International Journal for Quality Research 14(2) 623–634
ISSN 1800-6450

Mariana Enes
Ângela Silva[1]

SERVICE QUALITY IMPROVEMENT ON WAREHOUSE-STORE TRANSPORTATION IN A RETAIL FOOD COMPANY

Article info:
Received 06.11.2019
Accepted 02.03.2020

UDC – 656.01
DOI – 10.24874/IJQR14.02-18

Abstract: *This project was developed in a food retail company with a complex distribution system, with several distribution centres located in Portugal, different temperature requirements for their products and different dimension store formats. The aim of the work was to analyze procedures to increase the service quality to the warehouse and stores through the improvement of the volumetric occupancy rate of the trucks, which depends mainly on the relationship between the number of pallets transported in each vehicle and its volume. After analyzing and diagnosing the picking, loading and unloading operations, it was found that the volumetric occupancy rate of the vehicles was 48.5%, which means that more than half of the truck is empty. To increase this indicator, two strategies were proposed to be implemented: the revision of the current volume and weight limits; and the consolidation of different product categories in the same pallet for the small-format stores. After conducting pilot tests, a potential gain was obtained of more than 577,908 €/year.*

Keywords: *Service Level; Transportation; Vehicle Volumetric Occupancy*

1. Introduction

In the repercussion of globalization, new markets and new customers, transport activities are becoming more diversified, the customers are becoming more demanding and the contractual conditions are becoming more sophisticated.

The quality of service is a key factor to increase the competitivity between the companies, so they need to meet the customer requirements and act in all the supply chain.

Veloso *et al.* (2018) present a multi-level and hierarchical model used as a framework to identify and capture the links between customer satisfaction, service quality, brand image and loyalty of customers in the Portuguese traditional trade. The results revealed that service quality is the main determinant of customer satisfaction and corporate image. Furthermore, customer satisfaction, corporate image and service quality significantly affect customer loyalty.

Some authors have analysed the effect of service quality improvements in the companies performance, for different activity sectors. Sukwadi, Muafi and Sanjaya (2018) developed a strategy for Airline X in order to improve their service quality based on the attractive service attributes and affected Kansei words. The result of the research is action plans to improve the service quality of Airline X. Using an Ordinary Least Square regression, Perovic et al. (2008) investigated whether intangible elements influence tourist's perception of service quality. The empirical results based on tourist survey in Montenegro, indicate that intangible elements

[1] Corresponding author: Ângela Silva
Email: angela.a@esce.ipvc.pt

of tourism product have a positive impact on tourist's overall perception of service quality in Montenegro.

The great demands of an increasingly competitive market have made logistics an essential part of all companies, so one of the biggest tasks of managers is to direct all activities that contribute significantly to better customer service and the lowest cost (Ballou, 1997).

According to Thomas & Griffin (1996), the largest cost component of logistics is transportation cost, usually accounting for 50% of the total logistics cost. At a time when the global economic and financial environment forces organizations to manage their resources in the most efficient way, and the retail market segment is highly competitive, demanding and complex, cost management is vital to success and sustainability of that companies.

In Kadłubek and Grabara (2015) work, customers' expectations and experiences towards the logistics service were examined as two fundamental areas which allow for recognizing the quality aspects of the customer service in commercial cargo motor transport enterprises (Kadłubek and Grabara, 2015). Physical distribution service quality is considered as a source of competitive advantage for manufacturers since it can be viewed as a differentiation factor in the way they are perceived by retailers (Giovanis & Tsoukatos, 2013; Giovanis et al., 2013).

Retail companies often operate several Distribution Centres (DCs) due to the geographical dispersion of the stores and the high aggregate volume that has to be distributed from the suppliers via the DCs to the outlets. Several regionally dispersed DCs, therefore, supply a dedicated subset of stores

Recently, Holzapfel, Kuhn & Sternbeck (2018) present a decision problem and provides an optimization model that considers the costs identified as relevant to decide to which of the DCs types to assign which product, i.e., inbound transportation costs to supply the DCs, cycle and safety stock as well as picking costs at the DCs, outbound transportation costs from the DCs, and operational costs at the stores. An appropriate solution approach is suggested that especially reflects circumstances and problem sizes relevant in retail practice.

