

MDSAA

Master Degree Program in
Data Science and Advanced Analytics

Optimising Order-to-Cash Process:

A BPM Approach for the Construction Retail Industry

Inês Isabel Rodrigues Silva

Master Project Work

presented as partial requirement for obtaining a Master's Degree in Data Science and Advanced Analytics

NOVA Information Management School
Instituto Superior de Estatística e Gestão de Informação
Universidade Nova de Lisboa

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by
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Master Project Work presented as partial requirement for obtaining the Master's degree in
Data Science and Advanced Analytics, with a specialization in Business Analytics

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STATEMENT OF INTEGRITY

I hereby declare having conducted this academic work with integrity. I confirm that I have not used plagiarism or any form of undue use of information or falsification of results along the process leading to its elaboration. I further declare that I have fully acknowledged the Rules of Conduct and Code of Honor from the NOVA Information Management School.

Lisbon, 30th April 2025

Inês Silva

DEDICATION

To my beloved family whose support and encouragement gave me the values to work hard as well as the strength to give my best every day. These are the people that inspired me to take leaps in the dark, challenged me to keep on studying and that made it possible to get this far in my career. This project is dedicated to all of them, it reflects their unwavering love and inspiration.

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ABSTRACT

This project intended to improve the Order-to-Cash process of a company that sells construction materials as well as extend the BPM discipline impact. The execution of this project will allow to increase the efficiency and effectiveness of the company, making it more prepared to compete in the retail and construction industries. The BPM Lifecycle Framework and the Bizagi software were used to perform simulations. The results of the collected data, the designed models and potential scenarios indicate promising outcomes if the company automatizes some of its manual procedures as well as tries to revolutionize the payment timelines. Consequently, it is expected that the company will be able to optimize its resources in a way that customer relationships will improve while reducing employees' workload. Additionally, the study allows to promote BPM into new industries as well as demonstrate that the application of this knowledge to businesses has a wide range of benefits.

KEYWORDS

BPM; O2C Process; Construction Materials Retail Sector; Automatization

Sustainable Development Goals (SDG):



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LIST OF ABBREVIATIONS AND ACRONYMS

ARIS	Architecture of Integrated Information Systems
BI	Business Intelligence
BPA	Business Process Analysis
BPM	Business Process Management
BPMN	Business Process Modelling and Notation
BPMS	Business Process Management System (or Suite)
BPR	Business Process Re-engineering
FIFO	First-In-First-Out
KM	Knowledge Management
O2C	Order-To-Cash
SDG	Sustainable Development Goals
WFM	Workflow Management

1. INTRODUCTION

Business Process Management (BPM) is a discipline that focuses on improving operational business processes whether with the support of technologies or not. Includes a broader scope than Workflow Management (WFM) by not exclusively focusing on process automation but also process analysis (van der Aalst, 2013). In a nutshell, BPM is a continuous process which investigates optimization of companies' processes by analyzing, designing, implementing and monitoring processes. The adoption of BPM impacts positively a company (Kasim et al., 2018) as it gives a competitive advantage by improving efficiency (e.g. through the eradication of non-value-adding activities), cost reduction (e.g. with better resource allocation, or parallel work), augmented quality (e.g. by reducing error along the process), employee empowerment (e.g. employees feel more valuable when participating in restructuring business), decrease risk (e.g. by finding and reducing errors), and improve customer satisfaction (e.g. if the company becomes more efficient so does their services) (Mäkinen, 2019; PwC, 2013). BPM is a recognized field that has past proven results in optimizing organizations' processes, offering practical solutions that are strategically aligned with the organization goals. This area can be applied to various business contexts and industries, which highlights the advantages of this sector. Based on that, this project will develop a BPM case study focused on the Order-to-cash (O2C) process (Cronie, 2009).

The O2C process is one of the most important processes of a company, having a significant impact on the organizations' revenue as it incorporates all procedures from the moment an order is placed until it is delivered, subsequently, demanding the cooperation between the many departments and people (KPMG, 2023; Muurinen, 2020).

A small/medium-sized company that sells construction materials located in Lisbon will be used to conduct this project. Inserted into a niche of the market influenced by factors from both the retail and construction materials sectors, increasing the number of risks associated with themselves, the company faces rapidly changing market dynamics, complex supply chains, and some challenges on technology adoption, data management, and risk management.

Although exists many projects and studies developed around the topic of optimization of retail processes (Marjanovic & Roose, 2011; Shankararaman et al., 2012) as well as BPM projects and process optimization in the construction area, the specific niche of construction materials has been to some extent neglected. Due to the many distinguished characteristics of this sector is extremely necessary to develop a unique use case targeted at this specific market subset that can serve as a basis for future projects in the sector and provide recommendations on optimization strategies. Consequently, the main research objectives of this study are: (1) discover, analyze and redesign the O2C process of the company; (2) be pioneer and create a recommendation guide on how to improve processes on the specific market sector of construction materials. This project is expected to, firstly, enrich operational efficiency,

enhance cash flow management, boost customer satisfaction, and identify further investments in data analytics and new business opportunities for the company studied. Secondly, it is expected to extend the current body of knowledge about the application of BPM framework as an optimization methodology for organizations, by creating a use case on a specific market niche – construction materials. Finally, this work will serve as a guide on how to apply efficiency to the construction materials organizations, providing recommendations for improvement. The optimization process presented in this project will open the door to the application of digital transformation initiatives, being this a key strategy to keep every company on the cutting edge of the industry (Koelemen et al., 2024).

In the interest of reaching the above goals, this project will next present a literature review on BPM, explaining the area and exploring the current state-of-the-art on past use cases in the sector. Later the used framework will be introduced, and a results section will incorporate four main stages: (1) Process identification (architecture); (2) Process Discovery (AS-IS model); (3) Process Analysis (qualitative and quantitative analysis); (4) Process Redesign (To-Be model). Finally, a discussion of the findings, theoretical and practical implications and limitations and future research directions will be addressed.

2. LITERATURE REVIEW

2.1. BUSINESS CONTEXT

The construction materials sector is a key player of the construction industry since the companies that compose this market are the intermediaries between the manufacturers of crucial construction materials (e.g. steel, cement, plasterboard) and the end-users, contractors and builders. These companies shape the market, considering that they are the ones that control availability and so decide the quality and innovation of the products.

This sector plays an enormous role globally since its daily processes require intercountry or even intercontinental relationships in order to bring to their location the necessary and the cutting-edge products available worldwide, this way keeping a healthy relationship around the world which improves communication and integrity. Moreover, it also impacts the world's sustainability since this constant communication implicates that new more sustainable products become available in a vaster network of countries (e.g. many countries are already looking at greener solutions in constructions which have not yet reached many countries but with this immense network, the access to them is easier and can be normalized worldwide faster) (Chen et al., 2023). Let's take Portugal as an example. It is a country that still does not have many green regulations regarding construction, but it imports many of its construction materials. Subsequently, it means that it has great communication tools with other countries, so the implementation of green materials can soon become normalized as it manages astronomical amounts of resources whether material or human from many countries. This way contributing to increase the GDP and promoting large amounts of trade (Correia & Kaizeler, 2023).

The company in study is a retail company expert in the commercialization of construction materials. Therefore, the company is inserted into the complex market niche of the construction materials where even though some materials are required for almost all projects, most of them differ from constructor to constructor and from client to client considering that these projects are personalized according to each person's ideas and influenced by the architecture's strategy. Thus, this process involves a wide range of people all with their own point of view, making it harder to establish purchase patterns and requiring constantly performing tailor-made customer orders. Additionally, it is faced with constant price changes since this industry is highly affected by the housing market that has been growing exponentially in the past few years, in Portugal (Vieira, 2023). Moreover, the company must deal with bulk orders, which means it must be equipped with multiple trucks, know the laws its drivers are subject to and the car restrictions. It is also important to look at the company's major competitors to see whether they are of medium or big size. Accordingly, selecting the business process with the greatest impact will allow narrow efforts into the most important processes, this way improving itself in an efficient way. So, it was concluded that the O2C process is the procedure with greatest potential and that adds the most value to the company.

2.1.1. Scarcity of studies about improving the O2C of construction materials retail through BPM

Table 2–1 Support Papers Analysis

Focus	Brief Description	BPM Application	Lacks	What does it offer to this study
BI-Enabled, Human-Centric Business Process Improvement in a Large Retail Company (Marjanovic & Roose, 2011)				
-Retail Company; -Business intelligence; -Human-centric BPM.	It explores how to improve business processes in a large retail company using BI and human-centric BPM.	Human-Centric BPM.	It does not focus on the O2C process nor it studies a similar industry.	It gives insights into the application of human-centric BPM.
A Retail Bank's BPM Experience (Shankararaman et al., 2012)				
- BPM; - Retail Banking; -Process Improvement; - Technical Solution.	BPM application in a retail Bank to improve application verification.	Process redesign and automation.	It does not focus on the O2C process.	Although the industry is different, it gives insights unto the application of BPM.
Examining the Impact of Material Management Practices on Project Performance in the Construction Industry (Yıldız & Güneş, 2024)				
-Material Management; - Project Performance.	It explores how project performance in construction is affected by the way materials are managed.	General Project Performance.	It does not focus on a specific process, in this case O2C process.	Importance of material management.
Integration between knowledge management and business process management and its impact on the decision making process in the construction sector: a case study of Jordan (Abuezhayeh et al., 2022)				
Knowledge Management (KM); - BPM Integration.	It looks at improving decision making through BPM and KM.	BPM Integration.	It does not focus on a specific process, in this case O2C process.	It presents the benefits of combining BPM and KM.
Exploring the Power of BPM in the Construction Industry (prime@admin, 2024)				
Workflow optimization.	It studies how to improve efficiency in construction through BPM.	General BPM in construction.	It does not focus on a specific process, in this case O2C process nor it looks at the retail of the construction materials.	It presents the benefits of combining BPM in construction.
Business process management – a construction case study (Dave, 2017)				
Workflow optimization.	It highlights the importance of applying continuous BPM strategies in a construction company.	General BPM in construction.	It does not focus on a specific process, in this case O2C process.	It presents the benefits of applying BPM in construction and a need for continuous improvement.

Source: Own Author

Subsequently to an analysis of the current available projects using BPM or technique applications to reorganize and improve the O2C process of a company, it was clear that there is an unexplored territory since there are no studies about the application of BPM in the O2C process of a company that sells construction materials.

2.2. BPM

Each company has their own business goal, which is achievable only by performing a collection of business processes (which is a collection of activities that is necessary to reshape an input into a specific outcome valuable to the business), in the words of Davenport a business process is *“a set of logically related tasks performed to achieve a defined business outcome for a particular customer or market”* (Weske, 2019, p. 5). However, organizations have many business processes which must be well managed, otherwise it will implicate inefficiencies that may jeopardize the quality of the product/service. Consequently, if a company can implement BPM in their daily operations, it is expected to be able to mitigate those risks.

This concept of BPM has been evolving over the years. Nevertheless, BPM is described as a revival of Business Process Re-engineering (BPR used to be focused on planning and organizing processes). However, one must know that although both take a business process as a starting point, BPM is a broader discipline, *“provides concepts, methods, techniques and tools that cover all aspects of managing a process”* (Dumas et al., 2018, p. 15). This term then comes adding the necessity of managing process on an on-going basis to meet targets, namely, customer expectations, competitors benchmarks and market trends (Vom Brocke & Rosemann, 2015) by integrating a diverse set of analysis' types and sometimes automating and restructuring processes. BPM distinguishes itself from Process Mining, as well, since the latest is data-driven, it is based on event logs to provide insights immediately. Considering the company in question, BPM is a more suitable solution considering that not only does the company not have its processes well organized, but this way also does not have the available information to implement process mining.

Along the years, many BPM frameworks were developed such as BPM Six Core Elements Model - This model besides looking at BPM from an holistic viewpoint, it also goes into technical detail, categorizing it into six areas, strategic Alignment, Governance, Methods, Information Technology, people and culture (vom Brocke & Mendling, 2018; Vom Brocke & Rosemann, 2015)), Architecture of Integrated Information Systems (ARIS) *“a concept that creates a guideline for developing, optimizing and implementing integrated application systems from a process point of view”* (Bernus et al., 2006, p. 600), ARIS-House of Business Process Management, *“a general architecture of business processes management that consists of the following three levels: Strategy, Process-Design, -Optimization and -Controlling, and Execution”* (Bernus et al., 2006, p. 600), Lean Six Sigma (LSS) *“is an organizational improvement focus one expanding investor value by enhancing quality, customer satisfaction,*

speed and reduction in costs. It has been achieved by integration of tools/techniques and philosophy from Lean and Six Sigma methodologies. LSS is dominant and efficient strategies, facilitating the organization to eliminate weakness and for retaining their improvement” (Raval & Kant, 2016, p. 277). Additionally, there is the “BPM lifecycle structure” (Dumas et al., 2018), one of the most used frameworks in BPM, which includes the following steps – (1) Process Identification, (2) Process Discovery, (3) Process Analysis, (4) Process Redesign, (5) Process Implementation, (6) Process Monitoring – and then starts all over again from (2) Process Discovery making it a lifecycle because it is a constant process.

