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Improving replenishment practices at the store level to minimize out-of-stock levels: a case study in a Portuguese grocery retailer

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Master in Management of Services and Technology

Supervisor:
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Acknowledgements

My master's degree is now complete, marking the end of a chapter in my life. It was a very challenging journey, with some ups and downs but also very rewarding. It would not be possible without the unconditional care and support of my family, friends, and professors.

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Resumo

Na Europa, o problema das roturas na indústria do retalho alimentar continua a ser bastante significativo, variando entre os 7% e 10%. Este é um reflexo da indisponibilidade de producto nas prateleiras, um indicador-chave na avaliação do serviço ao cliente. Este problema remete para a necessidade de encontrar soluções devido às consequências negativas para todos os elementos da cadeia de abastecimento. As principais causas das roturas encontram-se na loja, estando relacionadas com as práticas de colocação de encomenda, reposição e planeamento.

A presente investigação enfatiza a importância de abordar as principais causas dos problemas relacionados com as práticas de reposição num hipermercado de um retalhista português, para o qual a falta de reposição representa a principal causa de roturas.

O caso de estudo caso seguiu uma abordagem qualitativa, onde foram utilizadas várias técnicas de recolha de dados, como observação direta, entrevistas, e dados da empresa, com o objetivo de identificar os principais problemas e ineficiências nos processos em vigor, e propor respetivas melhorias, de modo a que a loja possa reduzir a taxa de roturas por falta de reposição.

Após a compreensão das operações da loja e das causas relacionadas com as práticas de reposição, foram propostas algumas soluções. Estas soluções passam pela necessidade de melhorar o cumprimento do planograma através da sensibilização para a importância da disponibilidade de produto, da formação dos funcionários para melhorar o seu desempenho, do redesenho do processo de reposição, e da introdução de soluções tecnológicas para a deteção de roturas.

Palavras-chave: Retalho alimentar; Reposição; Disponibilidade de produto; Gestão de inventários; Produtos de grande consumo

Classificação JEL:

L81 - Retail and Wholesale Trade, e-Commerce

M11 - Production Management

M21 - Business Economics

O14 - Industrialization; Manufacturing and Service Industries; Choice of Technology

Abstract

The extent of the out-of-stocks (OOS) in the European grocery retail industry continues to be a major problem, ranging from 7% to 10%, reflecting poor on-shelf availability (OSA), which is a key performance indicator of customer service. This calls for the need for solutions to overcome this pressing issue, as it has consequences for all supply chain actors. The main causes of OOS are originated at the store level, being those related to ordering, replenishment and planning practices.

The following research emphasizes the importance of addressing the leading causes of poor replenishment practices in the context of a hypermarket of a Portuguese grocery retailer, to which lack of replenishment represents the cause that contributes the most to OOS.

The case study followed a qualitative approach, where multiple data collection techniques were used, such as direct observation, interviews, and data collected from the company, aiming at identifying the main problems and inefficiencies with the current procedures taking place at the store, in order to make improvement suggestions to address the problems identified, so the store can reduce the current OOS rate motivated by lack of replenishment.

After understanding the store's operations and the causes of the poor replenishment practices, some solutions were proposed. These solutions can be summarized in the need of improving planogram compliance by creating awareness of the importance of OSA, training the employees to improve their performance over the daily activities, redesigning the shelf replenishment process, and introducing technology-based solutions for OOS detection.

Keywords: Grocery retail; Replenishment; Product availability; Inventory management; Fast-moving consumer goods

JEL Classification:

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Glossary of Acronyms

DC - Distribution centre

FEFO - First expired first out

FMCG – Fast-moving consumer goods

IRI - Inventory records inaccuracies

PBL - Picking by line

PBS - Picking by stock

POS - Point-of-sale

RFID – Radio Frequency Identification

SKU - Stock keeping unit

OSA - On-shelf availability

OOS - Out-of-stock

Contents

CHAPTER 1

Introduction

The European grocery retail industry is characterized by low-profit unit margins and strong competitive pressure, and the current average level of OOS, which ranges from 7% to 10%, is considered to be unacceptably high for the industry (ECR Europe, 2016), showing a poor alignment between the actors of a supply chain.

The repeated occurrence of OOS has a cost to the retailer, not only from the point of view of sales loss risk, where the European average lays on 3.7% of sales loss due to OOS, but also considering the loss of shoppers risk (Moussaoui et al., 2016). Additionally, shoppers are getting more demanding than ever, and, according to ECR Europe (2016), OOS is one of the biggest concerns of consumers. When confronted with an OOS situation, consumers have different reactions, as they may buy a different brand, buy the brand elsewhere, return later to the store, buy a different size, or don't buy anything at all (ECR Europe, 2016). However, this problem can also be seen as an opportunity, since retailers' earnings can be improved just by addressing their OOS issues (Corsten & Gruen, 2003).

According to the findings of (Corsten & Gruen, 2003), worldwide, the main cause of OOS is store ordering, responsible for 34% of the OOS, followed by store shelving and merchandising, with 25%, as illustrated in figure 1.1. While most regions of the world follow the worldwide trend, in Europe it differs slightly, as 38% of the OOS are caused by bad store shelving and merchandising, and the second main cause is store ordering, accounting for 21%. These causes are usually related to a general process, such as ordering, replenishing, or planning, which are transversal to all elements of the supply chain, not exclusive of the retail store. Thus, annex A provides a summary of the potential root causes of each process, and of each element of the supply chain that is impacted by poor OSA (Gruen et al., 2002).

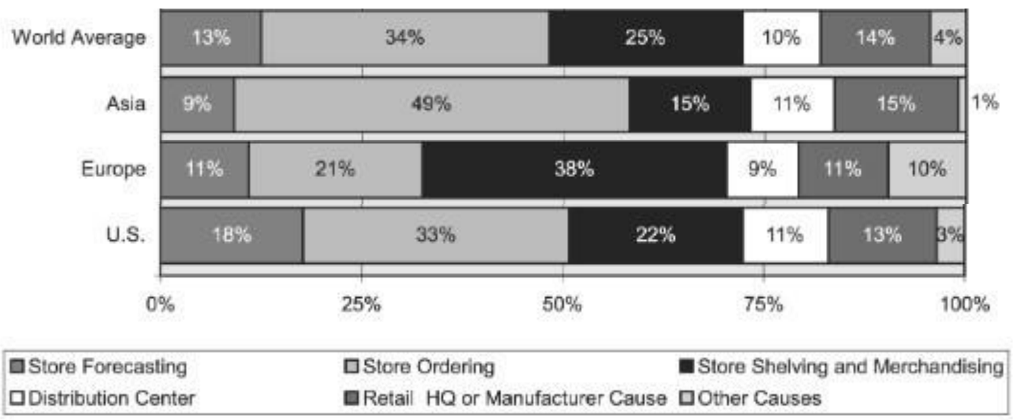

Figure 1. 1. OOS causes by region (Source: Corsten & Gruen, 2003).

Considering the responsibility of the OOS from an aggregate view it is similar worldwide, around 72% of the causes are caused at the store level, due to poor ordering and replenishment practices (Gruen et al., 2002). The remaining 28% of OOS are originated along the supply chain, mostly due to inefficient replenishment and planning practices.

Having in mind the extent of the problem of the OOS but also the benefits of addressing them, learning more about its causes becomes critical so that improvement measures can be delineated and undertaken. Corsten & Gruen (2003) highlighted the six main causes of OOS from poor replenishment at the store level, being those staffing, backroom congestion, receiving errors, shelf replenishment frequency, planogram compliance, and shrinkage. To expand the knowledge on these causes, research such as Mou et al. (2018) and Moussaoui et al. (2016) provide critical insights. To complement, researchers also provide suggestions on how the OOS could be addressed, considering the context of their case study research, not making them adaptable to all contexts (Barros et al., 2021; Corsten & Gruen, 2003; Mou et al., 2018; Moussaoui et al., 2016).

This master thesis was developed as an in-company project and was identified a problem in the company regarding the recurrent pattern of high OOS levels. From 2019 to 2022, the Fast Moving Consumer Goods (FMCG) department has been registering an increase in the average OOS rate. In 2019, the OOS rate was 2.21%, increasing to 2.90% in 2020, and having a major improvement in 2021 as the rate was 1.72%. In 2022, the OOS rate increase again to 2.85%. The company has managed to identify and quantify the leading causes of OOS among the multiple stores of the company, categorizing them into lack of replenishment, delivery failures from the suppliers, insufficient inventory, blocked articles, lack of orders, and inventory records inaccuracies (IRI).

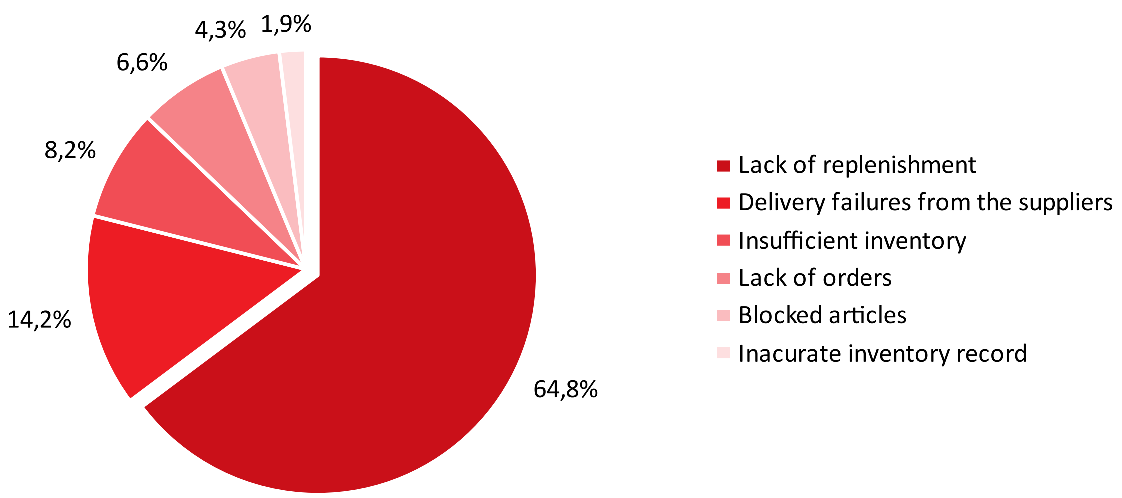

Figure 1. 2. Main Causes of OOS at an hypermarket (Source: adapted from the company).

The figure 1.2 shows the data collected from a hypermarket of the company during the second semester of 2021, regarding the leading causes of OOS. As can be observed in the figure below, the cause that stands out is the lack of replenishment, with 64.8%.

This means that in most OOS situations, the products are, in fact, available in the store backroom but were not replenished on time. Knowing that OOS is costly to the retailer, it is urgent for the company to address this issue to increase its earnings and retain and build customer loyalty.

As Moussaoui et al. (2016) and Barros et al. (2021) state, there is already a significant number of research focused on OOS. Campo et al. (2000) studied OOS from the point of view of customer responses, according to the characteristics of the product, consumer, and situation. Most studies focus on identifying causes and drivers of OOS and OSA as Moussaoui et al. (2016), while only Corsten & Gruen (2003) focus on identifying specifically the main causes of OOS from replenishment at the store level. Nevertheless, it is important to highlight that a wide range of variables influences the OOS rate, such as the characteristics of the OOS, store format, and location of the store, making the causes specific to each retailer (Ehrenthal & Stölzle, 2013).

The extent and consequences of OOS are already well-known by the researchers. However, despite the vast research on the area, the replenishment practices alone at the store level have not, yet, deserved much attention from scholars, even though OOS due to replenishment practices represent, between 25% (Gruen et al., 2002) and 35% of the causes of OOS (Aastrup & Kotzab, 2009). Chuang et al. (2016) identifies some calls for future research, as the influence of execution of store activities in the achievement of OSA due to a store being understaffed and by overall poor ability of employees to properly execute their daily activities, stressing the importance of having clear guidelines for the operational processes to easily monitor performance and correct any deviation.

Consequently, the goal of this master thesis, as an in-company project, is to focus on the study the leading causes of OOS regarding poor replenishment practices at the store level in a hypermarket of a Portuguese grocery retailer, in order to fulfil this existing calls in the literature. Therefore, the research question that this project aims to answer, considering the gap and the existing problem at the company under study, is the following: How to reduce OOS motivated by poor replenishment practices?

The research method used was a case study, as the goal of this in-company project was to have an in-dept understanding of a complex process in the organization (Creswell et al., 2007). The thesis focus on a single-case of a grocery retailer, as its particularities make it unique (Cooper & Schindler, 2015; Saunders et al., 2010). For the data collection was applied a mixed-method approach and were used multiple sources of information to enrich the research (Yin, 2018). Due to the use of different qualitative data collection techniques, triangulation of data is imperative to ensure the verification of the data prevenient from different sources (Saunders et al., 2010).

There is no defined structure on how to conduct a case study (Creswell et al., 2007), being mostly up to the researcher to find the research design and data collection methods that allows to acquire the necessary data to answer the proposed research question (Leedy & Ormrod, 2019). Similar research on the area also followed a case study design, as the example of Aastrup & Kotzab (2009) and Ehrenthal & Stölzle (2013), which followed a qualitative approached, using data collection techniques as semi-structured interviews, observation and documentation from the company. Based on these examples, the research design starts with the description of the current state of the case and detection of existing inefficiencies, followed by the identification of potential improvements to overcome the existing inefficiencies. For primary data collection were used interviews, observation and documents from the company. In respect to secondary data collection, it was based on online research on technical magazines and websites on the internet. The description of the current state of the case was made through direct observation, archival documents provided by the company and semi-structured interviews, in order to have a holistic view and in-dept view of the case. The access to this data collection methods was only possible due to the internship made at the company, on the lean department, where it was possible to visit the stores and follow closely the processes. From the online research was drawn a conceptual framework that was used as a starting point for the observation and interviewing techniques. For the second step were used the interviews' outputs on suggestions, complemented with the main findings from the online research.

This thesis is divided into six chapters, being those the Introduction, the Literature Review, the Methodology, the Case Study, the Data Analysis and Discussion, and the Conclusion chapters. In the Introduction is made a contextualization and explained the relevance of the thesis, the problem that is going to be addressed, the objectives and the research question that is aimed to be answered. This chapter also comprises the summary of the methodology followed, and the thesis structure. The Literature Review chapter summarizes the main ideas and findings from other researchers on the extent and characteristics of OOS, as well as on the identification of the main causes of poor replenishment practices at the store level. In the Methodology is identified the research design and data collection sources chosen for the development of the case study, in order to answer the proposed research question. The Case Study chapter starts with a brief introduction of the company where the internship took place, the description of the general processes of the store to understand how the replenishment practices fit in the daily operations of the store. Then, in the Data Analysis and Discussion chapter it is presented the data retrieved from the various sources utilized to evaluate the causes of poor replenishment practises, which is going to be analysed, contributing to the identification of improvements for the company to minimize the extent of OOS. The Conclusion chapter summarizes the main findings of this case study, the managerial implications for the company, the limitations of the work, and gives recommendations for future research.

CHAPTER 2

Literature Review

2.1. Definition and extent of OOS

A persistent problem in retailing are the OOS (Grewal & Levy, 2007), which represents a situation where the customer does not find a product in the desired form, flavour or size, or in saleable condition or not shelved in the expected location, when they wish to purchase it (ECR Europe, 2016). OOS comes frequently associated with the concept of OSA that refers to the probability of a desired product to be available when the customer intends to purchase it (Moussaoui et al., 2016). These metrics complement each other, as OOS can be interpreted as poor OSA, as are critical to evaluate the performance of customer service of a retailer.

Although a great attention is being given in addressing OOS, especially on the FMCG industry, it has not being enough since no significant improvements were achieved over the past years, and it will continue to be a problem (Corsten & Gruen, 2003). The current attempts to minimize OOS include initiatives to improve the collaboration between retailers and suppliers, the increasing use of new technologies, as point-of-sale (POS) data analytics and radio-frequency identification (RFID) (Aastrup & Kotzab, 2009).

Worldwide, the average OOS rate is about 8.3%, with slightly differences among different regions, as shown by figure 2.1. In Europe, the problematic of OOS continues to be significant, presenting substantial differences between the Northwest region (Norway, Denmark, Sweden, France, Belgium, Netherlands, Germany, Switzerland, Austria) and the Southeast region (Portugal, Spain, Greece, Poland, Hungary, Czech Republic, Slovakia), with this latter registering an average OOS rate of 10.8%, the highest among the different world regions.