Supply chain integration has affected the replenishment operations between suppliers and store-level retailers. Therefore, the collaboration between the supplier and the store-level retailer does improve the performance of the holistic supply chain (Lyu, Ding, Chen, 2010).

Food retailing can demonstrate that the production of consumer products may be located close to a retail store where the products are sold, but in most cases, the products will first be transported to the retailer warehouse, and then be distributed to the individual stores. The driving factor that makes this economically reasonable for the retailer, are economies of scale, in the form of the bundling of goods for transport and warehousing. This example shows that freight transport demand can sometimes be more driven by the shape of the logistic structures than by the locations of production and consumption (Friedrich, 2010).

In retail, small, frequent deliveries by road are increasingly common as retailers attempt to keep inventories low and meet consumer needs. Retailers are working to restructure logistics and transportation reducing number of transports and improving transportation efficiency. Retailer activities to reduce transport include management systems, load planning, increasing load utilization, route planning, lane sharing and pooling, local sourcing and postponement.

The present work was developed in a food retail company where the loading units prepared in the warehouses to transport to the stores do not have a standard height and the average of this is low. Due to this factor and to the differences in the typologies of boxes packaged in the pallets, it is not possible to overlap them, with only a floor occupancy of the vehicle and not in height, when loading and conditioning the loads on trucks. Thus, because the load units have an average height of 1 meter and since they cannot be stack, there is a low occupancy rate of the trucks in height, resulting in high transport costs. In this sense, as transport is as more economical as the greater the capacity utilization of the vehicles, it became crucial to identify measures to improve the height of the load units, guaranteed the service level to the stores (clients).

This work was developed mainly considering a case study research strategy. The purpose of the project was to analyze the current process of picking, and loading, conditioning and unloading of trucks operations used in the warehouse-store transportation, identifying the factors that influence the height of load units, and the study and evaluation of measures to improve it, considering the impact in the supply chain.

2. Retail supply chain

Transformations in the retail supply chain have led retailers to see a restructuring of the logistics network: switching from "passive recipients of products" to "manufacturers with anticipation of demand", which currently control, organize and manage the whole chain (from production to consumption) - the current essence of retail logistics (Fernie et al., 2010).

In a functional perspective, the internal retail supply chain is predominantly divided into three logistical subsystems: (a) distribution centre (b) transport and (c) store (Figure 1). Since each subsystem, although with its own working and planning mechanisms, depends on the requirements of other systems, the result is a complex interrelated structure that must be considered in planning operations (Kuhn & Sternbeck, 2013).

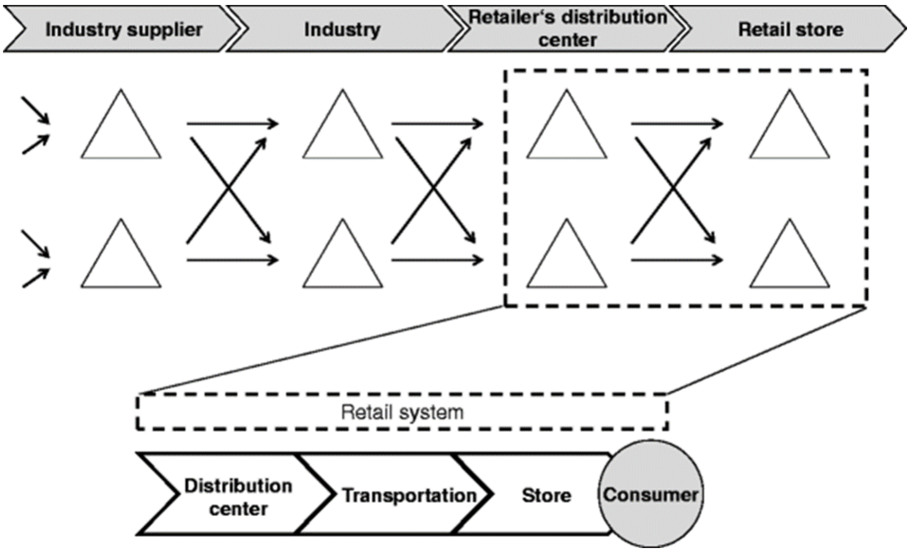

Figure 1. Retail supply chain configuration (Adapted from Kuhn & Sternbeck, 2013)

Transport activity management can be defined as the process of planning, implementing and controlling the most effective and efficient procedures and techniques with the goal of achieving cost reduction, increasing the level of customer service and increasing optimization of the company's resources (Lambert et al., 1998; Novaes, 2007).