BPM lifecycle structure is the framework chosen to be used throughout this project because it is clearly designed, incorporating many important aspects which in the context of retail construction companies is crucial due to the many players of its process. Moreover, this approach cares for implementing practical techniques with theoretical knowledge. Furthermore, this approach looks at the company’s processes from a holistic point of view allowing to guarantee that the proposed changes do not have negative impacts on the remaining processes. This technique outshines the Lean Six Sigma and the other methods by giving a special focus to the automation and implementation of cutting-edge technologies. Additionally, the BPM lifecycle is not limited to cutting out problems, it looks for improvements.

Consequently, complementing its work, this discipline uses Business Process Management Notation (BPMN) to design its models. It helps one define a diagram that visually describes the flow of the company’s processes, this way facilitating the use and understand processes to develop an objective management plan. Accordingly, there are some important modelling elements that a BPM model includes, namely, events, activities, gateways, sequence and message flow, data association, pools, lanes, data objects, messages, groups, text annotation (*Business Process Model and Notation (BPMN), Version 2.0, 2013*).

3. FRAMEWORK – THE BPM LIFECYCLE

The BPM Lifecycle is a guideline to managing a business process. Composed of many phases, it discovers, analyses and redesigns processes continuously.

3.1. PROCESS IDENTIFICATION

Business process management is not a free service, and all companies want to be cost-efficient as much as they can. Therefore, it is necessary to set criteria to ensure that the right process is being scrutinized so all processes must be examined. To perform this selection, firstly, it was used a process checklist (Dumas et al., 2018).

- Is it a process at all?
- Can the process be controlled?
- Is the process important enough to manage?
- Is the scope of the process not too big?
- Is the scope of the process not too small?

Secondly, the processes' profiles were defined following the structure presented below (Dumas et al., 2018).

Figure 1 - Process Profile Structure

Name of Process:		
Vision:		
Process Owner:		
Customer of process:		Expectation of Customer:
Outcome:		
Trigger:		
First Activity:		
Last activity:		
Interfaces inbound:		
Interfaces outbound:		
Required resources:		
Process Performance Measures:		

Adapted from Dumas et al., 2018

Thenceforward, a process selection is performed to narrow down the scope of the study, specifically, the processes that produce the highest profit margin and also the one with more areas to improve as well as with more automation opportunities.

3.2. PROCESS DISCOVERY

Process discovery gathers information on the operational workflow of the process, this way gaining insights on the activities that constitute it and the relationships that lead to the outcome, consequently, leading to an AS-IS Model of the process. Therefore, three different methods can be used to acquire this information, evidence-based discovery, interview-based discovery and workshop-based discovery (Dumas et al., 2018).

3.2.1. Evidence-Based Discovery

The analysts should look for documentation describing the processes that compose the business. However, many companies do not have these policies written down or even their organizational units. Hence, observation can be useful to have a good perception of how the process is applied in the company, with a great deal of comfort regarding the reality of the process. Automated process discovery is another technique that can be used but it requires that the company has adopted an enterprise system which is not the case for many businesses in Portugal of small/medium size (Mendes, 2018), making this approach difficult to use.

3.2.2. Interview-Based Discovery

Interview-Based Discovery is a double-edge sword considering although it produces a great deal of details crucial for the process design as one can see the process from many points of view, it highly depends on people's opinions which means it includes bias, making it crucial for the analyst to have superb professional skepticism. Subsequently, to mitigate this issue it is important to have a strategy to use this method, being those structure and free-form interview approaches (Dumas et al., 2018). The main difference between these methods is essentially the fact that the first requires the predefinition of questions whereas the second lets the expert describe the process in a free format. Afterwards, one represents the described model in an AS-IS model and evaluates with the interviewees if the representation performed is accurate.

3.2.3. Workshop-Based Discovery

Annually, a BPM conference occurs where a few workshops occur to address new ideas. These workshops put together specialist of certain areas to discuss advancements and techniques for the topics being explored to advance this discipline (Cabanillas et al., 2023). Although different, Workshop-Based Discovery works similarly as it involves having multiple participants in the process together to develop a description of the process, joining all the information they know in one single design in order to obtain a more detailed and accurate description of the process.

3.3. PROCESS ANALYSIS

Ensuing to selecting the process and discovering how it works, it is central to analyze it to detect inefficiencies and potential improvement areas, accordingly, qualitative and quantitative Business Process Analysis (BPA) are performed.

3.3.1. Qualitative Analysis

3.3.1.1. Value-Added Analysis

Value is defined by the process of customers, whether they are external or internal clients. Consequently, to proceed with this analysis value must be defined, so that the activities in the process can be well categorized between Value added (VA) – activities that actually create the value that the customer is looking for, Non-Value added (NVA) – tasks that do not create value according to the clients, and Business-Value added (BVA) – activities that are necessary to keep the business moving (Muralidharan & Raval, 2015).

3.3.1.2. Waste Analysis

Conversely to Value-Added, waste analysis investigates processes from a negative perspective. It scrutinizes processes as much as possible, since many issues are not clear, some are well hidden within the process. Classified into three main categories waste can be labelled

3.3.1.2.1. Move

The most common source of move waste in a process is transportation. In the context of this business, transportation waste is associated with handoffs between process participants. However, nowadays these tasks are easily handled by automatization by Process-Aware Information Systems (Dumas et al., 2018, p. 219). Furthermore, there is motion waste, this is associated with movement. In the context of this niche of the market, motion is associated with the multiple switching between the tools used to keep track of orders, where the invoice is inserted, etc. (Dumas et al., 2018, p. 221).

3.3.1.2.2. Hold

The first hold waste that it is very common in this sector is the inventory/work-in-progress. The bulk orders that a company must deal with require large quantities of physical storage because in order to deliver on time the material must be available, and most products are imported which means that they take a minimum of three days to become available if the manufactory has it available. Moreover, WIP is also a very common waste in this type of companies as most deliveries are by schedule, meaning that a lot of orders are on hold because the construction site does not have the conditions to collect the materials right way. Another type of hold waste is waiting, also one of the most common, there are always waiting periods. In this context, the waiting waste is mostly associated with stock availability from suppliers, availability of truck drivers and availability of delivery slots (Dumas et al., 2018).

3.3.1.2.3. Overdo

The overdo process can be associated to defects, overprocessing and overproduction. However, in the context of retailing construction materials does not implicate overproduction waste since the products are not produced by the company. On the other hand, defects is a common issue has sometimes the company has to deal with complains made about the products. In addition, the company can be faced with overprocessing, if they are overly perfectionists or there are tasks in the process that in the end are unnecessary. In conclusion, the identification of the different wastes in the process is crucial since all these should be eliminated (Dumas et al., 2018).

3.3.1.3. Stakeholder Analysis and Issues Documentation

3.3.1.3.1. Stakeholder Analysis

“Stakeholder analysis is an approach, a tool or set of tools for generating knowledge about actors – individuals and organizations – so as to understand their behavior, intentions, interrelations and interests; and for assessing the influence and resources they bring to bear on decision-making or implementation processes” (Varvasovszky, 2000, p. 338). Consequently, it is important to look at the major players of a company’s process so the following structure was used (*Stakeholder Analysis Worksheet*, 2024):

Figure 2 - Stakeholder List Structure

Stakeholder Category	Stakeholder
Those who are or will be directly affected	
Those with decision-making authority or other sources of influence	
Those who have resources or skills that may be needed	
Those who will be implementing the results or outcomes	
Those who will actively oppose or attempt to derail the process	
Those who will actively support or promote the process	

Adapted from *Stakeholder Analysis Worksheet*, 2024

Figure 3 - Stakeholder Analysis Structure

Stakeholder (Name of group or individual)	Interests (What are their biggest concerns?)	Position (What outcome is a “win” for them?)	Influence (Do they have special power in the situation?)	Involvement (What level of participation do you predict?)	Special Considerations

Adapted from *Stakeholder Analysis Worksheet*, 2024

3.3.1.3.2. Issue Register

Issue Register is a strategy that documents, in a table, the analysis of the issues and its impact on the company. The fields that compose this table are:

- Name of the issue.
- Description (1-3 sentences).
- Priority (compared with other issues).
- Data and assumptions (data used to justify the impact of the issue).
- Qualitative impact (the qualitative impact of the issue – customer and employee satisfaction, reputation, supplier relationship).
- Quantitative impact (the quantitative impact of the issue – loss and costs).

3.3.1.3.3. Pareto Analysis and Pick Charts

The Pareto Principle defines that a small portion of inputs, roughly 20%, is often responsible for a large portion of outcomes, roughly 80% (Yazdani, 2024). “The relevance of the Pareto Principle to business lies in its potential to optimize efficiency by enabling companies to focus on the most impactful elements of their operations” (Yazdani, 2024, p. 1). This principle can equally be applied to issues as it will narrow one's focus to the primary issues, this way increasing efficiency, and reducing costs and efforts. In this context, a typical approach is as follows (Dumas et al., 2018):

- Define the effect to be analyzed and the measure via which this effect will be quantified.
- Identify all relevant issues that contribute to the effect to be analyzed.
- Quantify each issue according to the chosen measure.
- Sort the issues according to the chosen measure (from highest to lowest impact) and draw a so-called Pareto chart. A Pareto chart consists of two components:
 - A bar chart where each bar corresponds to an issue and the height of the bar is proportional to the impact of the issue or factor.
 - A curve that plots the cumulative percentage impact of the issues.

The pick chart complements this analysis by helping categorize issues into Possible, Implement, Challenge and Kill by trade-offing between payoff and difficulty.

3.3.1.4. Root Cause Analysis

This technique is used to get to the actual reason why a problem occurs. A couple of techniques used to analyze issues are the “Why? Why?” and the cause-effect Ishikawa diagrams. Although the “Why? Why?” is mostly focused on recursively asking the question “Why?” to understand the indicators of the problem, the cause-effect Ishikawa diagram tries to evaluate why it happens so that it can identify the root cause of the issue (Damele et al., 1997).

3.3.2. Quantitative Analysis

3.3.2.1. Flow Analysis

This concept encompasses a collection of techniques to evaluate the performance of a process. It calculates cycle time using flow analysis (indicating the average time for a process to be complete), cycle time efficiency (cycles usually include waiting and processing time to analyze how time is being used), critical path method (if a process has low efficiency, it is important to look at the areas that cost most of the time so that those can be improved), Little's law (this law looks at ensuring that the processing part of the process is not out of control but it is only applicable on stable processes) and capacity and bottlenecks (looks at the theoretical capacity which investigates how many instances are completed per time unit). Similarly, this approach can be used to analyze the processing costs (Dumas et al., 2018).

3.3.2.2. Queue

Queuing is the waiting time expected between a customer placing a request and being served. Therefore, the "Queueing theory was developed to provide models to predict the behavior of systems that attempt to provide service for randomly arising demands" (Gross et al., 2011, p. 1). There is a collection of models to explore this theory. However, the ones being considered are the M/M/1 (used when the processing times follow an exponential distribution, there is a single server, and instances are served on a First-In-First-Out (FIFO)) and M/M/c Models (applied in the same situations but for 2 or more servers). These are statistical approaches to analyze a collection of samples to ensure that the numbers obtained are accurate. (Dumas et al., 2018).

3.3.2.3. Simulation

Simulation recreates the process, this way allowing to analyze multiple aspects regarding the process such as human capital, time, financial capital and its organization. Consequently, it allows for a holistic view of the process with statistical evidence (Iannoni & Morabito, 2006). This technique shall be used with the support of the tool "Bizagi Modeler", this application allows to design of models in a BPMN format to document and simulate processes graphically. The simulation approach was the chosen one because the flow analysis and queues are not as capable of capturing the dynamic side of the company's processes. Moreover, simulation is more equipped to deal with the uncertainty of the market world as it does not look at a scenario as a straightforward process. Additionally, Simulation is ready to deal with complex models and consider multiple aspects into its analysis, as was mentioned before, human and financial capital, time, etc.

3.4. PROCESS REDESIGN

The process of redesigning has the purpose of making the business process perform better by restructuring it. However, it implicates challenges namely, technical – design a radical improvement of the current process - and socio-cultural challenges – people accepting the suggested changes (Reijers & Liman Mansar, 2005).

Redesigning a process into a better version must include the aspects that the owner sees as an improvement which in most cases involves reducing the process time and costs while keeping or improving quality.

3.4.1.1. The Devil's Quadrangle

Changes are made in order to improve the process, but it is necessary to evaluate whether those changes have actual improvements or if there are more opportunities to improve them before pitching them to the company. This technique looks at measuring the performance of the new process according to Changes that are performed in order to improve the process, but it is necessary to evaluate if those changes had actual improvements or if there are more opportunities to improve it before pitching it to the company. A technique that looks at appraising the new process is the devil's quadrangle which covers the time, cost, quality and flexibility dimensions. The optimum outcome of this approach implies that the process decreases time and costs while quality and flexibility increase. However, this outcome cannot be fully approachable since the devil's quadrangle analysis has revealed that improving a dimension usually implicates loss of performance in another (Bui, 2016).