However, different studies show variations among the average rate of OOS, and despite not being very significant, it can be explained by the product categories under research, the methods used, as well as the region of each study considered for each study (Corsten & Gruen, 2003). When all these factors that may influence the measurement of the OOS rate are considered together, the averages of different studies show little discrepancies, thus providing a sense that the findings are reliable in the aggregate level, since the differences can easily be explained (Gruen et al., 2002).

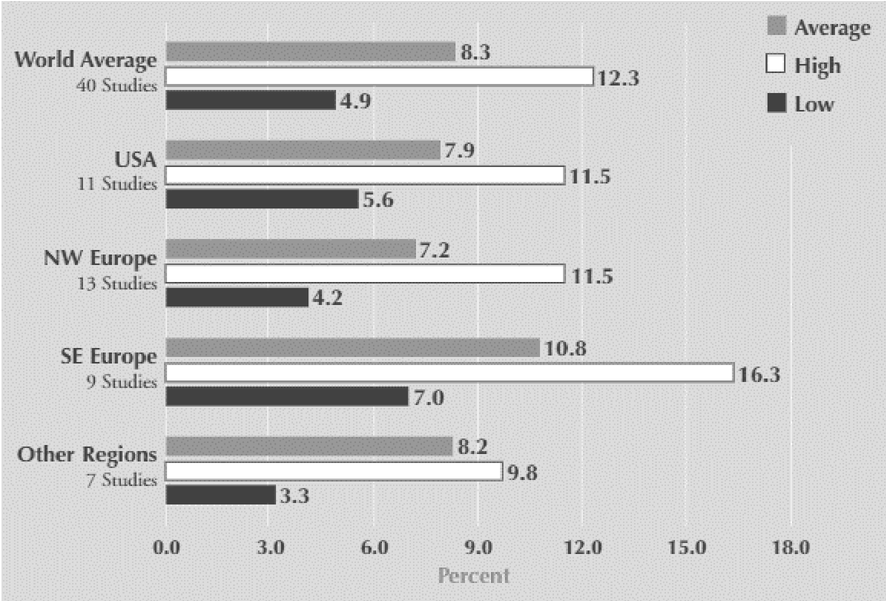

Figure 2. 1. Worldwide OOS Extent (Source: Gruen, Corsten, & Bharadwaj, 2002)

2.1.1. Characteristics of OOS

ECR Europe (2016) identifies three types of stockouts, being those the classic one, when there is shelf-edge ticket but no product on the shelf; there is also the stockout due to dual placement, meaning that the product is available at two different locations of the store but it is only available in one (or none) of those locations; and the delisting OOS, which corresponds to products listed but taken from the shelves by store staff.

Besides the different types of stockouts that can be considered, the stockouts are influenced by a wide range of different factors, as the characteristics of product categories, the promotional effect, the store format, the day of the week, the duration of the stockout, and the inventory level, which makes it very difficult to precise the OOS rate (Aastrup & Kotzab, 2009).

Starting with the characteristics of a product category, this is a crucial variable impacting OSA and OOS rates (ECR Europe, 2016). It is important to be aware of the effort and attention that each category requires, since there are more demanding and less demanding categories, where demanding product categories are the most problematic to retailers, registering OOS rates higher than 9%. These high stockout rates in different product categories may have different reasons. For example, about ready fresh meals, usually retailers must face a trade-off between product availability and wastage. Other example are the impulse-driven products, as confectionery, which are very hard to predict. On the other hand, less demanding items show OOS rates lower than 5% and show quite stable demand patterns.

Another factor that influences OSA is the promotional effect, as the OOS rate for promotional items is usually twice as higher as the rate for non-promoted items, being also much dependent on the product category (Corsten & Gruen, 2003). However, it should be expected from retailers to give more attention to these products, as it represents an effort to increase demand. This way, promotional activities end up accentuating the existing inefficiencies of the supply chain for the not promoted items, not taking advantage of the benefits expected from a promotion (ECR Europe, 2016).

There are also some differences in OSA between supermarkets and hypermarkets, with a variation of about 3%, with supermarkets performing generally better (ECR Europe, 2016). This difference in availability when considering different store formats may be due to complexity of the assortment, to the quantity of employees per stock keeping unit (SKU), how is the space managed and the amount of fast moving items. In these terms, supermarkets usually have more advantages, as they have less complex assortments, due to space limitations, which implies a better management of the space. Also, supermarkets might have more employees per SKU, which is a critical factor to avoid OOS. Despite this trend, there are still stores of the same format with major differences in product availability.

The day of the week contributes as well to the variation of the OOS rate (illustrated in figure 2.1), being Sunday and Monday the days with the highest levels of stockouts registered, while throughout the week is observed a decrease, as shopping tends to be higher on the weekend, opposed to deliveries that usually occur at the beginning of the week (Corsten & Gruen, 2003).

Also, even though deliveries have arrived to the store, they are not immediately replenished on the shop floor shelves (ECR Europe, 2016). Thus, the availability throughout the week is influenced by the demand, delivery schedule and the shelving process. The delivery schedule is linked to the store ordering process, and insufficient ordering will certainly influence OSA. On the other hand, the efficiency of the replenishment process also has a great influence on the availability, and, by its turn, it might be affected by the delivery schedule.

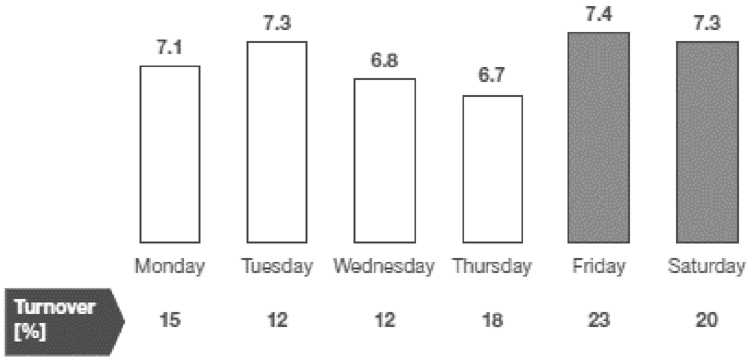

Figure 2. 2. OOS rate per day of the week (Source: ECR Europe, 2016).

Data on the duration of an OOS is very scarce, but it is a critical to measure the extent of OOS (Gruen et al., 2002). Only approximately 20% of products in OOS are replenished within the next eight hours, while a comparable amount remains OOS for more than three days. About 25% of these OOS are replenished in between eight hours and one day, and the remaining 36% are replenished in between one and three days.

Finally, high inventories do not imply good OSA, being likely to result in a congested backroom, slowing down the operations at the backroom (ECR Europe, 2016). The key to this issue is co-operation between retailers and manufacturers, as efficiently managed supply chains with lower inventories demonstrate lower OOS rates.

2.1.2. Implications of OOS

OOS impact directly the financial performance of a retailer on the short-term but might have more severe consequences on the long term (Ehrenthal & Stölzle, 2013; Zinn & Liu, 2008). Most studies focus only on the retailer sales loss caused by OOS and do not take into consideration the total cost of OOS, which affects the entire supply chain, as there is shopper loss risks and sales loss risks for both the retailer and manufacturer due to a diminution in both store and brand loyalty (ECR Europe, 2016; Zinn & Liu, 2008). However, this focus has a justification, as these areas of loss are interdependent, meaning that a reduction in the sales loss to the retailer also reduces the resulting shopper loss risk, the risk to the supplier, and the resulting supply-chain inefficiencies (ECR Europe, 2016).

Worldwide, the average sales loss to the retailer due to OOS is 3.9%, being slightly lower in Europe, with an average of 3.7% of sales loss (ECR Europe, 2016). Many retailers believe that improving OSA represents an opportunity to improve sales and increase the revenue (Moussaoui et al., 2016). Indeed, just by addressing their OOS issues, retailers can boost their earnings per share up to 5% (Corsten & Gruen, 2003).

Product availability is a major concern to shoppers, being it the third most important issue for shoppers, after the desire for shorter queues and having more promotions (ECR Europe, 2016). When facing an OOS, there are five main consumer responses, as per figure 2.3 shows: buy a substitute from a different brand (brand switch), buy an item at another store (store switch), delay purchase (buy later at the same store), buy a substitute within the same brand (for a different size or type), and do not purchase the item (lost sale) (Campo et al., 2000; Corsten & Gruen, 2003).

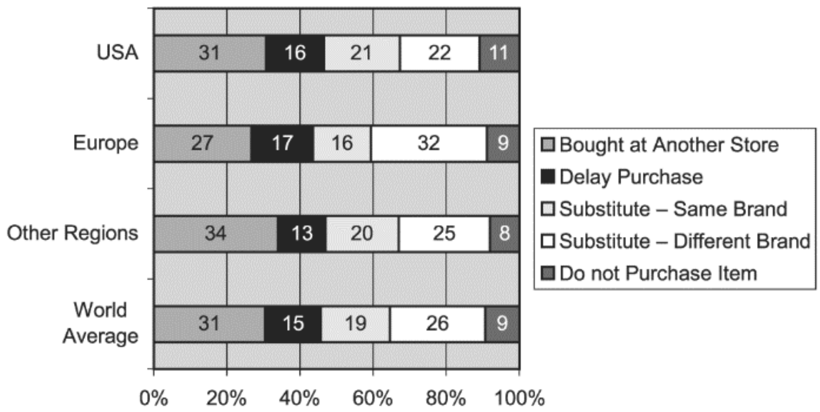

Figure 2. 3. Average consumer responses [%] when facing an OOS, by region (Source: Corsten & Gruen, 2003).

However, these responses can vary depending on the product characteristics, consumer characteristics, situation characteristics, as the immediacy of need, and on general brand and store loyalty, making it difficult to generalize the reactions of consumers (Campo et al., 2000).

Manufacturers appear to be significantly more affected by OOS than retailers, as customers tend to show more loyalty to stores, since customers desire to maximize their time when grocery shopping, aiming to find everything they need in only one store. (ECR Europe, 2016). However, with the repetition of OOS, consumers tend to not purchase or change to a different store, instead of substituting to a different brand or size. If in the short-term manufacturers might have a lot to lose from the likelihood of product switching, in the long-term retailers have as much to lose, as shoppers are more likely to buy elsewhere. In the end, increased OSA might also contribute to increase shoppers satisfaction and loyalty to the stores and brands, in addition to the expected boost in sales and profitability.

These different reactions that consumers can have when confronted with an OOS situation makes it hard to precise what is going to be the consumer response when facing an OOS (Corsten & Gruen, 2003). Thus, it sends an inaccurate picture of the demand behaviour, especially when the OOS is not detected on time.

OOS occurrences also have implications regarding logistics and information inefficiencies in the supply chain (Corsten & Gruen, 2003). The longer an OOS takes to be detected, the more inaccurate is the information about the demand pattern, as well as the sales history data. Therefore, the sales data used by the retailer to place order will not reflect the reality of demand, making this issue to perpetuate on time. If a retailer considers sales data and is not aware of the OOS, it is likely that the order will be too short to fulfil the actual demand, but if the retailer is aware of the OOS, it is likely to over order. Consequently, these irregular and rushed orders can cause logistics-fulfilment inefficiencies over the whole supply chain, as well demand amplification, also known as the bullwhip effect.

2.2. Root causes of replenishment issues at the store level

As observed in the figure below, in Europe, replenishment practices are the main cause of OOS. The replenishment can be divided into two categories, the store stocking, which accounts for 81% of the replenishment OOS, and the warehousing, which accounts for the remaining 19% of all OOS from poor shelf replenishment.

Worldwide Average	Store Ordering	Store Forecasting	ORDERING	Store Stocking	Warehousing	REPLENISHMENT	Management	Others	PLANNING
U.S.	18%	33%	**51%**	22%	11%	**32%**	13%	4%	**17%**
Europe	11%	22%	**32%**	38%	9%	**47%**	11%	10%	**21%**
Asia	9%	49%	**58%**	15%	10%	**25%**	16%	0%	**16%**
World	13%	35%	**47%**	25%	10%	**35%**	14%	4%	**18%**

Figure 2. 4. Detailed OOS Causes by General Process (Source: Gruen et al., 2002*).*

Considering the potential causes of OOS from replenishment listed at annex A, at the store level, those causes will be deepened in order to understand their drivers.

2.3.1. Staffing

Retail shelf maintenance is labour intensive and relies on the continuous alertness of store personnel in monitoring and replenishing the shelves (Moussaoui et al., 2016). Hence, shelf maintenance is much dependent on the availability of store personnel, as well as the quality of shelf maintenance since it deteriorates when there is an understaffed replenishment team (Reiner et al., 2013).

Poor shelf maintenance is also associated with high employee turnover (Aastrup & Kotzab, 2009; Raman et al., 2001), as new employees are not as familiar with the store's assortment and replenishment practices, thus, increasing the likelihood of making mistakes (Raman et al., 2001).

Most employees view "the daily replenishment from back store inventory to be done in-between other tasks" (Aastrup & Kotzab, 2009, p. 777). Organizations have limited resources; thus its efficient allocation is critical (Moussaoui et al., 2016). To improve the quality of the replenishment and the flow of products, store employees should be assigned to clear logistics roles and responsibilities, applicable for a considerable period, so employees can incorporate a daily work routine and become more efficient in completing its tasks (Ehrenthal & Stölzle, 2013). Nevertheless, planning the available workforce to match the peaks of replenishment would help minimize the impact of being understaffed, or even just to provide guidance on a better workforce planning, as it is a major factor affecting OSA (Aastrup & Kotzab, 2009). In addition, it should also be considered a staff alignment to shopper peaks, so there are employees available for the shelves replenishment after a peak of sales time (Corsten & Gruen, 2003).

An alternative solution would be to outsource the replenishment of the shelves, although it is a more costly alternative (Moussaoui et al., 2016).

2.3.2. Congested backroom

When products arrive to the store at the designated receiving area, either from internal distribution centres (DC) or directly from suppliers, store employees proceed to its reception and inspection (Mou et al., 2018; Reiner et al., 2013). The products that are damaged or do not match the order specifications are returned, while the ones that meet the order placed may go directly to the store's shelves or to the backroom, for temporary storage, if there is no shelf space availability at the moment.

The use of a backroom in retail stores is a mainstream practice among retailers due to its importance, as it useful for the temporary storage, effectively working as a buffer of delivered products that do not fit the store shelves due to space limitation, thus giving retailers the ability to anticipate and react to shifts in product demand (Mou et al., 2018; Pires et al., 2017).

However, despite the advantages, the use of a backroom also brings some disadvantages that need to be taken into consideration (Eroglu et al., 2013). The design, size and number of backrooms are major drivers of shelf OOS (Raman et al., 2001). The design of backroom areas is far from being optimal, as since it is an area of support of the store and does not create value to the customer, its design is usually neglected. Thus, the size and design of the backroom must be aligned with the store needs, in order to maximize the efficiency of its operations (Pires et al., 2017). In fact, larger backrooms are usually inefficient, as it induces department managers to over-order, leading to higher inventory levels, which tend to congest the backroom and difficult in-store operations (Raman et al., 2001). Regarding the number of backrooms, it happens that in some stores that products are stored in multiple locations, as the receiving area, the backroom itself and the shop floor, which increases the complexity of backroom operations (Eroglu et al., 2013; Raman et al., 2001).

According to Waller et al. (2008), around 10% of the time, store personal is unable to locate the necessary products to be replenished from the backroom. This is a result of the aforementioned causes that lead to a congested backroom, in addition to minimally-sophisticated tracking and shelving systems of the backrooms (Moussaoui et al., 2016; Raman et al., 2001).

2.3.3. Receiving errors

When orders arrive to the store, receiving errors can occur. These errors might be due to the store personnel, as a proper inspection of the order might not be done upon its reception (ECR Europe, 2016). Another cause of these errors could be due to faulty DC operations, where the order could be wrongly delivered to the store or the order could just not correspond to the specifications, by missing or exceeding products (Moussaoui et al., 2016). Regarding DC deliveries, there is usually little or no verification by the store personnel.

