Management (BPM) has emerged as a possible tool to provide continuous improvement for their production processes, thereby raising efficiency levels, reducing costs and, as a consequence, maximizing profits (LOPES, 2008, p.02; DUMAS *et al.*, 2018). According to Andrade *et al.* (2017), Business Process Management (BPM) is also seen as a way of leveraging results and mitigating the occurrence of mistakes through a detailed study of internal processes. The authors' research additionally sought to accelerate the exchange of information among sectors, with the aim of delivering high-quality products in an increasingly agile way. BPM is applied in several business areas, industry or commerce, public or private organizations (vom BROCKE; MENDLING, 2018; BANDARA *et al.* 2018).

In this context, the proposal of the current work was to conduct an action research through the application of Business Process Management (BPM) in a Clinic attending dental and medical patients, situated in the state of São Paulo, Brazil. The intention was to analyze the company's present situation, understand and model its existing critical processes and then propose alternatives with the aim of improving the efficiency of its business management.

Within the existing academic literature, there is a concentration of studies on medium- and large-sized companies. Through the implementation of BPM in a small business, this

work contributes to the identification of opportunities for improvement, and consequently growth and strength, of micro and small business, and seeks to increase the knowledge base of this research topic. As a result, it is hoped to propose ways to reduce barriers to the use of BPM in micro and small businesses.

2. LITERATURE REVIEW

2.1 Business Process Management

According to Andrade *et al.* (2017), Business Process Management (BPM) emerged as a way of leveraging results and mitigating the occurrence of mistakes through a detailed study of internal processes. In addition, the authors' research sought to accelerate the exchange of information among sectors, with the aim of delivering high-quality products in an increasingly agile way.

According to ABPMP (2013), BPM comprises a set of business activities that cover strategy, objectives, culture, organizational structures, roles, policies, methods and technologies to analyze, draw up, implement, manage performance, and control and improve processes of organizations in order to match client expectations.

Organizations that apply BPM can measure the evolution of process improvement and its maturity over time (TARHAN, A.; TURETKEN, O.; REIJERS, 2016).

2.2 BPM Life Cycle

There are many process management models in the literature, and they all share a common cyclical form (BEZERRA *et al.*, 2016, p. 5). Baldam, Valle and Rozenfeld (2014) created a Unified BPM Life Cycle (Figure 1) for process management, which is composed of four phases.

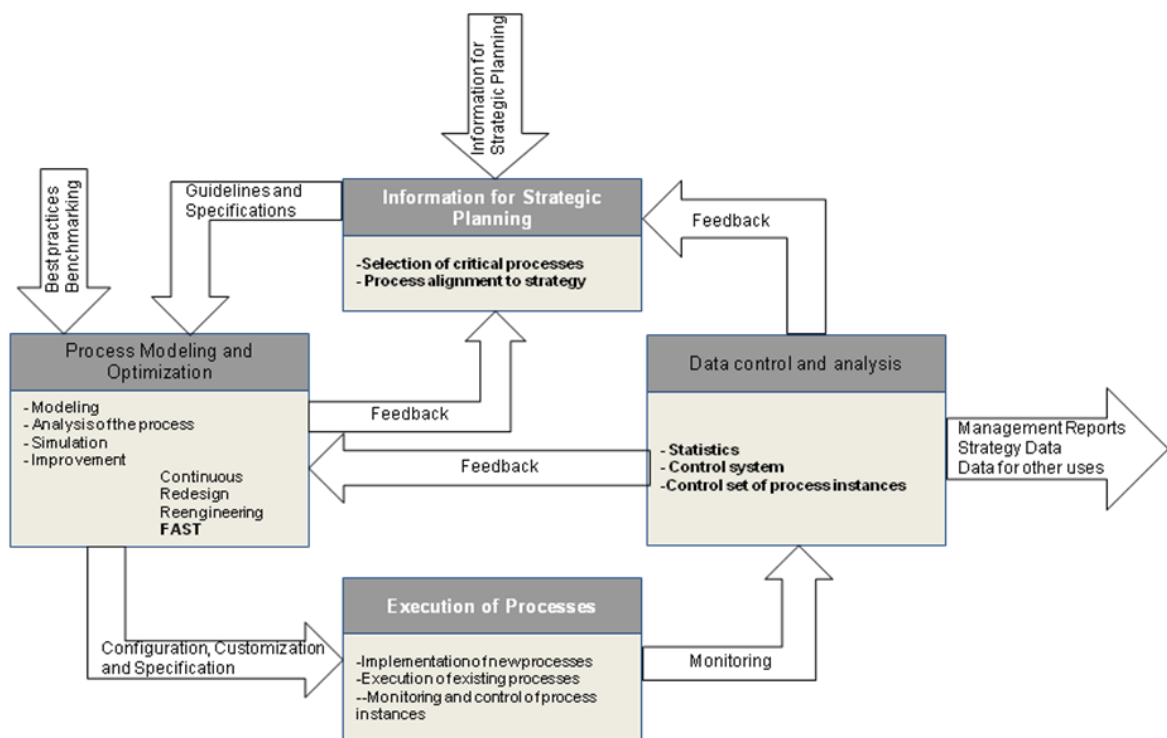
The first phase covers BPM planning, which seeks to define BPM activities that contribute positively to achieving operational goals, by means of a verification of the critical business processes points to which an organization commits as a whole. The main activities carried out are: a situational analysis to understand the internal and external environment and organizational strategy of the organization; defining strategies and objectives; selecting and prioritizing processes.