3.4.2. Transactional Methods

These methods help optimize transactional processes by improving efficiency while keeping accuracy and improving customer satisfaction.

3.4.2.1. Heuristic Process Redesign

The heuristic process redesign looks at a problem at a time and finds a solution for it. There is a collection of heuristic solutions to tackle some problems associated with the different dimensions. Those can be categorized as follows:

- Task level:
 - Elimination: Exclude unnecessary tasks.
 - Composition or decomposition: Smaller tasks are composed into one or many or complex tasks into simpler tasks to be more manageable.
 - Triage Specialization or Generalization: Tasks are categorized into priorities.
- Flow-level:
 - Re-sequencing: Change the order in which tasks are completed.
 - Parallelism enhancement: Tasks are performed simultaneously not sequentially.
- Process level:

- Specialization or standardization: Tasks are performed by specialized people or tasks are generalized.
- Resource optimization: Minimize waste by using resources efficiently.
- Communication optimization: Communication between the different departments is clear.
- Automation: Invest in tools that minimize human intervention.

Although these are used to tackle problems and optimize certain dimensions of the process, the application of these always implies a trade-off with other dimensions as the figure below shows (Dumas et al., 2018; Reijers & Liman Mansar, 2005).

Figure 4 - Heuristics' Summary

Level	Heuristic	Description	Time	Cost	Quality	Flexibility
Task	1	Task elimination	Improves	Ambiguous	Worsens	No effect
	2	Task composition	Improves	Ambiguous	No effect	Improves
		Task decomposition	Worsens	Ambiguous	No effect	Worsens
Flow	3	Triage - Specialization	Improves	Ambiguous	No effect	Worsens
	4	Re-sequencing	Improves	Improves	No effect	No effect
	5	Parallelism enhancement	Improves	Ambiguous	No effect	No effect
Process	6	Process specialization	No effect	Ambiguous	Ambiguous	Worsens
		Process standardization	No effect	Ambiguous	Ambiguous	Improves
	7	Resource optimization	Improves	Improves	No effect	Ambiguous
	8	Communication optimization	Improves	Ambiguous	Ambiguous	Worsens
	9	Automation	Improves	Ambiguous	Ambiguous	Worsens

Adapted from Frederico Jesus (2022), *Slides BPM Chapter 6 – Process Redesign*, NOVA IMS.

3.5. PROCESS IMPLEMENTATION

This part of the plan only happens if a high-quality project is developed and well-pitched to management so certain aspects must be considered. The previous steps provided the steps needed to accomplish a conceptual model but applying it in the context of a company is not a straightforward process and not all tasks are executable by using BPMS, as mentioned before, in the context of this project is the Bizagi tool that shall be used. Subsequently, a collection of actions must be taken to implement the model, namely, analyzing if its granularity is executable, whether the company has all the resources necessary or if they are aware that even if it is an improvement, there are always limitations. Consequently, the success of this phase depends as much on the quality of the project as on the employees' openness to change. Accordingly, the BPM team should consider,

- Findings Report (It is the backbone of the project without it none of the changes will look plausible).
- Process Mapping (Both AS-IS and TO-BE models must be mapped to give management a holistic view of what is going to change).
- Implementation Plan (Change implies acceptance from the client, and in order to change their habits there must be good propositions and well-structured so that they trust the work to continue).

- Expected Results and Limitations (Part of the process of pitching the process, results and limitations must be presented because it provides structure and trust).

3.6. PROCESS MONITORING

Process monitoring is a service performed afterwards to the implementation of the process in a real-life context. It includes analyzing the new execution and checking if it is working according to the expected results because if not adjustments should be implemented. Moreover, keeping track of the process helps with internal auditing, quality checks, and even new project development.

4. RESULTS

4.1. PROCESS IDENTIFICATION

Overall, a company has many processes which lead to the necessity of applying the previously mentioned strategies ([3.1. Process Identification](#)), namely, the process checklist, resulting in five processes (Quote-to-order, Order-to-Cash, Procure-to-Pay, Inventory Management and Bid-to-Win), followed by, these profiles design, as can be seen in the below figures.

Figure 5 - Quote-to-Order Process Profile

Name of Process:	Quote-to-Order.		
Vision:	The objective of the process is to generate concise quotes and permute them into sales.		
Process Owner:	Sales manager.		
Customer of process:	Sales team and External Customer.	Expectation of Customer:	Efficiency and accurate quotes. Profitability and Customer satisfaction.
Outcome:	Customer satisfaction and the quote being accepted.		
Trigger:	Sales opportunity acknowledged.		
First Activity:	Inquiry received.		
Last activity:	Quote approved (by both parties).		
Interfaces inbound:	Client's preferences, product availability and pricing.		
Interfaces outbound:	Quote terminated, order placed and confirmed.		
Required resources:	Sales team and tools.		
Process Performance Measures:	Cycle time, accuracy, revenue and customer satisfaction.		

Adapted from Dumas et al., 2018

Figure 6 - Order-to-Cash Process Profile

Name of Process:	Order-to-Cash.		
Vision:	The aim of the process is to be efficient when processing orders and collect payments while increasing customer retention rates.		
Process Owner:	Company's manager.		
Customer of process:	Sales team and External Customer.	Expectation of Customer:	Efficiency when shipping, invoicing and processing payment.
Outcome:	Customer satisfaction, revenue and increase of cash flow.		
Trigger:	Sales order is placed.		
First Activity:	Order received.		
Last activity:	Order closed.		
Interfaces inbound:	Order, inventory and shipping.		
Interfaces outbound:	Invoices, receipts and shipping documents.		
Required resources:	Sales, warehouse and accounting teams as well as shipping drivers.		
Process Performance Measures:	Cycle time, accuracy, revenue and customer satisfaction.		

Adapted from Dumas et al., 2018

Figure 7 - Procure-to-Pay Process Profile

Name of Process:	Procure-to-Pay.		
Vision:	The purpose of the process is to be able to order all the necessary supplies for the company's success and keep a good relationship with the supplier.		
Process Owner:	Procurement manager.		
Customer of process:	All company departments.	Expectation of Customer:	Availability of supplies on time with good prices on instantaneous payment.
Outcome:	Obtaining the products in a cost-effective way leading satisfaction from both parties.		
Trigger:	Requisition of goods.		
First Activity:	Purchase requested.		
Last activity:	Make payment.		
Interfaces inbound:	Order, inventory and shipping.		
Interfaces outbound:	Requisitions, delivery documentation and invoices.		
Required resources:	Procurement and accounting teams.		
Process Performance Measures:	Cycle time, accuracy, payment cycle.		

Adapted from Dumas et al., 2018

Figure 8 - Inventory Management Process Profile

Name of Process:	Inventory Management		
Vision:	The objective of the process is to manage inventory to have available in a short time for the placed orders but at the same time have not stocked for too long to keep quality as high as possible. In conclusion, optimise stock availability.		
Process Owner:	Inventory manager.		
Customer of process:	Company and External Customer.	Expectation of Customer:	Accurate records, stock renewal and avoid stockouts.
Outcome:	Optimise stock and boost customer satisfaction.		
Trigger:	Customer demand or low levels of stock.		
First Activity:	Low inventory recorded.		
Last activity:	Inventory records levelled.		
Interfaces inbound:	Order and shipping documentation.		
Interfaces outbound:	Stock adjustments.		
Required resources:	Warehouse team.		
Process Performance Measures:	Cycle time, stock rate and customer satisfaction.		

Adapted from Dumas et al., 2018

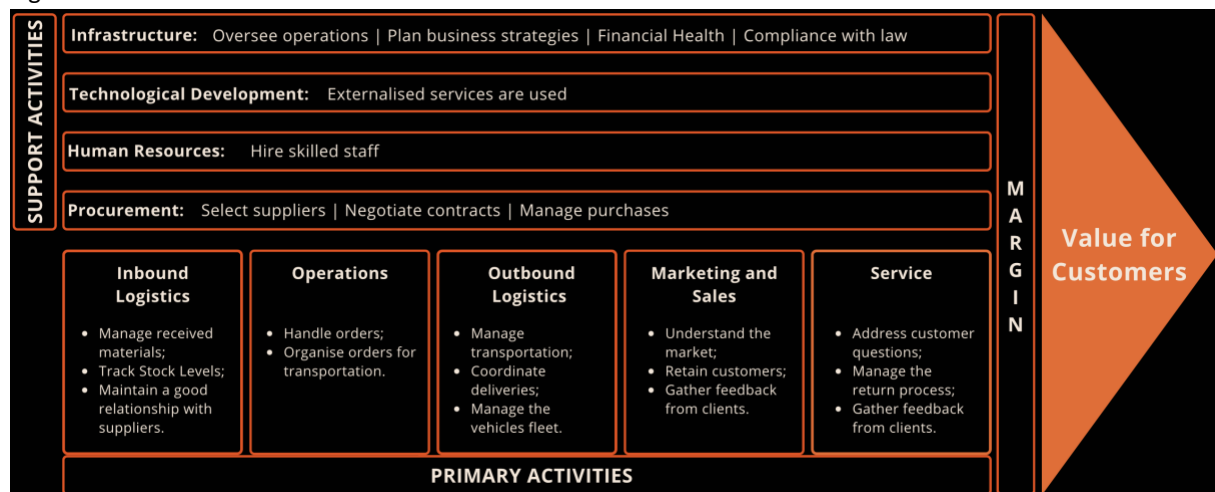
Figure 9 - Bid-to-Win Process Profile

Name of Process:	Bid-to-Win.		
Vision:	The aim of the process is to analyse potential projects and develop a strategy to acquire those contracts.		
Process Owner:	Bid manager.		
Customer of process:	Bid team and External Customer.	Expectation of Customer:	High-quality proposals and competitive bids.
Outcome:	Get the project and increase revenue.		
Trigger:	Project opportunities.		
First Activity:	Bid found.		
Last activity:	Contract won.		
Interfaces inbound:	Pricing and product specifications.		
Interfaces outbound:	Quote documentation and contracts.		
Required resources:	Bid team and the company's manager		
Process Performance Measures:	Bid win rate, profit margin and customer satisfaction.		

Adapted from Dumas et al., 2018

Looking at the Value Chain Model, Figure 10 - Value Chain Model, it shows that the key actions of the O2C process compose this model, this way having a great impact on the business goals (customer satisfaction, revenue, efficiency, etc.). Moreover, the Value Chain Model shows an overview of the complex connection between the many processes and how crucial it is. Furthermore, it highlights many of the areas that have clear issues which compose the O2C process. Consequently, the process with the biggest opportunity to be improved is the O2C process.

Figure 10 - Value Chain Model



Adapted from Porter's Value Chain

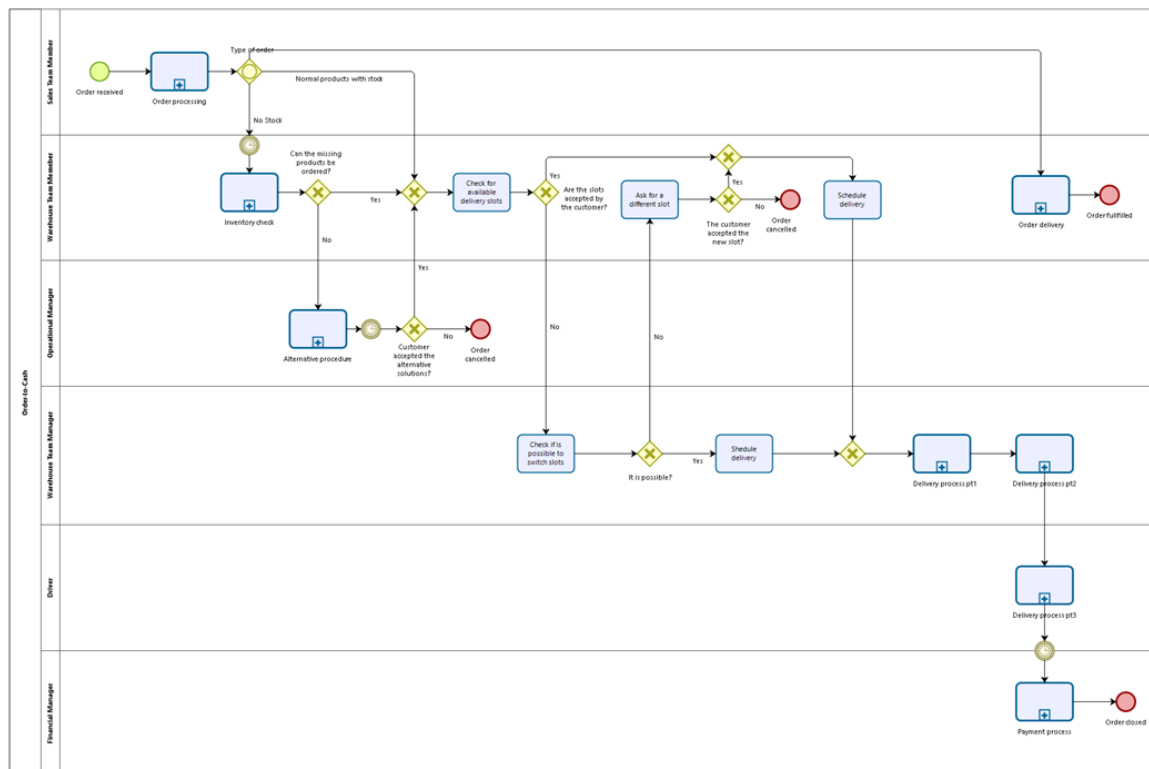
4.2. PROCESS DISCOVERY

In order to understand the process itself, an interview-based discovery process was used which allowed to design the AS-IS Model of the O2C process of the company. The operational, warehouse and financial managers were interviewed in order to design the AS-IS Model.

