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SHRINKING SHRINKAGE: HOW AND WHY IS FRUIT SHRINKAGE BEING CAUSED IN SONAEMC'S CONVENIENCE STORES? FINDING OPPORTUNITIES OF IMPROVEMENT ENVISIONING ITS OPTIMIZATION

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Abstract

This work project regards a challenge presented by a Portuguese organization on the retail sector, SONAEMC, which is a case study of how and why fruit shrinkage occurs in the fruit supply chain within their convenience stores. A qualitative research methodology enabled to infer in which stages throughout the chain shrinkage's causes occur and, to conclude that internal rules for procedures and processes are not always followed and whose compliance would be enough to reduce fruit shrinkage. The key conclusion is that if fruit stock loss is reduced by as much as 15% the category's profitability could increase about 8%.

Keywords: retail industry**,** fresh groceries, fruit shrinkage, supply chain management

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1 Introduction

Shrinkage is a common and highly significant issue across the increasingly diverse, complex and competitive industry that is food retailing. It can be defined as the "cash value of products that a retailer has bought but that it neither sold nor has in stock" (Buck and Minvielle, 2013: 26) or the "intended sales income that was not and cannot be realized" (Chapman and Templar, 2004: 4). Shrinkage can be divided into two categories: "known" and "unknown". Known shrinkage refers to losses whose nature is readily identified and clarified while the other is mainly revealed when grocery retailers do inventory audits and infer discrepancies between the book inventory and the physical inventory (Chapman and Templar, 2004). Regarding the sources of shrinkage, in general, they are normally referred to as compromising four buckets: external theft or shoplifting, internal theft or dishonest employee theft, inter-company fraud or vendor or supplier fraud and finally, administrative and non-crime losses or process/operational failure (Beck and Peacock, 2009).

Globally, the loss shrinkage value between 2013 and 2014 was $128.51 billion from which, $40.09 billion, concerned only Europe (Deyle et al, 2014). This work project, focus on food retailing only i.e. supermarkets/grocery retailers. For this type of stores the European shrinkage rate accounted for 1.12% between 2013 and 2014 (Deyle et al, 2014). The given numbers clearly emphasize the dimension of this uncontrolled reality.

The major source of shrinkage for the grocery retailers in Europe is shoplifting with 31% followed shortly by administrative and non-crime losses with 29%. Particularly in Portugal, shoplifting has on its turn 50% of weight and administrative and non-crime losses 28.7% (Deyle et al, 2014). Despite the fact that diverse studies exploit and examine the four buckets of shrinkage, two specialists on the field strongly defend that process/operational failures represent a far greater proportion of shrinkage than what is currently recognized (Beck and Peacock, 2009). They defend that most of operational failures might create favorable conditions for shrinkage related to theft and fraud to occur. At some extent, understanding it

might be crucial to prevent shrinkage related to the other three buckets and evidently, shrinkage within operational failures itself. These failures can occur any time in the path products take throughout the supply chain[1] hence, it might be crucial to keep track of them through careful monitoring.

Following this reasoning, this work project tackles a challenge proposed by SONAEMC through an internship developed for approximately five months. The challenge focus on convenience stores *Continente Bom Dia (CBD)* and on fruit category shrinkage, a relevant fresh grocery within SONAEMC whose business unit fruits-and-vegetables has a penetration of almost 79%, which makes it a driver of store traffic and customer loyalty. The main concern is on fruits highly perishability that when mishandled can be severely compromised in terms of quality. Moreover, once damaged it will hardly sell and will concede a poor look to the entire section conditioning perceived quality and freshness and consequently affecting sales and, generating shrinkage. That being said, the main goal of the work project is to discuss the sources of fruit shrinkage while answering to how and why shrinkage is being caused in fruits under an operations management emphasis. At a later extent, the ambition is to propose ways of preventing and reducing it, foreseeing its optimization. In more detail three sub-questions will be considered in the analysis: to what extent do store operations cause fruit shrinkage? To what extent does active range of fruit *SKUs'* inadequacy cause fruit shrinkage? And, to what extent does Procurement causes fruit shrinkage? All considered process failures. Following the motivation, shrinkage has proven to be a resilient problem worth of attention in the industry and of a greater effort to understand its nature. For SONAEMC, understanding through an operations management approach how and why fruit shrinkage is such a long lasting loss in its convenience stores (fruit category is responsible for almost 57% of stores *CBD* total fruit-and-vegetables shrinkage) seems of most importance for profit opportunities through cost reduction and increased sales.

[1] "All the activities involved in supplying an end-user with a product or service" Meredith, Jack R. and Scott M. Shaffer. 2011. *Operations Management* (4th edition) pp. 249

1.1 SONAEMC Context

SONAEMC is a market leader company from the food retailing sector in Portugal and a core business of SONAE Group, which is presently recognized by its international expansion being present in about sixty-seven countries worldwide and with an EBITDA rounding the 417M euros. SONAEMC enfolds different formats, the franchising stores *Meu Super*, cafeteria and restaurants *Bom Bocado*, stationary *Note!*, animal products and services *ZU*, health shop *Well's*, hypermarkets *Continente* and *Continente Modelo* and the convenience stores *CBD*. Due to this project nature the focus is on convenience stores *CBD*. Those proximity stores dynamically expanding are divided in two regions, North and South, which summed up, at the start of the internship, a total of forty one stores.

2 Literature Review

This section reflects previous research related to the topic being studied with the intention of creating foundation for further research.

The value of shrinkage between 2013 and 2014 is estimated to have reached the $614 million in Portugal (and 1.18% in percentage of sales), positioning the country in the top five European countries with most shrinkage and top nine globally (Deyle et al, 2014), which gives evidence of the extreme relevance this loss has within the retail sector in the country SONAEMC operates.

Taking a detailed understanding of the four primary sources of shrinkage one can describe **external theft** as the act of theft from a customer inside stores. Issue aggravated after the appearance, in the industry, of self-scanning and self-checkouts (Chapman and Templar, 2004), and also, the one that has received more attention in studies (Beck and Peacock, 2009). **Internal theft** is verified when a similar behavior occurs but the act is taken by staff employed in the retailer. When it comes to **vendor or supplier fraud** is essentially due to suppliers delivering fewer products than what they charged the retailer for or retailers

returning fewer products to suppliers than what were agreed on (Beck and Peacock, 2009). Finally, **process/operational failures** that are "losses due to operating procedures within the organization including products which have become out of date, or have been reduced in price; incorrect pricing; product identification errors; incorrect stock counting; products which have been damaged, scanning errors; and errors in deliveries to the stores" (Beck, 2004: 3). All these causes are not mutually exclusive. Also, operational failure must not only encompass the previous topics in the definition but also, everything that can go wrong across all the supply chain from the supplier until the final exit in stores (naturally, excluding all kinds of theft) (Beck and Peacock, 2009).

Discussing fresh fruit shrinkage, it is important to refer that replenishment and quality-control processes are arduous and lengthy and fruit is highly seasonable. Also, different fruits have different temperature and handling requirements (Buck and Minvielle, 2013). Additionally, the rising consumption of fruit together with the trend of constant fresh produce promotion raised the need of a full and well stocked range of produce available at any time (Chapman and Templar, 2004). The consequence of the previous is that process/operational failures are enhanced for fruit due to such characteristics. Due to its nature fruit is prone to be damaged throughout the supply chain, which can be even more accentuated due to its packaging. In fact, 10% of all perishable goods are considered unusable before reaching the customer (Beck and Peacock, 2009).

Looking again at the industry, most of times there is no consensus on which of the four buckets is more responsible for shrinkage (Beck and Peacock, 2009). If in one turn certain research studies assured external theft as the biggest responsible, i.e., 39% of global shrinkage (Deyle et al, 2014), others showed that retail shrinkage managers themselves suggest that only about one third of loss is caused by external theft (Beck and Peacock, 2005). Loss prevention specialists defend that operational failures (in all their guises) need to be the starting point at which the root causes of shrinkage are examined since most create the

opportunity for malicious shrinkage to occur (theft and fraud) and logically, non-malicious too. Accordingly, most of shrinkage can be tackled through monitoring and control of procedures and processes across the supply chain (Beck and Peacock, 2009). Also, there is lack of academic studies related to operational failures and on top of that, internal theft is not likely to occur in fruits.

The theory has been recommended through a tool for shrinkage's prevention called the "Shrinkage Road Map" with the intent of "encouraging organizations to focus particularly on the processes used to manage and monitor the movement of goods throughout the supply chain. Poor processes, or lack of adherence to them, can not only generate shrinkage but also act as a mask or cover for other shrinkage-related behavior" (Beck and Peacock, 2005: 30).

Besides there is lack of academic studies on the topic devoted to produce typology individually, e.g., studies on fruit, meat, pastry etc., which can be crucial for a clear understanding of the how and why of shrinkage since different produce means different needs and features. In fact, according to Chapman (2010: 226) "shrinkage rates differ considerably both between and within product groups, between countries and even for the same type of product when sold through different but seemingly similar channels".

These facts enhance the value of the work here proposed. Minimizing fruit shrinkage across the fruit supply chain will provide a clear understanding of how and why shrinkage occurs in fruits, in a rising category in the industry (consumers increasingly perceive fruit as a healthy choice) and specifically, in a time when worldwide retailers have been focusing efforts on the topic due to the recent, weak economic situation (Deyle et al, 2014). There is an increasing need for preventing shrinkage drastic consequences that diminish customer and consumer loyalty or satisfaction and foster foregone sales that consequently create foregone margins.

3 Methodology

This section will provide an accurate overview of the methodology followed in this work

project. The best way to serve this project goal is through a case study research strategy. This method has an advantage when a "how" or "why" question is asked about a contemporary set of events over which the investigator has little or no control (Yin, 1989). Naturally, this project's research question and sub-questions are the methodological starting point of a case whose research object are convenience stores *CBD* of SONAEMC.

The first approach considered was a quantitative one and consequently, a case study explanatory[2] in its nature. It was imperious to validate and foil first approaches depleting all tools in hands. In fact, the first tool consisted in a set of variables available in SONAEMC's databases: Net Sales, Reported Net Sales, Shrinkage in value (euros), shrinkage in percentage of NS, shrinkage in percentage of RNS, square meters of fruit section (m^2), full time equivalent (*fte*), average duration of fruit storage "*dias de rotação*", age of the store and active range of SKUs. Full details on these indicators description can be found in appendix 1.