The second phase is that of modeling and process optimization, with the intention of better understanding the workings of a company as a whole. This is done through documentation and process analysis, generating information about the state of current working processes (*As Is* model), applying methodologies for process optimization, redesigning processes considering proposals for future improvements (*To Be* model), and generating specifications for implementation. According to ABPMP (2013, p. 72), the purpose of modeling is to create a complete and accurate representation of a company's operating process.

The third phase involves the execution of processes, and is when process implementation, technology transfer plans management, training, testing, implemented processes monitoring, transfer of control of execution and monitoring by the executing team is carried out.

The fourth phase is one of data analysis and control, and involves the monitoring of processes implemented through performance evaluation tools such as statistical methods and KPIs, to verify that the operation is conforming to plan.

Figure 1 – BPM Unified Life Cycle



Source: Adapted from Baldam, Valle and Rozenfeld (2014).

To carry out the BPM phases, several methods and tools can be employed, including process modeling (vom Brocke *et al.*, 2014; ROB *et al.*, 2016; MEDOH, C.; A. TELUKDARIE, 2017).

2.3 Process Modeling

According to Oliveira and Neto (*apud* TOLFO, 2009), regarding BPM initiatives, “modeling is important, because it enables the consolidation of a process model with the generation of operational diagrams. From these diagrams it is possible to understand or even rethink a company.”

Within the existing forms of representation, Business Process Modeling Notation (BPMN) provides a set of symbols to represent different aspects of business modeling (ABPMP, 2013; OMG, 2014). It has become a benchmark for process modeling, since it offers a well-defined notational standard, which is clear and easy for everyone involved in a process, from technicians to managers, to understand, (PIECHNICKI; BARAN; PIECHNICKI, 2012).

The four basic BPMN categories so that a user can understand the processes and their context, these are (MASCHKA, 2014; OMG, 2014):

- Flow Objects - the main graphical elements for defining business process behavior. There are three types of flow objects: event, activity and gateway.
- Connecting Objects - the connection of flow objects with other information is done via three objects: sequence flow, message flow and association.
- Swimlanes - is a concept used to assist the participation in and organization of activities. A BPMN diagram may include more than one process, as well as processes that show collaboration between private processes or participants. When this occurs, each private business process will be considered as having been carried out by different participants. Graphically, each participant will be partitioned, that is they will be contained in a rectangular box or “pool”. Pools can have sub-swimlanes, which are simply known as “Lanes”.
- Artifacts - are used to supply additional information about a process.