4.2.1. Level 1 Model (AS-IS Model of the O2C process)

The level 1 model provides an overview of the entire O2C process, where the starting point is receiving an order and putting it through the Order Processing (Order Processing) where a type of order is selected, immediate, normal or delayed delivery. If it is an immediate delivery, the next step is the order delivery process (Order Delivery) finishing with the fulfillment of the order. On the other hand, if there is not stock, the next step includes going through the Inventory Check process (Inventory Process) which lead to the question “Can the missing products be ordered?”. If the answer is “No”, it initiates the Alternative Procedure (Alternative Procedure) which either a customer accepts or not. If a customer does not cancel the order because of the lack of stock, then the order gets classified as a normal order. This type of orders usually implies a need to schedule a delivery slot. If the slot does not satisfy the client, then the warehouse manager will try to switch slots. If they agree to the change, then the delivery is scheduled. On the other hand, if the customer does not agree, they search for a schedule until it is good for both parties or the order is cancelled. Considering the positive outcome, once it’s time for the delivery, it sets in motion the Delivery processes (Order Delivery Part 1; Delivery Process Part 2; Order Delivery Part 3). Once concluded, it kicks off the payment process (Payment Process). In conclusion, the order is closed.

Figure 11 - Level 1 Model

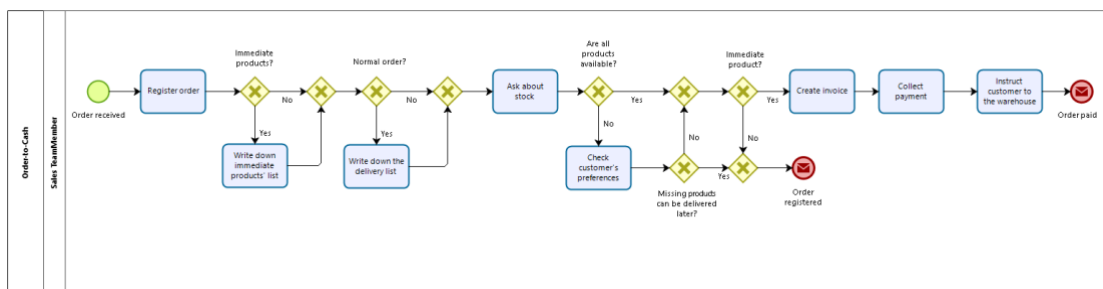


Source: Own Author

4.2.1.1. Order Processing

The subprocess, Order Processing, is performed by a sales team member which gets in action when an order is received. Subsequently, the employee registers the order where it is necessary to check if it is an immediate order, if so, the sales team member writes down the immediate products' list, if it is classified as a normal delivery, the delivery list is written down. Afterwards, the employee asks about stock, starting by asking "Are all products available?", if there are products missing, it is necessary to check customer's preferences. Moreover, it is required to check if it is possible to deliver the products. If yes, the order is registered. In addition, the sales team member needs to check if it is immediate products with stock because that involves the creation of an invoice, collecting payment and instruct customers to the warehouse which in the end leads to order payment.

Figure 12 - Order Processing Model

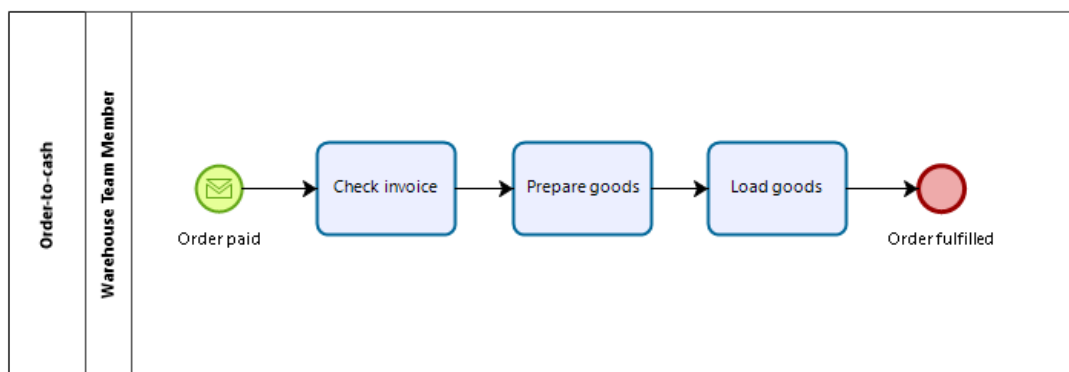


Source: Own Author

4.2.1.2. Order Delivery

The subprocess of order delivery sets off with an order paid. Thereafter, the warehouse team member checks the invoice, prepares the goods and loads them into the customer's car. This way, the order was fulfilled.

Figure 13 - Order Delivery Model

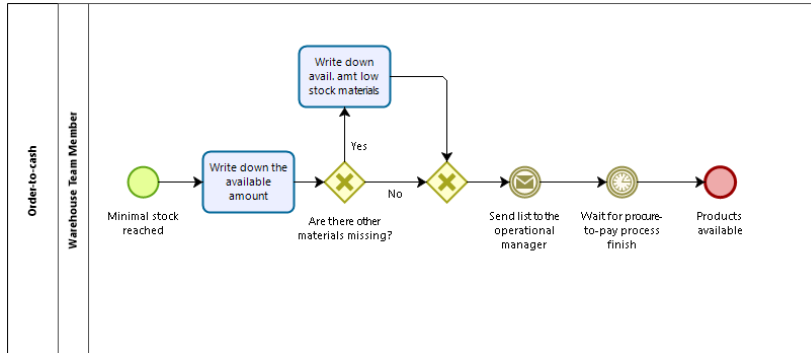


Source: Own Author

4.2.1.3. Inventory Process

The inventory process is completed by a warehouse team member and the subprocess is initiated when a minimal stock is reached. When this situation occurs, it is required to write down the available amount, and check if there are more materials missing. If so, it is necessary to write down the remaining available amounts of low stock materials. Subsequently, that person sends the list to the operational manager and waits for the procure-to-pay process to finish in order to have the products available.

Figure 14 - Inventory Process

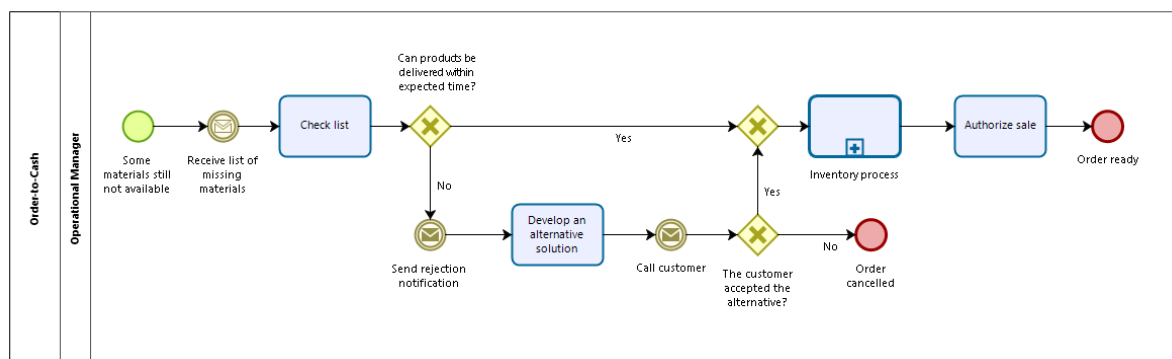


Source: Own Author

4.2.1.4. Alternative Procedure

The alternative procedure subprocess kicks off when some materials are still not available so the operational manager receives a list of all missing materials, checks the list and verifies whether the products can be delivered within the expected time. If they cannot, a rejection notification is sent, and an alternative solution is developed and communicated to the customer. If the customer does not like the proposition, the order is cancelled. However, if the proposal is accepted it goes back to the normal process which means going through the inventory process (Inventory Process), authorizing the sale and the order becomes ready.

Figure 15 - Alternative Procedure

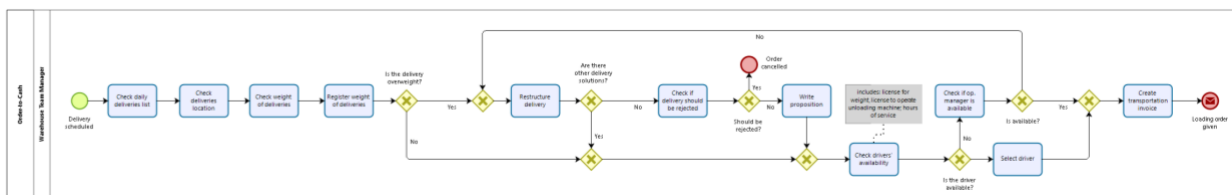


Source: Own Author

4.2.1.5. Order Delivery Part 1

The warehouse team manager checks the daily deliveries, their locations and weight. Once the weight is registered, the manager checks if there is overweight. In the scenario where there is overweight, the manager tries to restructure. If this solution does not work, the warehouse manager needs to consider reject the delivery which can be either cancelled or follow the normal process for within weight deliveries. Consequently, the next step, is checking drivers' availability. If there is an available driver, one is selected. However, if there is not one, it is necessary to check if the operational manager can drive to the delivery address because if he cannot, then the delivery must be restructured again. Nevertheless, in normal situations, there is always someone free to drive. In the end, a transportation invoice is created, and the order is loaded into the vehicle.

Figure 16 - Order Delivery Part 1

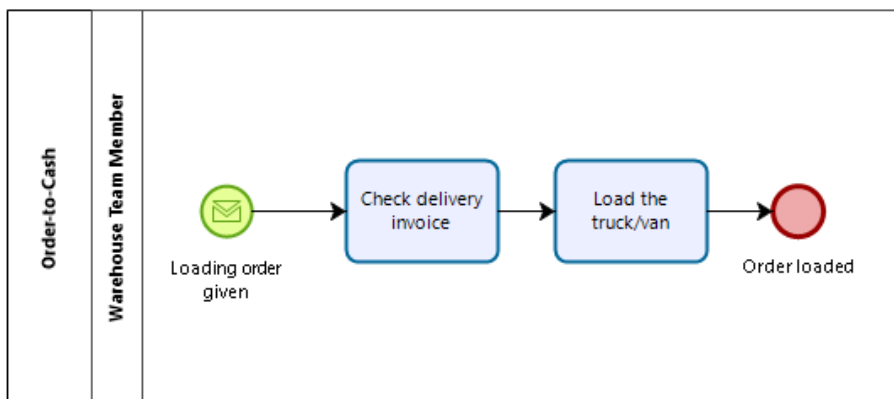


Source: Own Author

4.2.1.6. Order Delivery Part 2

The warehouse team member is responsible for loading the order given. Therefore, to do so, he must check the delivery invoice, load the truck/van and the order will be loaded for shipment.

Figure 17 - Order Delivery Part 2

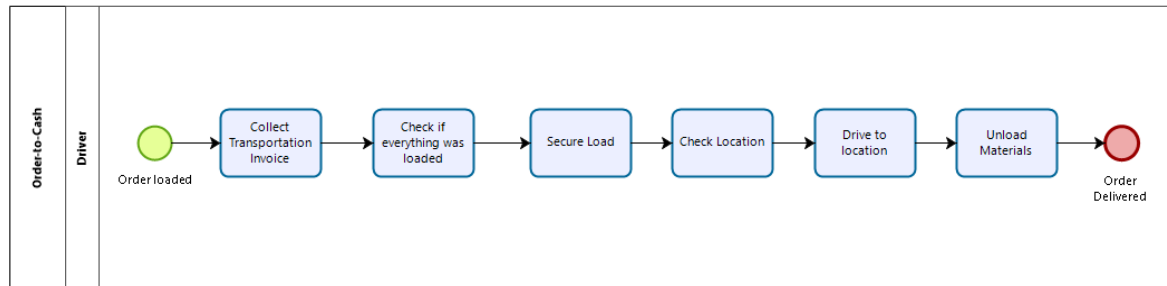


Source: Own Author

4.2.1.7. Order Delivery Part 3

The last part of the delivery process is under the responsibility of the driver. Once the order is loaded, he must collect the transportation invoice and check if everything is according with the invoice. Next, the employee must secure the load, check the location, drive there and unload the materials. Consequently, the order is delivered to the client.