Thus, Lambert et al. (1998) summarize the main functions of transport managers, stating that they should select the most appropriate mode and type of vehicles, select the vehicle fleet and manage it and, on a more daily basis, plan routes, loads and vehicles. In order to ensure an efficient and logistically efficient transport subsystem, it is necessary to take into account a set of factors that influence the physical distribution of load from the warehouses to the stores, such as the distance to be traveled, time of delivery, quantity transported, non-existence of return load, dimensions and morphology of the load, degree of fragility of the load and restrictions at the point of sale.

The goal of day-to-day planning should be vehicle optimization. The Transport Optimization Report (Europe, 2000) identifies three main areas of improvement in terms of transport optimization: improving vehicle occupancy, reducing empty kilometres and increasing the productive time as a proportion of the total time available, and stressing that each of these areas can be affected by one or more factors previously mentioned. There is a set of key performance indicators (KPIs) that can be used to measure and target each of the areas:

- Percentage of occupancy of vehicles;
- Percentage of kilometres in empty space;
- Productive time as a percentage of total available time.

Improving vehicle volumetric occupancy rate is one of the most attractive sustainable delivery measures for companies as it provides substantial economic and environmental benefits, hence the importance of their maximization in the success of a company (Mckinnon et al., 2010).

Traditionally, companies measure vehicle occupancy considering only the relationship between the weight of the load transported and the maximum weight of the vehicle (Mckinnon et al., 2010). However, as in the food retail sector products have an increasingly lower density, the weight-based occupation underestimated the true level of utilization [9]. In this sense, the occupancy of the truck is limited much more by the floor area or height of the vehicle than by the weight. A measure of occupancy that results from the product between the percentage of floor occupancy (equation 1) and the percentage of height occupancy (equation 2) is more appropriate to calculate the percentage of volumetric occupancy (Mckinnon et al., 2003; Mckinnon, 2000):

$$\% floor\ occupancy = \frac{nº\ of\ pallets\ transported}{Maximum\ nº\ of\ pallets\ on\ the\ truck}$$

$$\% height\ occupancy = \frac{Load\ units'\ average\ height}{Maximum\ truck\ height\ available}$$

When there are tight limits to the height of a load unit and when it is low and variable, the truck occupancy is usually restricted by the floor area rather than by the height of the vehicle and can be completely occupied on the floor by pallets with a height of 1.5 meters, leaving a meter or more of wasted space above them (Mckinnon et al., 2003; Mckinnon, 2000). The study made by McKinnon and Edwards (2010) reveals that companies often overuse their vehicles as a result of minimizing total logistics costs by making perfectly rational trade-offs between transport efficiency and other corporate goals such as minimizing stocks, optimizing storage space use, or maximizing productivity preparation of orders. However, Mckinnon (2000) and McKinnon and Edwards (2010) examined the possibility of improving the use of vehicles, including potential economic and environmental benefits.

One of the opportunities indicated was the increase of the load units' height. Generally, there are tightness volume and weight limits that restrict its height, so the increase of these limits can reduce the number of trucks required per year. This was one of the measures analysed and that will be described in the present work.

3. Study context and Critical Analysis

The company studied is the national market leader in food retail, with a set of distinct formats that offer a wide range of products. It essentially operates with three major players in its logistics chain: suppliers, distribution centers and stores.

It has strategically two large logistics centres, where the warehouses are located that operate in a specialized and independent way. Both platforms supply different regions of the country, with food products at ambient, fresh and frozen temperature, covering the entire national territory and the islands. In these logistical platforms, two types of flows are implemented: PBL (Picking by Line) and PBS (Picking by store). The main distinguishing characteristic of these flows is the lack of storage in the PBL warehouse due to their dispatch in less than 24 hours, which means the products are received and distributed immediately by the stores, while in the PBS the products are collected of their picking locations, existing stock. The division of the articles between PBS and PBL is performed considering the rotation of the products, the quality of service of the supplier and the validity of the product itself.