3. METHODOLOGICAL PROCEDURES

The present study used the action research approach, with its stages adapted to be in line with the development stages of BPM. The first stage was characterized by a literature review in order to gain a better understanding of business process management, in which studies were carried out related to the implementation and execution of BPM in micro and small companies, and support tools used for this activity. Information was collected from scientific articles, books and academic papers.

Subsequent activities were carried out based on the first two phases of the BPM Unified Life Cycle proposed by Baldam, Valle and Rozenfeld (2014): BPM planning and the analysis, modeling and optimization of the process (see Figure 1). The business selected to be studied in this work was a small clinic attending medical and dental patients, in a town located in the state of São Paulo. In addition to a literature review, the study was structured in two phases, each phase being divided into two sub-phases, as described below.

3.1 BPM Planning

This phase involved the development of a BPM application plan, in order to identify activities that work in partnership with the organizational directives of the clinic. The plan was divided into two parts:

Situational analysis and strategy identification: The first step in identifying problems and proposing solutions for a given organization is to analyze and understand its current strategic situation. To do this a SWOT Matrix, a strategic planning tool that analyzes strengths, weaknesses, opportunities and threats to the organization's environment, was used;

Selection and prioritization of processes: Determined by the company's present situation, company processes were identified and, from a prioritization matrix, critical processes were selected, that is, those that had the biggest impact on organizational results and on success. The matrix was adapted from the Management Excellence Model – MEM (FNQ, 2018) and comprised processes identified by the clinic which received a score according to certain defined criteria. In view of the importance of the processes relating to strategic objectives, a formula was developed whereby the owners and employees rated the organizational processes. Persons closely associated with the business were chosen, because they have better knowledge about the activities developed and how they can impact the

GEPROS. Gestão da Produção, Operações e Sistemas, v. 15, nº 3, p. 102 - 116, 2020.

business. In this way, it was possible to propose improvements for the organization, and thus improve processes - as described in the next step.

3.2 Analysis, modeling and process optimization

From the preliminary collection of information and data, visits to the company were organized. Observations were made and interviews held with those involved in the process, by which means work on modeling and process improvement could be started. The process modeling notation adopted was BPMN (Business Process Model and Notation) being a standard created by the Object Management Group and accepted as one of the principal modeling tools by the international community. The tool chosen for the process modeling was the Bizagi Process Modeler, since it has a free version, enabling the use of BPMN notation to create process diagrams, maps and models, and allowing an efficient and simple graphic visualization of processes and flows and, therefore, helping to identify flaws and problems, and propose improvements. The sub phases are described next:

As Is Model: Firstly, a modeling of the current situation of the company was carried out (*As Is*), the objective of which was to define the way that existing processes operate, as a means of understanding activities and results, and analyze the limitations that affect company performance. From this, recurring business problems were identified;

To Be Model: In this stage a new model was developed, leading to a proposal to incorporate improvements in critical processes. These processes were redesigned, having in mind future ideas that could optimize them, based on a gap analysis of the current situation.

4. RESULTS AND DISCUSSION

4.1 BPM Planning

Initially, information about the organizational environment of the company was collected from employees. The intention was to understand internal and external company environments and, by means of a situational analysis, its strategies and objectives. A SWOT matrix was prepared, which highlights the internal (strengths and weaknesses) and external (opportunities and threats) factors of the company. Figure 2 shows the results obtained from the SWOT analysis.

Figure 2 - SWOT Matrix for the Clinic

Strengths	Weaknesses
<ol style="list-style-type: none"> 1. Quality service to clients; 2. Quality specialized services: implantology, oral maxillofacial and dental surgery, in the case of dentistry; gynecology, in the case of medical; 3. Well located clinic, with easy access. 	<ol style="list-style-type: none"> 1. Inadequate stock control; 2. Overworked employees, with activities in various sectors; 3. No ERP management system; 4. Unstructured processes; 5. Use of a manual appointment system.
Opportunities	Threats
<ol style="list-style-type: none"> 1. Little competition in the services offered; 2. Competitors lacking in management knowhow; 3. Use of advanced technologies; 4. Increase in concern about health and aesthetics. 	<ol style="list-style-type: none"> 1. Critical economic environment; 2. Reduced purchasing power; 3. New competitors entering the marketplace.