Independently of what is the driver of receiving errors, it leads to IRI, which is a driver of OOS (Moussaoui et al., 2016). IRI represents a divergence between the real and the theoretical inventory levels (Mou et al., 2018). According to the findings of Raman et al. (2001), retailers are unable to quantify with precision the existing units of any product at the store, as inventory of more than 65% of the SKU of a retailer can show inaccuracies. Besides the receiving errors, there are a variety of causes of IRI, as checkout errors, shrinkage, spoilage, damaged products and product misplacement (Fernie & Grant, 2008; Mou et al., 2018). Ignoring IRI may have consequences for the retailer as poor store performance, affecting the effectiveness of demand estimation and inventory planning, and potential loss of revenue (DeHoratius & Raman, 2008). With the current landscape of data accuracy, IRI should no longer be an issue, but it still represents about 10% of the OOS (ECR Europe, 2016).

2.3.4. Shelf Replenishment

The replenishment process of products from the backroom area to the store shelves is considered by many authors as not being an efficient process (Pires et al., 2017). It consists on various steps, as grabbing/opening case packs, searching and walking for the shelf location, preparing the shelf for stacking the new items, filling new inventory on the shelves before putting the old one back (assuming a First Expired First Out (FEFO) inventory management policy), and disposing waste packages (Curşeu et al., 2009). The steps that take longer are the shelf stocking (44%) and the grabbing and opening of the packs of new items to replenish (21%).

The inefficiency of the replenishment process ends up leading to poor service delivery to the customer (Pires et al., 2017), which will be reflected on increased risk of sales loss and shopper loss (Corsten & Gruen, 2003). Accordingly, being this a behavioural issue, targeted training of store personnel can help in increasing their understanding on the importance of OSA, and on how their daily tasks contribute to the achievement of OSA (Aastrup & Kotzab, 2009; Raman et al., 2001).

In addition to the inefficiency of the replenishment process, comes the replenishment frequency, as the lower the replenishment frequency is, the higher it is the necessary amount for replenishment at once (Moussaoui et al., 2016). However, larger replenishment quantities imply high inventory levels, which was already stated to contribute to the congestion of the backroom. Thus, the longer the replenishment cycle, the more inefficient will be the overall backroom operations, and the more the existing inefficiencies of the replenishment process are intensified (Eroglu et al., 2013; Moussaoui et al., 2016). This way, replenishment should be planned to done on a daily basis, with multiple daily checks to the shelves (Aastrup & Kotzab, 2009).

Rethinking and redesigning the shelf replenishment process could pose as a solution to improve the efficiency of the process (Barros et al., 2021).

Another major challenge to the shelf replenishment is the detection of the OOS (Moussaoui et al., 2016). The current OOS estimation due to poor replenishment practises might be lower than it actually is (Moussaoui et al., 2016), since OOS detection rely mostly on visual checks, POS data, inventory data, and may also be identified using different types of technology, as RFID, shelf stoppers and weight, light or visual sensors (Delen et al., 2007; Ehrenthal & Stölzle, 2013; Papakiriakopoulos, 2012). Therefore, it might happen that an OOS goes undetected for a while, therefore not being considered in the OOS rate (Moussaoui et al., 2016). Furthermore, even when an OOS is detected, estimating its duration is challenging, and the continuous lag between the time it is detected and the time a corrective action takes, requires retailers to take preventive, instead of corrective, efforts to minimize the impact of shelf OOS.

From the four general methods to identify the OOS, visual checks are considered to be the most suitable for this purpose, as well as to simultaneously identify the causes of the shelf OOS, despite its effectiveness being dependent on the time and frequency of the manual stockout audits, and on avoiding human errors (Ehrenthal & Stölzle, 2013; Gruen et al., 2002). However, this method demands great workforce availability.

Nevertheless, there has been a growth trend in the adoption of information technology systems by companies throughout the food supply chain, aiming at improving their efficiency and responsiveness (Hingley et al., 2007). However, neither technological solution has the possibility to also identify the causes of the OOS (Ehrenthal & Stölzle, 2013).

Regarding the utilization of RFID with the only purpose of monitoring the stockouts, it ends up being a solution too costly for both retailer and supplier (Smart et al., 2010). However, there has been great progresses in the development of emerging technologies of intelligent tags(Corsten & Gruen, 2003). While the initial investment might be high, the return on the investment is expected to happen within three years, while the cost-savings are continuous, benefiting from savings with labour cost, shrinkage due to theft, reduction on stockouts due to the accuracy of the data and real-time tracking (Hingley et al., 2007; Kärkkäinen, 2003). This provides greater control over the inventory present on the store, providing an easier way to ensure hight product availability in a reliable manner (García-Arca et al., 2020). Although being clear that RFID will eventually be widely adopted over the supply chain due to contributing to the improvement of efficiency across the whole supply chain, it is not fully spread, and both retailers but specially suppliers are still not convinced on the cost-benefit trade-off (Hingley et al., 2007). In addition, according to Hingley et al. (2007) “the food and grocery industries are a notable challenge for RFID introduction (given the often low-value, hight volume nature of product and sometime difficult working conditions)” (p. 817).

When considering the use of POS data or inventory data for OOS detection, it relies on highly accurate data, and it is mostly trustworthy for demanding products (Papakiriakopoulos, 2012). As for the sensor-based technologies, weight sensors and imaging devices solutions are being proposed for automatic monitoring of OSA and inventory, and detect OOS (Frontoni et al., 2015; Milella et al., 2020). It presents advantages when compared to physical audits, as it is does not require the time and cost from the labour (Milella et al., 2020). Weight sensors on store shelves do not provide the possibility of identifying and monitoring the products. Computer vision systems are a more accessible solution and it presents various advantages, as the detection of OOS and misplaced products, and inventory monitoring (Frontoni et al., 2015). This way, depth sensing devices are proposed to autonomously identify OSA and early detection of OOS, in an accurate way (Milella et al., 2020). Unlike previous technology based-solutions, this one affirms a positive trade-off between performance and cost-efficiency.

2.3.5. Planogram

The bad execution and low compliance to the established planograms for the store operations, as the replenishment process or the backroom processes, contribute to OOS, as it poses as a barrier to better planning (ECR Europe, 2016). It is also important to consider that planograms might be outdated, for which a new analysis of the store processes would be critical to develop new planograms that can provide better guidance.

In part, the lack of efficiency of the planogram imposed is a result of staff members not being aware of the results that everyday activities have on store operations and product availability (Moussaoui et al., 2016). Thus, being this a managerial issue, focus on increasing their understanding on the importance of OSA, and on how their daily tasks contribute to the achievement of OSA is a critical factor to differentiate the store performance (Raman et al., 2001).

For better compliance with the planogram, the majority of the replenishment of the day could be done before the opening of the store, without shoppers, in order to have time to replenish before demand peaks and to be more efficient as no customers would be on the store (Aastrup & Kotzab, 2009). Managerial emphasis in prioritizing OOS at the store level is a key element in determining the performance of a store. Thus, management should clearly stress to the employees the importance of complying with the planogram, in order to work towards achieving a better performance regarding the OOS. Other actions that could contribute to improve the employees’ attitude towards the way they see OSA is to set tough targets, provide incentives and control more rigorously the processes’ execution (Corsten & Gruen, 2003). Make the employees feel they are a part and can contribute to the development of solutions to improve OSA promotes their satisfaction, which translates in motivation and commitment to the goal (García-Arca et al., 2020).

2.3.6. Shrinkage

Shrinkage is an issue faced by all retailers, and it can happen due to theft, obsolesce (when a product reaches the expire date) or damaged products (caused by product handling from either the client or store employees, or from bad storage of the items) (Gruen et al., 2002; Mou et al., 2018). Thus, it contributes to IRI, which by its turn a driver of OOS. As the inventory increases, it gets more difficult to control and avoid inventory shrinkage (Gruen et al., 2002).

2.4. Conceptual Framework

A conceptual framework is used to map the relationships among the most relevant concepts identified for a study, in order to draw coherent conclusions (Rocco & Plakhotnik, 2009). It also has the purpose to support the definition of the research design and data collection methods.

The problem under study is the high number of shelf OOS occurrences, namely the ones motivated by poor replenishment practices. Based on the existing literature on the topic, exposed along the chapter 2, a conceptual framework (figure 2.5) was developed, illustrating the root causes of the main causes that lead to poor replenishment practices, that, consequently, lead to OOS. This framework represents the starting point to evaluate the causes of the replenishment practices that are applicable in the context of a specific hypermarket.

Therefore, the conceptual framework intends to contribute to clarify the study' path in order to respond to the research question "How to reduce shelf OOS motivated by poor replenishment practices?".

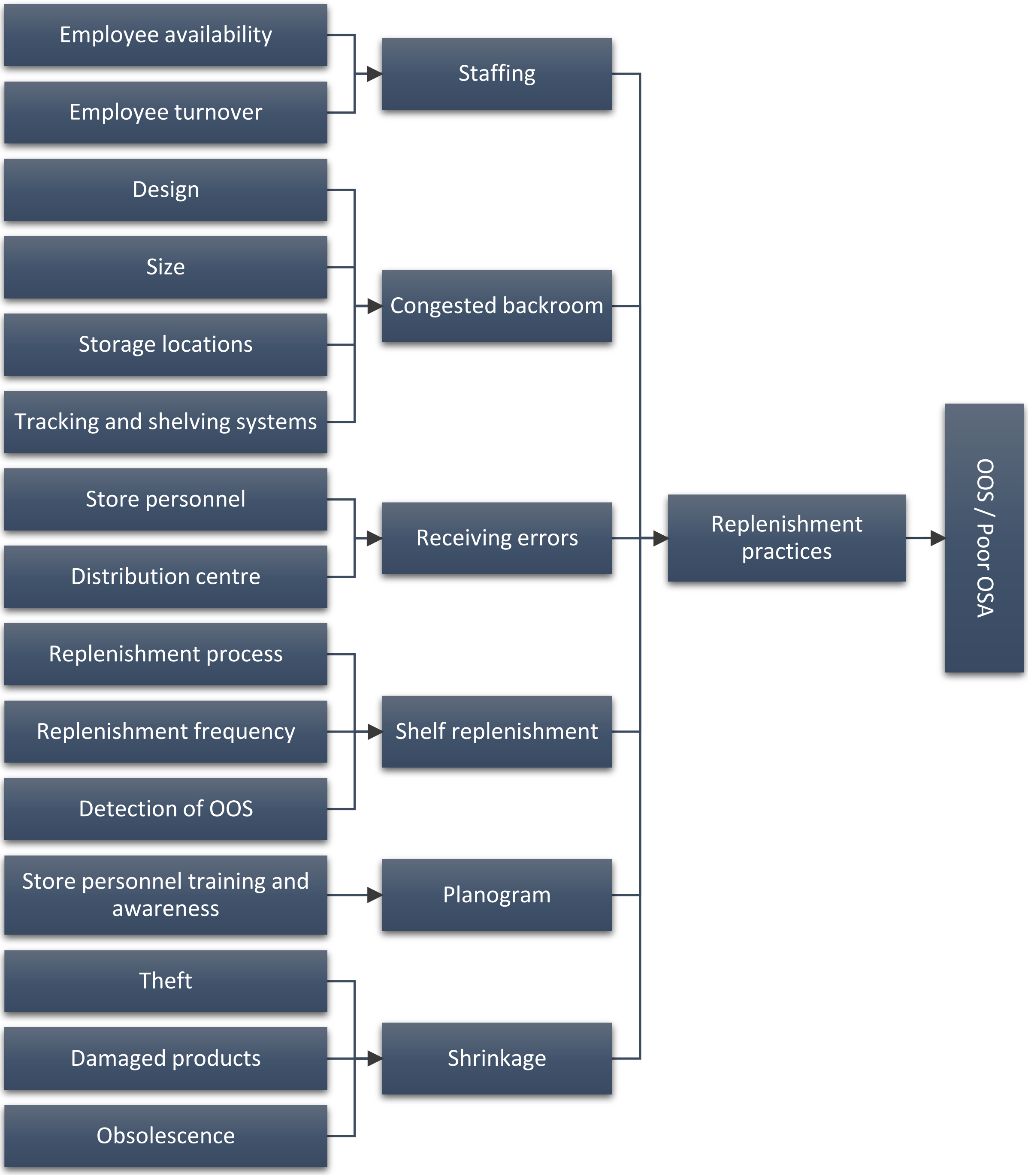

Figure 2. 5. Conceptual Framework (Source: own elaboration).

CHAPTER 3

Methodology

3.1. Research Design

The purpose of this in-company project is to answer the following research question "How to reduce OOS motivated by poor replenishment practices?" in the context of a Portuguese grocery retailer.

The case study was the research method chosen, as it is an explanatory approach that aims to answer "how" and "why" questions (Yin, 2018) in order to understand the problem under approach Bounded in terms of time and scope (Harrison et al., 2017), the suitability of this methodology also relates to the fact that a case study is considered to be an effective methodology when the goal is to have an in-depth comprehension of complex issues in real work settings (Creswell et al., 2007). This thesis focuses on a single-case, as it represents an unique case, in this case being a of a grocery retailer (Cooper & Schindler, 2015; Saunders et al., 2010). Additionally, it also meets the particularity of having to be defined, which for many students represent the company in which they are working, as it happens in this case.

The case study methodology relies on multiple sources of information that should be combined in order to enrich the research, as documents, interviews, observation, reports, and audio-visual materials, to obtain multiple perspectives on the case study (Cooper & Schindler, 2015; Creswell et al., 2007; Saunders et al., 2010; Yin, 2018). To address the research question and objectives of this thesis, it will be applied a qualitative data collection methods, for both primary and secondary data collection, will be employed in parallel. Consequently, it will be necessary to make data triangulation due to "the use of different data collection techniques within one study in order to ensure that the data are telling you what you think they are telling you" (Saunders et al., 2010, p. 146), in order words, triangulation ensures the corroboration of the research findings of a study.

3.2. Data Collection

A case study has little set structure (Creswell et al., 2007), depending much on the research question (Leedy & Ormrod, 2019). Therefore, it is up to the researchers to choose the research design and data collection methods in a way that helps acquire the relevant data to answer the proposed research problem. Due to the flexibility of this approach, it can be easily adapted to a wide range of issues, being helpful to "assist researchers to explore, explain, describe, evaluate, and theorize about complex issues in context" (Harrison et al., 2017, p. 15).

Similar researches on the area also followed a case study design. Aastrup & Kotzab (2009) started with a quantitative approach to evaluate the extent of the problem of OOS through the use of company data from the POS, as well as other documentation, and after followed a more qualitative to address the causes of the OOS on the field, by means of interviews and observation to analyse more in depth to case under study. As per Ehrenthal & Stölzle (2013), the methodology used started by conducting semi-structured interviews, use of archival records and fields trips for triangulation purposes (Cooper & Schindler, 2015), while the second phase of the methodology was focused mostly in field study.

Based on these examples, the research design is divided into two steps: the description of the current state of the case, as well as the detection of existing inefficiencies, followed by the identification of potential improvements to overcome the existing inefficiencies. Various data collection techniques were used. The data collection techniques to address the research question are divided into primary and secondary data collection. For the primary data collection, were used interviews, observation and documents from the company. In respect to secondary data collection, it was conducted online research on technical magazines, journals, books and websites on the internet to evaluate the existing theoretical concepts concerning the topic under study.

The description of the current state was made by doing direct observation, using archival documents provided by the company, and by doing semi-structured interviews to store employees. The observation was possible due to the realization of an internship at the company, which pertinence is to have a more holistic understanding over the case, as a complement of all the existing documented process by the company (Kawulich, 2016). The internship took place within the Lean department, responsible for the improvement of the operational processes across national stores.

Using direct observation and documentation from the company allowed to deepen the understanding on the replenishment practices of the store, graphically map them, and describe how each cause identified by the conceptual framework influences the replenishment in the store, since it was possible to follow thoroughly the processes, gaining knowledge that only through the use of documentation and interviews would not be possible. In this case, the goal of observation is also to identify the challenges and inefficiencies of the replenishment. To quantify the extent of OOS, the documentation itself was the only data source used.