The goal was to identify variables that would imply a relationship with fruit shrinkage and with that intention correlations were made in order to infer what kind of relationship existed between fruit shrinkage and variables empirically related with it. Also, a cross-sectional regression of the sample was run in order to infer whether fruit shrinkage as the dependent variable was affected in fact by any of the chosen variables as independent variables determining effect's magnitude if any. Yet, both revealed limitations. The data is not one hundred percent accurate namely due to the fact that the area that concerns the square meters occupied by the fruits' category only, of the whole fruits-and-vegetables business unit (fruits, vegetables and specialities) is not representative of the *CBD* reality since in stores sometimes that space is adjusted of what needs to be put in exposition from the all business unit. So, if one tries to prove that an exaggerated area of exposition will subject a perishable good to be under less favorable conditions, e.g., store's temperature or customer handlings while deciding the purchase, the result will be fallacious and therefore, the correlation R^2 will be

[2] "Studies that establish casual relationships between variables may be termed explanatory studies" Saunders Mark., Philip Lewis and Adrian Thornhill. 2009. *Research Methods for Business Students* (5th edition) pp. 140

(relatively) low not implying with certainty a relationship between the variables shrinkage and m^2. Upon that limitation, there is the important fact that even if a moderate correlation is implicit, it will not imply causality so one could not affirm that m^2 cause fruit shrinkage.

Similarly, the full-time equivalent variable corresponds to an accounts-base vision, which means that operationally in stores the given *fte's* may be allocated to other business units' sections. Also, there is not a value for *fte's* given to the fruit's category but instead, a value for all fruits-and-vegetables' business unit. The number of SKUs is also fallacious since it is a non-accurate indicator achieved by counting how many fruit SKUs sold in February and however, an SKU might be opened in stores but not sell or neither have the space to be exposed in stores. Equally important, the drive of the case study is a detailed/precise identification of processes, activities and/or procedures that indeed cause fruit shrinkage. According to the previous and since in a case study methodology the "research scope can be expanded, the focus shifted or other sources sought as the study progresses" (McCutcheon and Meredith, 1993: 243) a qualitative analysis became clear as the most appropriate methodology. Using qualitative research methods the case study grew into an exploratory nature, particularly suitable to clarify and understand a problem, such as when one is unsure of the precise nature of that problem (Saunders et al, 2009), which is the exact case regarding fruit shrinkage in this context. Within exploratory case studies there are three principal methods recommended, a search of literature, interviews with experts in the subject and focus group interviews (Saunders et al, 2009), hence, as one may infer later in this section, all the three are part of the research strategy followed in this work project.

Along with the technical research for this approach, which included a careful research of literature on retail industry, shrinkage matters, fruit as a product and, supply chain management, it became indispensable to have a perspective of SONAEMC's functioning and culture. Particularly, it was crucial to get familiar with all kinds of procedures and processes involved in the journey fruits take until its providence into stores. For those reasons, a

mapping of the fruit supply chain was cunningly designed and simultaneously, discussions with experts involved in it were taken in the form of non-structured informal interviews. The aim was to identify according to the people involved in the activities throughout the supply chain, how and why fruit shrinkage occurs and then allocate the spotted phenomena to the respective stage within the chain they occur. The abovementioned course was only possible through visiting stores both front and back-office, participant observation[3], research of SONAE's internal documents describing procedures and, open dialogue interviews with people involved in the activities. Regarding the participant observation, it is important to refer that about nine stores *CBD* were visited. Moreover, the conclusions on the methodologies were inferred through an interpretative paradigm. The about eighteen interviewees were selected as people that deal daily with fruit in the stores, fresh groceries managers, supply managers and store managers. The choice of non-standard interviews as the first qualitative data collection method fell on the allowance of freer flowing dialog due to the flexibility conceived to the interviewee. The described path enabled a primary identification in the fruit supply chain of danger zones and bottlenecks. A danger zone corresponds to a potential danger process or activity that can directly or indirectly cause shrinkage, i.e., a "hot process" (Beck & Peacock 2005) within the chain that may cause rupture but not for time enough to be considered a bottleneck, which causes inefficiencies through causing the whole chain to slow down by taking the longest time (Goldratt, 2004).

In order to validate the first conclusions semi-structured interviews were the chosen methodology. A densification and validation of the solidity of the identified dangerous zones and bottlenecks and implicitly of the sources of fruit shrinkage was therefore allowed and, ultimately, a rationale behind the prioritization of the improvement recommendations became possible. It was somehow an assurance of the validity of the qualitative research

[3] "method in which a researcher takes part in the daily activities, rituals, interactions, and events of a group of people as one of the means of learning the explicit and tacit aspects of their life routines and culture" DeWalt, Kathleen and Billie DeWalt. 2011. *Participant Observation: A Guide for Fieldworkers* (2th edition) pp. 1

methods since the quantitative was getting neither, near robust results, nor conclusions. As result, a group of thirty-three interviewees were carefully selected, i.e., professionals with the necessary know-how to grade the identified fruit shrinkage sources in terms of significance. It is important to refer that the analysis of this gathered qualitative data, i.e., the validation and graduation of the variables was conducted similarly to before through an interpretative paradigm. With that in mind, once semi-structured these were a type of face-to-face interviews that covered a list of predetermined questions the interviewer had to rank or in other words, to graduate interpretively consonant interviewees responses. Consequently, these semi-structured interviews were the main data gathering method as they grounded the final interpreted conclusions of how and why shrinkage occurs in fruits. Regarding improvement opportunities and correspondent solutions/recommendations the approach was analyzing its possibilities and making potentiality assessments in a superficial perspective.

4 The Fruit's Supply Chain

In order to map all the activities involved in supplying fruits to an end consumer within SONAEMC's it is important to mention, simplistically, that a supply chain comprises suppliers, distribution centers, retail stores, customers and the in-transit phases. Furthermore, the concept of supply chain management concerns managing effectively supply chain operations by preserving a precise track of products and guarantying the delivery of the right product to the right place at the right time while yielding the greatest possible profit and assuring quality for full customer and consumer satisfaction.

SONAEMC's end-to-end fruit supply chain starts in Commercial and Store's Space Department (C&SSD) where Commercial Managers sometimes with Micro Space Specialists review the active range of SKU's. Then, the in-store procurement stage followed by the Procurement and Stocks Management Department (P&SMD) stage where orders are processed and then communicated to the Distribution Center (DC), the stage that prepares

and ships merchandise until stores. Goods are stored in store's warehouse and also, the quality department stage arises since merchandise is subject to a quality control if needed. Posteriorly, the goods are exposed in the retail store stage. A detailed description crucial for a better understanding of the activities involved in it can be consulted in appendix 2.

It is important to emphasize that an active management of the all supply chain and the assurance that all steps are followed properly fosters a sustainable competitive advantage within a highly competitive industry that is retail food industry and in particular, within this concept of convenience stores that is boosting. Most importantly, neglecting it has a drastic impact on fruit shrinkage, which will be perceived further in the analysis.

5 How and why is fruit shrinkage being caused within the supply chain?

It is fundamental to reinforce that the how and why were inferred through an interpretation of the feedback received during the first interviews and through the participant observation while designing the supply chain. To each given cause, it was allocated a correspondent stage in the end-to-end supply chain.

5.1 Commercial Department and Store's Space Department (C&SSD)

The first bottleneck identified **[1]** belongs to C&SSD stage of the end-to-end supply chain. In fact, active range of fruit SKUs might not be adjusted to each store reality given its space available, which implies that supply is not adjusted to the demand. This occurs mainly because SKUs stores *CBD* have active selling are defined more generally than what would be advisable and not concerning each reality, individually. Hence, a *CBD* without determined SKU might have foregone sales while other with it is hampered since the SKU not selling and without rotation will be direct known shrinkage. Moreover, same fruit variety might be sold in different packaging molds hindering customer's purchase decision. Yet, some of the packaging may sometimes increase product's wastage likelihood, e.g., kiwi that is packed in

"*cuvetes"* and hence, too tight considering its semi-soft consistency. A*ctive range of SKUs* can also yield unknown shrinkage, fact clarified later in this sub-chapter.

5.2 In-store procurement

Within in-store procurement stage one of the main variables considered by the ordering system is the in-store fruit stock that most of the time is not accurate with the actual stock. Consequently, orders suggested by the system in danger zone **[2]** will be highly fallacious indirectly provoking unknown shrinkage since there is no immediate perception of stocks' misfit, which is only known after an inventory audit. To give context to this process failure one must consider that fruit is a product both bought by clients and received in stores daily. Thus, stores should order an optimum quantity for the daily sales to prevent excessive stock or, foregone sales if ordered stock is not enough to satisfy the demand.

Many motives can incite incorrect fruit stock levels in the system. The tool titled exceptions' list is computed daily by the ordering system and states all fruits with a negative stock in the system. Hence, the supply manager's duty is to verify the exception's list every day and check both at the warehouse and store the quantity of each fruit variety under the mentioned circumstances, and level it in the system accordingly to adjust the stock. When the exception's list is neglected the stock will remain incorrect and the orders inaccurate. So why are there products with negative stock? An issue known as causing negative stock concerns one of the activities in checkout cashiers since operators may inadvertently weight fruit in the checkout balance with the wrong price look-up (PLU). In practice, if one sells Pink Lady apples but registers it as a sale of Fuji apples the latter stock will be negative and the Pink lady's stock will be positive by as much. Thus, the system will have wrong information and consequently, it will generate a wrong order of Fuji apples. In summary, it will generate shrinkage in one case and foregone sales on the other. This situation is enhanced under moments of pressure when operators are struggling to reduce waiting lines, due to their lack of knowledge about fruit or because some fruits are indeed hard to differentiate within the

active SKUs, which explains why the latter also generate unknown shrinkage. The reason why distinction of some fruits is barely possible falls on the existence of two product lines "Continente" and "Selecção", the first with quality yet more economic than the second which is premium. E.g., if one considers both lines of kiwi or mangos their distinction is greatly hard due to its physic similarities, in fact, differences consist essentially on taste and size. As prevention, most of the products have a respective sticker indicating which line they belong to, yet some clients may simply disregard the sticker before putting the items on a plastic bag and buy the premium item at the economic price. If there are self-service weighting scales or self-scanning and self-checkouts, clients may also (intentionally or inadvertently) change the fruit PLU while weighting it or even, e.g., weight two apples and put instead four in a plastic bag (stealing). All these scenarios within danger zone **[3]** in the form of external theft will, similarly, trigger negative stocks and damage stocks levels accuracy.