Source: Prepared by the author.

Analyzing the company's main competencies - that is, the strengths that give value to clients and ensure the organization differentiates itself from competitors and has growth potential to gain space in the market - it can be seen that the company has an excellent focus on the quality of the services it offers and on its relationship with clients. In addition, particularly in its dental services, it has opted for the use of high-quality materials, meaning that clients feel highly satisfied with the results of the service.

Through a situational analysis of the company, critical processes could be determined. In this context, based on Costa (2014), whose work presents the typical processes of a clinic, organizational processes were identified by means of a survey carried out with the clinic's employees. The processes identified were as follows:

- **Customer service:** being one of the main processes of the company, the following activities are carried out: arranging appointments, ringing the client to confirm appointments, arranging follow-ups, checking pending client issues, carrying out an evaluation of patients, negotiate, carry out the consultation.

- **Stock control:** replace materials and products according to need; do stocktaking and reorder materials; take delivery of materials and products and allocate them to stock.

- **Management of infrastructure:** maintenance of consulting room equipment and routine cleaning of the clinic.

- **Generation and management of documents:** the generation of all patient documents is seen as part of the administrative support process.

- **Auxiliary support for the execution of dental procedures:** a process carried out by dental assistants, whose main tasks are: handle instruments for the dentist during a consultation; ensure the validity of surgical instruments; sterilize surgical instruments.

- **Management of financial resources:** control of cash; control of expenses, allocation of financial resources.

A process prioritization matrix was previously developed to identify and select the critical processes of the company. The matrix was adapted from the Management Excellence Model (MEM) and is structured according to the aforementioned processes that receive a score according to certain criteria: client impact, financial impact, impact on service quality, quantity of tasks and time spent to run each typical process cycle. The score system was defined as given in Table 1.

Table 1 - Process Score Scale

Score	Client Impact	Financial Impact	Impact on Service Quality	Quantity of Tasks	Time Spent to Run each Cycle
1	Very Low	Very Low	Very Low	1 to 3	Very Short
2	Low	Low	Low	4 to 6	Short
3	Medium	Medium	Medium	7 to 9	Medium
4	High	High	High	10 to 12	Long
5	Very High	Very High	Very High	13 or more	Very Long

Source: Prepared by the author.

To collect the scores, a form was devised for employees to complete - with the intention of defining a score for each criterion as an average of the responses (Table 2). In addition, weighting was given to each criterion, according to their importance for the process. These are shown in the first line of Table 2. This importance is explained by the SWOT analysis, where it can be seen that the company values, above all, the quality of its services and the excellence of customer service, in particular. Such criteria, therefore, receives the greatest weight, in this case 3. In terms of quantity of activities and time spent to run each task the weighting was 2, because despite the influence of client satisfaction, these activities are related to the high standard of quality. Finally, the weighting of financial impact was 1, also explained by quality, because better materials and equipment are necessary. Table 2 presents the prioritization matrix of the most critical processes, ordered from the most to the least critical.

The weight of each criterion is given in the last line of the table.