The interviews were made to the market manager of the sweet grocery market, the operational manager, the operational assistant and to a shop floor employee of the hypermarket, to gather detailed information on the store activities, with focus on the replenishment practices and its particularities. The semi-structured interview consists of four open questions, as per the annex C. Having interviews from employees from different hierarchical levels of the store means also having different perspectives on the case, contributing to a holistic view and a more insightful feedback on the replenishment practices (Cooper & Schindler, 2015). The interview questions were inspired in

Barros et al. (2021), which also followed a case study methodology to evaluate the causes of shelf OOS motivated by lack of replenishment. In this case, the pertinence of choice of semi-structured interviews is due to being a less strict approach, allowing to make additional questions if it seems pertinent along the discussion (Cooper & Schindler, 2015). The type of questions of the interview will be very similar to the ones of the case study presented by Barros et al. (2021). The first question asks to describe the current replenishment practices of the store, as it is important to give context for the evaluation of the causes. The remaining three questions are related to the causes of the OOS due to replenishment practices. In the second question will be presented to the interviewee the different causes of OOS identified in the conceptual framework, and the goal is, for the respondents, to identify which cause they believe to apply to the store. The third question aims to assess if a different cause for this problem can be identified, that was not listed before. For both these questions, il will also be asked the interviewees to explain the pertinence of the causes identified. To finalize, it will be asked which action they believe that could be taken to reduce the probability of that specific cause to occur again in the future.

Finally, to proceed to the second step, on the identification of potential improvements to overcome the existing inefficiencies, were used the outputs of the interviews made regarding the questions on suggestions. To complement, the main findings from the secondary data collection were used to make the improvement suggestions on how to improve OSA. It is critical to optimize the processes related to the problems identified, by assessing the possibility of adapting existing solutions proposed by researchers in the area, such as the use of new technologies, or by eliminating or simplifying the existing activities. Then, the processes' improvements will be mapped, to visualize the suggested improvements.

To conclude, the benefits of the proposed process improvements will be exposed.

CHAPTER 4

Case Study

4.1. Company introduction

Auchan Retail group was founded in 1961 by Gérard Mulliez, with the opening of the first store in Roubaix. Auchan is now present in 13 countries spread across Europe, Asia and Africa, with 1985 points of sale under the Auchan banner. At the end of 2020, the group had €31.6 billion of consolidated sales, and an EBITDA of €1.6 billion.

Auchan Retail entered the Portuguese market in 1996, with the acquisition of the group Pão de Açúcar, the owner of Jumbo, Box and Pão de Açúcar stores in the country, which opened its first store in Portugal in 1970. However, Auchan kept operating under the acquired banner until September of 2019. Nowadays, Auchan Retail Portugal has a total of 65 stores, including 31 hypermarkets, 4 supermarkets and 30 My Auchan (ultra-proximity stores), a new concept of store that was introduced in 2017.

4.2. Hierarchical structure of the store

The organizational structure of the store, regarding operational activities, is comprised by five hierarchy levels, as illustrated in the figure below. The store director is at the top of the hierarchy, being the party with the greatest decision-making power in the store. Next in the hierarchy, there are the market's managers, the operational manager, and its operational assistant.

The market manager reports directly to the store director, as well as the operational manager. Each market manager has its own team of shop floor employee reporting to them, however, during the replenishment period before the store opening, all shop floor employees report to the operational manager. Also, the operational manager works in collaboration with all market managers, since he must coordinate all store operations. Finally, the operational assistant reports directly to the operational assistant.

The market manager is responsible for the markets or department at his responsibility, such as the management of campaigns, the calibrations on the system to adjust the order quantities to the sales, and the management of its personnel schedule and the daily activities to be undertaken. The compilation of the daily activities defined by each market manager for their team is done by the market manager on-call, and it will be useful for the operational manager and the operational assistant to be aware of the activities that need to be performed each day.

Every day, a market manager is chosen to be on-call, meaning that besides managing its own markets, must also assist all the other store departments, and solution some problem that may arise throughout the day.

The role of the operational manager involves, above all, the integrated management of the store, ensuring alignment and communication between all market manager and the operational assistant i.e., between higher decision levels and a more operational management of the store. Besides supervising the store operations, one of its main focuses is to support the reception area.

Regarding the role of the operational assistant, it is mostly operational, being always present at the shop floor area and at the backroom, guiding the shop floor employees and assisting in all activities, guaranteeing that everything goes as planned.

4.3. Store operations

In a simplified overlook, the layout of a retail store usually follows a standard structure, composed of some key elements, of which a receiving area, a backroom area, the shop floor and the checkout area (Fisher, 2004). The product flow in the store begins with its arrival by the receiving area, where the operators are responsible for the unloading and inspection of the products, arriving either from internal distribution centres and/or from external suppliers (Mou, Robb, & DeHoratius, 2018). From there, the inventory may follow several directions: if the products are damaged or do not correspond to the expected delivery, it may be returned or go a dedicated area at the backroom; while accepted products may go directly to the shop floor for shelf replenishment, or they may go to the backroom for temporary stocking when it cannot fit immediately the shelf space, therefore being used for later replenishment when the shelf inventory reaches a threshold or an OOS event occurs. Eventually, the product flow will end when the products leave the store by the checkout area, after the customer has paid of the chosen products.

The store under study follows this standard description of a retail store operations. However, there are a lot more activities involved in the daily store operations routine.

The shop floor is organized by eight departments: textile, technological equipment, stationary and toys, FMCG, fresh products, nutrition, wellness, organic and dietetic, and home and decoration. Each of these departments is divided into smaller markets, which by its turn are divided into categories and these categories are divided into sub-categories. At the annex D are identified the markets of the FMCG department, the categories of the sweet grocery market and the sub-categories of the machine's capsules category.

The orders arrive at the store through the reception area, and they can come from their own DC or from direct suppliers. The orders coming from the DC can belong to one of two existing product flows, the Picking by Line (PBL) and the Picking by Stock (PBS). The PBL flow consists of the delivery of the same amount of sold products at the day before, with no review of the order. It arrives to the store around 5 a.m. and goes directly to the shop floor area for its replenishment. The PBS flow consists of automatically generated orders, which are also automatically adjusted to consider what has already arrived at the store through the PBL flow. Usually arrives around midday but goes to a specific waiting area on the unloading dock, while waiting to be repalletized, which only happens around 1 p.m. of the next day. The orders that arrive from direct suppliers need to have all products checked for the bar codes and quantities, to verify if it corresponds to the received order note. To the orders that arrive from the DC, it is only needed to scan the pallet bar code.

There is a daily standard of the activities to perform at the FMCG department to assure its well-functioning, as illustrated in the annex E. The activities are divided into three periods of the day, the pre-opening starts at 5 a.m. and goes until the store opening hour, at 9 a.m., the morning period is from 9 a.m. to 1 p.m., and the evening and closure period is from 1 p.m. until the end of the last shift, which happens between 10 p.m. and 11 p.m., depending on the closure hour of the store.

At the shop floor area, before the opening of the store, the first activities to be performed, if previously defined by the category manager, are the physical inventory of the store and the set-up of promotional shelves and campaigns. The main activity of the pre-opening period is the replenishment of the PBL and PBS flows, which is the mass replenishment of the store, critical for its opening. As soon as these pallets enter the receiving area, they are moved to the shop floor for its replenishment. Ideally, the replenishment should be concluded 30 minutes prior to the store opening hour, since that period is used to prepare the store for its opening, including tidying up the shelves, the handling of misplaced products by the customer, and collecting waste, material, pallets and merchandise from the shop floor area. During the mass replenishment, it is critical to finish the placement of the new price tags on the shelves in case it was not completed on the previous day, as well as the posters.

After the store opening, if the mass replenishment was not completed, it will be continued. Other activities performed in this time period are the replenishment of the store stockouts scanned at the day before, there is also the D+N process, which consists of the replenishment of the remaining OOS and pre-OOS, after both mass replenishment and replenishment of store stockouts from the day before. It is also done the management of expiry dates, the measurement of price tags reliability by market. At the warehouse is done the preparation of products for return and/or with quality issue (damaged), the organization of the warehouse, the repalletization and storage of the leftovers for the mass replenishment, and it is also done the pre-set up of campaigns.

Around 11 a.m. is done the audit to the expiry dates, which process consists on checking the dates of all products from the selected section to audit, scanning the products in vigilance, meaning that they are approaching its expiry date, scanning the products that are apt for price reduction due to close expiry date, for the manager to print the specific price tags, and, finally, take from the shelves products damaged or expired. It is also necessary to assure that the new price tags of products in reduction are correctly checking out.

The process of price tags reliability starts around 2 p.m. and consists on checking if the prices on the tags corresponds to the price at checkout, and if a price tag in incorrect, it is removed for correction. Every day is seen a different market, which takes about an hour and it is done by one employee.

For the evening, one of the planned activities is the scanning of all store stockouts, which happens around 5 p.m. and takes about an hour. The replenishment of the scanned OOS is only planned to happen the next day, after the opening of the store. This activity also allows to correct some situations where some products appear in OOS but in fact they are not being supplied anymore to the store. Then, there is the maintenance and replenishment of the shelves, namely the replenishment of the shelves at the top of aisles as they are more prominent and have higher demand, the replenishment of promotional stands and campaigns, the second replenishment of products with higher turnover, and the replenishment of mono products and big volume products, as sodas, milk or rice, among others. Regarding the replenishment of mono-products and high volume products, it should fully replenished by the end on the day. The replenishment of these products does not follow a standardized process, it is based on the needs identified by the operational or market manager. Only the products with higher turnover are previously identified.

The impression, cut and separation of the price tags that need to be changed can be done before the closure of the store, but its placement can only happen with the store closed to the public.

After the closing time of the store, the misplaced items all over the store are collected and replenished, the repalletized pallets from the PBS flow are taken to the respective aisles, and the necessary material for replenishment is also brought to the shop floor area to prepare the opening of the next day.

4.4. Problem contextualization

The store under study in this thesis was the hypermarket of Coina, which is one the stores of the group with the highest rate of OOS.

The company is focused on identifying the leading causes of the OOS for each store, in order to have a clear picture of the roots of the problems of the OOS. These causes are lack of replenishment, delivery failures from the suppliers, insufficient inventory, blocked articles, lack of orders, and inventory records inaccuracies.

As illustrated in picture 1.2, the leading cause of the OOS at this particular store is the lack of replenishment of the store shelves, representing 64.8% of all causes identifies by the company. It is followed by delivery failures from the suppliers with 14.2%, then the insufficient inventory represents 8.2%, while lack of orders stands for 6.6% of the causes. The causes with least impact are the blocked articles, with are the products that are no longer part of the assortment, and the IRI, representing 4.3% and 1.9%, respectively.

This data shows that for most of the registered OOS, there is actually stock at the backroom of the store, just not replenished on time. The leading causes of the lack of replenishment are meant to be analysed in the next chapter, in order to suggest some improvement to overcome and mitigate the identified cause for the lack of replenishment, aiming to improve product availability.

CHAPTER 5

Data Analysis and Discussion

5.1. Extent and characterization of the OOS

5.1.1. OOS extent

Due to the dimension of the store, it is not possible to pay attention to everything that is happening, thus being important to select a crucial market of the store (Leedy & Ormrod, 2019). For this purpose, was chosen the product category with the higher number of stockouts from lack of replenishment, within the market of products also with the higher number of stockouts, of the FMCG department.

The OOS rate of the FMCG department in 2021, was of 1.72%, which is lower than the average European OOS rate of 7.1%. For the calculation of this rate are only considered the products of the regular assortment, not being considered the products that have temporary locations due to promotional campaigns. The FMCG department represented 62% of the store OOS. Looking deeper to the markets of the FMCG department, the Sweet Grocery market had the higher number of OOS, representing alone 20% of the department's OOS. Then, moving to the category of Sweet Grocery with the higher number of OOS, stands out the Capsules for Machines category, responsible for 17% of the OOS, representing an average OOS rate of 3.5%, varying between 1% and 8.9%. Regarding only OOS for lack of replenishment, this category has an average OOS rate of 2.5%, but it can be as low as 0.7%, or as high as 6.3%. The OOS rate the company under study for this particular product category is slightly higher from the average OOS rate of 2.1% for the category of coffee/tea from the research conducted by Aastrup & Kotzab (2009).

Therefore, based on the impact of the Capsules category, in terms of stockouts, it is the representative sample of the behaviour of the FMCG department, thus being the object of study of the OOS issue.

5.1.2. Characterization of the OOS

The company considers the classic type of stockout, meaning that there is an OOS whenever there is a shelf-edge ticket, but no correspondent product available for the customer to purchase.

Considering that the OOS rate for the Capsules category is on average 3.5%, which according to ECR Europe (2016) is not a demanding category, as its rate is lower than 5%, thus, it should not require great attention from the store personnel to ensure its OSA. However, this rate can be as high as 8.9%, which already represents a more demanding category, and as low as 1.0%. Nevertheless, the measurement of this rate may not be very accurate as it done before the peak period of demand of the store. A measurement of the OOS closer to the closing period of the store, would give a more realistic sense of the OOS of the store. Also, the process of collecting the whole store OOS is not performed every day in the hypermarket, leading to lack of data regarding OOS on Fridays and Saturdays.

The capsules category has 284 SKUs, from which, in the period between 31st October 2021 and 2nd December 2021, were found 75 SKUs (27%), at least one time, in OOS by lack of replenishment.

Another factor that influences OSA is the day of the week. The store does not receive any deliveries from the PBL flow on Sundays and Mondays. As per the figure below, there is no clear pattern on how the OOS behave according to the day of the week, the number of shelf OOS presented a significan evaluation. The total number of shelf OOS occurrences within the period considered were 186, representing around seven daily shelf OOS. Usually, there are some peaks on Monday, and a decrease throughout the week, which supports the affirmation of Corsten & Gruen (2003), when saying that most of stockouts occur on the days where there are no deliveries, followed by a decrease. Therefore, Monday was the day with the higher number of shelf OOS, with an average of ten daily OOS. It is followed by Tuesday with 8 occurrences, then by Wednesday and Sunday with seven OOS occurrences each, and, finally, there is Thursday with only six occurrences, making this the only day of the week with an average of daily shelf OOS occurrences below the daily average of the period in consideration.

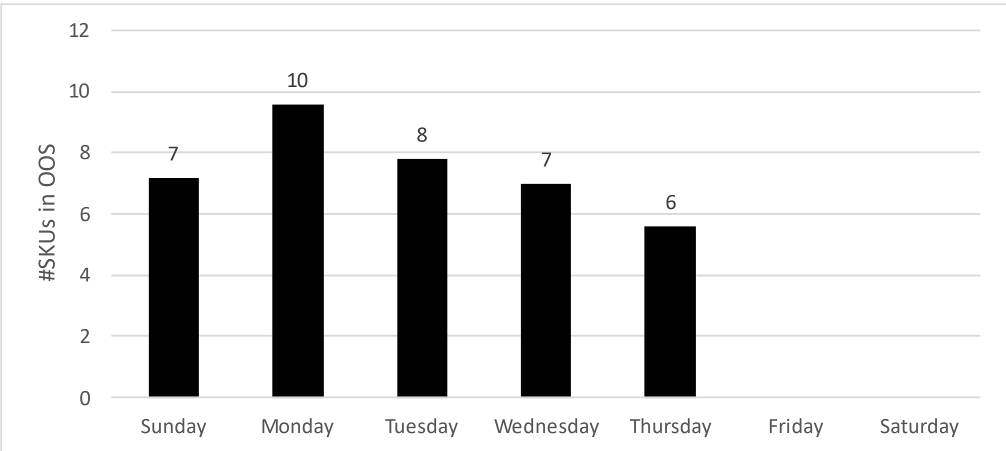

Figure 5. 1. OOS per day of the week (source: adapted from the company).

Another characteristic of an OOS is its duration. The company cannot precise when an item got in OOS, but through the registration process of the OOS of the whole store, it is possible to have a perception on how many days have a product been in OOS before a replenishment was made. The majority of the stockouts identified were singular occurrences (69%), while the remaining stockouts were identified several days in a row. About 22% of OOS happened for two days in a row, 5% happened for four days in a row, and 2% happened for 3 and 5 days in a row. Regardless of most of the shelves OOS being singular events, it is of more concern the stockouts that are identified several days in a row, since the stockout is known but there is no action towards its replenishment.

The products from the Capsules category with the higher number of shelf OOS occurrences in the period in consideration are as follows in the table below. All these 10 SKUs have been more than 20% of the time period under analysis in OOS, which shows that replenishment practices as the replenishment of the store stockouts or the D+N process were not realized for this product category.