Motives for simply incorrect stock levels in the system go beyond the exception's list. Although unusual in fruits and so not recognized as a danger zone, internal theft may occur if operators steal fruit either within the store's warehouse or anywhere in the DC. Moreover, the loss each fruit variety produces must be registered in the system daily and after approved by the responsible operator. Yet, that registration may neither occur nor be approved, which in the last case means the approval will be by the system which can lead to errors. Both are process failures within danger zone **[4]** of the store's warehouse stage.

Fruit inaccuracy stock values may also be due to one issue in danger process **[5]**, the invoiced fruits not corresponding to the received in stores, i.e., when there is stock missing in the delivered merchandise due to a mistake in the DC. Again referring the ordering system, the activity **[6]** within the in-store procurement stage is considered a danger zone since supply manager's critics (cuts and reinforcements) may be more based on gut feeling than prior experience, which naturally, risks order's accuracy.

5.3 Distribution Center

A danger zone **[7]** is spotted in the DC since pallets loaded in transportation vehicles may inadvertently or due convenience violate restraining loads, which is a process failure that cause directly known fruit shrinkage. Restraining loads consist, e.g., in temperature requirements accordingly fruit's typology. Pallets must be loaded accordingly, in order to minimize the impact on fruit during in-transit phase and to slow down the ripening process.

5.4 Store's warehouse

In this stage, there is a danger zone **[8]** considering that pallets delivered may not be in proper conditions, e.g., at the adequate ripening stage if supplier sent product non-compliant with the necessary specifications or, without stains or mashed if not properly loaded in vehicles by the DC. Also, non-conformities might not have been detected during the quality checkup in the DC since it accounts only for a random sample. Another danger zone **[9]** concerns the fact fruit merchandise might not be disposed in the existent layout and accordingly each product typology in order to avoid heavy fruit above softer fruit, which directly causes known shrinkage. Moreover, operators may not place fruit requiring cold in the fruits-and-vegetables refrigeration chamber or in the Charcuterie-and-Cheese's (sharing is allowed with this business unit), which means, e.g., ripening of strawberries or grapes will be fastened and provoke direct known loss within this danger zone **[10]**. This occurs namely due to structural reasons, e.g., lack of space, or lack of concern. The warehouse might also have an inadequate temperature for fruit's maintenance, occasionally hard to control if caution is not taken.

5.5 Retail store

Some operational failures also enhance known fruit shrinkage probability. The first failures creating a danger zone in process **[11]** are directly related with a merchandising manual that deters pre-defined indications of how to expose fruit in shelves and displays to avoid its damage, e.g., acquiring stains or being mashed. That said, overfilling during exposition must

be avoided, some fruit must be maintained in its original box and some must be put in alveoli. Similarly, the non-compliance of the methods FIFO (First In, First Out) and FEFO (First Expired, First Out) will directly generate known shrinkage through wastage and, the lack of fruit highlight if under promotional activities, since the extra stock to fulfil extra demand that way will not reach its full potential of sales.

Another danger zone arises in process **[12]** due to lack of sorting and multi-replenishment both crucial for an appealing fruit's section. The first not only avoids foregone sales but also a poor look of the section. During replenishment it should be given priority to items with more rotation since the problem is a contribution to excessive stock accumulation. Also, the handling of fruit during it might not be the correct to minimize damage, e.g., holding boxes touching other fruit, sloppily evict a determined fruit variety... In what regards sorting, it might not be as frequent as necessary (there is more concern during *CBDs* opening). Yet, only one piece of damaged fruit may contaminate others nearby. In practice, and through the participant observation, most of the stores *CBD* do not follow the manual and that, might be due to structural reasons, e.g., lack of human resources (*fte's*) or space in stores.

Adding more danger zones within this stage, not updating to format "*Repus*" means less restrictions preventing overfilling of shelves or displays due to the restructured format. Indirect shrinkage may also occur due to fierce competition and less sales if intense competition nearby the store, either modern retail or traditional retail. Also, if *CBDs* are under promotional activities and the competitors respond accordingly, the extra ordered stock will generate known shrinkage if not selling. Though, this is not that linear since a store might lack competition but have little consumers. The design of the fruit end-to-end supply chain and correspondent danger zones/bottlenecks identified are discriminated in appendix 4.

6 Interviews analysis

6.1 Categorization

Interviewees from SONAEMC were selected according to their assumed knowledge on the subject base on their job titles somehow related, years of experience and different hierarchy levels (within individual departments). Equally important, they were expected to cover all the supply chain but it was not possible to schedule an interview with DC representatives neither through email. The remaining stages are diversely represented, which contributes to a complete and proper data gathering. A descriptive table of the interviewees is presented in appendix 5. Interviews were conducted face-to-face with the exception of few store operators that were exceptionally through email due to distance reasons. They covered twenty-nine predefined questions about processes and activities identified during the informal interviews as causing fruit shrinkage, which allowed a planned efficient discussion. Precise and detailed, questions allowed a direct response and thus, an accurate interpretation of their ranking. Underlining, questions were structured to deduce through interviewees' opinions the extent that the compliance of certain procedure or activity within the stages influence the prevention/reduction of fruit shrinkage.

6.2 Interpretative paradigm

The method to interpret interviewees' responses follows. If the interviewer interpreted the response as stressing intensively the compliance of the phenomenon referred in a determined question, a maximum intensity was considered to the implicit cause in it. If that interpretation ascertained otherwise and the interviewee did not stress at all the topic in the question, no intensity to the implicit cause within it was inferred (see appendix 6). The linkage between questions and implicit fruit shrinkage cause can be observed through appendixes 7 and 8, e.g., if QA was poorly stressed the primary cause A was interpreted as having minimum intensity (minimum weight on how and why fruit shrinkage occurs).

6.3 Group Responses

The first method to analyze interviewee's responses was through groups of interviewees belonging to each of the stages of the supply chain. Thus, each stage of the supply chain reached a different result, which is a great indicator of how important is including in the interpretation of fruit shrinkage causes, a diverse sort of opinions with different interviewees' backgrounds. An example of a group response's detailed analysis is offered on appendix 9.

6.4 Global Tendencies

The second bench of interviews allowed a densification of the how and why fruit shrinkage occurs and an accurate insight of primary identified causes intensity to validate with more certainty and through analyzing global tendencies, which ones can indeed be considered danger zones and bottlenecks (see global tendencies' results in appendix 10).

Starting by the phenomena **stressed intensively**, one can mention reckless handling of fruit during replenishment and lack of frequent sorting. Both maximum intensity danger processes since both increase fruit's damage and the likelihood of not being bought by customers. Those if complied could prevent known shrinkage significantly. The maximum weight was also given to the non-compliance of the FIFO and FEFO methods indeed maximum intensity danger activities. Likewise both, the ordering system with its inaccuracy in stocks levels and the (consequent) excessive accumulation of stock were concluded as maximum intensity danger zones. Yet, the second cause was taken out from these final conclusions since it is implicit in the first (it is a direct consequence). The last maximum intensity danger zone is the negligence of the exceptions list that if managed effectively can reduce errors in stock levels in the ordering system and so, prevent misfit orders and its direct consequences. These danger zones and activities are the ones with most impact among all.

The **highly stressed** causes concern fruit exposition non-complying with the merchandising manual, a lack of multi-replenishment and consequent excessive accumulation of stock in the warehouse or a lack of highlighting of goods under promotional activity not enabling stock to

be cleared out. These three causes are high intensity danger activities. It were also highly stressed wrongly weighted goods in self-service weighting scales, the change of PLU codes by customers and cashiers' staff or a too high temperature in stores and in the warehouse. Additionally, the non-placement of goods needing cold in a refrigeration chamber, the absence of daily shrinkage recording, cuts and reinforcements based on gut feeling, mismatch in active SKUs considering stores' reality and space available, merchandise non-compliant with specifications in terms of quality or ripening state, missing stock in the pallets prepared for stores in the DC by mistake and finally, packed pallets in the vehicles not concerning different fruit typologies and consequent impact in fruit. These mentioned causes occur within different stages of the supply chain and all but two consist on high intensity danger zones or activities. Accordingly, the mismatch of active SKUs and the in-transit phase of merchandise loaded randomly in pallets are considered bottlenecks. The first because SKUs revision takes considerable time, effort and resources and the execution of outcomes is not straightforward. Yet, during the process fruit shrinkage keeps indirectly occurring. The second is a bottleneck since the in-transit duration can cause damage in the merchandise (due to wrong pallets packing) that will arrive in stores already in the form of known shrinkage.

Increasing both high intensity bottleneck efficiencies can reduce fruit losses occurrence.

Interpreted as in the category of variables with **moderate intensity** regarding impact on fruit shrinkage is the external theft in self-scanning and self-checkouts, a non-update of stores for the REPUS format, which could prevent overfilling of exposed fruit, among others, intense competition that prevent the stock rotation, the merchandise storage neither according each fruit typology nor in the designated layout, the fruit shrinkage approval by the ordering system encouraging errors and the merchandise transportation from DC until stores in inadequate conditions. Though moderate, these phenomena cause enough damage to be considered medium intensity danger zones. The only stressed poorly and so, interpreted with

minimum intensity is the internal theft of fruit. For that reason, it was not given enough impact to be considered a danger zone.

6.5 Exceptions

A group of three interviewees, fresh groceries managers each from a different *CBD,* stood out from the results for having particular responses regarding what in their opinion had most importance. That said, they essentially stressed almost all the phenomena with no intensity at all to moderate intensity. These singular responses can be observed in appendix 11.

6.6 Additional exploratory research information

Global tendencies had the particularity of not having any of the variables stressed with no intensity, which gives validity and robustness to the prior conclusions. In fact, only two of the variables were updated to bottlenecks and one excluded from the list by being intrinsically related with other. Nevertheless, additional reasons of how and why fruit shrinkage occurs were mentioned by SONAEMC's specialists during these interviews, which completed the value of the gathered qualitative information. Their detailed identification and description is available on appendix 12.