Table 2 - Prioritization Matrix

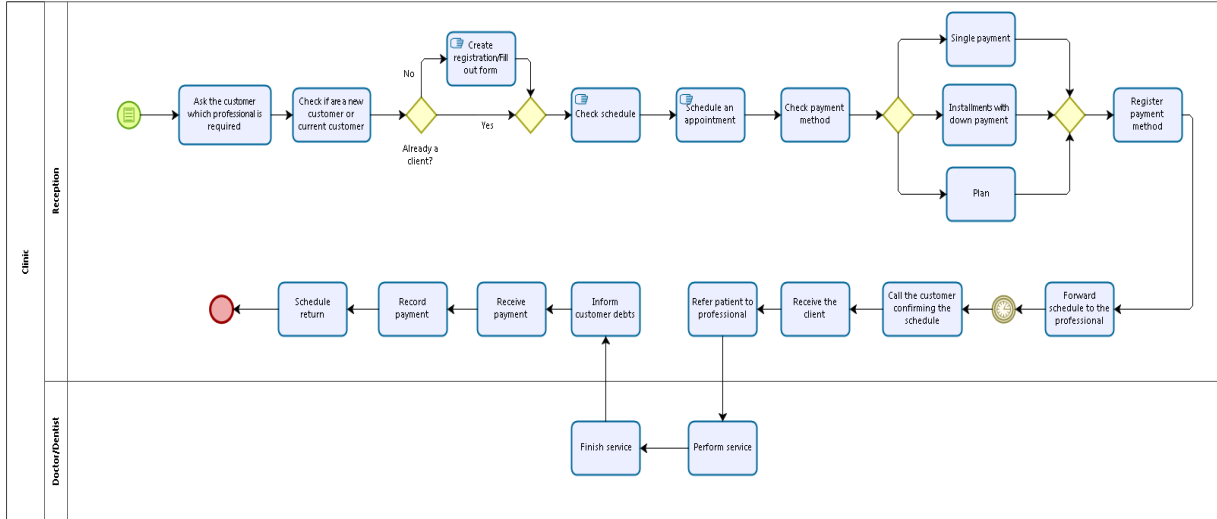
	Analysis Criteria					Totals
	mpacto n client	Financial impact	Impact on the quality of service	Number of activities	Time spent to run one cycle of the process	
CRITERIA WEIGHTING	3	1	3	2	2	
Attend the client	5	5	5	4	4	51
Manage stock	5	5	5	3	3	47
Manage infrastruture	5	4	5	2	3	44
Generate and manage documentation	4	4	4	3	3	40
Auxiliary support to the execution of dental procedures	5	4	5	3	3	46
Manage financial resources	5	5	3	3	3	41

Source: Adapted from the Management Excellence Model (FNQ, 2018).

4.2 Process analysis, modeling and optimization

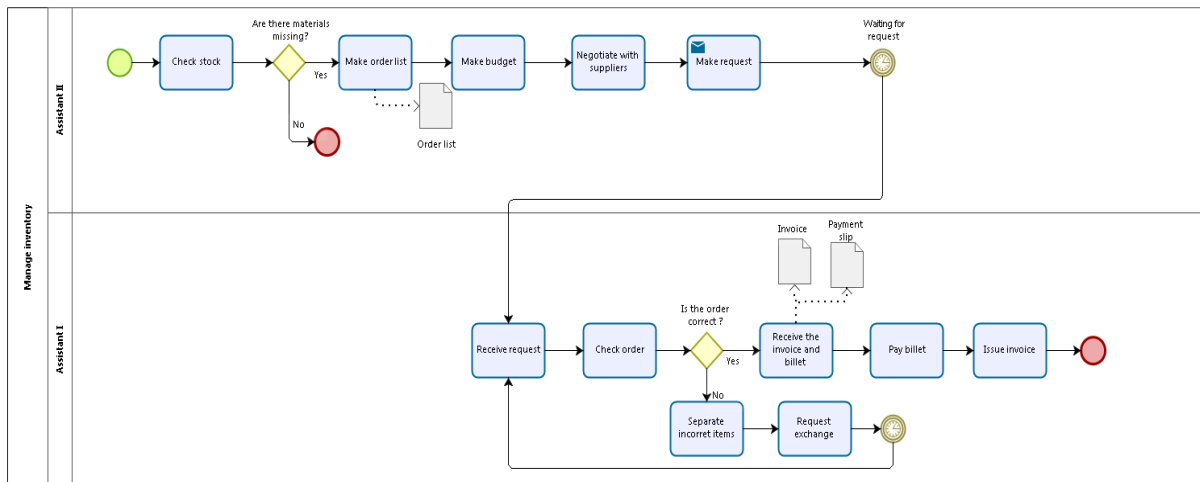
In this stage, the two highest scoring processes, that is, the most critical company processes were modeled in *Bizagi Modeler* (As IS Models), they are: the customer service process (Figure 3) and stock management (Figure 4)

Figure 3 - As Is Model of the customer service process



Source: Prepared by the author.