Comparing the warehouses of different temperatures, there is a higher dispatch volume in the ambient temperature warehouses. For this reason and for the elaboration of this research project, the analyzed warehouses were the PBL and PBS at ambient temperature in both platforms.

In order to be able to define strategies for improvement, it became essential to frame the current situation of the company regarding the current volumetric occupancy rate of trucks and a diagnosis and analysis of the operations under study. Currently, in the company, only the percentage of floor occupancy is monitored monthly, including only the trucks of 33 pallets since the fleet is composed mostly by this type of vehicles. Thus, this indicator is used to measure vehicle occupancy efficiency, although it is not very robust.

In this way, the project began with the calculation of the current volumetric occupancy rate of the trucks. With an average floor occupancy rate of 84.0% and a height occupancy rate of 57.7% in 2017, an average value of 48.5% was obtained, as shown in equation 3:

$$\boldsymbol{Volumetric\ occupancy\ rate} = \mathbf{84.0}\% \times \mathbf{57.7}\% = \mathbf{48.5}\%$$

Thus, it is proven that more than half of the truck is air, reinforcing the importance and necessity of improving this measure. As the variable that causes the greatest negative impact on the volumetric occupancy rate is the height occupation, the objective of the project was focused on the improvement of the latter.

Shipment to stores can be done on four types of handling units: picking pallets (euro or half pallet) and complete pallets (euro or half pallet). The picking pallets are originated by the preparation activity in the warehouses, while the complete pallets are shipped with a single item and are delivered to the store exactly in these quantities, with no preparation in the warehouse. As the picking pallets, in total, represent 68.1% of the pallets transported, it became necessary to focus the analysis on this type of handling unit to understand the factors that influenced its volume and, therefore, its height.

Both in PBL and PBS flows, when preparing load units for stores, it may break down by two factors: volume or weight. For each category, the system has defined the maximum limit of volume and weight that a load unit can reach so that whenever an order reaches one of the limits, the picker needs to continue the preparation in a new pallet.

Currently, the volume limit, in the same flow, is the same for all categories, with the PBS limit being 15% higher than the PBL limit. Regarding the weight limit, this is the same for PBL and PBS in all categories. In this sense, it was important to compare the average volume of each category with the respective limit to identify differences and to understand the impacts of changing the parameterized limits in the system. An improvement to be implemented has gone through the revision of the current volume limits and the adjustment of it according to the average weight per box (strategy 1).

Besides that, picking pallets have, for each store format A, B and C, a weighted average volume of 1.38 m3, 1.13 m3 and 0.99 m3, respectively. The small stores (format C) are those with the lowest average volume value, and some factors have been identified that contribute to this fact. The reduced daily volumes demanded by contemporary retail, with frequent deliveries of increasingly smaller orders, associated with the fact that the company is looking for a “store friendly " logistics, preparing by category, means that only 1 pallet is prepared per day and per category, with a low volume of products. As the expansion of these stores is expected, instead of preparing the orders by category on different pallets, it has been suggested that all the categories of each flow could be consolidated on the same pallet (strategy 2).

4. Improvement Proposals and Results

The two proposed strategies and their expected results are presented below.

4.1. Revision of the current volume limits based on average weight per box

With the previous diagnosis, in particular, the percentage of pallets, for each category, which breaks by volume, by weight or by neither of those and the average weight per box, the need arose to evaluate the impact that would have occurred if the limits parameterized changed. For the categories that mostly broke through the volume and the weight, the adjustment of the limits was studied. A change in these can enhance the placement of boxes at a higher height, so an adjustment to the average weight per box was the criterion used to consider the ergonomic conditions of the operators. Thus:

- For the categories with the smaller value of average weight per box, compared to the other categories of the same flow, increase the volume limit;
- For the remaining categories with the highest average weight per box, maintain the volume limit.