Figure 18 - Order Delivery Part 3

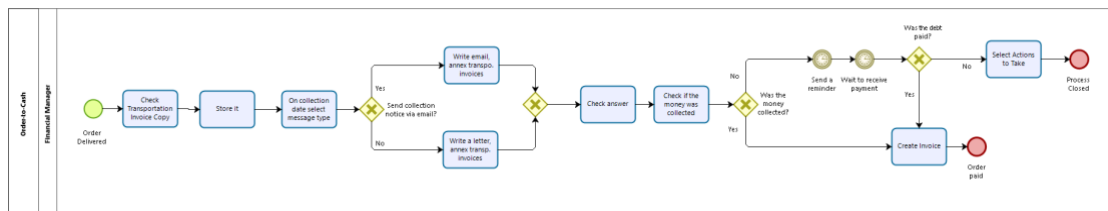


Source: Own Author

4.2.1.8. Payment Process

The payment process is triggered by an order delivered, which means that the financial manager needs to check the transportation invoice copy and store it. When the collection date is reached, it is necessary to select a message type which can be either an email or a letter where the invoice is attached. Afterwards, she checks the answer and whether the money was collected. If yes, then creates an invoice and the order is paid. Otherwise, a reminder is sent and waits to receive payment. If the debt was paid, then an invoice is created, and the order is paid. Else, an action is selected so that the process is closed.

Figure 19 - Payment Process



Source: Own Author

4.3. PROCESS ANALYSIS

4.3.1. Qualitative Analysis

4.3.1.1.1. Value-Added Analysis

Considering the different types of classifications that an activity/event can have, the following structure was used:

- **VA**: Activities that add value to the customer.
- **BVA**: Activities that do not directly add value to the customer but are necessary.
- **NVA**: Activities that do not add value.

4.3.1.1.2. Level 1 Model

Table 4–1 Value Added Analysis of the Level 1 Model

Activities/Events	Classification
Order Received	VA
Check for Available Delivery Slots	BVA
Check If It is Possible to Switch Slots	BVA
Ask for a Different Slot	BVA
Schedule Delivery	BVA
Order Cancelled	NVA
Order Fulfilled	VA

Source: Own Author

When looking at the many activities and events that compose the Level 1 Model, there are two **VA**, four **BVA** and one **NVA**. In conclusion, it probably means that there is a margin to improve, namely, ensure that the number of cancelled orders is as small as possible. Consequently, it indicates that the **BVA** that leads to this outcome must be minimized and the remaining need to be optimized.

4.3.1.1.3. Order Processing

Table 4–2 Value Added Analysis of the Order Processing

Activities/Events	Classification
Order Received	VA
Register Order	BVA
Write Down Immediate Products' List	BVA
Write Down the Delivery List	BVA
Ask about Stock	BVA
Check Customer's Preferences	NVA
Create Invoice	BVA
Collet Payment	BVA

Instruct the Customer to the Warehouse	NVA
Order Registered	VA
Order Paid	VA

Source: Own Author

The Order Processing subprocess is well structured, including three VA, six BVA and two NVA. However, the NVA, Instruct the customer to the warehouse is not as disadvantageous as it looks, considering that in some situations can be good to promote a good relationship with the client.

4.3.1.1.4. Order Delivery

Table 4–3 Value Added Analysis of the Order Delivery

Activities/Events	Classification
Order Paid	VA
Check Invoice	BVA
Prepare Goods	BVA
Load Goods	BVA
Order Fulfilled	VA

Source: Own Author

The Order Delivery subprocess is considered to be efficient since it only includes VA and BVA activities.

4.3.1.1.5. Inventory Process

Table 4–4 Value Added Analysis of the Inventory Process

Activities/Events	Classification
Minimal Stock Reached	VA
Write Down the Available Amount	BVA
Write Down the Available Amount of Low Stock Materials	BVA
Send List to the Operational Manager	NVA
Wait for Procure-To-Pay Process to Finish	NVA
Products Available	VA

Source: Own Author

When looking at the many activities and events that compose the Inventory Process, there are two VA, two BVA and two NVA which means that great part of this process can be considered inefficient since most of the time is spent on paperwork, sending it and waiting.

4.3.1.1.6. Alternative Procedure

Table 4–5 Value Added Analysis of the Alternative Procedure

Activities/Events	Classification
Some Materials Still Not Available	VA
Receive List of Missing Materials	NVA
Check List	BVA
Send Rejection Notification	NVA
Develop an Alternative Solution	BVA
Call Customer	NVA
Authorize Sale	BVA
Order Cancelled	NVA
Order Ready	VA

Source: Own Author

The Alternative procedure subprocess, is usually activated when the customers' orders cannot be fulfilled on the normal procedure which means that these orders must be dealt with extreme care and as much efficiency as possible. Subsequently, three of the NVA must be avoided as much as possible, Send Rejection Notification and Order Cancelled because these can lead to losing clients.

4.3.1.1.7. Delivery Process Part 1

Table 4–6 Value Added Analysis of the Delivery Process Part 1

Activities/Events	Classification
Delivery Scheduled	VA
Check Daily Deliveries List	BVA
Check Weight of Deliveries	BVA
Register Weight of Deliveries	NVA
Restructure Delivery	BVA
Check If Delivery Should be Rejected	BVA
Write Proposition	NVA
Check Drivers' Availability	BVA
Check If the Operational Manager is Available	BVA
Select Driver	BVA
Create Transportation Invoice	BVA
Order Cancelled	NVA
Loading Order Given	VA

Source: Own Author

The Delivery Process Part 1 is composed by two VA, eight BVA and three NVA which means that great part of this process can be considered efficient since most of the time is spent on required actions. Nevertheless, this process shows some opportunities for improvement, namely, avoiding time noting down information that is not legally required and will not be

used for longer than thirty seconds. Moreover, this process also presents a scenario of order cancelation which means that the **BVA** must be optimized as much as possible to avoid any negative outcomes.

4.3.1.1.8. Delivery Process Part 2

Table 4–7 Value Added Analysis of the Delivery Process Part 2

Activities/Events	Classification
Loading Order Given	VA
Check Delivery Invoice	BVA
Load the Truck/Van	BVA
Order Loaded	VA

Source: Own Author

The Delivery Process Part 2 is considered to be efficient since it only includes **VA** and **BVA** activities.

4.3.1.1.9. Delivery Process Part 3

Table 4–8 Value Added Analysis of the Delivery Process Part 3

Activities/Events	Classification
Order Loaded	VA
Collect Transportation Invoice	NVA
Check If Everything was Loaded	BVA
Secure Load	BVA
Check Location	BVA
Drive to Location	BVA
Unload Materials	BVA
Order Delivery	VA

Source: Own Author

A considerable part of the Delivery Process Part 3 is efficient since it includes two **VA** and five **BVA** activities. However, it includes a **NVA** which could be automated and spare resources.

4.3.1.1.10. Payment Process

Table 4–9 Value Added Analysis of the Payment Process

Activities/Events	Classification
Order Delivered	VA
Check Transportation Invoice Copy	BVA
Store It	BVA
On Collection Date Select Message Type	BVA
Write Email Annexing the Invoice	BVA
Write a Letter Annexing the Invoice	BVA
Check Answer	BVA

Check If the Money was Collected	BVA
Send a Reminder	NVA
Wait to Receive Payment	NVA
Create Invoice	BVA
Order Paid	VA
Select Actions to Take	BVA
Process Closed	VA

Source: Own Author

Considering all activities/events that compose the payment process, three VA, nine BVA and two NVA. Overall, the process is quite well built since over 85% of the process is built of VA and BVA. Consequently, only a pair of NVA need to be dealt with, to lead this process to greater success.

4.3.1.2. Waste Analysis

This analysis looks at the different wastes that compose the process and classifies them to understand their relevance so that deciding whether these should stay or be eliminated. Consequently, the 3.3.1.2 Waste Analysis Categories, were used.

Table 4–10 Waste Analysis Categorization Sum Up

Categories	Description	Sub-types
Move	Wastes that are related to movement	Transportation
		Motion
Hold	Wastes arising from holding things	Inventory
		Waiting
Overdo	Wastes arising from doing more than is necessary to deliver value to the client or the business	Defects
		Overprocessing
		Overproduction

Adapted from Frederico Jesus (2022), *Slides BPM Chapter 4.1 – Qualitative Process Analysis*, NOVA IMS.

Table 4–11 Waste Analysis in the business context

Activities/Events	Classification
Order Cancelled after the processing being initiated	Overproduction
Check Customer's Preferences (Check for their authorization)	Waiting
Instruct the Customer to the Warehouse	Motion
Send List to the Operational Manager	Motion
Wait for Procure-To-Pay Process to Finish	Inventory
Send Rejection Notification	Overproduction
Call Customer (Check for their authorization)	Waiting
Register Weight of Deliveries	Motion
Write Proposition	Overprocessing
Collect Transportation Invoice	Motion
Send a Reminder that the customer has not paid yet	Waiting

Wait to Receive Payment	Waiting
Drive deliveries to the client	Transportation
Having products in stock	Inventory
Customers must wait for their delivery	Inventory
Drivers waiting for instructions	Waiting
Lack of drivers	Defect
Order excessive or wrong products	Overproduction
Personalized prices per customer	Overprocessing

Source: Own Author

Considering the above categorization, there are five activities/events related to Move waste, eight activities/events that are Hold waste, and six activities/events that are considered overdo waste. Accordingly, the biggest issues of the company's O2C process are Hold waste which usually there are measures that can be applied for improvement.

4.3.1.3. Stakeholder Analysis

The stakeholder's analysis is important to understand the different players in this process since this technique classifies them according with their roles allowing to understand the needs that the process includes.

Table 4–12 Stakeholder List

Stakeholder Category	Stakeholder
Those who are or will be directly affected	Customers and Suppliers.
Those with decision-making authority or other sources of influence	Management.
Those who have resources or skills that may be needed	Warehouse Staff.
Those who will be implementing the results or outcomes	Finance team.
Those who will actively oppose or attempt to derail the process	Competitors.
Those who will actively support or promote the process	Management and Marketing Team.

Adapted from *Stakeholder Analysis Worksheet*, 2024

Nevertheless, this analysis can help further the nature of the relationships these stakeholders have with the O2C process. Thus, it was also performed an stakeholder's analysis covering their interests, position, influence and involvement, as can be seen below in the Table 4–13 Stakeholder Analysis Structure.

Table 4–13 Stakeholder Analysis Structure

Stakeholder (Name of group or individual)	Interests (What are their biggest concerns?)	Position (What outcome is a "win" for them?)	Influence (Do they have special power in the situation?)	Involvement (What level of participation do you predict?)
Customers	"The customers are likely to be concerned with issues such as slow cycle time, defected, lack of transparency, or lack of traceability" (Dumas et al., 2018). Moreover, they want this process to be	Get products on a competitive price within the expected time window with good customer services.	These people are direct influencers as there is a direct correlation between their satisfaction and the company's reputation as well as sales.	Their level of participation relies mostly in providing feedback on the quality of what they purchased.

	done with excellent customer service.			
Suppliers	The suppliers' main interests are essentially having a good relationship with the company and also receiving payments on time.	Suppliers get to have a consistent satisfied customer for future purchases.	They influence stocks and the time necessary to satisfy customer orders.	These companies participate by making available any necessary products on a good price range.
Management	These people are concerned with strategy and performance.	Management wins because the company becomes more efficient allowing for greater profitability as costs may reduce.	These people are responsible for making decisions as well as for company organisation.	These are the people that define goals and the strategies to get there this way shaping how the O2C will work.
Warehouse Staff	These team is worried with stock availability and orders clearly organised.	They win when stock is within the expected levels and organised.	These people are directly responsible for the orders accuracy and answer time.	They play a major role as they are the ones that organise orders and so have some of the best practical insights into the matter.
Finance Team	The Finance team is concerned with cash flow.	When the invoicing process occurs smoothly this department wins as it is helping with cash flow.	These team is responsible for following regulations and have financial stability.	This people are responsible for billing so they are responsible for financial aspects which means they can reshape a process to try and increase profitability.
Marketing Team	These people are concerned with the quality of services and products as it influences the accuracy of the information they share about the company.	They win when their advertisement campaigns bring more sales. Those only work if what they are selling is as good in reality which means the O2C must be as good as possible.	These people have high influence in sales as they are the ones that engage customers into buying the products and services that the company offers.	They do not have much involvement in this process, this department is mostly impacted by the quality of the product.
Competitors	These companies are interested in outshining others to have higher customer retention and higher profits.	If the company's O2C process is not as good as possible, competitors have a window to still business opportunities as well as customers.	They can have major power if they manage to have greater services/products, customer experience, prices, etc.	They are not directly involved but if their actions do if they influence the market which means that the company has to change their strategy to keep up, namely, the O2C process.