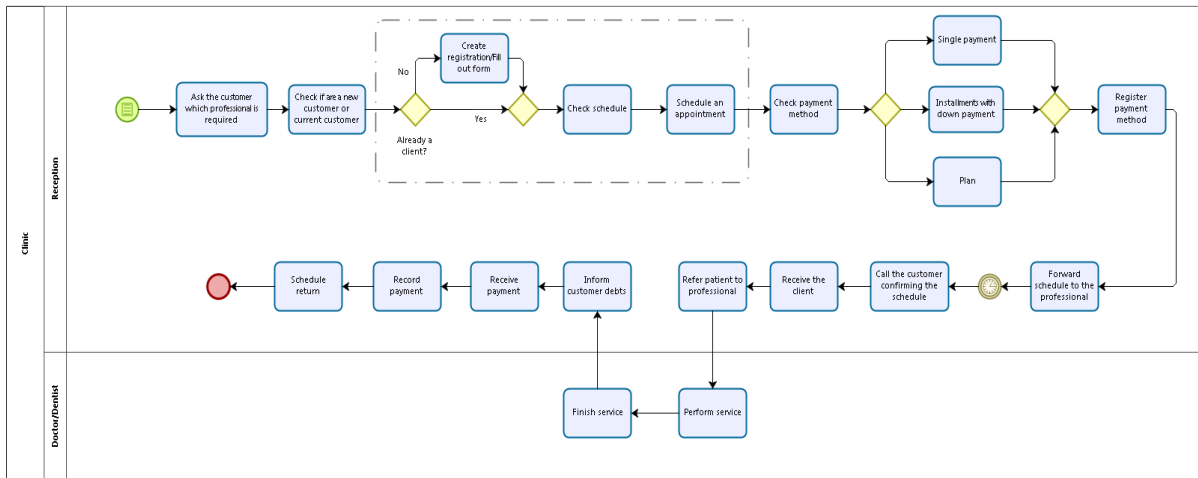
Figure 4 - As Is Model of the stock management process



Source: Prepared by the author.

Regarding the *To Be* model for the Customer Service process (Figure 5), it can be seen that client registration and appointments are done manually, with details recorded on paper. As an improvement, computer software, specifically designed for use in clinics and medical practices, was suggested: this software offers a customized diary for each professional, in addition to patient data and financial management records. In this way, it is possible to optimize time and avoid potential appointment errors, which often cause client dissatisfaction.

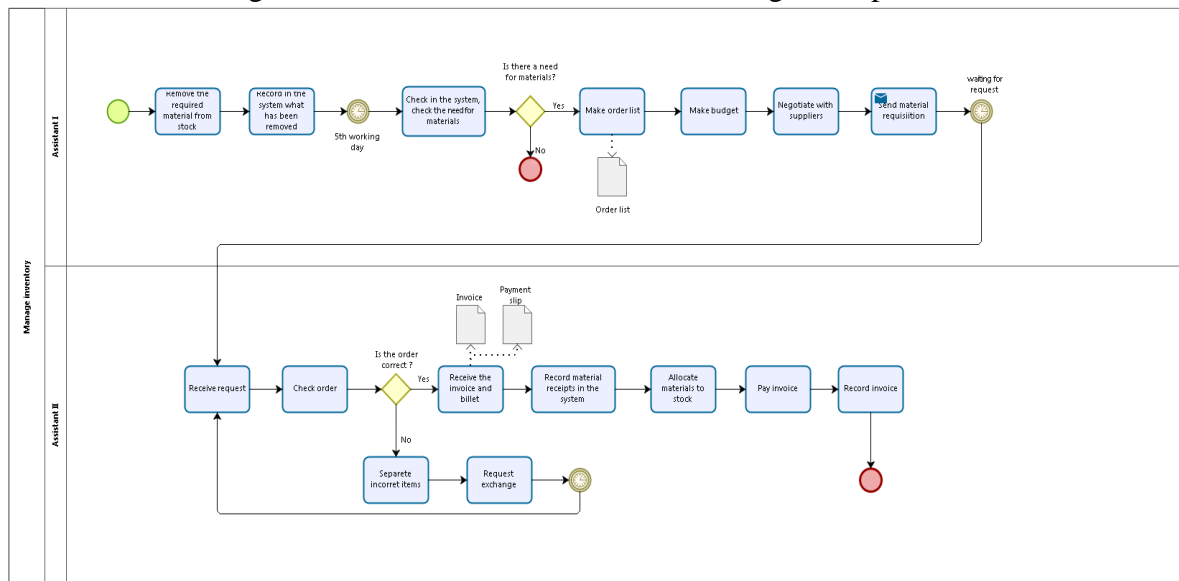
Figure 5 - *To Be* model for the Customer Service process