Through several pilot tests, it was possible to measure the impact of these changes in each one of the actors of the chain: warehouse, transport and store operations. By increasing the volume limits of the pallets, it is possible to place more boxes on the same pallet which can consequently result in a reduction in the number of pallets prepared and shipped. This reduction has an impact on the floor space occupied in the warehouse and at the backroom store, on the time of loading and unloading of the trucks, as well as the associated transportation cost. Also, this increase in the limits may or may not result in an increase in the productivity of operators because, although more boxes are placed per pallet, it also increases the difficulty in the construction of the storage, which can cause the operator to waste more time in the quality assurance.

Based on the data obtained through pilot tests, the number of pallets that would have been prepared were simulated by category, store and date of delivery to the store, if the limits remained the same as the current ones, and this value was compared with the number of pallets generated during the pilot tests with the proposed limits. It was found that for PBS, instead of 7,492 pallets being prepared with the current limits, 7,325 pallets were generated in the week of the pilot test, corresponding to a reduction of 2.2% in the number of pallets and so a reduction of 18,264 pallets per year. Likewise, in the PBL, instead of generating 4,976 pallets, 4,818 pallets were generated during the test period, equivalent to a reduction of 3.2% in the number of pallets and to less than 25,889 pallets per year.

Still with the results of the pilot tests, the relation between the picking productivity and the number of boxes per pallet was analyzed to understand if the proposed changes had a significant impact and whether it was positive or negative. There was an approximately linear behaviour, allowing to conclude that the bigger the number of boxes per pallet, the greater the productivity of the operators.

Finally, the impact of this scenario on the volumetric occupancy rate was estimated, corresponding to an increase of 0.8%, resulting from an increase in the percentage of height occupancy rate (+0.9%).

After calculating all the impacts of this strategy, the annual benefits in euros, associated with the changes in the proposed scenario (Figure 2), were estimated by logistic subsystem (warehouse, transport and store).

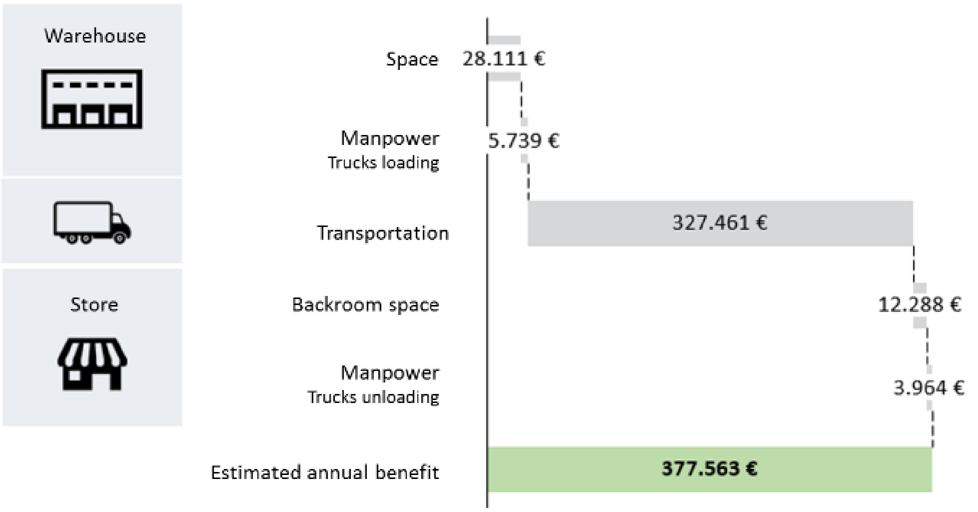

Figure 2. Estimation of the potential annual benefit of strategy 1

Observing Figure 2, this proposal has a potential benefit of 377,563 €/year, being that the transport logistics subsystem is the largest part, approximately 86.7%. This proves that, in fact, transport has a high weight in the logistics cost structure, so any solution that seeks to reduce the air inside the truck, results in a very significant impact.

Due to its enormous potential, in May 2018, this strategy was implemented, provided that its results were monitored through to a cockpit chart. Table 1 shows the results obtained for the indicators whose changes are directly related to the implementation of this strategy, as well as the percentage variation obtained between January and September 2018.