TOP SKUs in OOS by lack of replenishment		Days in a row in OOS					Total days in OOS	% of days in OOS
Article	Description	1x	2x	3x	4x	5x		
1067192	CAFÉ EXPRESSO DQ AUCHAN:VIVACE INT.10 10UN	1			2	2	19	76%
3052768	CÁPSULAS CAFÉ NICOLA:NSP LOTE MUNDIPACK 30 UN		1		2		10	40%
3305076	CÁPSULAS CAFÉ AUCHAN:NSP ALUM EXPR INTENSO 20 UN	7					7	28%
3376497	CÁPSULAS CAFÉ BUONDI:NSP EXTREME 10 UN	1	3				7	28%
3287768	CÁPSULAS STARBUCKS:HOLIDAY BLEND 10 UN	1				1	6	24%
3290955	CÁPSULAS CAFÉ AUCHAN:NSP ALUM BAUNILHA 10 UN	4	1				6	24%
94864	CÁPSULAS DOLCE GUSTO:GINSENG 16 UN	2	2				**6**	24%
33595	CÁPSULAS DOLCE GUSTO:NESQUIK 16 UN	1			1		**5**	20%
47948	CÁPSULAS BUONDI:INTENSO PACK 40 UN	3	1				**5**	20%
76492	CÁPSULAS L'OR:ONYX 20 UN	2		1			**5**	20%

Table 5. 1. Products with more shelf OOS occurrences from the Capsules category (source: adapted from the company)

Regarding the inventory levels, the interviewees stated to exist an excess of inventory considering the store backroom capacity, and shop floor shelves replenishment. However, the poor organization state in which the backroom founds itself does not help, as per the subtilized space on the racks, leading to the need of placing pallets in front of the racks, obstructing the passage and the access to other products.

5.2. Factors that influence the replenishment practices

5.2.1. Staffing

One of the factors that largely impacts the replenishment practices is the employee availability and the employee turnover. On the FMCG department, the employee availability is not constant throughout the whole week, while the activities on the daily standard of the department are expected to be performed the same. The workforce consists of 19 shop floor employees, from which 14 work full-time, and from the 5 part-time employees, there are four working five hours a day and another working only four hours a day.

Despite the variation on the employee availability throughout the week, during the day, there are, on average 8 full-time employees, 3 part-time employees working five hours, and another part-time employee working four hours. Usually, there is only one full-time employee working the night shift, which starts around 2 p.m. and goes until 11 p.m..

When crosschecking the necessary time for the accomplishment of the store activities with the employee's availability, one can observe that the FMCG department is understaffed for its needs in most periods of the day, as the figure below illustrates.

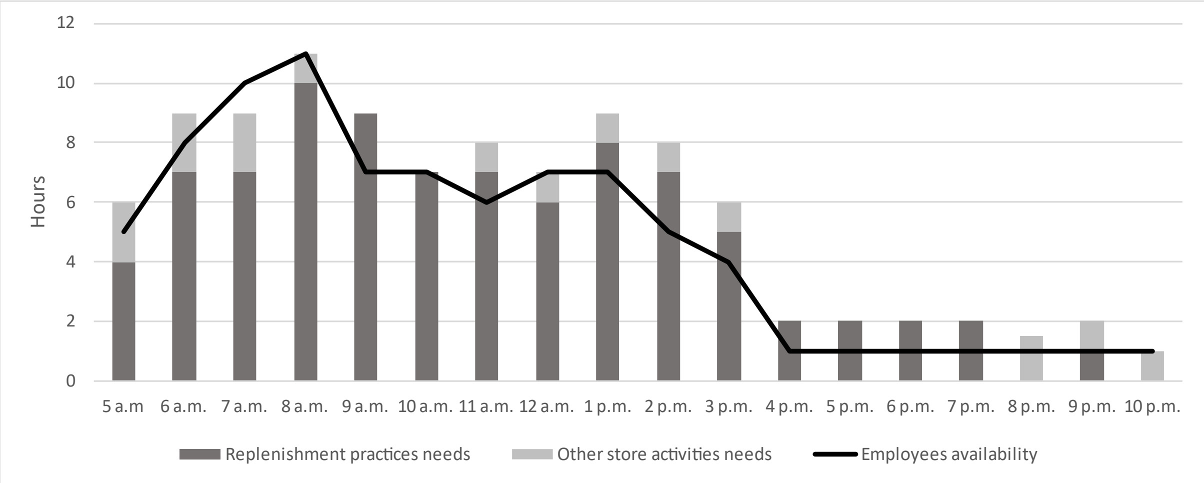

Figure 5. 2. Distribution of employees availability and workforce needs for the accomplishment of the store activities, in hours, during the day (source: adapted from the company).

According to the interviews to the market managers, operational manager and operational assistant, being understaff was stated to be one of the main reasons that justifies the existing high levels of OOS, as few humans resources mean insufficient time for the accomplishment of all desired activities. replenishment, which is an activity that requires a great amount of time. As for the shop floor employee interviewed, in his perspective there was too much workload for the workforce availability. Thus, despite continuously working in improving the management of the human resources, as well as the planning of the daily activities or even the activities themselves, an investment in increase the number of shop floor employees available, would reflect more OSA and, consequently, more sales for the store.

In addition, whenever there is lack of time/resources, it is, usually, the replenishment that is compromised, which is a decision from the market manager and operational manager. Thus, the importance and impact of the lack of replenishment seems not to be totally understood by the market managers. The morning period is when there is the higher staff availability due to the needs that the mass replenishment requires. However, as per decision of the store managers, the tendency observed is to delay the treatment of the OOS or the D+N process when some adversities happen during the day. Thus, the availability of employees to perform the replenishment becomes scarce, making it difficult to respond to the lack of product availability throughout the rest of the day.

At the FMCG department, the employee turnover of the store, in 2021, was 13.11%. Considering the time it takes for an employee to be familiar with the store assortment and practices, would be desirable to reduce the turnover rate for the benefice of the efficiency of the company.

Despite being slightly understaffed in some periods of the day, no improvement is needed in terms of allocation of employees availability, as resources are already efficiently allocated. The workforce is already concentrated during the replenishment peaks, which corresponds to the mass replenishment before the opening of the store, and during the rest of the day there are already various planned moments of replenishment. The problem of being understaffed relates more to the inefficiencies in shelf replenishment process itself, as well as with the compliance with the planogram, that need to be improved, as explained further in this chapter.

Nevertheless, the could consider the possibility of outsourcing the shelf replenishment for specific moments where it is predicted more workload.

5.2.2. Congested Backroom

As illustrated in the conceptual framework, the main factors that lead to a congested backroom are the design, the size, the number of storage locations and the tracking and shelving system.

The backroom of the store for products at room temperature, is organized by departments and by markets, within each department, as illustrated below in the layout of the store backroom. In each market, the products are aggregated into categories, in pallets, along 4 levels of racks, existing the possibility of having more than one pallet per product category. On the racks are labels to identify the location of each product category, following a specific colour code to facilitate. At the first level of racks are the articles with higher turnover and that need frequently a second replenishment, and at the second level are the products with lower turnover. In the third level are stocked the leftovers from finished promotional activities and/or the inventory for future promotional activities. Lastly, at the fourth level are seasonal products that are currently not part of the assortment.

In the backroom, there are also two areas for promotional products, divided into promotional FMCG and promotional non-food products, and an area for the set-up of campaigns.

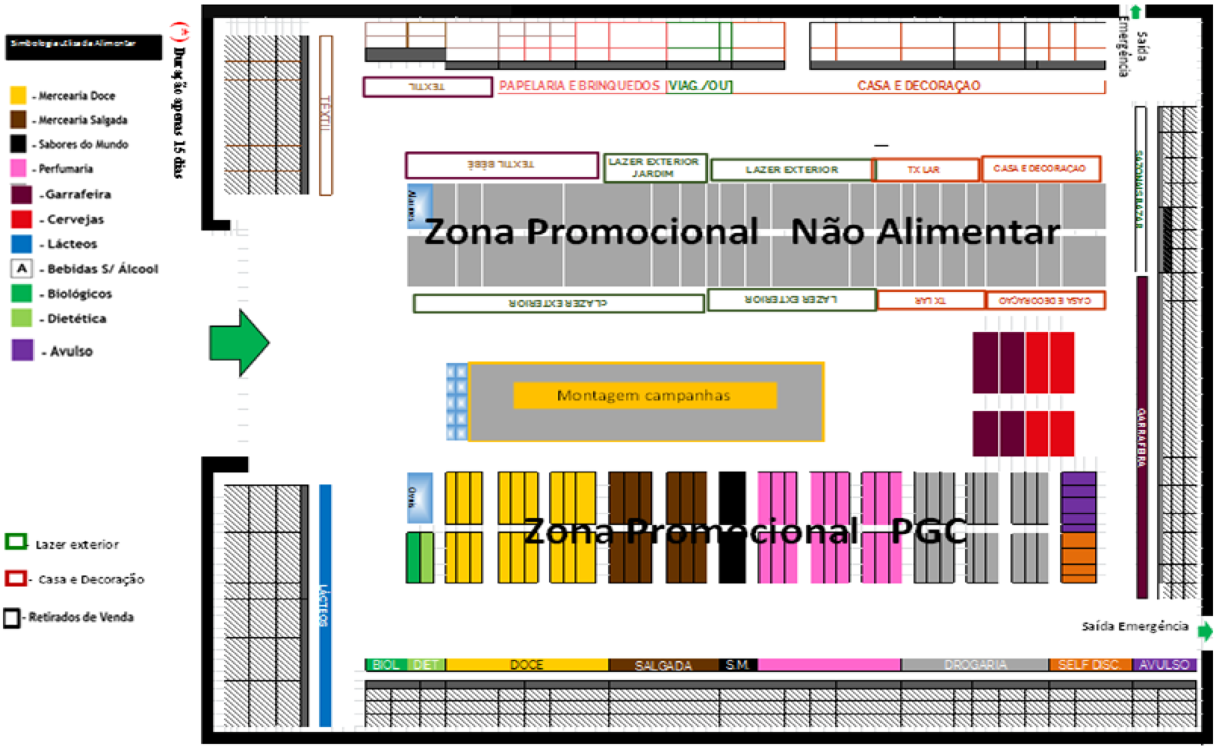

Figure 5. 3. Layout of the backroom of the store for room-temperature products (source: from the company).

The design and layout of the backroom had been recently updated to better suit the needs of the store, according to the size of the backroom, since there was no possibility to change it.

The figure below illustrated the current state of the backroom. The main issue stated on the interviews regarding the backroom was its congestion due to excess of inventory, being suggested a review to the buying policies of the store, as too much inventory difficult when searching for products. However, there was a major benefit for the efficiency of the store operations from the new design of the warehouse, as it used to be organized according to the store's aisles, with a lot of mixed products categories within the same pallet, and now it is organized by market and product categories. At the interviews, was mentioned the benefit of the D+1 process for the organization of the backroom, as it consists of storing the leftovers from the pallets taken to the store into existing pallets of the same product category, making a better use of the storage space and avoiding placing pallets over the backroom aisles. Besides contributing to the organization of the backroom, it giver the managers a better view of the existing inventory at the backroom.

Figure 5. 4. Store backroom (source: from the company).

The picking of the scanned products, either from the store stockouts or from the D+N process, can take between 30 and 60 minutes, depending on the market and number of scanned SKU, since it is usually necessary to move one or more pallets to reach the desired product due to overstock or underutilization of the storage space, causing the need to have pallets on the floor, in front of the racks, or it might happen that there are pallets with mixed product categories and sub-categories. Due to the congestion of the backroom, the operational manager considers this to be the activity that takes the longest from the replenishment process.

The tracking and shelving system at the backroom is very simplistic. There are labels on the racks to indicate the right place for each product category pallet, and papers to indicate when the last time was that a pallet had been taken to the store for replenishment. Also, on the labels of the racks, most of it have the indication of when that product category should go to the store for replenishment, which is useful for the daily operations.

Finally, there is the issue of having multiple storage locations, which increases the complexity of the backroom operations, since it makes it difficult to locate the items. In this particular case, there might be inventory at the unloading dock tracks at the backroom hallway, at the backroom shelves and at the shop floor shelves (see annex F for illustration).

5.2.3. Receiving Errors

When the orders arrive at the dock from the DC, it is only necessary to scan the bar code of each pallet and verify if it matches the order. However, it may happen that the order received was meant for another store and it was not properly checked by the employees, or that the products in the order do not match with the information on the bar code, which is difficult to be detected by the employees. Thus, independently of the who's fault it is, it will lead to IRI.

For the orders arriving from direct suppliers, there is more control, as all items have to be scanned. Even though some errors might occur, as some products might not be scanned and other might be scanned twice, it is more reliable than the orders coming from the DC.

According to the market managers, the inaccuracy of the orders coming from the DC is frequent, meaning that there are repeatedly discrepancies between the information on the bar code that integrates with the system records and the real order delivered to the store, which affects largely the reliability of the stocks, as well as the management of the inventory.

However, this must be an issue to be solved at the DC level, as according to the operational manager, checking the orders coming from the DC as are checked the orders coming from the direct suppliers would not be feasible due to the higher volume that comes from this flow, which would imply a hight need of human resources, as it would take too much time.

5.2.4. Shelf replenishment

There are several moments of shelf replenishment throughout the day. Before the opening of the store there is the mass replenishment of the products from PBL and PBS flows. In the morning period there are the replenishment of the stockouts registered on the day before, and the D+N process. During the evening, closer to the closure of the store there is the replenishment of promotional stands, campaigns, second replenishment of products with hight turnover and the replenishment of mono products and big volume products.

The mass replenishment of the day is mapped in the figure below. Before the replenishment of the orders from both flows, the pallets should be repalletized by markets to facilitate its replenishment, making it faster and more efficient. The difference is that the repalletization of the order from the PBL flow is done in the morning upon its arrival, while the repalletization of the order from the PBS flow is done the previous day, around 1p.m., as it is planned on arriving at midday. The store assistant oversees, guaranteeing that the designated area, the backroom hallway, is free to perform the activity and that all necessary material is in hand for the employees to use. He is also in charge of identifying the pallets in need for repalletization, according to the defined criteria, as pallets with products mainly from the same market do not need to be repalletized. It is also important to guarantee that there are enough resources, and for planning purposes the market manager considers that each employee is capable of repalletize six pallets per hour.

There are usually between 5 and 10 pallets from the PBL flow, while from the PBS flow the store receives on average between 50 and 60 pallets. Since the pallets do not come from the DC organized by markets or categories, it is what justifies the importance and need of repalletization, so, when replenishing, the employees avoid unnecessary transportation movements of the pallets, which do not add value to the process.

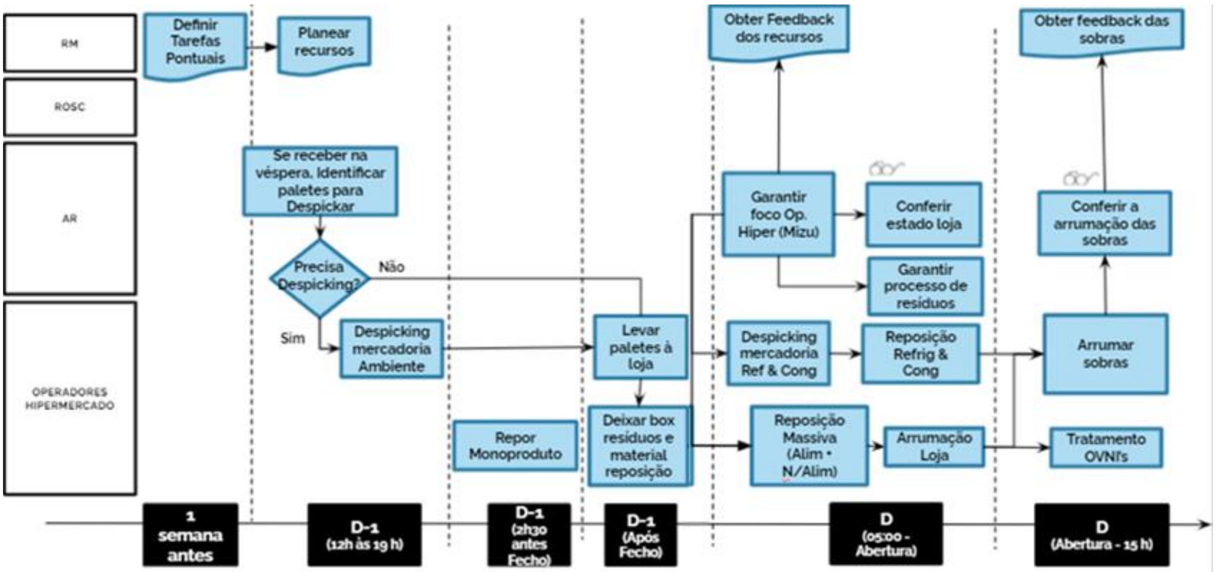

Figure 5. 5. Mass replenishment process before the store opening (source: from the company)

After the opening of the store there is the replenishment of the stockouts registered on the day before, around 5 p.m.. From this list, there are three types of stockouts, the ones that refer to products that are no longer supplied to the store or that have been temporarily suspended from the store assortment, reason why there is no stock to fulfil the OOS, there are the ones due lack of stock in the backroom and, finally, the stockouts due to lack of replenishment. However, regarding the OOS due to lack of replenishment, it is necessary to verify once again if the registered OOS have, or not, been already fulfilled during the mass replenishment, before proceeding to the picking of the products and later replenishment.