Source: Prepared by the author.

According to Dantas (2015), the way in which stock is stored and controlled, in addition to avoiding problems, can increase company profitability. Its efficient control is essential for a business to adequately accomplish its tasks, as well as guarantee that stock does not run out or that unnecessary purchases are made. In the *To Be* model (Figure 6) related activities were added to the records of entry and exit of stock items, to ensure a better control of stock levels. This was because there was formerly no information about which items (or the quantity of the same) had been taken.

Figure 6 - *To Be* Model for the stock management process



Source: Prepared by the author.

The verification of stock was done by an assistant through observation, that is, reorders were made intuitively. For such records, a stock management system or tool is recommended to avoid possible stock gaps or excesses, which could impact customer service.

5. CONCLUSIONS

In light of the challenges faced in today's business world, an efficient management system is essential for a company to maintain its place in the market. Recognizing that this is especially true of the significant role micro and small businesses play in a country's economy, and that such companies face difficulties to remain active in the market due to inefficient management, and a lack of planning and process organization, this study aimed to map out the critical processes of a clinic attending dental and medical patients, based on a situational analysis of the company. Through observations and interviews it was possible to identify all of the business's processes and select two of the most critical processes – namely, stock management and customer service - by means of a prioritization matrix. By mapping these two processes it was possible to structure their activities, and propose improvements and standardization. These results provide evidence that BPM can be effectively used for micro and small businesses. However, as the present study was carried out in only one company, it has not been possible to affirm that the results are valid in other organizations. This would require research in other micro and small business in the sector. Further studies might also carry out studies to establish future difficulties, and quantify the long-term benefits of the models from this clinic, in addition to carrying out research in other micro and small businesses.

References

ABPMP, Association of Business Management Professionals. **BPM CBOK V.3** – Guia para gerenciamento de processos de negócio corpo comum do conhecimento. 1. Ed. ABPMP, 2013.

AGÊNCIA SEBRAE DE NOTÍCIAS. **Em cinco anos, número de pequenos negócios crescerá 43%.** Brasil, 2017. Disponível em: <<http://www.agenciasebrae.com.br/sites/asn/uf/NA/em-cinco-anos-numero-de-pequenos->

negocios-crescera-43,608b10f0fc10f510VgnVCM1000004c00210aRCRD>. Acesso em: 23 jul. 2018.

ANDRADE, F. S. ; BATISTA, L. A. M. L.; BATISTA, L. T.; MASIH, R. T. Aplicação do gerenciamento de processos de negócios visando a identificação de oportunidades de melhorias nos processos administrativos e logísticos para o auxílio do desenvolvimento de um sistema integrado de gestão: estudo de caso em uma empresa distrib. In: ENCONTRO NACIONAL DE ENGENHARIA DE PRODUÇÃO, n.37, 2017. **Anais...** ENEGEP, Joinville, 2017.

BALDAM, R; VALLE, R; ROZENFELD, H. **Gerenciamento de Processos de Negócio**: Uma referência para implantação prática. Rio de Janeiro: Elsevier, 2014.

BANDARA, W.; BAILEY, S.; MATHIESEN, P.; MCCARTHY, J.; JONES, C. Enterprise Business Process Management in the public sector: the case of the Department of Human Services (DHS) Australia. **Journal of Information Technology Teaching Cases**, v. 8, n. 2, p. 217–231, 2018.