Table 1. Presentation of results obtained (Jan. vs Sept) by the implementation of strategy 1

Nº	Indicator	January	September	Variation
2	Height Occupancy rate (%)	56.2%	57.7%	+2.7%
2a	Average volume per pallet (m^3)	1.10	1.11	+0.9%
2b	Reduction in the number of picking pallets (%)	-	2.6%	+2.6%
2aa	Average volume per picking pallet (m^3)	1.14	1.19	+4.4%

A 2.7% increase in truck height occupancy rate was achieved. It is not an increase as significant as the one achieved in the indicator 2aa because, as there are four handling units and since complete pallets, due to its low average volume, negatively influence the indicator 2a, an increase in the percentage of complete pallets (euro and a half) contradicts the positive impacts of this strategy.

Regarding indicator 2b, the average reduction target of 2.7% of pallets previously estimated has been met, translating into a potential annual benefit of 345,104 €/year.

4.2. Consolidation of the categories in the same pallet for the stores of the format C

As mentioned above, the format C stores are those with the lowest average volume per picking pallet, which is related to the fact that 1 pallet per category per day is dispatched to these stores. As the expansion of small-format stores is expected, some changes have been suggested in the picking process of these stores: to increase the average volume of the pallets to these stores and, thus, increase its height, instead of these orders being prepared by category on different pallets, all categories of each flow would then be prepared on the same pallet, until one of the volume or weight limits is reached.

A pilot test was made on PBS for one store of format C. As the strategy in the previous subsection, this solution entails placing more boxes on the same pallet and therefore can reduce the number of pallets prepared and shipped to stores. This reduction has an impact on the floor space in the warehouse and at the backroom store, on the time of loading and unloading of the trucks, on the shelf replacement time in the store and on the associated transportation cost. Warehouse productivity can increase with more boxes on the same pallet, but this effect can be offset by the fact that the operator loses more time in stowage quality assurance.

With the pilot test data, the reduction in the number of pallets was calculated. For this, it was simulated, by category and date of delivery to the store, the number of pallets that would have been obtained if there was no consolidation, comparing this value with the number of pallets shipped during the test period. The impact of this solution on warehouse productivity was also analyzed, comparing the average productivity obtained in boxes per hour from January to May with that obtained in the test week, considering only the store submitted to pilot test. Finally, a visit to the chosen store was made to quantify the impact on shelf replacement time.

A reduction of 17.4% was observed in the number of pallets prepared and shipped to format C stores, which corresponds to less 24,284 pallets per year. This represents a reduction of 1.5% in the total number of picking pallets prepared.

Regarding warehouse productivity, it was verified that it did not suffer any impact, presenting the same value without and with consolidation. With consolidation, the difficulty of constructing the storage is increased, but the number of setups can be reduced, so the operator places more boxes per pallet in the same task, justifying this behaviour.

About the shelf replacement time, with consolidation, the products of the different categories are mixed, not separated by layer. However, this additional manipulation of separating the boxes of different categories is not significant in the total shelf replacement time per pallet (0.7%).

It was also calculated the impact of this solution on the volumetric occupancy rate, with an increase of 0.8% in it, resulting from an increase in the percentage of height occupancy rate (+0.9%).

Finally, considering these impacts, it was possible to estimate the annual benefits per logistic subsystem associated with this solution (Figure 3).