These causes identified after semi-structured interviews can be as significant as the others mentioned before, nevertheless, intensity could not be assigned since they were gathered as additional comments and not through the same technical process. A summary of final conclusions regarding fruit shrinkage causes' intensities is presented in appendix 13.

7 Improvement Solutions

7.1 Checklist

One of the main deductions from the semi-structured interviews is that **process failures** within store operations are of major importance concerning fruit shrinkage prevention. Numbers support this interpretation, known shrinkage accounts for 84% of total shrinkage in *CBDs* while unknown accounts for 16%.

The Checklist, directed to Fruit Store Implementation Specialists from C&SSD, recommends close and efficient monitoring of stores behavior regarding procedures interpreted as essential in known fruit shrinkage reduction. Ultimately, allows its prevention even if only already defined procedures are followed and controlled throughout the supply chain. Since the trade-off between cost and implementation was not foreseen as disquieting this tool was developed throughout the internship. The criteria to define store's activities to be included required them to be observable and so, they concern both operations within stores and its warehouse and process failures in the supply chain that are only perceived in stores. In appendix 14, a sampling of the Checklist computation is presented of the part that concerns fruit's exhibition in *CBDs* aiming at verifying whether they respect the merchandising manual. Since it would not be feasible to check exposition norms in the merchandising manual of every fruit variety at stores, a top ten of fruit with higher known shrinkage (in value) must be taken (and monthly updated due to seasonality) to have priorities of observation. The Checklist was designed for insignia Bom Dia but can easily be adapted to other realities. In fact, it was tested with a Fruit Store Implementation Specialist (Carmo Matias) in nine best and worst performance *CBDs* in terms of fruit shrinkage, whose know-how was of most importance to actually attest its usability.

Within *CBDs* is particularly crucial to have a flawless looking fruits' section since customers within convenience stores buy mostly products of the day, which is fruit's case. Customers evaluate essentially quality and freshness, which is perceived through eyesight or smell. These considerations contextualize the store's operations importance since without them that perception is impossible. If this does not occur, customers will hardly buy, independently of the price. As the Checklist helps guarantying these conditions, if impeccable, overall store sales can increase considerably.

It is crucial to refer internal activities and procedures mirrored in the thirteen variables in the Checklist may not be obeyed since stores lack favorable conditions, either structural if

considering some *CBDs* have significantly little space in the warehouse or in the fruit's section itself in-store or, either lack of human resources. Precisely, the Checklist deters an extra column, which validates if the non-compliance of determined procedure is due to structural motives and other, to elaborate and comment.

7.2 Human Resources

The lack of human resources may affect negatively the shrinkage issue, operators may not have enough "time" to perform all tasks assigned thus compromising the success of complying with variables on the Checklist and also, with others previously mentioned as relevant within different activities in the supply chain. Having more people assigned to in-store work has especial potential considering *CBDs*, which due to its dimension are the stores with less *fte's* than advisable. The trade-off stands for added costs but this necessity referred frequently by second interviewees is vital to motivate overworked employees and in the long term, improve *CBDs* sustainability.

7.3 Ordering System

It is of maximum intensity priority to increase precision on the orders the system launches, one step towards this goal is to perform a more frequent inventory count, which is directly related to the need for extra resources. Upon that it must be institutionalized stores' obligation of fortnightly and accurate inventory audits. Likewise, the activities categorized as stock information influencers, namely exceptions' list inferred, must be taken as an issue and be addressed. Also, the variables used by the ordering system should be revised and extended with others that can increase the exactitude of the suggested orders. In fact, it would add value if the system considered as variable what the competitors have in promotional campaigns and correspondent prices since sometimes campaigns have mutual fruits in promotion and the extra quantity ordered might be undermined for that reason, mainly, if the competitor's price is the most appealing. Also, since the system estimates next sales based on an average of the foregoing, it would be valuable to consider the price cuts seldom made

(which increase quantities sold, yet, as a consequence of an isolated event) within a period shorter than the presently forty eight hours. That delay jeopardizes orders during the given period. Also, it is important that operators analyze (effectively) orders by the system and critic it within the possible period so emphasis and control of this procedure accordingly should take place otherwise excessive or lack of stock will be verified.

7.4 Active range of SKUs

SKUs are defined for fruit category based on clusters that enclose hypermarkets Continente and Modelo and convenience *CBDs*. Logically, these three insignias are separate realities and the range of fruits sold in a *CBD* should not probably deter as much variety as one from Continente with the triple space for fruit section. Moreover, stores even within the same insignia have different customer profiles and different typologies (e.g., rural or urban), which increases the need for a SKUs definition based on more exclusive clusters. In order to infer the level of misalignment of the SKUs an ABC analysis was conducted to classify them in terms of their relative importance. The time horizon enclosed 2014 and therefore all the fruit SKUs that were active throughout that year. As it can be deducted from appendix 15, 75% of all fruit SKUs account for almost 88% of net sales while the remaining account only for 12,2% of sales. Similarly, 75% of SKUs represent 86,1% of profitability while the others 13,9%. In summary, there is potential to define new clusters and to propose adjustments in the SKUs to a better fit with each store reality.

7.5 Final remarks

Additionally to the suggested solutions based on the known priorities, one must remember that the huge impact shrinkage has may be caused due to numerous reasons. In fact, this work project reunited a group of thirty seven "hows" and "whys" that together have harsh consequences. Proposing additional key changes upon priorities even if, naturally, some have more impact than others, is crucial for an effective management of the problem. If little changes are made the final potential might be surprising. Bearing this in mind, and

remembering staff employees in cashiers being responsible for some changes of PLU codes it would be of most importance include in their training apart from cashier functions classes about the fruit category. And also, to officially require them before starting daily functions to take a look of the section and infer, which fruits are being sold. In fact, it is the only fresh grocery they indeed sell in the sense they have to weight it and scan the respective PLU code. Sufficient knowledge about the products to distinguish, e.g., different apple varieties or whatever they need to weight is crucial.

8 Limitations

Regarding the semi-structured interviews there is a limitation given that the intensity of the listed variables compliance in reducing and preventing shrinkage depends somehow on fruit varieties. Different variety different intensity, one may infer. Yet, it was not feasible neither pragmatic conducting a study regarding only one fruit variety thus, it is important to underline the responses by interviewees and correspondent interpretation was made thinking generally about the fruit as a perishable fresh grocery.

In part justified by the perseverance in the industry of the studied theme is crucial to refer its complexity and by that emphasize that conclusions on the causes were reached through a reliable and detailed path, which would never be possible if not actually inside SONAEMC's and direct, constant and tuned contact with professionals and stores' realities. However, the interpreted causes are not surely representative of all that is causing fruit shrinkage in the company even because the research method was qualitative, so, other not mentioned "hows" and "whys" might exist to be discovered.

If more time was given more detail could have been specified in supply chain, however, it deters an accurate and detailed representation of the reality since minimal activities were not considered like the selling of fruit through Continente Online.

9 Conclusion

It is impossible to completely extinguish fruit shrinkage due to the natural perishability of the product that even if subject to minimal handlings is easily damaged. Also and as previously mentioned, different fruit varieties have different requirements in terms of handling or temperature. For those reasons, this work project sought a better understanding of the roots of the problem through exploring how and why fruit shrinkage is caused in SONAEMC's *CBDs* dynamically expanding. It was conducted with the purpose of answering this same statement and simultaneously three correspondent sub-questions.

In a global summary, the fruit shrinkage in insignia Bom Dia concerns three principal areas of occurrence with similar intensity. That said, and answering the mentioned sub-questions, store operations and procurement are responsible for an extensively portion of fruit shrinkage while active range of fruit SKUs account for a highly portion. Hence, one can discriminate operational shrinkage and procurement related shrinkage as the principal roots followed shortly by the range of SKUs.

The key reflection is that controlling and monitoring identified process failures throughout the supply chain and giving operators conditions to a better performance, increasing their sense of responsibility towards a good store performance, has great potential in fruit shrinkage optimization. In fact, guaranteeing monitoring and control of the processes inherent to the supply chain might be more effective, easier and faster to deal with, than the other sources[4]. This is valid for the two major fruit shrinkage sources. Underlining, operators due to overwork get demotivated and not seeing its value recognized will stop caring and fighting for adding value to the company. Improvement is dependent on human capital

[4] "In addition, fixing many process failures can often be much easier and quicker than dealing with other types of shrinkage such as external and internal thieves, primarily because it is often about ensuring that staff throughout the supply chain maintain and observe company procedures and processes. It does not necessarily require significant investment in new technologies - the solutions are often much more straightforward in the form of better training, supervision and control." Beck A. and Colin Peacok. 2009. *New Loss Prevention: Redefining Shrinkage Management, pp. 82*

needed to perform and control the daily processes inherent to end-to-end fruit supply chain. It is of most importance to verify that is not the lack of resources preventing must activities to be followed. In what concerns, the range of fruit SKUs, although slightly lower impact, it is indeed worrying given the indirect impact it has one the operational and procurement related shrinkage. The excessive accumulation of stock or foregone sales due to the supply mismatch with demand are not the only consequences of the lack of adjustment SKUs given stores reality. In fact, to that shall be added the enhancement of PLU codes exchange namely due to excessive references of apple and the direct consequence it has on wrong stock levels in the system.

Furthermore, prices' competitiveness and product's quality is essential considering the highly competitive industry it is food retailing. In fact, a freshness image must be seen not only within the fruit category but also in the whole fruits-and-vegetables business unit. Each category section next to each other, emanating excellence, will enhance cross-selling. SONAEMC works hard, on a daily basis, to provide the best quality produce to its stores and to increase its competitive advantage. Yet, the motivations must encompass there is always room for improvement and that is mirrored in the interest of this challenge, aiming at strategies for fruit shrinkage optimization. In fact, after the computation of the Checklist next steps enclose a SKU's range revision by defining clusters for stores *Bom Dia* for each respective region individually.

Thinking about the industry as a whole, it is already time for the loss prevention departments being given total support from upper levels and that new strategies and solutions suggested become a priority rather than being awaiting respective implementation. Fruit shrinkage consequences need to be clearly perceived and communicated within enterprises potential drastic realities in the long term.