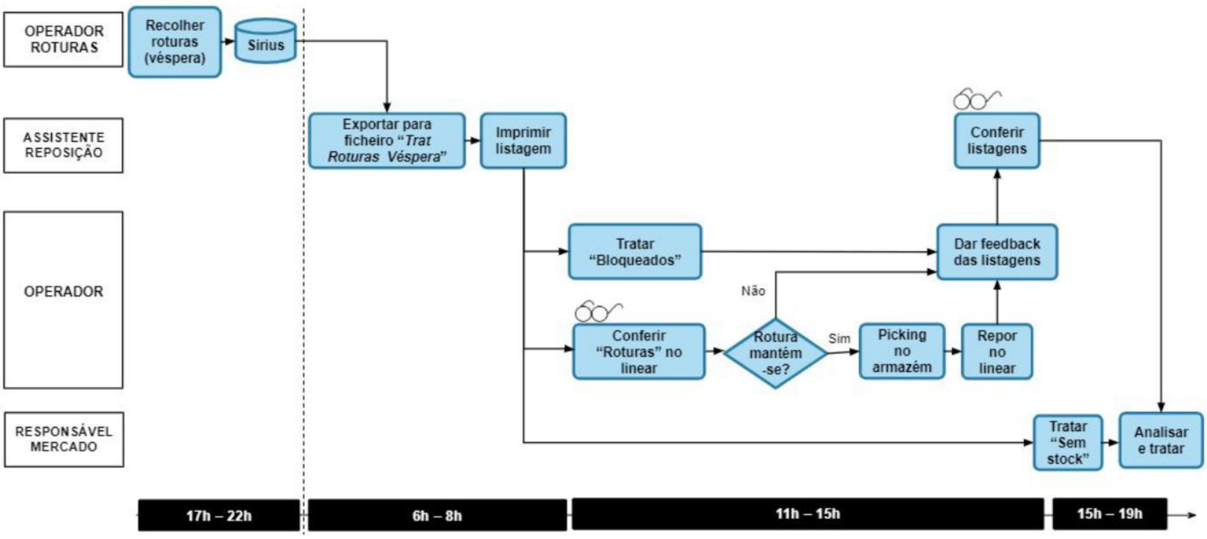

Figure 5. 6. Previous-day OOS replenishment (source: from the company)

After, starts the D+N process, which is focused on the remaining OOS, since not all OOS might have been replenishment with the previous efforts, as well as in its prevention. This replenishment process has two variations. There is the D+N scanning process, mapped below, which consists of scanning all the products that are in stockout or that have 50% or less of its shelf capacity available. Whenever the employee scans a price tag it is mandatory to insert the existing quantity on the shelf, in order to bring only the exact product quantities from the backroom to the store. This process takes longer when scanning products with 50% or less of the shelf capacity, as the employee must count the existing articles at the shelf. Overall, this activity takes between 10 and 20 minutes per aisle, depending on the number of products to scan. From there, a list of the scanned products is printed, showing the available stock at the backroom and the necessary quantities as singles items and in boxes for the shop floor employee to make the picking. Between scanning and printing the list, it takes around 20 minutes, due to the delay in the processing of the data by the system. Depending on the extent of the list and on the congestion of the backroom, the picking activity may take between 30 and 60 minutes, by market. The replenishment of a pallet takes about 30 minutes, as it is necessary to open the boxes and, in case there are some products on the shelf, it is necessary to take them out in order to keep them more accessible, so the FEFO policy is met. Finally, after the replenishment, feedback is given regarding any stockout situation that has not been restocked, for example per lack of product on the backroom, showing incorrect stocks or a congested backroom that makes it difficult to find the product, or per lack of time for previous replenishment.

The shelf replenishment was the cause with the most emphasis during the interviews, especially the D+N scanning process. As said before, when the workload is higher than the workforce available, the D+N is the first process of the daily standard to be dropped, even though the store managers are conscious of the benefits of this process to the product availability to customers.

This process has as advantages the fact that it allows to respond to the exact existing shelf OOS, it helps in the prevention of future shelf OOS, only goes to the shop floor the exact products for replenishment, and most of the waste from the packaging stays at the backroom.

Nevertheless, it has disadvantages as well. As already stated, the scanning activity takes a long time, as well as the search in the backroom for the exact products and quantities of the list. The system takes about 20 minutes to make the list available to be printed, leading to a long idle time. In addition to time the system takes to process, errors may occur and all the information previously scanned gets lost, forcing the employee to redo all the work. The picking of the products at the backroom also takes a long time, as due to the congestion of the backroom, according to the store assistant it might be necessary to move ten pallets to find five products, and a lot of time is lost in this activity. Also, due to IRI, the employees can lose time searching for products that, in fact, do not exist in the backroom. Thus, to prevent some of these situations, whenever the system indicates the existence of three or less units of a product, the market manager should consider it as non-existent. However, in the long term, this practice might contribute to shrinkage due to product obsolescence, as well as to IRI.

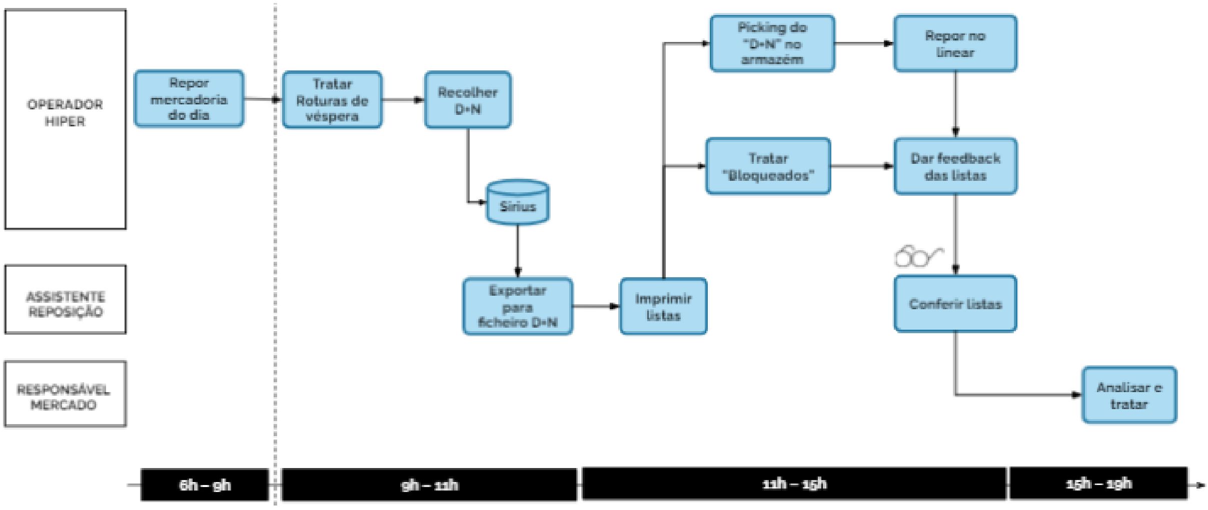

Figure 5. 7. D+N scanning process (source: from the company)

Then, there is the D+N pallet process, mapped below, that consists of taking full pallets to the store to replenish the available space on the shelves with the products on the pallet. The choice of which pallet to bring to the store is defined by the market manager, according to the demand. However, unlike the D+N scanning process, there is no replenishment of the stockouts registered the day before, being that information used solely for analysis purposes, and it is done right after the replenishment of the products from the PBL and PBS flows. Here, the goal is to bring all the pallets from the backroom to the store at least once a week. When all possible products are replenished from the pallet. The remaining products are scanned for monitoring and stored once again at the backroom, which is called the D+1 process, however this is an optional procedure that stores are not obliged to do. In this case, the store does not do it on a regular basis but understands the relevance and benefits this process as to the inventory management, especially given the existing IRI. At the backroom, is also kept track on which days had each pallet went to the store.

This variation of the D+N process is perceived by the employees to take less time as there is no need to scan the OOS or pre stockouts situations, as well as no need for picking. However, it may not be sufficient to cover all the replenishment needs, and unnecessary transportation movements are likely to being done, as not all products will fit on the shelves.

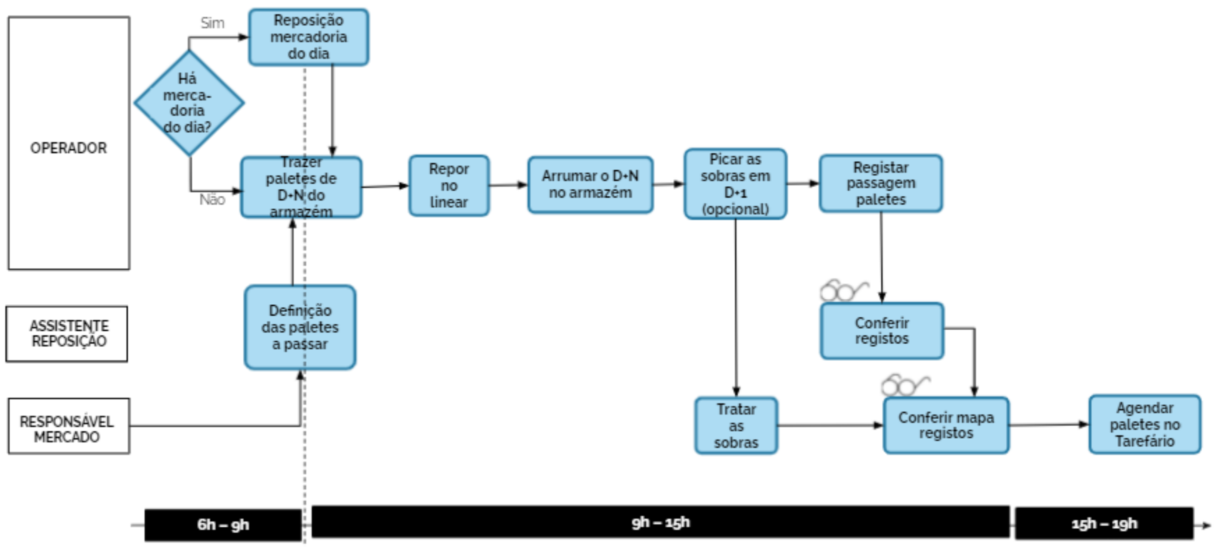

Figure 5. 8. D+N pallet process (source: from the company)

To not ignore completely the D+N scanning process, the adopted strategy of the store was to do the scanning by aisle and the shop floor employee also makes the picking of the products of an aisle at a time. This allows to fulfil the aisles that the operational assistant consider to be more problematic in more dept, as with the D+N pallet process this is not ensured.

The store conducts mainly the D+N pallet process mostly due to the convenience and the time it takes. For this reason, the market's managers had already established specific days of the week to bring the pallets to the shop floor, which are written on the racks, next to the identification of the product category. These established days can be emended on weekly-basis, monthly-basis, or on any other time periodicity, as seems suited. However, this strategy is not showing significative improvements on the reduction of shelf OOS by lack of replenishment.

The D+N pallet process is also used for the replenishment of top aisles shelves, campaigns and promotional stands, general shelves maintenance, second replenishment, mono-products and big volumes, not existing a standardized way for this latter replenishment to be conducted.

5.2.5. Planogram

Most of the employee availability is in the morning period due to the mass replenishment needs. Thus, any delay in complying with the planogram will jeopardize the accomplishment of the planned activities for the rest of the day, as human resources will get scarce.

According to the operational manager, delays in the delivery of the orders coming from the DC have the biggest impact in the replenishment. If the delivery of the PBL flow arrives later than 5 a.m., a significant part of the replenishment will not be possible to be done before the store opening. The same happens with the PBS flow, as a delay in the delivery means less time for the repalletization, and without it, the replenishment of each pallet will take longer. Being this a recurring issue at the store, the daily standard could be adapted to consider the possibility of occurring delays, and provide an alternative activity schedule, or define the delivery for an early period than necessary, as suggested by (Barros et al., 2021).

As per the characterization of the OOS puts in evidence, there are several SKUs in OOS for several days in a row, which suggest bad compliance with the replenishment practices on the daily standard of the department. More specifically, it is related the fact that the processes of replenishment of the OOS identified in the previous day and the D+N are not being performed. Otherwise, in one of these processes, the stockouts would have been addressed. A strong influence is the fact that shop floor employees do not fully understand the scope of the implications of their tasks, not seeing the replenishment activities after the store opening the main priority of the store.

It is clear that poor compliance with the planogram contributes to OOS, confirming the statement of ECR Europe (2016).

5.2.6. Shrinkage

Shrinkage affects the inventory accuracy, but it is very difficult for a retailer to avoid it and quantify each cause.

The shrinkage due to obsolesce of products is mainly a management issue, as there are strategies at the shop floor, as price reduction or the correct implementation of FEFO when replenishing, that could prevent this issue. However, this obsolescence might happen as well at the backroom, when products get lost or misplaced. For damaged items, if it is due to poor handling from the client, it is not a situation under the control of the retailer. Nevertheless, it might happen due to poor handling from the employees or bad storage of the items, which could be overcome with more training and awareness to the employees regarding this issue.

According to the market managers, most of the shrinkage due to theft happens because of shopping with the app. The objective of the app is for the customer himself to check the articles as he puts them on the shopping basket, thus avoiding the checkout lines. The payment is done in specific automatic checkout machines. However, even though random clients are called to check if the scanned products correspond to the products on the basket, there is little control on the overall checkout process and clients may not pay for all the items on their basket. Additionally, the areas where are products sold in bulk, as nuts and sweets for example, are also propitious to theft.

With the years, the estimated value of shrinkage has been increasing, representing in 2020 around 10252.00€, which is 0.78% of the operational sales.

Ano	Valor (k€)	%Venda Operacional	Evo %
2018	8652	0,68%	
2019	9668	0,76%	12%
2020	10252	0,78%	6%

Figure 5. 9. Estimation of unknown shrinkage extent (source: from the company)

5.3. Improvement suggestions for better OSA levels

The insights obtained from the interviews were very helpful in guiding the research and observation at the store processes. However, there were no suggestions on practices that could be implemented to reduce the impact of the identified causes of OOS, as the store has already been implementing adaptations of the processes or actions that in their opinion would be advantageous and improve product availability.

Over the description of the replenishment practices and the factors that directly influence it, it is possible to identify some inefficiencies.

There is a vast contribution from researchers to understand where the problem of the OOS is by identifying its causes over the supply chain, but an effective procedure to lower the stockouts has not yet been developed (Trautrims et al., 2009). Nevertheless, researchers have made improvement's suggestions from addressing the issue, with the main limitations being that they are mainly experimental and tailored to the needs of the retailer in study. However, it can still be used as a starting point for other researchers.

5.3.1. Planogram compliance and managerial emphasis on OSA

Overall, there is lack of compliance with the planogram defined for the daily store activities. The problem is concentrated on the shelf replenishment, which by its turn is affected by process's inefficiencies as the detection of the OOS, the frequency of replenishment, the delay in the delivery of the daily orders, and the congestion of the backroom.