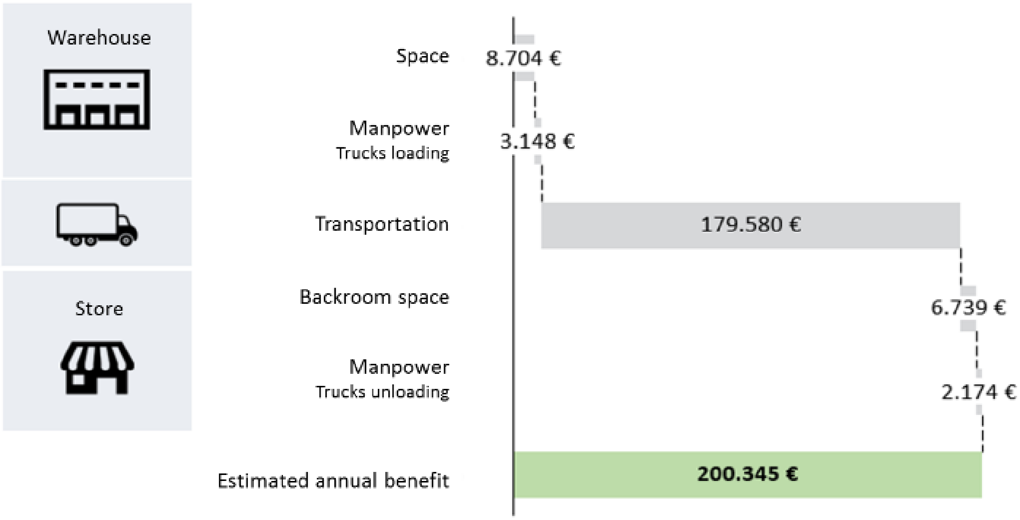

Figure 3. Estimation of the potential annual benefit of strategy 2

This strategy has an estimated annual benefit of 200,345 €/year, and in the same way as strategy 1, it is in the transport logistics subsystem that the greatest benefit is found, approximately 89.6% of the total parcel. Since this solution presented great potential, which was recognized by the company, this strategy was extended to 20 stores and its impacts are still being evaluated, in order to have a more significant sample and, therefore, more robust results.

5. Conclusions

Since transportation is responsible for absorbing between one-third to two-thirds of the total logistics cost, and as often involves trade-offs between customer responsiveness capacity (greater frequency of supply) and chain efficiency (more trips, lower vehicles occupancy, and therefore higher transport costs), any decision-making in its management is reflected along the logistic chain.

Through the methodology of the case study, a study was carried out on the vehicle's occupancy in the warehouse-store transport, in a retail food company. Although this project involved only one study explaining the current state and future state and a comparison of costs versus benefits, strategies were identified to be implemented in the short term.

In this way, the project started by measuring the performance of the current situation, that is, by calculating the value of the volumetric occupancy rate, equal to 48.5%. This low value is due to the low height occupancy, which is around 57.7%. After a detailed analysis of the current picking, loading, conditioning and unloading operations, one of the main causes of this waste were identified: the low average volume of the transported pallets.

Thus, the improvement proposals, studied in order to measure their impact and quantify their potential, were focused on the improvement of the picking pallets height: the revision of the volume limits according to the average weight per box (strategy 1) and the consolidation of the PBS categories in the same pallet for the small stores (strategy 2). Both proposals had benefits in the floor space occupied in the warehouse and in the backroom store, in the time of loading and unloading of the trucks, as well as in the associated transport cost. Considering the estimated results for each strategy, it was obtained a total of:

- Reduction in the number of picking pallets (%): 2.7+1.5=4.2%
- Increase in height occupancy rate (%): 0.9+0.9=1.8%
- Increase in volumetric occupancy rate (%): 0.8+0.8=1.6%
- Estimated annual benefit: 377,563+200,345=577,908 €/year

Although the increase in the percentage of height occupancy is not very significant, it translates into a very high annual monetary benefit, proving that in fact any small improvement in transport has a very significant impact on the efficiency of the chain. Strategy 1 was accepted and implemented by the company, while strategy 2 is being evaluated for 20 small format stores to validate these benefits. In order to monitor the results of strategy 1 on a monthly basis, a cockpit chart was constructed. It has been very advantageous because it has allowed monitoring of the volumetric, in height and floor occupancy indicators, which until the beginning of this project was not possible and the results have been very positive, especially regarding the average volume per picking pallets and the height occupancy rate. Comparing January and September, there was an increase of 4.4% and 2.7%, respectively.

Finally, it can be concluded that these initiatives had a positive impact on service level along all the supply chain (Warehouse-transport-stores).

Acknowledgement: This research is supported by national funds through FCT - Foundation for Science and Technology, I.P., Portugal under the project UID/EMS/04005/2019.

References:

Ballou, R. (1997). Business logistics: Importance and some research opportunities. *Gestão & Produção*, *4*(2), 117-129.