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Appendix 1 - *Description of data indicators collected for CBDs*

Indicator	Explanation
Fruit's net sales (NS)	This indicator of net sales considers the discounts given to customers in *Continente*'s card. Money that can be applied in other SONAEMC's insignias.
Fruit's reported net sales (RNS)	This indicator does not consider the discounts given to customers in their *Continente*'s card, which means that the value in the card is taken from the indicator;
Fruit shrinkage in value	Value of shrinkage in euros (€);
Fruit shrinkage in percentage of NS	Fruit shrinkage in value divided by fruit's NS;
Fruit shrinkage in percentage of RNS	Fruit shrinkage in value divided by total fruit's RNS;
Fruit's square meters in stores (*m2*)	The square meters the fruit's section ocuppies at stores;
Full time equivalent (*fte*)	One *fte* corresponds to forty hours of labor (by employees) in fruit's section at stores;
Average duration of fruit storage "*Dias de Rotação*"	Number of days fruit stock in stores takes to be sold;
Age of the store	Number of months since the store's opening date;
Active range of SKUs	The number of SKUs of fruit category active in stores;

Appendix 2 – *Detailed Description of the activities and processes that take place throughout the supply chain*

The end-to-end supply chain starts where commercial managers review active range of SKU's due to fruit's seasonality and when considered necessary propose optimizations. If feasible, those proposals are evaluated by the store's space department in terms of validity considering the space available in stores for the fruit section. Hence, within this Commercial and Store's Space Department (C&SSD) stage there is an active communication between the two parties that define a macro planogram in the form of merchandising manual. The latter serves, namely, to guide stores while defining the presentation stock (PS), which is the fruit stock required for in-store presentation purposes so that shelves and displays do not look empty and that fruit when in its season is highlighted. Also, PS's definition needs to be inserted in the store's online system due to in-store procurement reasons. Already in in-store procurement stage, there is a set of activities concerning how fruit's orders are processed. Stores own an automatic ordering system that calculates the optimal quantity for daily fruit orders that have a lead time of forty-eight hours. That ordering system uses an algorithm of paramount importance, it combines an estimate of different variables that will infer the suggested orders and, its accuracy on calculating the orders has direct impact on the loss. Detail on those vital variables can be observed in appendix 3. Based on this algorithm for each fruit variety an order is launched. Then, the *supply manager* if not satisfied with the orders suggested can critic with cuts or reinforcements, which are in a next stage, validated by the Procurement and Stocks Management Department (P&SMD). The stock managers evaluate the stock possibility and the timing of the cuts and reinforcements and decide a final order and buy fruit from suppliers that will later deliver the merchandise in the distribution center (DC). It is important to refer that orders computed in stores may be directly requested to a supplier without P&SMD intervention, a process called "Direct Delivery" with a lead time of twenty-four hours. After deciding the orders the department buys from the supplier and the DC is given all the information about it.

In the DC stage, the communication of orders received is analyzed and accordingly the

pallets for each store, individually, are prepared. If there is enough stock in the center to satisfy the order a picking by stock (PBS) takes place. If not, the operators wait for receiving the daily merchandise delivered by the supplier and a picking by line (PBL) is verified. In any case, a sample of the merchandise is verified in terms of quality and, if not in proper conditions it is immediately returned to the supplier or in the inability, properly identified and separated from the remaining fruit to be disregarded later where there is an end. If conforming to the specifications pallets are prepared and loaded in transportation vehicles for its shipping until stores.

In a later stage, the merchandise is received in the store's warehouse either directly from the supplier, as mentioned, or through a "Centralized Delivery", which means it was shifted from the DC. After the reception, fruit' quantities are registered in the ordering system and goods itself are subject to a quality checkup that, at this stage, involves all the merchandise received and not just a sample. If the conditions are the expected, the fruit is directed to its storage according to its typology and the existent layout. In contrast, if fruits are not in a satisfactory condition the store is given the tools to launch a note ("*PDE"* as in request of devolution) for the Quality Department (QD) and ask consent for a credit in the respective supplier or for a physical trade, either way, the process ends. The note has twelve hours to be done, after the reception of the merchandise and must be accompanied by descriptive pictures. If consent is not given, fruit is registered as shrinkage in the ordering system and separated from the rest in a designated area. The process ends when is taken to the garbage.

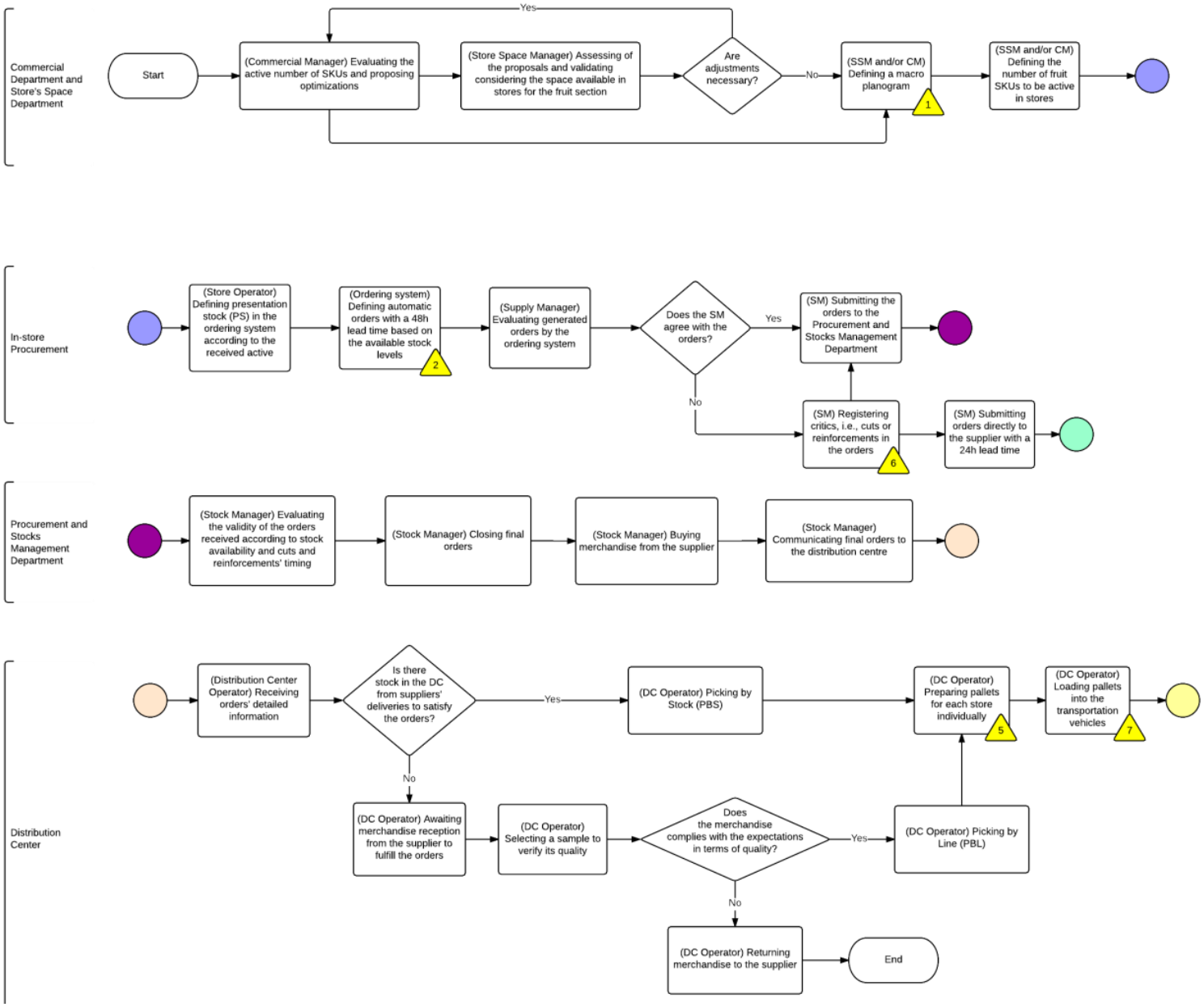
Ahead in retail store stage, the fruit is exposed in displays and shelves according to existent procedures within the merchandising's manual and hence, presented to customers. The customers originate a sale if their decision is to buy. If their decision is otherwise, fruit with no rotation is direct loss and once more, its quantity must be registered in the ordering system as shrinkage. Either way, the fruit supply chain ends.

Appendix 3 – *Description of variables included in the ordering system*

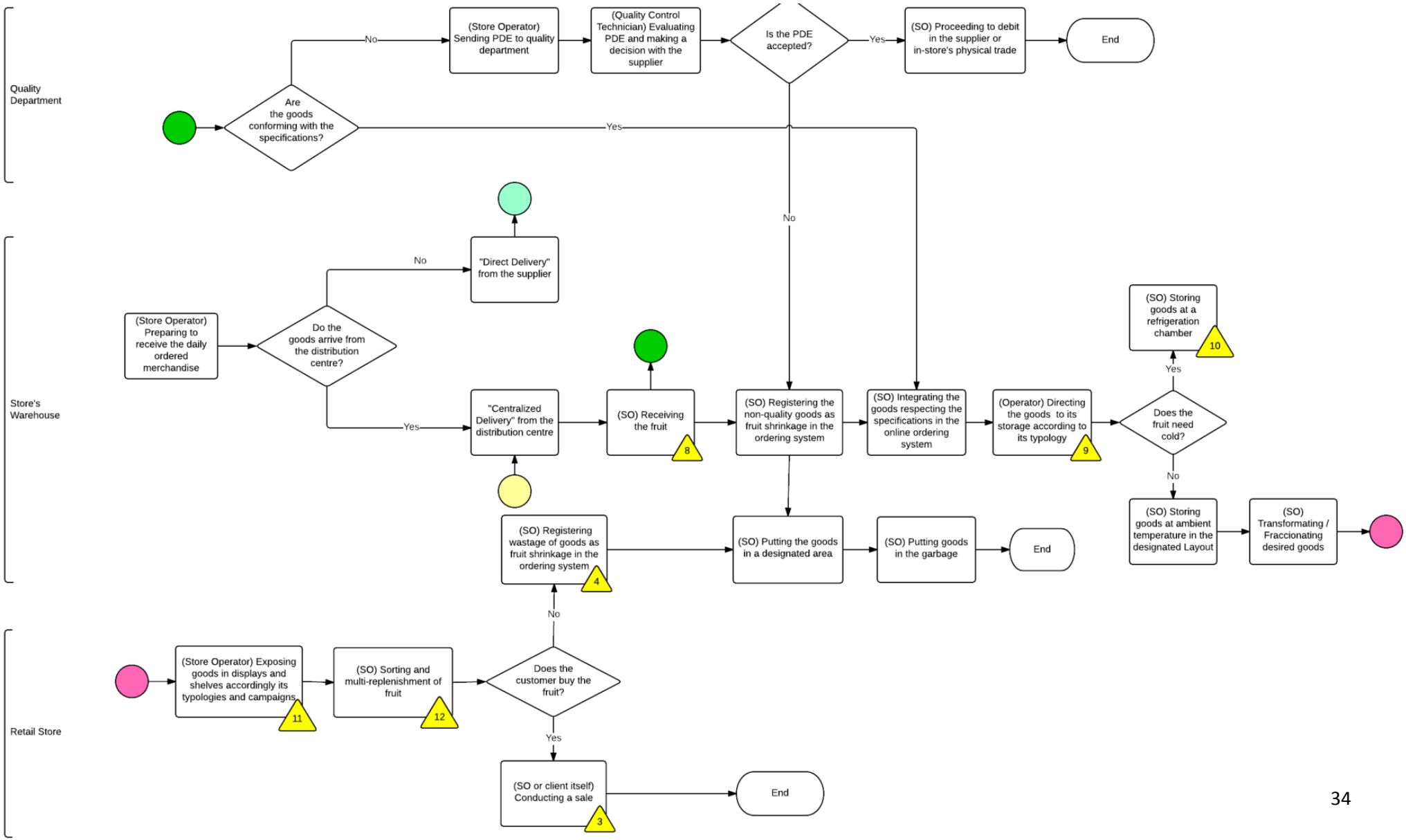
The ordering system uses an algorithm that combines an estimate of different variables and computes an order for each fruit variety active in the range of SKUs:

- An estimation of fruit's sales two days from the date the order takes place, based on average past sales;
- The day of the order (to have in consideration stores sell more at weekends);
- Convenience stores *CBD's* promotional campaigns;
- The active range of *SKU's*;
- The presentation stock;
- The levels of fruit stock in it;
- In-transit fruit stock and expected fruit stock (the stock stores are going to receive today and tomorrow, respectively);
- Minimum and maximum stock needed to avoid foregone sales ("*cobertura de stock"*)

Appendix 4 – *Identification of danger zones e bottlenecks in the end-to-end fruit supply chain (Part I)*



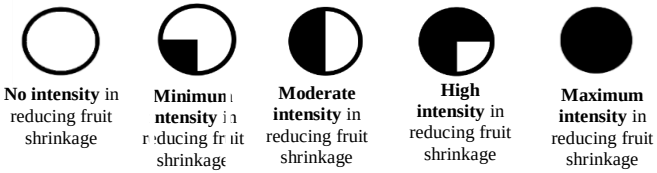
Continuation of Appendix 4 - *Identification of danger zones e bottlenecks in the end-to-end fruit supply chain (Part II)*



Appendix 5 – *Interviewees' categorization*

Interviewee	Name	Age	Experience(years)	Job Tittle	Department/Supply chain stage	Hierarchy	Group
I1	Patrícia Nogueira	33	14	Project Manager	Business Analysis and Development Department	3	I
I2	Luís Belchior	57	20	Operations Manager (Stores Bom Dia South Region)	Store Operations Department	3	I
I3	Daniel Almeida	38	15	Senior Business Analyst	Loss Prevention Department	3	I
I4	Carla Martins	42	14	Fruit Store Implementation Specialist	Commercial Department of Fresh Groceries	3	II
I5	Carmos Matias	47	12	Fruit Store Implementation Specialist	Commercial Department of Fresh Groceries	3	II
I6	Elsa Antunes	40	8	Director	Commercial Department of Fresh Groceries	1	II
I7	Vasco Gomes	50	10	F&V Business Unit Manager	Commercial Department of Fresh Groceries	2	II
I8	Nuno Passadinhas	40	14	Fruit Commercial Manager	Commercial Department of Fresh Groceries	3	II
I9	Rui Júlia	43	17	Pricing Analyst	Commercial Department of Fresh Groceries	3	II
I10	Elsa Peixoto	44	21	Fruit Stock Manager	Procurement and Stocks Management Department	3	III
I11	Carla Guerra	44	14	Fruit Stock Manager	Procurement and Stocks Management Department	3	III
I12	Tiago Marques	42	20	Director	Procurement and Stocks Management Department	1	III
I13	Luísa António	40	14	Area Coordinator	Procurement and Stocks Management Department	2	III
I14	Francisco Patrício	29	<1	Fruit Campaign Technician	Procurement and Stocks Management Department	3	III
I15	Miguel Mamede	30	4	Senior Business Analyst	Procurement and Stocks Management Department	2	III
I16	Susana Sousa	44	18	Quality Control Technician	Quality Department	3	IV
I17	Cátia Pereira	31	6	Quality Control Technician	Quality Department	3	IV
I18	Sandra Serra	38	20	Fresh Groceries Manager of CBD Massamá Sul	Warehouse of the Retail Store and Retail Store	2	V
I19	Ricardo Martinho	31	13	Fresh Groceries Manager of CBD Alvalade	Warehouse of the Retail Store and Retail Store	2	V
I20	Salete Pereira	45	16	Fresh Groceries Manager of CBD Pragal	Warehouse of the Retail Store and Retail Store	2	V
I21	João Alves	33	9	Fresh Groceries Manager of CBD Queluz	Warehouse of the Retail Store and Retail Store	2	V
I22	Inês Moreno	39	21	Fresh Groceries Manager of of CBD Caneças	Warehouse of the Retail Store and Retail Store	3	V
I23	Carla Nunes	34	10	Fresh Groceries Manager of CBD Santa Quitéria	Warehouse of the Retail Store and Retail Store	3	V
I24	Mónica Martins	39	12	Fresh Groceries Manager of CBD Massamá Norte	Warehouse of the Retail Store and Retail Store	3	V
I25	Joana Cardoso	27	<1	Fresh Groceries Manager of CBD Celeirós	Warehouse of the Retail Store and Retail Store	3	V
I26	José Santos	40	11	Perishables Manager of CBD Prelada	Warehouse of the Retail Store and Retail Store	3	V
I27	Natércia Gonçalves	39	14	Fresh Groceries Manager of CBD Boucinhas	Warehouse of the Retail Store and Retail Store	3	V
I28	Carla Marques	29	7	Fresh Groceries Manager of CBD Matosinhos	Warehouse of the Retail Store and Retail Store	3	V
I29	Paula Freire	40	11	Supply Manager of CBD Laranjeiro	In-store Procurement	1	VI
I30	Vitalina Monteiro	30	9	Fresh Groceries Supply Manager of CBD Def. Chaves	In-store Procurement	2	VI
I31	Catarina Santos	24	2	Fresh Groceries Supply Manager of CBD Matosinhos	In-store Procurement	2	VI
I32	ElisângelaCanto	28	9	Fresh Groceries Supply Manager of CBD Alvalade	In-store Procurement	2	VI
I33	Paula Helena	39	16	Fresh Groceries Supply Manager of CBD Alverca	In-store Procurement	2	VI

Appendix 6 - *Interviews interpretation criteria:*



Appendix 7 – *Primary conclusions on what causes fruit shrinkage*

Stage of the supply chain	Subject	ID	Succinct explanation of phenomena answering how and why fruit shrinkage occurs
Store	Store operations	A	Fruit Exposition not according the merchandise manual
		B	Lack of multi-replenishment and accumulation of stock in the warehouse
		C	Lack of care while handling fruit during replenishment
		D	No sorting or simply no frequent sorting
		E	No highlight of goods under promotional activity
	Operators behavior (mixes with the stock available in the ordering system)	F	Internal theft of fruit
		G	Change of PLU codes in cashiers by staff
	Customers behavior (mixes with the stock available in the ordering system)	H	Change of PLU codes or in quantities weighted versus inside the plastic bag in self-service weighting scales
		I	External theft in self-scanning and self-checkouts
	Store conditions	J	High temperature
		K	No update for *Repus* format
	Store location	L	Intense competition
Store's warehouse	Merchandise storage	M	Merchandise storage not positioned in designated Layout
		N	Merchandise storage not according to each fruit typology
	Goods needing cold require storage in a refrigeration chamber	O	Lack of attention to put goods needing refrigeration in the adequate chamber (exclusive or shared)
	FIFO/FEFO methods	P	Non-compliance of FIFO and FEFO
	Warehouse's temperature	Q	Store's warehouse high temperature
In-store Procurement and Procurement and Stocks Management Department	In-store Procurement	R	Wrong levels of fruit stock in the ordering System
		S	Excessive accumulation of stock in stores
	Influencers of wrong stock levels and consequent misfit orders	T	Negligence of the exception's list
		U	Absence of daily shrinkage recording
		V	Shrinkage daily approval by the automatic ordering system encouraging errors
		W	Critics, i.e., cuts and reinforcements based on gut feeling on the orders suggested by the ordering system
Commercial and stores' space department	Active fruit SKUs	X	Mismatch in active SKUs considering stores reality and fruit section dimension
Quality Department	Goods non-compliant with required specifications	Y	Notes noticing reception of non-quality goods launched by stores for the quality department (e.g., inadequate ripening state)
Distribution Center	Merchandise quantity (mixes with the stock available in the ordering system)	Z	Missing stock when preparing pallets to be delivered in stores
	Merchandise preparation for in-transit phase	AA	Merchandise disorganization in terms of fruit typology to minimize the impact when loading vehicles for transportation
		AB	Merchandise's inadequate transportation conditions from distribution center until stores (e.g. temperature inside the vehicle)