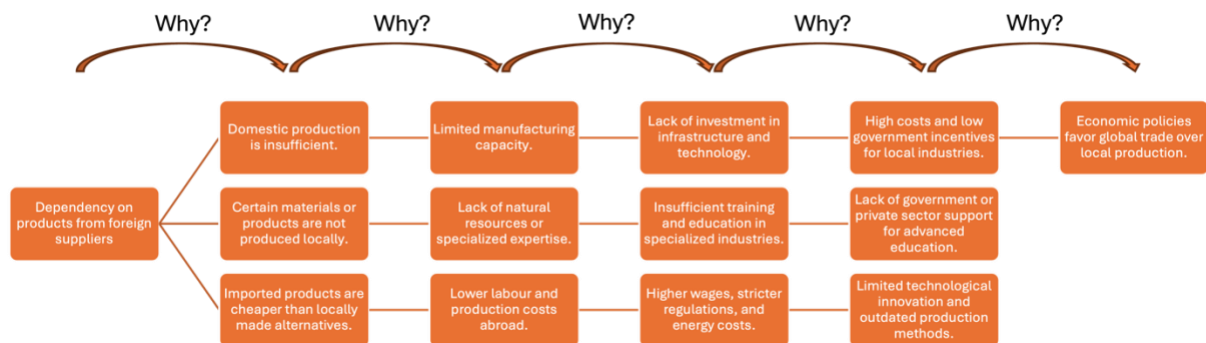
Adapted from *Stakeholder Analysis Worksheet*, 2024

In conclusion, there are 7 major shareholders that influence the O2C process of the company. However, these holistic view of the shareholders, points out that this process involves a complex network of people with complicated needs.

4.3.1.4. Root Cause Analysis

To understand the underlying causes of the problems composing the O2C process of the company, Why-Why diagrams were designed.

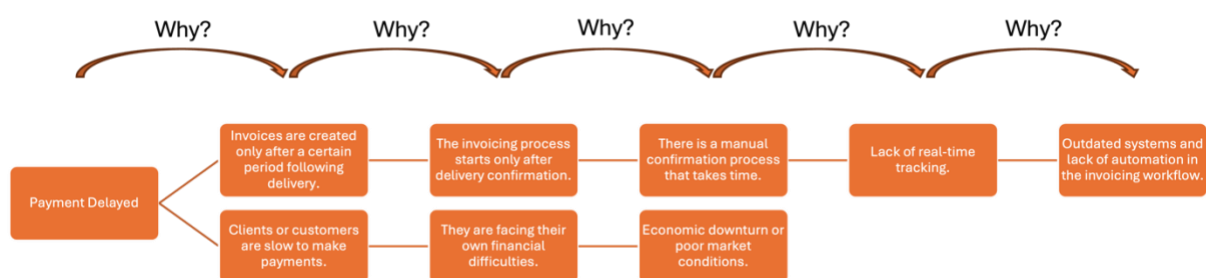
Figure 20 - Why-Why Diagram - Dependency on products from foreign suppliers



Adapted from Dumas et al., 2018

Taking into consideration that most products are imported from Spain, a problem that occurs with some frequency is lack of available products to sell which means that the company is highly dependent on products from foreign suppliers. Consequently, after performing the Why-Why strategy to find the root cause of this problem, 3 reasons were found, namely, *Economic policies favor global trade over local production*, *Lack of government or private sector support for advanced education*, or *Limited technological innovation and outdated production methods*.

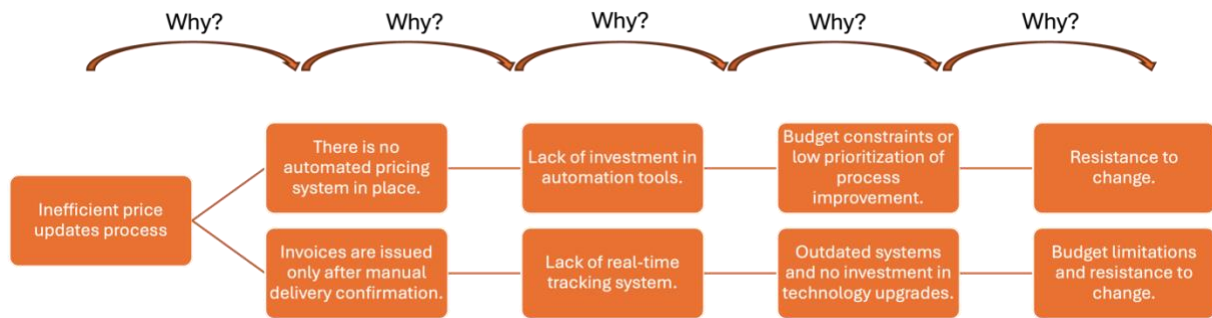
Figure 21 - Why-Why Diagram - Payment Delayed



Adapted from Dumas et al., 2018

Payments usually are collected after a period of 60 days which means that orders are delivered before being paid. Subsequently, a frequent problem is delayed payments. After the application of the Why-Why diagram two root causes were highlighted, specifically, *outdated systems and lack of automation in the invoicing workflow* as well as *economic downturn or poor market conditions*.

Figure 22 - Why-Why Diagram - Inefficient price updates process



Adapted from Dumas et al., 2018

The process of price updating is manual, inefficient which is a problem that the company faces frequently since this is a market that is constantly faced with price changes. The Why-Why diagram applied to this problem pointed out that the root causes are related with *budget constraints* and *resistance to change*.

In conclusion, the root cause problems to the three problems mentioned above are related to the economical state of the market in general, lack of technological investment and budget limitations and resistance to change, a long term problem associated to Portugal (Lopes, 2015).

4.3.2. Quantitative Analysis

A quantitative analysis was performed in order to complement the qualitative analysis. Consequently, it was necessary to collect all the necessary information to perform the simulation, namely, processing times, resource usage, and error probability.

To assemble all this information a set of questions were raised to the company manager (operational manager), specifically,

1. On average how many orders does the company receive, per week?

Answer: On average, 280 orders are received, per week.

2. Do all employees work eight hours?

Answer: Yes, they do.

3. Is the company affected by seasonality?

Answer: No, it isn't.

4. How many members the sales team has?

Answer: The team has 3 members.

5. How many members the warehouse team has?

Answer: The team has 3 members

6. How many drivers the company has?

Answer: The team has 6 members

7. How many operational, warehouse and financial managers the company has?

Answer: There is one operational, one warehouse, and one financial manager.

Subsequently, the BPM Team went to the company's facilities to collect the average times and probabilities of the activities that compose the O2C process. The results pointed to the probabilities described in the Table 4–14 Event Probabilities.

Table 4–14 Event Probabilities

Type	Name	Probability
Event	Type of order	60% - Immediate products (paid) 38% - Normal Products with Stock 2% - No Stock
Event	Can the missing products be ordered?	98% - Yes 2% - No
Event	Customers accepted the Alternative Solution?	75% - Yes 25% - No
Event	Are the slots accepted by the customer?	87% - Yes 13% - No
Event	Is it Possible?	99% - Yes 1% - No
Event	The customer accepted the new slot?	99% - Yes 1% - No

Source: Own Author

Afterwards, the simulation was performed for a duration of 5 days and using minutes as a time unit. Besides using the collected values as average times, it was also required to select the type of distributions so that the simulation can account for the different realities (Table 4–15 Types of Distributions). These four distributions were used and applied to the Events and Activities that compose the O2C Process so that the simulation could be as accurate as possible.

Table 4–15 Types of Distributions

Distribution	Reason
Poisson Distribution	It is used for arrival of orders and for independent events.
Truncated Normal Distribution	It is used in Normal distribution situations but with limitations, in this case, situations where the times do not change much and so it is possible to limit the range of the interval in a matter that suits the company's reality.
Negative Exponential Distribution	It is used in situations where the times are unpredictable or vary quite frequently and depend on a situation.
Numeric Distribution	Based on observed data and to express a pattern.

Source: Own Author

The BPM Team over an entire week collected the values represented in Table 4–16 Simulation Parameters in terms of time and human resources. These aspects allowed to simulate both the overload of work and the average time of each activity that compose the process to observe the parts of the process that are more inefficient.

Table 4–16 Simulation Parameters

Type	Name	Distribution	Duration (in minutes)
Event	Order Received	Poisson Distribution	Average: 8.3
Activity	Order Processing	Truncated Normal Distribution	Average: 3 Standard deviation: 0.5 Resources: 1 Sales Team Member
Activity	Order Delivery	Negative Exponential Distribution	Average: 7 Resources: 1 Sales Team Member and a Warehouse Team Member
Event	Wait for the Inventory Check	Numeric	Average: 2880
Activity	Inventory Check	Truncated Normal Distribution	Average: 3 Standard deviation: 0.1 Resources: 1 Warehouse Team Member
Activity	Alternative Procedure	Truncated Normal Distribution	Average: 2 Standard deviation: 0.1 Resources: 1 Operational Manager
Event	Wait for the customer to accept the alternative solution	Numeric	Average: 2880
Activity	Check for available delivery slots	Truncated Normal Distribution	Average: 2 Standard deviation: 0.1 Resources: 1 Warehouse Team Member
Activity	Check if is possible to switch slots	Truncated Normal Distribution	Average: 5 Standard deviation: 0.5 Resources: 1 Warehouse Team Manager
Activity	Ask for a different slot	Truncated Normal Distribution	Average: 5 Standard deviation: 0.02 Resources: 1 Warehouse Team Member
Activity	Schedule delivery	Truncated Normal Distribution	Average: 1 Standard deviation: 0.01 Resources: 1 Warehouse Team Member or 1 Warehouse Team Manager
Activity	Delivery Process pt1	Truncated Normal Distribution	Average: 4 Standard deviation: 0.5 Resources: 1 Warehouse Team Manager
Activity	Delivery Process pt2	Negative Exponential Distribution	Average: 25 Resources: 1 Warehouse Team Member, 1 Warehouse Team Manager or Operational Manager
Activity	Delivery Process pt3	Negative Exponential Distribution	Average: 120 Resources: 1 Driver or 1 Operational Manager
Event	Wait for payment	Negative Exponential Distribution	Average: 64800
Activity	Payment Process	Negative Exponential Distribution	Average: 5 Resources: Financial Manager

Source: Own Author

The resource utilization simulation presents low usage of the Financial Manager and the Sales Team members. However, these people play other roles in other processes besides the O2C which means that allocating them to other jobs in the process could lead to overwork. Opposingly, the operational manager is highly used and takes on more job which means there is an opportunity to try and reduce the manager's workload.

Table 4–17 Simulation | Resource Utilization

Resource	Utilization
Sales Team member	8.68 %
Warehouse team member	18.25 %
Operational manager	38.45 %
Warehouse team manager	12.01 %
Driver	26.91 %
Financial manager	0.58 %

Adapted from Bizagi Extraction

Even though the simulation shows some instances that were not completed, this is not considered to be a problem because a big portion of the orders require delivery and not all of them are delivered within a timespan of a week. Additionally, one can also observe that the order deliveries subprocesses are the ones that consume the highest percentage of the time. However, the results also show that on average each delivery takes less than three hours (including delivery) which is a good result as deliveries, considering that trucks are limited by speed limits, traffic, location and other factors. The results show a significant number of deliveries that are not completed but this is not considered an major issue since many customers pay within 60 days which is out of the study scope. Additionally, as the simulation and the process design point out, the process has many manual processes, namely, slot register/selection, communication of lack of inventory and other aspects.

Table 4–18 Simulation Summary

Name	Instances completed	Instances started	Avg. time (m)	Total time (m)	Avg. time waiting for resource (m)	Total time waiting resource (m)
Order-to-Cash	166	280	161,783	25821,407		5741,145
Order received	280					
Order fulfilled	158					
Can the missing products be ordered?	4	4				
Customer accepted the alternative solutions?	0	0				
Check for available delivery slots	122	122	2,722	332,030	0,725	88,485
Are the slots accepted by the customer?	122	122				
Order cancelled	0					
Check if is possible to switch slots	14	14	9,940	139,162	5,014	70,197
It is possible?	14	14				
ExclusiveGateway	108	108				
Schedule delivery	108	108	1,222	131,955	0,222	23,932
Shedule delivery	14	14	2,347	32,865	1,349	18,882
Ask for a different slot	0	0	0	0	0	0

The customer accepted the new slot?	0	0				
Order cancelled	0					
ExclusiveGateway	122	122				
ExclusiveGateway	122	122				
Order closed	8					
Type of order	280	280				
TimerIntermediate	8	122				
TimerIntermediate	4	4				
TimerIntermediate	0	0				
Order processing	280	280	3,003	840,801	0,003	0,941
Inventory check	4	4	3,035	12,139	0	0
Order delivery	158	158	6,765	1068,940	0,214	33,823
Alternative procedure	0	0	0	0	0	0
Delivery process pt1	122	122	6,794	828,863	2,763	337,054
Delivery process pt2	122	122	23,875	2912,746	0,147	17,991
Delivery process pt3	122	122	159,674	19480,188	42,212	5149,840
Payment process	8	8	5,215	41,717	0	0

Adapted from Bizagi Extraction

4.4. PROCESS REDESIGN

The process redesign looks at the AS-IS Model and attempts to optimize the process by changing it through many factors. Primarily, three WHAT-IF simulations were run in order to have a better perception of what changes to consider. The WHAT-IF 1 simulation considers a scenario where a sales team member can also play a role in the activities “Check for available delivery slots”, “Ask for a different Slot”, and “Schedule delivery”. This change not only led to an increase in the role of the sales team members in the O2C by over 1,62%, but also to decrease the workload of the warehouse team members and manager as well as the drivers. However, the decrease in the workload of these resources was not significant enough. Although this change did not have a significant impact on the average time each order takes to finish, it caused an increase in time.