However, the low compliance comes mainly from managerial drivers, as it is a consequence of the lack of awareness from the store employees on the impact of their daily responsibilities on OSA (Moussaoui et al., 2016). Significant improvement can be obtained regarding the reduction of shelf OOS by increasing the level of awareness on the store regarding the importance of OSA (Raman et al., 2001). There is a particular example of a process that clearly illustrates this issue, that is the D+N scanning process. It is a process that store employees, but also managers, put in second plan due to the time and workforce require to accomplish it, not seeing it benefits in the long-term.

A factor that deserves the attention of the store management are the backroom organization procedures, as its congestion represents a lot of lost time in a non-added value task, as one of the main complains of the employees was the difficulty in finding the products in need. The congestion of the backroom is mostly due to the poor compliance with the planogram, as there are organization procedures defined, but the reality shows underutilization of the racks space, and, consequently, there is the need of putting pallets in front of the racks, blocking its access. Despite the efforts in updating the design of the backroom, in addition to the backroom practices defined, it was not enough to maintain it organized.

Regarding the delivery delays, this is an issue to which the store as little control over, thus, as said, a feasible solution would be to anticipate the deliveries (Barros et al., 2021) to ensure the orders are at the unloading dock when necessary for the mass replenishment, avoiding any delay in the store shelves replenishment.

The improvement suggestions for the shelf replenishment process will be developed further in the following chapter. However, this is a process that requires a continuous improvement as new solutions will came up in the future, to solve these common problems of the grocery retail industry. Therefore, store managers should include the employees in the improvement process, as if employees feel they are contributing, it also promotes their overall satisfaction and commitments, thus translating into higher levels of compliance (García-Arca et al., 2020).

5.3.2. Redesign the replenishment process

The process of shelf replenishment asks for a redesigning of its activities to best suit the capacity of the store in terms of the workforce and to improve its efficiency (Barros et al., 2021), specially speaking of OOS detection and replenishment frequency. In this case, to rethink and redesign the process, it played a major difference to have been able to be on site to observe and understand why each part of the process is done, i.e. what is the purpose of each task, and to understand the store environment that influences the activity flow.

5.3.2.1. OOS detection

One the main inefficiencies of the replenishment practices is related with the detection of OOS, as it is a very time consuming process for employees, and there is also some redundancy of work.

After the completion of the replenishment of the OOS identified the day before, it is done the D+N scanning process. For the replenishment of the OOS identified on the previous day it is necessary to verify once again if the products are in fact in OOS, before its picking in the backroom, due to the possibility of having already been replenished during the mass replenishment. The D+N scanning process, which is planned to be performed right after, starts by also checking the existing OOS missing from the mass replenishment and the replenishment of the OOS identified the day before, in addition to also checking the pre-OOS. After the replenishment from each process, the shop floor employee is responsible for giving feedback to the market manager on the reasons why some products were not able to be replenished.

Based on this, at a first instance, the suggestion would be to keep the manual audit of OOS of the store shelves (Ehrenthal & Stölzle, 2013; Gruen et al., 2002), at a given period of the day, preferably after the peak of customer demand, in order to have a more accurate perspective on the extent of OOS, and to evaluate if the replenishment practices are having the desired outcome in ensuring product availability. The main advantage of this process is to have the daily information of the existing OOS on the store, at a given moment in time, which is useful for managerial purposes.

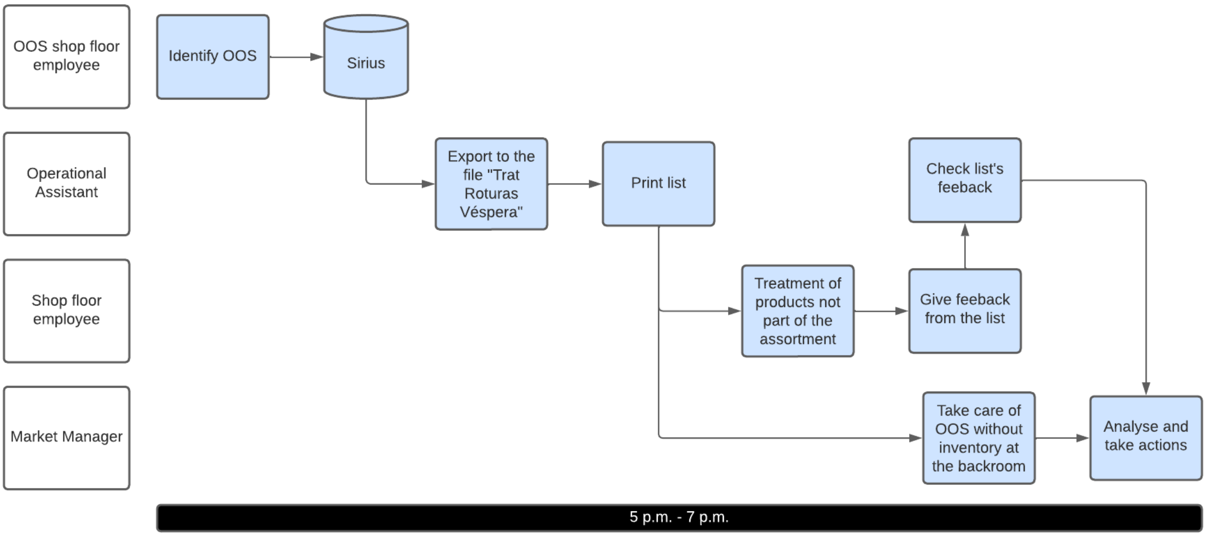

Figure 5. 10. Detection of daily OOS (source: own elaboration)

In the current process, the feedback on the causes of each OOS is only given on the day after its identification, after the mass replenishment. However, it could be given right after the OOS identification, as the feedback consists on informing on products that have a shelf-edge label but are no longer part of the assortment, on products that are OOS due to lack of inventory on the backroom, from which is up to the market manager to identify the causes of the lack of inventory, if it was a delivery error or poor ordering practices, and on products that have stock on the backroom but were not replenished.

Hence, the replenishment of the stockouts in the morning period can be done using the D+N scanning process. This is a more complete process in identifying the OOS, as it not only identifies the exiting OOS, but also the pre-OOS. However, the identification the pre-OOS is the most time-consuming task from the OOS detection, as employees must count and insert on the scanning pistol the exact number of products of a SKU with less than 50% of its current shelf capacity. Although the goal of identifying the pre-OOS is to have a more proactive rather than only reactive approach to improve OSA, it reduces drastically the efficiency of the replenishment, having the opposite result. This way, the D+N scanning process should consider only the identification of the products fully OOS.

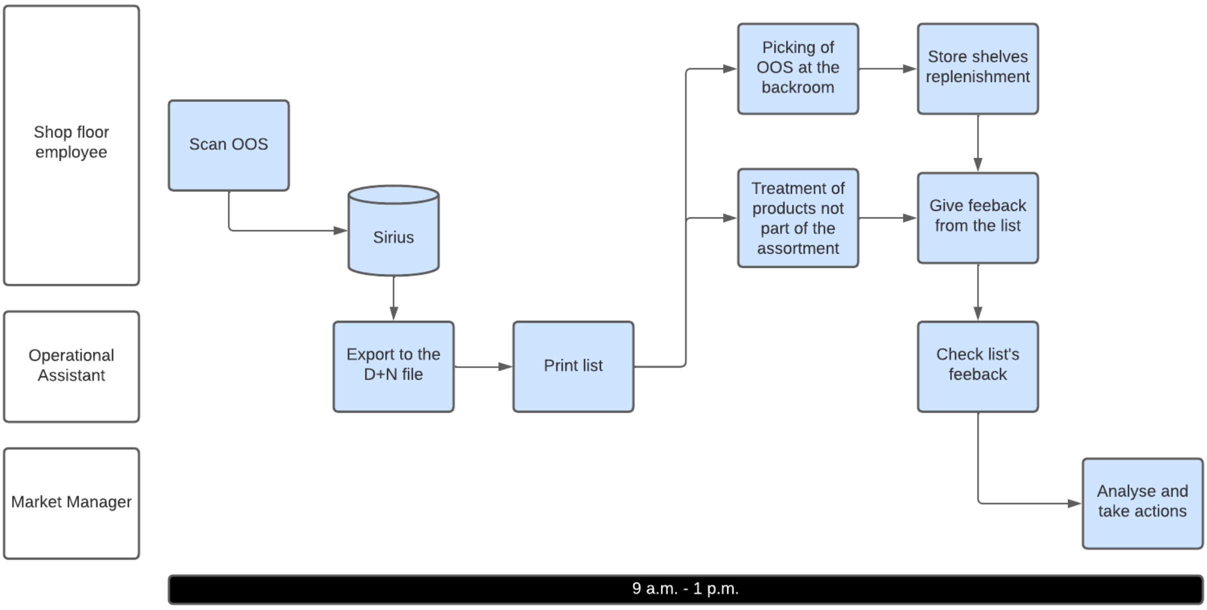

Figure 5. 11. D+N scanning process (source: own elaboration)

5.3.2.2. Replenishment frequency

There are four main shelf replenishment moments at the store, during the day, which are the mass replenishment before the store opening, the previous-day OOS replenishment, the D+N scanning process and the replenishment of the shelves at the top of aisles as they are more prominent and have higher demand, the replenishment of promotional stands and campaigns, the second replenishment of products with higher turnover, and the replenishment of mono products and big volume products.

According to the previous suggestion for the detection of the OOS, the replenishment of the OOS identified in the previous day will not be considered anymore in the daily activities' standard, leaving three main replenishment moments.

Regarding the mass replenishment, it is already an efficient process, as is happens before the store opening, allowed the replenishment to be done in a more efficiently manner, as it corresponds to the products sold the previous day. The only suggestion change would be to do the D+1 process over the leftovers from the replenishment, in order to have a better control over the inventory at the backroom.

Moving to the D+N scanning, the required change was in respect to the scanning of the OOS themselves and not with the rest of the process, which is already an optimized process despite being necessary to work on the back room congestion and on IRI, to make the most out of the process.

The redesigned D+N process only acts on the replenishment of the existing stockouts, being a reactive process. However, the sustainability in the improvement of OSA relies on a proactive approach, to which the mass replenishment already contributes to, as the goal is to fulfil the remaining space on the shelves, despite the product in question being or not in OOS at the moment.

Considering that the shelf space capacity is adjusted to the demand, besides the products that are already identified as needing a daily second replenishment, the mass replenishment combined with the D+N process should ensure product availability throughout the day.

Therefore, the replenishment at the evening period should adopt a rather preventive approach to OOS. This way, all the replenishing moments of the evening should follow the D+N pallet process. In this process the backroom inventory comes to the store, and similarly to what happens at the mass replenishment, all possible products are replenished on the shelves. The same applies to the second replenishment products, as the whole pallets containing that product category should come to the store to maximize the transportation movements of the pallet from the backroom to the shop floor. The D+1 process should become mandatory, as it allows managers to have a better visibility on the real stock available at the backroom, which would also reduce the frequency of need to perform the inventory counting of the backroom.

5.3.2.3. Introducing a technology-based solution

Technology-based solutions may be more reliable for products with certain characteristics and provide information in real-time. This allows to overcome one of the main inefficiencies of the shelf replenishment, being it the time spent by employees in identifying the products in OOS, and the timing of detection.

There has been great progresses in the development of emerging technologies of intelligent tags and smart ships, as the RFID (Corsten & Gruen, 2003), as it provides greater control over the inventory present on the store, offering an easier way to ensure hight product availability in a reliable manner (García-Arca et al., 2020). However, its advantages do not seem to convince retailers and suppliers to adopt it. Nevertheless, as years go by, it is expected a wide adoption of the technology, to which the store should be open to implement in order to improve the overall efficiency of its operations (Hingley et al., 2007).

Therefore, the suggestion to be adopted by the store is to utilize depth sensing devices, as it tackles exactly the main issued identified, by automatically identifying OOS in a timely and accurate manner (Milella et al., 2020). It consists of a 3D shelf monitoring system with a camera, allowing to not only identify the existence or inexistence of product on the shelves, but also provides as estimation of the number of available products. One of the advantages in that is does not require any training to employees and the only requirements for better results are proper illumination and optimal placement of the visual sensors.

Considering the implementation of this system across the various FMCG markets, it would not require a daily physical audit of the OOS, but it might be beneficial to the store to perform it once a week to keep track of the main causes of OOS. The identification of the OOS in the D+N process would be suppressed, giving more time for employees to dedicate to the replenishment itself. The D+N pallet process, instead of relying on the market manager or operation manager to identify which product categories to replenish, it would be based on the information provided by the visual sensors at the time.

CHAPTER 6

Conclusion

Product availability is considered to be a key performance indicator of customer satisfaction (Aastrup & Kotzab, 2009). Besides the short-term consequences translated into immediate sales loss, there are also long-term consequences on customer demand, as the repeated occurrence of OOS can lead to the risk of shopper loss (Corsten & Gruen, 2003; Moussaoui et al., 2016).

Therefore, retailers seek to address the OOS, but to do so it is necessary to precisely determine the extent of OOS and to clearly understand the causes (Ehrenthal & Stölzle, 2013). Only with these conditions reunited it is possible to successfully address the OOS.

Recurring to the use of data collection methods such as direct observation, archival documents and data from the company, and semi-structured interviews, it was possible to deepen the knowledge of the company where the internship has taken place. The understanding of the replenishment processes of the store and its environment allowed to gain insights to be able to answer the proposed research question of this case study, which goas as "How to reduce OOS motivated by poor replenishment practices?" in the context of a Portuguese grocery retailer.

6.1. Suggestions and Managerial Implications

Considering the description of the current context of the store, in addition to the suggested improvements from different researchers, were proposed some suggestions to contribute to the reduction of the OOS from poor replenishment practices, at the store level. These suggestions address almost all the identified causes for the poor replenishment, being related with the detection of the OOS, replenishment frequency, backroom organization, compliance with the planogram, shrinkage, receiving errors and delay, and with the staffing. However, these causes are not independent from each other, leading to suggestions that address various causes at once, and that can even have a positive influence of other store practices. With the implementation of the suggested improvements to address the inefficiencies identified at the store, it will be possible to gradually improve the OOS rate.

The compliance with the planogram might be the most critical action to ensure long-term OSA, as no matter how good the defined procedures are or how much was invested in new solutions or in the workforce, if the planogram with a defined set of actions is not followed, it will not be feasible to improve the OSA levels. This way, it is necessary to have management levels creating awareness on the importance of OSA and how the accomplishment of the daily activities from which each employee is responsible for, affects the sustainability of product availability, thus increasing stockouts. Employees should be included in the improvement processes so the feel part of the change, making them more committed to complying with the defined processes as the vision will be fully understood.

The processes directly related with replenishment practices and that deserve more attention are the backroom organization procedures and shelf replenishment processes, as the D+N scanning process. For this processes, the store management should give more training sessions to employees to be better prepared them to more efficiently and effectively perform the designated activities. Another issue that affects the overall compliance with the planogram are the delays in deliveries, as a delay in the mass replenishment will delay all the other activities, ending up being jeopardized the replenishment throughout the day. This would imply a reorganization of the delivery route from the DC to the store, to identify the best period for this delivery to happen.

The remaining suggestions relate with the rethinking and redesigning of the shelf replenishment practices, namely the OOS detection and replenishment frequency. These processes improvements should be responsibility of the Lean department of Auchan, working closely with the store to include the comments from the store managers and personnel, as they have a better understanding of the implications and feasibility of the suggestions made. The need for training to the employees relies, once again, on aiming to improve the efficiency of their overall performance, to minimize the occurrence of errors.

At a first stage, it is suggested a change in the process of previous-day OOS identification to suppress the replenishment part and to be used mostly as a process to support management decisions and provide the extent and causes of the OOS problem at the store level. The D+N scanning process would have suffer some changes, leaving aside the scanning of the pre-OOS and considering only the existing OOS. This more reactive approach to OOS is compensated by the D+N pallet process and by the mass replenishment, that aim to fulfil the shelves capacity with the existent stock of a certain product.