Appendix 8 - *Questions' content of the semi-structured interviews*

Stage of the Supply Chain	Context	ID	Questions
Retail Store	Store operations	QA	In your opinion, to what extent does the fruit's exposition being accordingly the merchandising manual, e.g., filling, number of overlapping alveoli etc., influence the prevention/reduction of fruit shrinkage?
		QB	In your opinion, to what extent does a multi-reposition according to products' rotation, i.e., reposition priorities according to fruit varieties' sales, influence the prevention/reduction of fruit shrinkage?
		QC	In your opinion, to what extent does a reposition with a careful and correct handling influence the prevention/reduction of fruit shrinkage?
		QD	In your opinion, to what extent does a frequent and whenever needed sorting influence the prevention/reduction of fruit shrinkage?
		QE	In your opinion, to what extent does a highlight of the fruit under promotional activity according to internal norms influence the prevention/reduction of fruit shrinkage?
	Operators behavior (mixes with the stock available in the ordering system)	QF	In your opinion, to what extend does having internal employees that do not steal fruit influence the prevention/reduction of fruit shrinkage?
		QG	In your opinion, to what extent does staff in the cashiers vigilantly avoid changing PLU codes in the weighting scales, influence the prevention/reduction of fruit shrinkage?
	Customers behavior (mixes with stock available in the ordering system)	QH	In your opinion, to what extent do customers in the self-service weighting scales having attention for not changing fruit PLU codes influence the prevention/reduction of fruit shrinkage?
		QI	In your opinion, to what extent do customers not stealing in self-scanning and self-checkouts influence the prevention/reduction of fruit shrinkage?
	Store conditions	QJ	In your opinion, to what extent does an adequate store's temperature with favorable conditions for exposed fruit durability influence the prevention/reduction of fruit shrinkage?
		QK	In your opinion, to what extent does new store format "Repus" enabling a compliance of the most recent store procedures, e.g., exposition according to the merchandising manual influence the prevention/reduction of fruit shrinkage?
	Store location	QL	In your opinion, to what extent does the lack of intense competition of retail shops nearby influence the prevention/reduction of fruit shrinkage?
Store's warehouse	Merchandise storage	QM	In your opinion, to what extent does the warehousing of fruit being at a designated layout influence the prevention/reduction of fruit shrinkage?
		QN	In your opinion, to what extent does storing pallets according to fruit's typology and its resistance influence the prevention/reduction of fruit shrinkage?
	Goods needing cold require storage in a refrigeration chamber	QO	In your opinion, to what extent does the existence and effective utilization of a refrigeration chamber for BU fruits-and-vegetables or a shared one with Charcuterie&Cheese influence the prevention/reduction of fruit shrinkage?
	FIFO/FEFO methods	QP	In your opinion, to what extend the compliance of the methods FIFO and FEFO influence the prevention/reduction of fruit shrinkage?
	Warehouse's temperature	QQ	In your opinion, to what extend does an adequate temperature of the warehouse of the retail store creating favorable conditions to the fruit's maintenance, influence the prevention/reduction of fruit shrinkage?
In-store Procurement and P&SMD	In-store Procurement	QR	In your opinion, to what extent a daily assurance of correct stock levels of fruit in the ordering system so that it considers all the needed variables to generate a correct order, influence the prevention/reduction of fruit shrinkage?
		QS	In your opinion, to what extent does preventing stock accumulation given fruit being a product of the day influence the prevention/reduction of fruit shrinkage?
	Influencers of stock available in the ordering system	QT	In your opinion, to what extent do operators not neglecting the exceptions' list influence the prevention/reduction of fruit shrinkage?
		QU	In your opinion, to what extent do the operator responsible registering fruit shrinkage daily influence the prevention/reduction of fruit shrinkage?
		QV	In your opinion, to what extent does attention for fruit shrinkage not being approved automatically by the ordering system (to avoid errors) influences the prevention/reduction of fruit shrinkage?
		QW	In your opinion, to what extent do grounded cuts and reinforcements made to the orders computed by the ordering system influence the prevention/reduction of fruit shrinkage?
CD&SSD	Active SKUS	QX	In your opinion, to what extent does active SKU's adjustment for each store reality and available space in shelves and displays for fruit influence the prevention/reduction of fruit shrinkage?
Quality Department	Goods non-compliant with required specifications	QY	In your opinion, to what extent does good quality of fruit received in stores in terms of degree of ripening, for instance, influence the prevention/reduction of fruit shrinkage?
Distribution center	Merchandise quantity (mixes with the stock available in the ordering system)	QZ	In your opinion, to what extent do goods shipped from the distribution center are the expected (i.e., there is no missing stock by mistake) influence the prevention/reduction of fruit shrinkage?
	Merchandise preparation for in-transit phase	QAA	In your opinion, to what extent do the pallets in the transportation vehicles being packed according to each fruit typology to minimize impact in it influence the prevention/reduction of fruit shrinkage?
		QAB	In your opinion, to what extend does the compliance of internal procedures during transportation of fruit from the distribution center until stores influence the prevention/reduction of fruit shrinkage?
Additional Open Question		QAC	Are there additional phenomena you consider important regarding fruit shrinkage prevention/reduction?

Appendix 9 - *Commercial Department of Fresh Groceries' group response*

			Commercial department of fresh groceries						Group II Tendency
			Group II						
			I4	I5	I6	I7	I8	I9	
Retail Store	Store operations	QA	●	●	◕	◕	◕	●	●
		QB	◕	●	◕	◕	●	●	●
		QC	●	●	●	◕	◕	●	●
		QD	●	●	●	●	◑	●	●
		QE	◕	◑	◕	◑	◔	◕	◑
	Operators behavior (mixes with the stock available in the ordering system)	QF	◔	○	◑	○	○	○	○
		QG	●	◑	◕	◕	◔	◑	◕
	Customers behavior (mixes with the stock available in the ordering system)	QH	◕	◑	●	◕	◑	◕	◕
		QI	◕	◔	◑	◕	◑	◔	◑
	Store conditions	QJ	●	◔	●	◕	◕	●	◕
		QK	●	◔	◑	○	◑	◔	◑
	Store location	QL	◑	◑	●	○	○	◑	◑
Store's warehouse	Merchandise storage	QM	◕	◑	●	●	○	●	◕
		QN	◕	◑	●	◑	◑	◕	◕
	Goods needing cold require storage in a refrigeration chamber	QO	●	●	●	◔	◑	◕	◕
	FIFO/FEFO methods	QP	●	●	●	◕	●	●	●
	Warehouse's temperature	QQ	●	◑	●	◕	●	●	●
ISP & PSMD	In-store Procurement	QR	●	◕	●	●	●	◕	●
		QS	●	◕	●	●	●	◕	●
	Influencers of stock available in the ordering system	QT	●	◕	◕	●	●	◕	●
		QU	●	◑	●	◕	◑	◕	◕
		QV	◕	◑	◕	○	◑	◑	◑
		QW	◕	◑	●	●	●	◕	◕
CD & SSD	Active fruit SKUs	QX	●	●	●	◕	●	◕	●
QD	Goods non-compliant with required specifications	QY	●	●	◕	◕	●	◕	●
QD	Goods non-compliant with required specifications	QY	●	●	◕	◕	●	◕	●
DC	Merchandise quantity (mixes with the stock available in the ordering	QZ	◕	◑	◕	◑	◑	◕	◕
	Merchandise preparation for in-transit phase	QAA	●	◑	◕	◑	◕	◕	◕
		QAB	◕	◑	◕	◑	◕	◑	◕
Are there additional phenomena you consider important regarding fruit shrinkage prevention/reduction? Or, do you wanna give additional comments?		QAC	"Fruit shrinkage can be slightly reduced if clients do not taste fruit in stores"	"There is lack of fte's in stores for na accurate compliance of all the procedures and activities within stores"	"Avoidance of "Push" and its correct appliance (e.g. not to stores that sell little) in case it indeed happens could help highly the reduction of shrinkage"	"Regarding fruit shrinkage the main concerns are in procurement and operations. Then the mismatch of SKUs given different store's realities"	"Known shrinkage is more relevant for us than the unkwon shrinkage"		
			"Fruit shrinkage might be slightly reduced if customers do not violate fruit's packaging to be confunded in cashiers as fruit sold per kilo, e.g. madeira banana versus dollar banana"		"A frequent control of PLU codes actualization can prevent its exchange and reduce moderately fruit shrinkage"				
					"There is lack of human resources in stores and extra personnel could reduce fruit shrinkage intensively"				

Continuation of Appendix 9 - *Summary of the CDFG group response*

Members of the commercial department stressed intensively all store operations from cause A to D (see ID relationship in appendix 7 and 8) with the only exception of E that was only given a moderate intensity. Yet, not exclusively since also variables P to T and X and Y were given maximum intensity. Variables I, K, L and V were considered part of the moderate intensity phenomena.

As it can be similarly deducted variables G, H, J, M, N, O, U, W, Z, AA and AB were given by the interviewees a high intensity. Compared to the other group responses, the CDFG gave more incidence of maximum relevance to the identified causes a priori.

Appendix 10 – Global tendencies

			Global Tendency
Retail Store	Store operations	QA	◕
		QB	◕
		QC	●
		QD	●
		QE	◕
	Operators behavior (mixes with the stock available in the ordering system)	QF	◔
		QG	◕
	Customers behavior (mixes with the stock available in the ordering system)	QH	◕
		QI	◑
	Store conditions	QJ	◕
		QK	◑
	Store location	QL	◑
Store's warehouse	Merchandise storage	QM	◑
		QN	◑
	Goods needing cold require storage in a refrigeration chamber	QO	◕
	FIFO/FEFO methods	QP	●
	Warehouse's temperature	QQ	◕
ISP & PSMD	In-store Procurement	QR	●
		QS	●
	Influencers of stock available in the ordering system	QT	●
		QU	◕
		QV	◑
		QW	◕
CD & SSD	Active fruit SKUs	QX	◕
QD	Goods non-compliant with required	QY	◕
Distribution Center	Merchandise quantity (mixes with the stock available in	QZ	◕
	Merchandise preparation for in-transit phase	QAA	◕
		QAB	◑