Consequently, the WHAT-IF 2 simulation was performed, where it not only considers the WHAT-IF 1 changes but also takes into consideration another driver. In this reality, most resources decrease their overload, especially the drivers’ group since their workload decreases around 3,35%. Additionally, this modification has a bigger impact on the operational managers overload as it decreases 2,58%.

Finally, the WHAT-IF 3 simulation takes into consideration the automatization of certain parts of the ordering process, through a 20% reduction in time in certain activities. At the resource level, it helps exclusively with decreasing the sales team members workload, but this decrease is less than 1%. On the other hand, on the time level, it only reduced a little bit the average time.

Table 4–19 WHAT-IF Simulations | Resource Utilization Comparison

Resource	AS-IS Utilization	WHAT-IF 1 Utilization	Var	WHAT-IF 2 Utilization	Var	WHAT-IF 3 Utilization	Var
Sales Team member	8,68 %	10,30%	1,62%	10,30%	0%	9,53%	-0,77%
Warehouse team member	18,25 %	17,03%	-1,22%	17,06%	0,03%	17,06%	0%
Operational manager	38,45 %	39,02%	0,57%	36,44%	-2,58%	36,44%	0%
Warehouse team manager	12,01 %	11,66%	-0,35%	10,92%	-0,74%	10,92%	0%
Driver	26,91 %	26,67%	-0,24%	23,32%	-3,35%	23,32%	0%
Financial manager	0,58 %	0,58%	0%	0,58%	0%	0,58%	0%

Adapted from Bizagi Extraction

Table 4–20 WHAT-IF Simulation | Summary Comparison

Name	AS-IS	WHAT-IF 1	Var	WHAT-IF 2	Var	WHAT-IF 3	Var
Instances Started	280	280	-	280	-	280	-
Instances Completed	166	166	-	166	-	166	-
Average Time (m)	161,78	161,90	0,12	162,56	0,66	161,95	-0,61
Total time waiting resource (m)	5741,14	5859,18	118,04	1914,79	-3944,39	1914,79	-

Adapted from Bizagi Extraction

Taking into consideration, the data collected in the previous steps, these transformations can be significant in the TO-BE Model. Nonetheless, it is hard to predict its impact on the TO-BE Model, because this model will suffer other organizational changes.

The TO-BE Model investigates possible improvements to the current model, by optimizing the workflow and its resources by considering investing in both technological and human resources. Consequently, for this new model, it was necessary to deliberate on the activities that could be automatized, the activities that would only become more efficient by hiring more people or the activities that by changing their workflow, their performance time would decrease and therefore make the O2C process faster. Subsequently, to each subprocess of the AS-IS Model, the following question was applied, “Can anything be changed in this process to improve the process?” and the following conclusions were attained.

Table 4–21 Possible changes list

Process	Can anything be changed?	What possible changes can I make to improve the process?
Level 1 Model	No	N/A
Order Processing	Yes	Automatize the process of order registering so that all data is available inter departments and time can be saved.
Order Delivery	No	N/A
Inventory Check	Yes	Implement an alert that informs the managers that a certain product as reached the minimum stock level.
Alternative Procedure	No	N/A

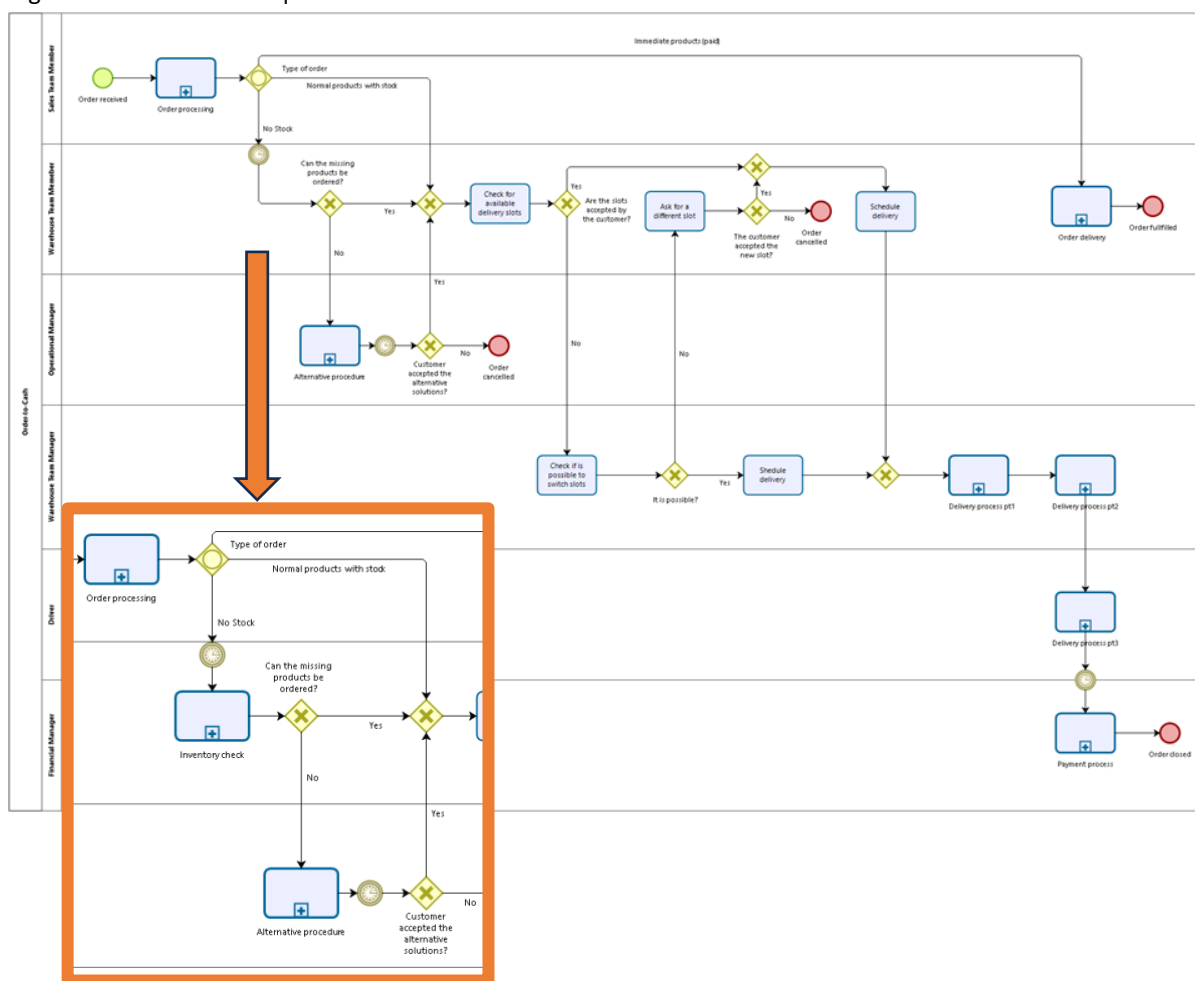
Order process pt 1	Yes	Implement the usage of a route improvement software, meaning a software that provides the faster and best routes in order to save time.
Order process pt 2	No	N/A
Order process pt 3	No	N/A
Payment Process	Yes	Implement a software for customer management to reduce the number of clients paying over 30 days.

Source: Own Author

4.4.1. Heuristics

Beside applying the changes considered in the WHAT-IF Models, the Heuristic 1 (Elimination) and Heuristic 9 (Automation) were used to improve the model. By applying the Heuristic 1 to the processes “Order Processing”, “Inventory Check” and “Order Processing pt1” some of the tasks that composed the processes were eliminated. Consequently, these changes led to no longer existing an “Inventory Process” and the changes designed below. As highlighted in orange, visually no longer includes the inventory process, previously needed when there was no stock of a product.

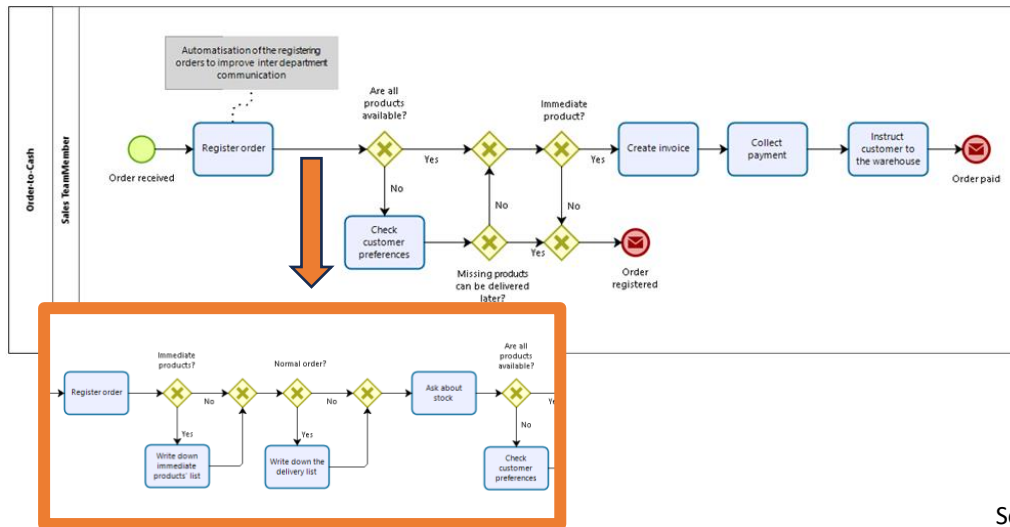
Figure 23 - TO-BE Model | Level 1 Model



Source: Own Author

The emphasized area represents all the activities that existed before and that now have been automatized, making the process simpler and more efficient.

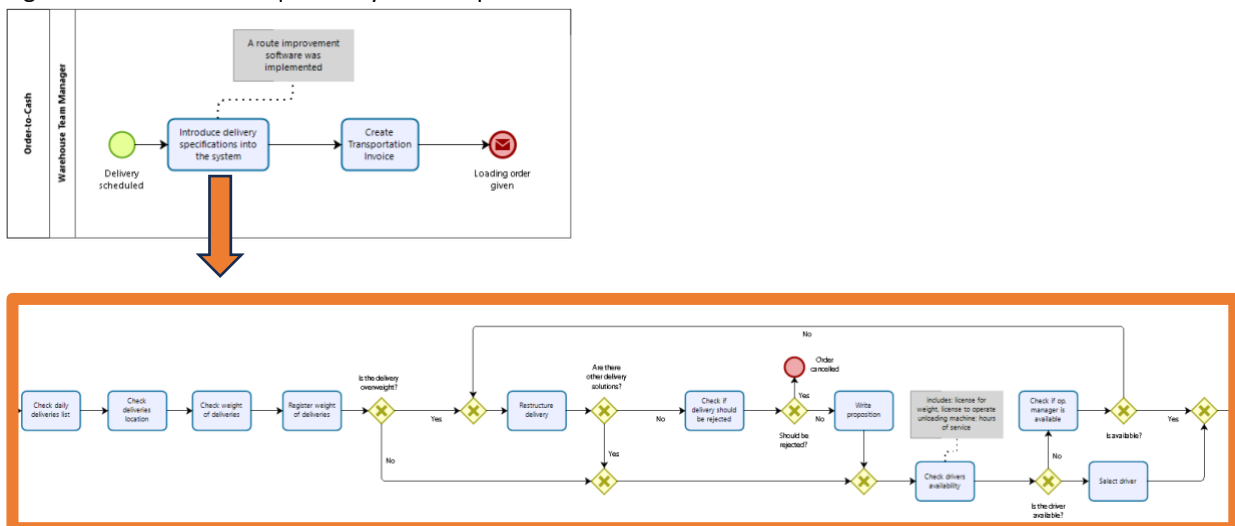
Figure 24 - TO-BE Model | Order Processing



Source: Own Author

Lastly, the other process that visually has been improved is the Delivery Process pt1 since the introduction of the delivery specifications into the system replaced the extensive amount of steps required to lead to the creation of the transportation invoice.