At a second stage, considering the long-term, the suggestion is based on the incorporation of technology-based solution. Despite RFID being a promising solution for overall supply chain efficiency due to major advantages it brings specially to the retailer on improvement of OOS detection, has also a positive influence on the detection of receiving errors, on the accuracy of the inventory and consequently on the ordering practices as there will be a more reliable visibility over the real inventory level, and on the reduction of shrinkage, it is not widely adopted yet, as suppliers and some retailers still hold some doubts regarding its implementation. It will require a considerable financial investment from the company and the implementation process might take some take. This solution does not ask for employee training, although employees should have a session to be explained the goal and advantages of such solution, following the rational of creating awareness and involving all employees in the improvement processes. Nevertheless, the long-term benefits can surpass it the investment. This way, the use of a visual sensors to provide a timely and accurate identification of OOS, presents itself as the technology-based solution with the best cost-efficiency trade-off. With its implementation, physical audits could be eliminated from the replenishment process, giving employees more time to dedicate to the actual replenishment of the shelves.

Considering the suggestions made, it is possible to minimize OOS from poor replenishment practices by improving and optimizing the current procedures implemented, which can be potentialized by the introduction of technology, and by insisting on spreading awareness through the different hierarchy levels of the store on the importance and impact of their actions on improving customer satisfaction through product availability, and its respective benefits in the long-term.

6.2. Limitations

One of the limitations of this study refers to the fact that, contrary to most case studies that explore the extent, causes and consequences of OOS, it was only analysed the context of one store, not being possible to make a cross-case analysis on the replicability of the methodology used, as well as on the findings and research over various single-case studies (Yin, 2018).

A common limitation to most studies in the area is the fact that the findings are very context specific to the reality of the case under study, and to the characteristics and extent of OOS. Thus, since the improvement suggestions on how the OOS by poor replenishment could be minimized are tailored to address the causes and to suit the reality of a specific store, it might not hold true in other contexts (Ehrenthal & Stölzle, 2013).

Another limitation concerns, once again, the improvement suggestions to address the main issues identified, as they were not tested in the context of the store environment, which would be an major insight to the research to validate the expected benefits.

6.3. Future Research

For future research, researchers could start by addressing the aforementioned limitations of the study, providing a fresh view of the subject.

It would also be very appealing to quantify the impact of each cause of poor replenishment practices in different product categories, similarly to what Reiner et al. (2013) did for the category of dairy products, as it corresponds to a gap in the existing literature. This would allow to take conclusions on the impact of each cause depending on the characteristics of the OOS and between products categories.

The methodology followed in this study could be applicable to a multiple-case study with the goal of analysing if the same product category across different stores of a retailer would present similar results. It could also be analysed, within the same store, if the different causes of poor replenishment practices affect equally, or not, the different product categories, from a qualitative and quantitative perspective.

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Annexes

Annex A – Root Causes of OOS

Root Cause		
Planning	**Ordering**	**Replenishing**
Store		
• Incongruence between shelf capacity and replenishment frequency. • Product purchasing frequencies. • Large number of SKUs in assortment.	• Data (bad POS data, inaccurate records). • Forecasting (inaccurate forecast, long cycles). • Inventory (inaccurate inventory or book-stocks). • Ordering (no order, late order, wrong order, backorders).	• Staffing (insufficient or busy staff). • Backroom (congested). • Receiving (receiving errors, inaccurate records). • Shelf replenishment (infrequent, late or no shelf filling). • Planogram (bad execution and compliance). • Shrinkage (damage, theft).
Distribution Center		
	• Data (bad data, inaccurate records). • Forecasting (inaccurate forecast). • Inventory (inaccurate inventory or book-stocks). • Ordering (no order, late order, wrong order, backorders).	• Transportation (shipping, loading). • Receiving (loading errors, inaccurate records). • Storage (put away/ break pack). • Replenishment (infrequent, late or no store replenishment). • Lead times (long and infrequent). • Shrinkage.
Wholesaler/Retail Headquarter		
• Assortment (new or discontinued item). • Data and communication (master data). • Planogram design and implementation (shelf allocation). • Promotions and pricing decisions. • Advertising and display planning. • Store layout and service levels.	• Data (bad data, inaccurate records). • Forecasting (inaccurate forecast). • Inventory (inaccurate inventory or book-stocks). • Ordering (no order, late order, wrong order, backorders).	• Availability (shortage).
Supplier		
• Assortment (new or discontinued item). • Data and communication (master data). • Promotions and pricing decisions. • Advertising and display planning.	• Data (bad data, inaccurate records). • Forecasting (inaccurate forecast). • Inventory (inaccurate inventory or book-stocks). • Ordering (no order, late order, wrong order, backorders).	• Availability (packaging, raw materials and ingredients).

Source: *Corsten & Gruen (2003)*

Annex B – Concepts retrieved from the Conceptual Framework cited by relevant authors

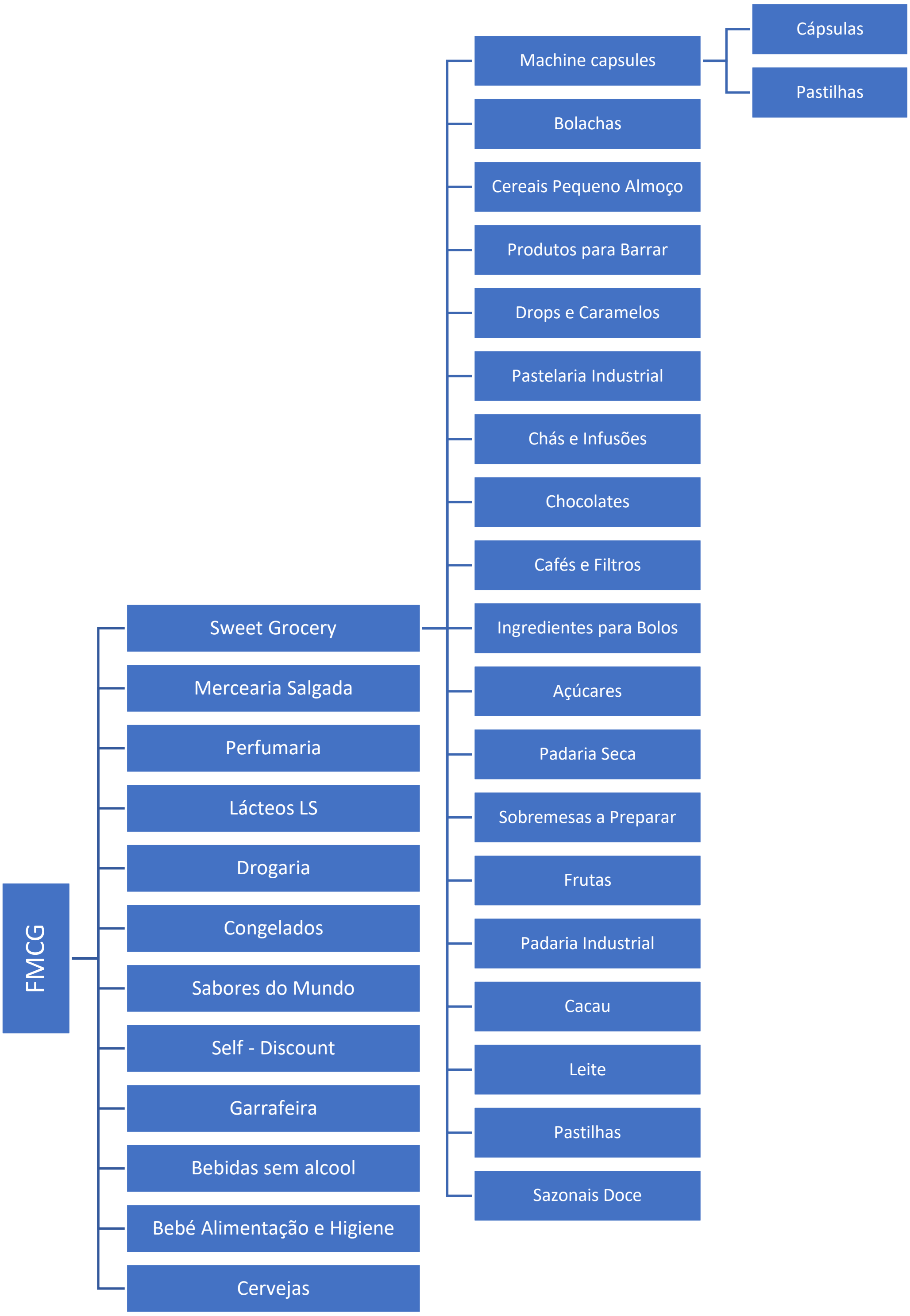
Concepts	Authors
OOS / Poor OSA	(ECR Europe, 2016) (Moussaoui et al., 2016)
Replenishment practices	(Corsten & Gruen, 2003) (Gruen et al., 2002)
Staffing	(Gruen et al., 2002) (Moussaoui et al., 2016)
Employee availability	(Reiner et al., 2013)
Employee turnover	(Aastrup & Kotzab, 2009) (Raman et al., 2001)
Congested backroom	(Gruen et al., 2002) (Moussaoui et al., 2016) (Pires, Pratas, Liz, & Amorim, 2017)
Design	(Reiner et al., 2013)
Size	(Pires, Pratas, Liz, & Amorim, 2017) (Raman, Dehoratius, & Ton, 2001)
Storage locations	(Eroglu, Williams, & Waller, 2013) (Raman, Dehoratius, & Ton, 2001)
Tracking and shelving systems	(Moussaoui et al., 2016) (Raman, Dehoratius, & Ton, 2001)
Receiving errors	(Gruen et al., 2002)
Store personnel	(ECR Europe, 2016)
Distribution centre	(Moussaoui et al., 2016) (Raman, Dehoratius, & Ton, 2001)
Shelf replenishment	(Gruen et al., 2002b)
Replenishment process	(Curseu, Woensel, Fransoo, Donselaar, & Broekmeulen, 2009) (Pires, Pratas, Liz, & Amorim, 2017)
Replenishment frequency	(Moussaoui et al., 2016)
Detection of OOS	(Moussaoui et al., 2016) (Papakiriakipoulos, Pramatari, & Doukidis, 2009)
Planogram	(ECR Europe, 2016) (Gruen, Corsten, & Bharadwaj, 2002)
Store personnel training and awareness	(Aastrup & Kotzab, 2009) (Moussaoui et al., 2016) (Raman, Dehoratius, & Ton, 2001)
Shrinkage	(Gruen et al., 2002b)
Theft	(Gruen et al., 2002b) (Mou, Robb, & DeHoratius, 2018)
Damaged products	(Gruen et al., 2002b)
Obsolescence	(Mou, Robb, & DeHoratius, 2018)

Source: own elaboration

Annex C – Semi-Structure Interview Questions

1. Please describe the replenishment practices of the store, throughout the day.
2. In the literature, I was able to identify the main causes that contribute to high levels of OOS. Taking these causes in to consideration, and based on your daily experience, which causes do you believe to contribute the most to the poor replenishment practices? Why?
3. Besides the mention causes, is there any other cause that you consider relevant in terms of the negative impact on the replenishment practices? Why?
4. For the causes said to impact the most the replenishment, what do you believe that could be done to reduce its impact and the chance of happening again?

Annex D – FMCG Department's Markets, Sweet Grocery Market's Categories, and Machines Capsules Category's Needs



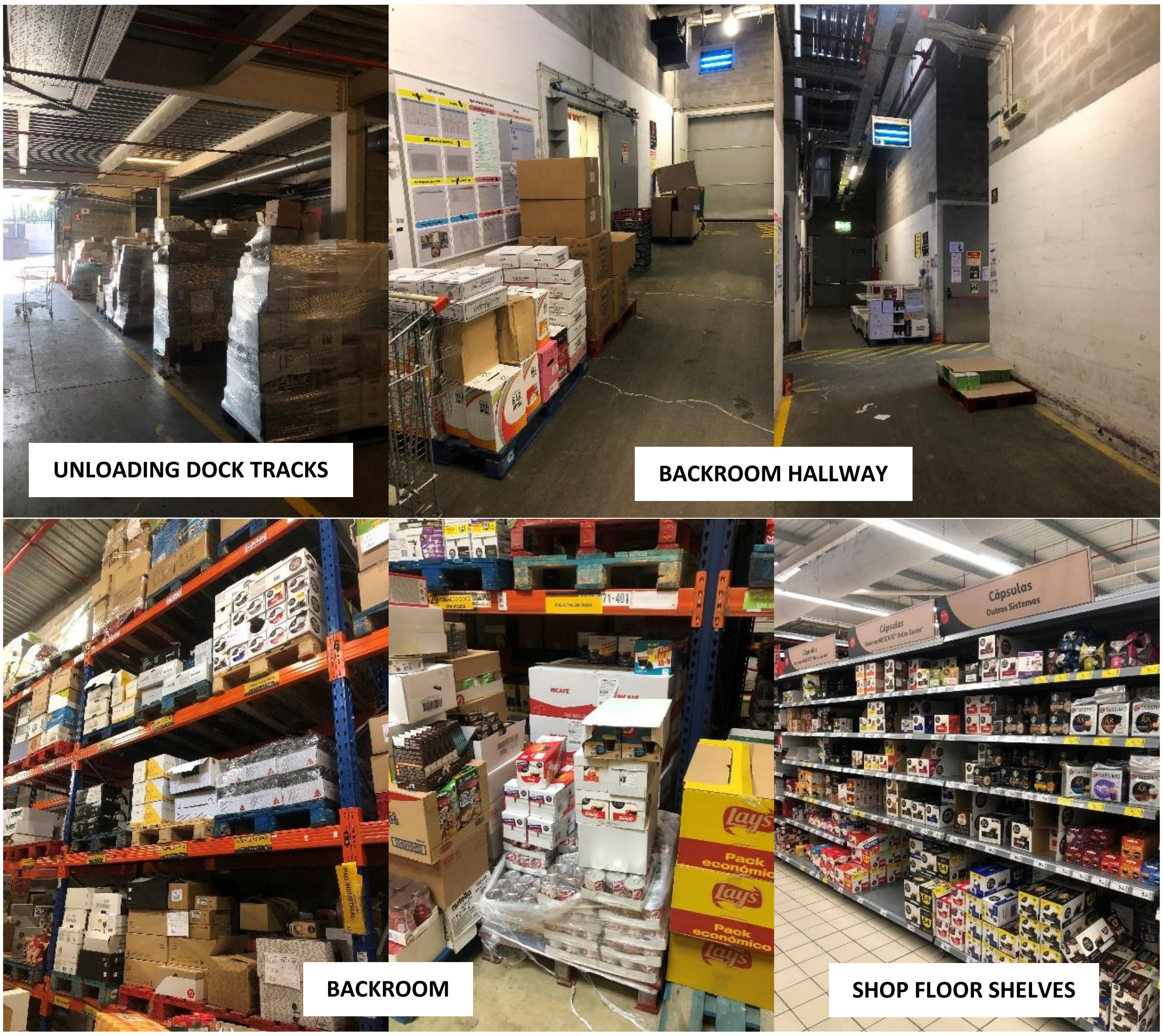
Source: adapted from the company

Annex E – Daily Standard of activities of the FMCG Department

	PRE-OPENING (5 a.m. - 9 a.m.)
1	**Activities before replenishment**
	Inventory
	Set-up of promotional shelves and campaigns
2	**Replenishment**
	Change of the remaining price tags and posters
	Mass replenishment
3	**Opening preparation (30 minutes before the opening)**
	Handling of misplaced products
	Collection of waste, material, pallets and product leftovers
	Tide up the shelves
	OPENING (9 a.m. - 1 p.m.)
4	**Staff meeting**
5	**Replenishment (continuation)**
6	**Replenishment of store stockouts**
7	**D+N process**
8	**Warehouse management**
	Handling of damaged products
	Storage of product leftovers from mass replenishment (repaletization)
	General warehouse organization
	Pre-set up of campaigns
9	**Expiry dates management**
	EVENING (1 p.m. - 11 p.m.)
10	**Price tags reliability check**
11	**Store maintenance**
	Maintenance and replenishment of top asile shelves
	Maintenance and replenishment of campaigns and promotional stands
	Maintenance and replenishment of the the shelves and 2nd replenishment
	Replenishment of mono-products and big volume products
12	**Price tags**
	Impression, cut and separation of the price tags
	Placement of the price tags (after store closing)
13	**Preparation fot the opening of the next day**
	Collection and replenishment of the misplaced items over the store
	Placement of the pallets on the shop floor area
	Placement of the support material on the shop floor area

Source: adapted from the company

Annex F – Multiple storage locations at the store



Source: own elaboration