Europe (2000). The Transport Optimisation Report.

Fernie, J., Sparks, L., & McKinnon, A. C. (2010) Retail logistics in the UK: past, present and future. *International Journal of Retail & Distribution Management*, *38*(11/12), 894-914.

Friedrich, H. (2010). *Simulation of logistics in food retailing for freight transportation analysis* (Dissertation, Fakultät für Wirtschaftswissenschaften).

Giovanis, A. N., Tomaras, P., & Zondiros, D. (2013) Suppliers logistics service quality performance and its effect on retailers' behavioral intentions. *Procedia - Social and Behavioral Sciences*, *73*, 302-309. doi: 10.1016/j.sbspro.2013.02.056.

Giovanis, A. N., & Tsoukatos, E. (2013) On the relationships between logistics service deliverables, customer satisfaction and loyalty in industrial supply chains. *Journal for International Business and Entrepreneurship Development*, *7*(1), 63. doi: 10.1504/jibed.2013.052132.

Holzapfel, A., Kuhn, H., & Michael G. S. (2018). Product allocation to different types of distribution center in retail logistics networks. *European Journal of Operational Research*, *264*, 948-966.

Kadłubek, M., & Grabara, J. (2015) Customers' expectations and experiences within chosen aspects of logistic customer service quality. *International Journal for Quality Research*, *9*(2), 265-278.

Kuhn, H., & Sternbeck, M. G. (2013) Integrative retail logistics: An exploratory study. *Operations Management Research*, *6*(1-2), 2-18.

Lambert, D. M., Stock, J. R., & Ellram, L. M. (1998). Fundamentals of Logistics Management.

Lyu, J., Ding, J-H, & Chen, P-S. (2010) Coordinating replenishment mechanisms in supply chain: From the collaborative supplier and store-level retailer perspective. *International Journal of Production Economics*, *123*(1), 221-234.

Mckinnon, A. (2000). *Sustainable distribution: opportunities to improve vehicle loading*. School of Management and Languages, Heriot-Watt University.

Mckinnon, A., Culliinane, S., Browne, M., & Whiteing, A. (2010). *Green logistics: improving the environmental sustainability of logistics.* London: Publishers, Kogan Page.

McKinnon, A., & Edwards, J. (2010). Opportunities for improving vehicle utilization. *In Green Logistics: Improving the Environmental Sustainability of Logistics*, Kogan Page Publishers, 197-213,

Mckinnon, A., Ge, Y., & Leuchars, D. (2003). Analysis of transport efficiency in the UK food supply chain. *Full Report of the 2002 Key Performance Indicator Survey*. Logistics Research Centre, School of Management and Languages, Heriot-Watt University, EDINBURGH, UK.

Novaes, A. G. (2007) *Logística e gerenciamento da cadeia de distribuição - estratégia, operação e avaliação* (3a Edição). Elsevier Editora Ltda (Portuguese language).

Perovic, D., Stanovcic, T., Moric, I., & Pekovic, S. (2008) What factors influence quality service improvement in montenegro : empirical analysis. *International Journal for Quality Research*, *7*(1), 63-70.

Thomas, D. J., & Griffin, P. M. (1996). Coordinated supply chain management. *European Journal of Operation Research*, *94*(1), 1-15.

Sukwadi, R., Muafi, & Sanjaya, H. P. (2018) Incorporating Kansei engineering into service quality tools to improve the airline services. *International Journal for Quality Research*, *12*(2), 297-316. doi: 10.18421/IJQR12.02-02.

Veloso, C. M., Magueta, D., Ribeiro, H., & Alves, S. R (2018). The links between service quality, brand image, customer satisfaction and loyalty in the retail industry. *28th International Scientific Conference on Economic and Social Development,* Paris, 19-20 April 2018

Mariana Enes
Escola de Engenharia,
Universidade do Minho,
Guimarães,
Portugal
mariana_enes_@hotmail.com

Ângela Silva
Escola Superior de Ciências Empresariais,
Instituto Politécnico de Viana do Castelo,
Valença,
Portugal
angela.a@esce.ipvc.pt