Figure 25 - TO-BE Model | Delivery Process pt1



Source: Own Author

4.4.2. TO-BE Model Simulation

After collecting possible solutions to improve the O2C process, it is necessary to compare if the proposed solutions improve or worsen the current model. Consequently, a new simulation was run. The changes performed were the average time of the order processing decreasing to 2.4 minutes, the inventory process is fully automatized which no longer plays a role in the

simulation, the delivery process part 1 takes on average 3.2 minutes and the waiting time for payment decreases for an average of 30 days. Moreover, it was also considered that the usage of software for route optimization could lead to a 20% reduction on the average time the Delivery process pt3, which meant that the average time would be 96 minutes. Keeping the remaining characteristics and types of distributions the same as the AS/IS Model, the resource utilization was optimized since the resources that had more responsibilities, now have less utilization and the ones that participated less had an increase of less than 1%.

Table 4–22 TO-BE Simulation | Resource Utilization

Resource	TO-BE Model Utilization
Sales Team member	10,43 %
Warehouse team member	16,82 %
Operational manager	35,59 %
Warehouse team manager	10,50 %
Driver	18,14 %
Financial manager	0,74 %

Adapted from Bizagi Extraction

The new model presents hopeful results, increasing the completed number of instances per week and reducing the total waiting time almost by five times less than the current model.

Table 4–23 TO-BE Simulation Summary

Name	Instances completed	Instances started	Avg. time (m)	Total time (m)	Avg. time waiting for resource (m)	Total time waiting resource (m)
Order-to-Cash	176	280	283,421	17637,279		480,986
Order received	280					
Order fulfilled	163					
Can the missing products be ordered?	9	9				
Customer accepted the alternative solutions?	0	0				
Check for available delivery slots	117	117	1,996	233,527	0	0
Are the slots accepted by the customer?	117	117				
Order cancelled	0					
Check if is possible to switch slots	19	19	7,178	136,376	2,345	44,550
It is possible?	19	19				
ExclusiveGateway	98	98				
Schedule delivery	98	98	1,000	98,014	0	0
Shedule delivery	19	19	1,485	28,224	0,487	9,260
Ask for a different slot	0	0	0	0	0	0

The customer accepted the new slot?	0	0				
Order cancelled	0					
ExclusiveGateway	117	117				
ExclusiveGateway	117	117				
Order closed	13					
Type of order	280	280				
TimerIntermediate	13	117				
TimerIntermediate	9	9				
TimerIntermediate	0	0				
Order processing	280	280	2,415	676,148	0	0
Order delivery	163	163	8,191	1335,135	0,557	90,813
Alternative procedure	0	0	0	0	0	0
Delivery process pt1	117	117	5,218	610,496	2,055	240,394
Delivery process pt2	117	117	22,762	2663,119	0	0
Delivery process pt3	117	117	100,877	11802,616	0,820	95,969
Payment process	13	13	4,125	53,624	0	0

Adapted from Bizagi Extraction

5. DISCUSSION AND APPLICATIONS

5.1. BUSINESS IMPLICATIONS

When comparing the TO-BE Model with the AS-IS Model, it is possible to observe that more orders can be completed also increasing the number of orders that are paid in a shorter window of time. Consequently, reducing the risk of unpaid accounts and increasing the available capital.

Table 5–1 Comparison of Instances completed and Started between the AS-IS and TO-BE Models

Name	Instances completed AS-IS	Instances completed TO-BE	Instances started AS-IS	Instances started TO-BE
Order-to-Cash	166	176	280	280
Order received	280	280	-	-
Order fulfilled	158	163	-	-
Can the missing products be ordered?	4	9	4	9
Customer accepted the alternative solutions?	0	0	0	0
Check for available delivery slots	122	117	122	117
Are the slots accepted by the customer?	122	117	122	117
Order cancelled	0	0	-	-
Check if is possible to switch slots	14	19	14	19
It is possible?	14	19	14	19
ExclusiveGateway	108	98	108	98
Schedule delivery	108	98	108	98
Shedule delivery	14	19	14	19
Ask for a different slot	0	0	0	0
The customer accepted the new slot?	0	0	0	0
Order cancelled	0	0	-	-
ExclusiveGateway	122	117	122	117
ExclusiveGateway	122	117	122	117
Order closed	8	13	-	-
Type of order	280	280	280	280
TimerIntermediate	8	13	122	117
TimerIntermediate	4	9	4	9
TimerIntermediate	0	0	0	0
Order processing	280	280	280	280
Inventory check	4	-	4	
Order delivery	158	163	158	163
Alternative procedure	0	0	0	0
Delivery process pt1	122	117	122	117
Delivery process pt2	122	117	122	117
Delivery process pt3	122	117	122	117
Payment process	8	13	8	13

Adapted from Bizagi Extraction

Additionally, this model also implies positive impacts to the efficiency of the company, meaning after looking at the average time and total time per process, most of them had a decrease in time, except for the order delivery process (since we are serving more customers per day, it also increases slightly the waiting time per order). Similarly, the payment process has a higher total time because now more orders are passing through that subprocess.

Table 5–2 Comparison of Average and Total Times between the AS-IS and TO-BE Models

Name	Avg. time (m)	Avg. time (m)	Total time (m)	Total time (m)
	AS-IS	TO-BE	AS-IS	TO-BE
Check for available delivery slots	2,722	1,996	332,030	233,527
Check if is possible to switch slots	9,940	7,178	139,162	136,376
Schedule delivery	1,222	1,000	131,955	98,014
Shedule delivery	2,347	1,485	32,865	28,224
Ask for a different slot	0	0	0	0
Order processing	3,003	2,415	840,801	676,148
Inventory check	3,035		12,139	
Order delivery	6,765	8,191	1068,940	1335,135
Alternative procedure	0	0	0	0
Delivery process pt1	6,794	5,218	828,863	610,496
Delivery process pt2	23,875	22,762	2912,746	2663,119
Delivery process pt3	159,674	100,877	19480,188	11802,616
Payment process	5,215	4,125	41,717	53,624

Adapted from Bizagi Extraction

Some of the potential solutions mentioned above incorporate automatization and advertisement resolutions to decrease the number of customers that pay after more than 30 days. Successively, some more concrete solutions will be presented.

5.1.1. Proposed Systems

The automatization of the Inventory Process can be performed by a software update. The company on a daily basis has implemented SAGE software. However, there are many service packages of SAGE which can improve the company's performance. Let's consider SAGE X3, according to its manual one can observe customers' behavior patterns, consolidate suppliers' relationships and obtain a better perspective in inventory, delivery dates, costs and other financial factors. Additionally, the adoption of this software can improve connection between the warehouse and the sales team which can decrease the average time each order takes to be loaded (*Sage X3 - Gestão da cadeia de abastecimento | Sage PT, 2020*).

OptimoRoute is a Route optimization and planning software, that already is used in many different industries, Retail Distribution & Delivery, Installation & Maintenance, and Logistics. These industries all have something in common with the services that the company provides. Thus, OptimoRoute may be a great solution for the business. Some of the services that this software provides are Automated Planning, Driver and vehicle, Order and Task, Proof of

Delivery, Realtime Route Modification, Analytics, and some more (*OptimoRoute | Delivery Route Planning & Field Service Scheduling*, 2025)

The adoption of these two software could exponentially improve the O2C process of the company. Even though they are incredible solutions to increase efficiency and decrease time, it is necessary to consider the company's likelihood of adopting a more complex software and its budget for technology. The actual cost of implementation for these software cannot be precise without asking the supplier for a quote but the estimate per system will not be below four thousand a year per system.

5.1.1. Advertisement Campaigns

Both AS-IS and TO-BE Models point that a major flaw in the O2C Process of the company is the time clients take to pay their invoices. However, this is a setback difficult to overcome since many of the orders are in bulk and collected by employees not the construction site supervisors. As a result, this project proposes monetary/commercial incentives to increase efficiency in payment, namely, customer categorization by payment quality, and annual prizes rewards.

5.1.1.1. Customer Categorization

After delimiting baseline for the average profit per product unit, bulk orders should be categorized by the average time the customer usually takes to pay. For example, if a customer takes more than 90 days to pay then the average price per unit could reach maybe a 15% profit margin, between 60 to 90 days the profit margin could be around 10% and keep on decreasing according to the client's timespan to pay orders and its seniority with the company.

5.1.1.2. Annual Prize

This campaign analysis the customers behavior through the year and rewards them accordingly. Let's consider the top three best customers in terms of the number of purchases, seniority and payment efficiency. These businesses could be rewarded with prizes such as a pallet of a certain product, others could get some deliveries free of delivery charges or other potential solutions with a low financial impact to the company but that improve customer satisfaction.

5.2. THEORETICAL IMPLICATIONS

Besides the impact on a business level, this project not only affects the BPM subject but also influences the Sustainable Development Goals (SDG).

The business impact revolves around benefits for customers and stakeholders. The embracing of this study can allow the company to increase efficiency, considering that resources decreased their workload and can perform tasks in a shorter period of time. Additionally, there is economic growth since fulfilling orders takes less human and time resources, the remaining

ones can be used for other activities producing more value. These reductions usually can be accompanied by cost reductions and potential price cutbacks, making customers happier and improving the company's relationship with its clients. Moreover, satisfied customers can increase publicity by word of mouth, which expands the company's client basis.

The development of this project contributed for BPM discipline on many different levels as it explored an unmapped industry looking at new solutions and furthering its impact worldwide. More specifically, it shows that BPM's applicability can be extended, it is not restricted just to a few sectors, that it is adaptable and relevant largely to businesses, this way improving BPM's credibility. Furthermore, this study presents BPM from a different perspective, from the retail and construction materials industry's point of view, allowing for disciplinary growth, in other words, new standpoints. Subsequently, it can have many theoretical benefits, such as discovery of new limitations, approaches and needs which can lead to the development of new tools. Consequently, the study can also be useful to promote continuous transformation of the subject so that it can be adapted to many other industries and have major impacts.

This paper also promotes the benefits of technological integration which on an SDG perspective can contribute to the ninth goal - Industry, Innovation and Infrastructure. Claiming, this proposal looks at promoting investments in innovation, reduction of manual tasks and paper based records. In addition, the proposed solutions try to reduce the company's footprint since route optimization can reduce carbon emissions and system registered reduces the number of physical documents being transported among the different departments.

5.3. LIMITATIONS AND FUTURE WORK

Although this study provides a wide range of solutions, it does not eliminate the limitations it has. Some of its disadvantages are its highly theoretical perspective as it looks at the processes from a certain point of view, it does not account for major changes, in other words, it does not consider the complexity of the process nor the resources limitations such as employees tiredness, sick leaves, vacation days. Furthermore, efficiency and quality cannot be fully measured because not only the data was collected only for three service days but also the project was not implemented nor monitored, making these potential positive solutions as expectations rather than statistics.

Additionally, the solution is highly dependent on the company's managers' openness to change. Conversely, it is important to not forget that this is a company located in Portugal, a country known for its resistance to change (Cunha, 2005) which means that the likelihood of such a high investment may be rejected implicating a change of approach or development of strategies to increase openness and education on the subject.

Taking into consideration everything mentioned before, there is future work to be done in order to make this project highly impactful. Primarily, it is important to develop a plan to convince the company's owners to adopt the suggestions made alongside this project. Secondly, ensure that such transition can be performed on a long term basis and in an organized way.

6. CONCLUSION

The ultimate purpose of this study is to optimize the Order-to-Cash Process of a company that sells construction materials through the usage of Business Process Management in order to increase its efficiency, effectiveness and profit. Nonetheless, the impact of this research is not limited to the company, it can also benefit the discipline of BPM, by showing that its knowledge can be applied to more industries and can have significant effects to the market.

Consequently, many steps were necessary to accomplish this project, more specifically, understanding up to which point the construction materials retail industry had been explored through BPM. Subsequently, the lack of research on this niche market made it necessary to analyze the company's and the industry's current situation. Successively, fit the available knowledge about BPM techniques into potential techniques to apply to this company.

Afterwards, the collected information was transformed and analyzed through The BPM Lifecycle Framework which implicated submitting the company's O2C process to multiple analysis, and simulations. Once concluded the replication of the current reality, some potential changes were considered and a TO-BE Model was achieved by considering automatization and marketing campaigns as potential solutions.

Although the changes considered pointed to significant positive outcomes, it is important to highlight that the study was met with some limitations, such as the fact that the project was conducted entirely on a theoretical basis, it was not submitted to the implementation phase. Moreover, the BPM model and the tool used (Bizagi) do not account for many impactful factors such as employees' physical limitations, transportation limitations, or even the company's owner's openness to change.

On the other hand, all the knowledge about this study opened the opportunity for future work, namely, find solutions to make this and other BPM projects more appealing to companies, discover techniques to implement these changes on a timely manner and that ensures both quality and safety in companies of a Portuguese mentality. Additionally, if implemented the study will allow us to analyze the accuracy of projects similar to this, meaning theoretical based. Furthermore, it makes available information for anyone that wants to work on the gaps of discipline.

Nowadays, adaptability is a key factor in success. Consequently, if one takes into consideration the full potential of this research paper, it can bring prosperity to both the BPM subject and the company.

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