Appendix 11 – Exceptions

			Exceptions			
			I21	I22	I24	
Retail Store	Store operations	QA	◔	◔	◔	◔
		QB	◔	◔	○	○
		QC	◔	◑	◔	◔
		QD	◔	◑	◔	◔
		QE	◔	○	○	○
	Operators behavior (mixes with the stock available in the ordering system)	QF	◔	○	◔	◔
		QG	◑	●	◕	◕
	Customers behavior (mixes with the stock available in the ordering system)	QH	◕	○	◑	◑
		QI	◔	○	●	◑
	Store conditions	QJ	◕	◑	◑	◑
		QK	◔	○	○	○
	Store location	QL	◔	●	◔	◑
Store's warehouse	Merchandise storage	QM	◔	○	◔	◔
		QN	◔	○	○	○
	Goods needing cold require storage in a refrigeration chamber	QO	◔	○	◑	◔
	FIFO/FEFO methods	QP	◔	◔	○	◔
	Warehouse's temperature	QQ	◑	○	◑	◔
ISP & PSMD	In-store Procurement	QR	◑	○	◑	◔
		QS	◑	○	◔	◔
	Influencers of stock available in the ordering system	QT	◔	◔	◑	◔
		QU	◔	○	○	○
		QV	◔	○	○	○
		QW	◔	○	○	○
CD & SSD	Active fruit SKUs	QX	◑	◑	◑	◑
QD	Goods non-compliant with required specifications	QY	◔	◔	◕	◑
Distribution Center	Merchandise quantity (mixes with the stock available in the ordering	QZ	◔	◕	◑	◑
	Merchandise preparation for in-transit phase	QAA	◔	◔	◑	◔
		QAB	◔	○	◑	◔
Are there additional phenomena you consider important regarding fruit shrinkage prevention/reduction? Or, do you wanna give additional comments?		QAC	"Promotional campaigns must be adapted accordingly the stock that needs to be cleared down "			

Appendix 12 – *Additional fruit shrinkage causes after semi-structured interviews*

Although mentioned, the inventory audit was not listed as causing shrinkage yet, it may be a reason why fruit shrinkage is enhanced if not done accurately both in warehouse and store (staff miscounting fruit) and, with the monthly obligation instituted by SONAEMC's internal norms. In fact, the norm states inventory audit should be done whenever *CBD*s realize stock levels are wrong, which is not always possible, namely, due to lack of human resources. Human resources were mentioned as a structural limitation of *CBDs* and an implicit reason for the non-compliance of several store operations, reason why it was not added individually. Yet, its importance demands its addiction to the group.

Furthermore, as discussed earlier in the DC, the checkup of merchandise's sample quality may allow non-good merchandise pass through if the sample analyzed is not representative of all. Yet, this time consuming activity requires significant human resources and a different approach would not be feasible. Still, it should be considered a danger zone. Related, other missed topic concerns supplier deliveries that might have merchandise distributed unevenly by the boxes in pallets. Consequently, the order requested might be of fifty kilos but instead of five boxes of ten kilos each, one might have nine and other eleven. Thus, stores will not invoice what is actually received which will jeopardize accuracies in the ordering system, yet, thinking in fruit shrinkage levels as a whole of all *CBDs* the impact will be null. The same consequence will have delays or errors in the mentioned integration of daily received merchandise. Also, after fresh groceries supply managers scrutinizing orders by the automatic system through cuts or reinforcement they might not be accepted by the P&SMD even if with foundation. That occurs if the critics are computed after the period for that purpose expires. Regarding merchandise received in DC, when not totally dispersed to all *CBDs* its accumulation may cause fruit to reach an advance ripening state. If that occurs, the DC can make a "Push", which means that merchandise is forcibly sent to stores even if not ordered which means it might be hard to sell, generating known fruit shrinkage. Aggravating, the "Push" may be poorly done if the store chosen for the merchandise reception is not the one with best sales' performance. Upon all the mentioned reasons, the change of PLU codes might also occur due to its non-update whenever active SKUs are changed, which is frequently due to seasonality. Interviewees also added that customers may taste fruit while deciding the purchase, e.g., likely with grapes or cherries. If most of the daily *CBDs* thirty thousand customers taste one cherry, at the end, the loss relatively significant is direct fruit shrinkage. Another scenario that creates fruit shrinkage opportunities concerns the promotional campaigns, if those are not thought accordingly the minimization of stock excesses and its loss of value while being cleared.

Finally, specialists mentioned fruit shrinkage can occur within stores that have low performance in terms of sales, yet, those stores still have to fill the shelves and displays.

Appendix 13 – *Final conclusions on what causes fruit shrinkage and respective intensities*

Stage of the supply chain	Subject	ID	Succinct explanation of phenomena answering how and why fruit shrinkage occurs	Interpreted Intensity
Store	Store operations	A	Fruit Exposition not according the merchandise manual	High Intensity
		B	Lack of multi-replenishment and accumulation of stock in the warehouse	High Intensity
		C	Lack of care while handling fruit during replenishment	Maximum Intensity
		D	No sorting or simply no frequent sorting	Maximum Intensity
		E	No highlight of goods under promotional activity	High Intensity
		AC	Non-update of PLU codes whenever active range of SKUs is updated	-
	Store facts	AD	Promotional campaigns not thought accordingly the minimization of stock excesses and its loss of value	-
		AE	Stores with low performance in sales still have to full its shelves and displays to a decent presentation	-
	Operators behavior (mixes with the stock available in the ordering system)	F	Internal theft of fruit	Poor Intensity
		G	Change of PLU codes in cashiers by staff	High Intensity
	Customers behavior (mixes with the stock available in the ordering system)	H	Change of PLU codes or in quantities weighted versus inside the plastic bag in self-service weighting scales	High Intensity
		AF	Customers tasting fruit (e.g., grapes, cherries) while deciding the purchase	-
		I	External theft in self-scanning and self-checkouts	Moderate Intensity
	Store conditions	J	High temperature	High Intensity
		K	No update for *Repus* format	Moderate Intensity
	Human resources	AG	Lack of human resources in stores (lack of fte's)	-
	Store location	L	Intense competition	Moderate Intensity
Store's warehouse	Merchandise storage	M	Merchandise storage not positioned in designated Layout	Moderate Intensity
		N	Merchandise storage not according to each fruit typology	Moderate Intensity
	Goods needing cold require storage in a refrigeration chamber	O	Lack of attention to put goods needing refrigeration in the adequate chamber (exclusive or shared)	High Intensity
	FIFO/FEFO methods	P	Non-compliance of FIFO and FEFO	Maximum Intensity
	Warehouse's temperature	Q	Store's warehouse high temperature	High Intensity
In-store Procurement and Procurement and Stocks Management Department	In-store Procurement	R	Wrong levels of fruit stock in the ordering System	Maximum Intensity
		AH	Lack of frequency in what concerns inventory audits	-
	Influences of wrong stock levels and consequent misfit orders	T	Negligence of the exception's list	Maximum Intensity
		U	Absence of daily shrinkage recording	High Intensity
		V	Shrinkage daily approval by the automatic ordering system encouraging errors	Moderate Intensity
		W	Critics, i.e., cuts and reinforcements based on gut feeling on the orders suggested by the ordering system	High Intensity
		AI	Critics (cuts and reinforcements) sent to P&SMD after the designated possible period	-
Commercial and stores' space department	Active fruit SKUs	X	Mismatch in active SKUs considering stores reality and fruit section dimension	High Intensity
Quality Department	Goods non-compliant with required specifications	Y	Notes noticing reception of non-quality goods launched by stores for the quality department (e.g., inadequate ripening state)	High Intensity
Distribution Center	Quality check-up	AJ	Quality check-up in distribution center only concerning a sample that might not be representative of all merchandise received	-
	"PUSH"	AK	"PUSH" when distribution center forces merchandise into store that may be even to stores with bad sales performance	-
	Merchandise quantity (mixes with the stock available in the ordering system)	Z	Missing stock when preparing pallets to be delivered in stores	High Intensity
	Merchandise preparation for in-transit phase	AA	Merchandise disorganization in terms of fruit typology to minimize the impact when loading vehicles for transportation	High Intensity
		AB	Merchandise's inadequate transportation conditions from distribution center until stores (e.g. temperature inside the vehicle)	Moderate Intensity
Supplier	No equal distribution of stock	AL	Suppliers distributing unevenly the stock in the boxes of a pallet	-

Appendix 14 – *Sampling of the Checklist*

***Insígnia*:**	***CNT Bom Dia***
Store: ?	
Date: ?	

	Variables	Fruit variety	To verify:		Conclusion (Yes/No)	Structural (Yes/No)	Reasons/Comments
Store	**Fruit's exposition according to the merchandising manual**	DOLLAR BANANA CNT	The product is…	"em topo ou ilha?"			
				"retirado da caixa e exposto com o caule virado para cima (em barco) com duas a três camadas em superfície lisa?"			
		STRAWBERRY CNT		"exposto em mural do frio ou ilhas frio?			
				"no caso anterior, com 2 a 3 camadas de massificação?"			
				"exposto em ambiente (topo ou ilha)? (em caso de campanha ou promoção)"			
				"em caixas sobrepostas em função da sua rotação?"			
		CLEMENTINE CNT		"exposto em caixa 6410 (tabuleiro) com mais 2 a 3 camadas (aproximadamente 20 cm)?"			
		MANGO CNT		"próximo da Manga, Kiwi e Papaia/Mamão?"			
				"exposto em caixa de origem com mais uma camada ou sobreposição de caixa, mais uma camada?"			
		MADEIRA BANANA CNT		"próximo à Banana importada?"			
				"retirado da caixa e exposto em concha com duas a três camadas em superfície lisa?"			
		PAPAYA CNT		"exposto em linear em tabuleiros (6410)? (lojas com pouca rotação)"			
				"exposto em ilha ou topo com caixas de origem (cx 6418)? (lojas com grande rotação)"			
				"massificado em função da sua rotação?"			
		ORANGE CNT		"exposto em linear em tabuleiros (6410)? (lojas com pouca rotação)"			
				"exposto em ilha ou topo com caixas de origem (cx 6418)? (lojas com grande rotação)"			
				"massificado em função da sua rotação?"			
		"MAMÃO" CNT		"exposto em caixa de origem com mais uma camada ou em sobreposição de caixa com mais uma camada?"			
				"próximo da Papaia?"			
				"fracionado e exposto sobre o produto inteiro (a utilizar PLU artigo fracionado)?"			
		RED GLOBE GRAPE CNT		"exposto perto de toda a gama de uvas (inclusive as uvas embaladas)?"			
				"exposto apenas em caixa de origem sem sobreposição de produto?"			
		GOLDEN APPLE CNT		"exposto em caixa de origem 6418 com mais um a dois Alvéolos sobrepostos?"			
				"expor em caixa de origem 6410 com mais dois a três alvéolos sobrepostos?"			
				"expor caixas de cartão (de origem) com sobreposição de caixas?"			

Appendix 15 - *Potential of the SKUs revision in Fruits category it is conferred by the distribution of Net Sales and Profitability in 2014*