BEZERRA, M. C. C.; IDROGO, A. A. A.; BRITO, A. M. V. G.; BERNARDES JUNIOR, E. J. Gerenciamento por processo: Aplicação da metodologia do BPM em uma empresa produtora de bebidas energéticas. In: ENCONTRO NACIONAL DE ENGENHARIA DE PRODUÇÃO, n.36, 2016. **Anais...** ENEGEP, João Pessoa, 2016.

COSTA, J. M.. **Melhoria de processos em uma clínica odontológica**. 2014. 105 f. TCC (Graduação) - Curso de Engenharia de Produção, Universidade de São Paulo, São Paulo, 2014.

DANTAS, J. C. A. **A importância do controle de estoque**: estudo realizado em um supermercado na cidade de Caicó/RN. 2015. 55 f. TCC - Curso de Ciências Contábeis, Universidade Federal do Rio Grande do Norte, Caicó, 2015

DUMAS, M.; LA ROSA, M.; MENDLING, J.; REIJERS, H. **Fundamentals of Business Process Management**. Berlin: Springer, 2018.

FNQ. **3 ferramentas para priorizar processos**. Disponível em: <<http://www.fnq.org.br/informe-se/noticias/3-ferramentas-para-priorizar-processos>>. Acesso em: 05 nov. 2018.

LOPES, M. A. B.; BEZERRA, M. J. S. Gestão de processos: fatores que influenciam o sucesso na sua implantação. In: ENCONTRO NACIONAL DE ENGENHARIA DE PRODUÇÃO, n. 28, 2008. **Anais...** ENEGEP, 2008.

MASCHKA, M. G. **Gestão de Processos de Negócios**: Um Estudo Empírico em Micro e Pequenas Empresas Brasileiras. 2014. 89 f. Dissertação (Mestrado) - Curso de Ciência da Computação, Universidade Federal de Pernambuco, Recife, 2014.

MEDOH, C.; A. TELUKDARIE, A. **Business Process Modelling Tool Selection**: A Review. IEEE International Conference on Industrial Engineering and Engineering Management (IEEM). Proceedings..., 2017.

OMG - Object Management Group. **Business Process Model and Notation (BPMN) Language**, 2014. Disponível em <<https://www.omg.org/spec/BPMN/>>. Acesso em: 19 mai. 2020.

PIECHNICKI, F.; BARAN, L. R.; PIECHNICKI, A. S. Proposta de modelagem de um processo de manutenção industrial baseada no padrão BPMN e na norma ISA-95. In: ENCONTRO NACIONAL DE ENGENHARIA DE PRODUÇÃO, n.32, 2012. **Anais...ENEGEP**, Bento Gonçalves, RS, 2012.

VANWERSCH, R. J. B.; SHAHZAD K.; VANDERFEESTEN, I.; VANHAECHT, K.; GREFEN, P.; PINTELON, L.; MENDLING, J.; van MERODE, G. G.; REIJERS, H. A. A Critical Evaluation and Framework of Business Process Improvement Methods. **Business and Information Systems Engineering**, v. 58, n.1, p. 43-53, 2016.

TARHAN, A.; TURETKEN, O.; REIJERS, H. A. Business process maturity models: A systematic literature review. **Information and Software Technology**, v. 75, p. 122–134, 2016.

TOLFO, C.; MEDEIROS, T. S.; MOMBACH, J. G. Modelagem de Processos com BPM em pequenas empresas: um estudo de caso. In: ENCONTRO NACIONAL DE ENGENHARIA DE PRODUÇÃO, n. 33, 2013. **Anais...ENEGEP**, Salvador, BA, 2013.

VOM BROCKE, J.; SCHMIEDEL, T.; RECKER, J.; TRKMAN, P.; MERTENS, W.; VIAENE, S. Ten Principles of Good Business Process Management. **Business Process Management Journal**, v. 20, n.4, p. 530-548, 2014.

VOM BROCKE, J.; MENDLING, J. **Business Process Management Cases**. Berlin: Springer, 2018.