

Reducing Shrinkage and Stockouts in a Food Retail Store: A Portuguese Case Study

Pedro Alexandre Marques^{1*}, André Mendes de Carvalho¹

Abstract: Lean thinking is transforming the traditional way of a retail business operates to new and more effective practices. In particular, the food retail business is facing previously unseen challenges which require daily operational excellence to meet them with success. Low productivity, high variability in task completion, lack of work planning should be faced with daily relentless improvement actions. Kaizen, the continuous improvement pillar of Lean, needs to be seen not only as a methodology but also as a philosophy, a vision that needs to be written on everyday actions and personified by each individual. This paper describes an improvement event in the fresh food markets, specifically in the cold meat section, meant to decrease the shrinkage rate as well as the number of out-of-stock (OOS) situations. The methodology adopted followed the seven-step problem-solving procedure provided by the A3 thinking tool.

Keywords: Lean thinking, out-of-stocks, retail, shrinkage rate structured problem-solving.

Introduction

Challenging competitors and increasingly demanding customers make the food retail market one that needs to be updated with innovation and continuous improvement efforts. Some of the challenges faced by retailers often include the need for a more efficient replenishment process, adequate on-shelf availability, suitable inventory levels, and acceptable amount of product shrinkage. Companies from this sector are increasingly more aware of the importance of adopting Lean practices to boost their operational performance, enhance teams' productivity, and increase customer satisfaction. The systematic adoption of standardized work, structured problem-solving activities, process flow optimization through the detection and elimination of non-value adding tasks, are just a few examples of the correct behaviors that drive operational performance and business results.

This paper presents a real case study of a Lean project conducted by the local teams of a Portugal food retail store. The improvement event took place in the cold meat area, which comprises both a counter and a self-service shelving area. The seven stages of the A3 methodology provided the problem-solving for this event, which main goal was to minimize the product shrinkage rate generated in this market and to decrease the number of stockouts.

Methods

Lean Management

The concept of Lean Management can be traced to the Toyota Production System (TPS), a manufacturing approach developed by the Japanese engineers Taiichi Ohno and Shigeo Shingo [1]. Ohno's career remained with Toyota, while Shingo introduced these concepts to many other industries, not only in Japan, but also in the US and in Europe [2]. In a simplistic way, Lean aims to create value for the customer and to the business by reducing waste factors in the organizational processes [3], hence increasing efficiency and productivity. It offers a wide variety of methods and tools that can be effectively adopted by any type company to eliminate anything that does not add value in a process [4]. According to Goetsch and Davis [5], Lean was conceived as a company-wide management system, not just for the manufacturing floor. In fact, a Lean management system must be designed and implemented to align and integrate long-term strategic planning with day-to-day improvement targets [6]. Lean has also been successfully integrated with other management practices, including Six Sigma in a combined approach known as Lean Six Sigma [7].

In order to operationalize continuous improvement efforts by the local teams in their workplaces and processes, Lean provides a set of tools to assist during group-based problem-solving initiatives [8]. The A3 thinking tool provides a useful and systematic framework to go through all the necessary stages that encompass the problem-solving process [9]. It is a single page problem-solving tool, also used for visual report purposes, that is designed to fit on a standard

¹ EIGeS – Research Centre in Industrial Engineering, Management and Sustainability, Lusófona University. Campo Grande 376, 1749-024 Lisbon, Portugal.

Email: pedro.alexandre.marques@ulusofona.pt;
andre.carvalho@ulosofona.pt

*Corresponding author

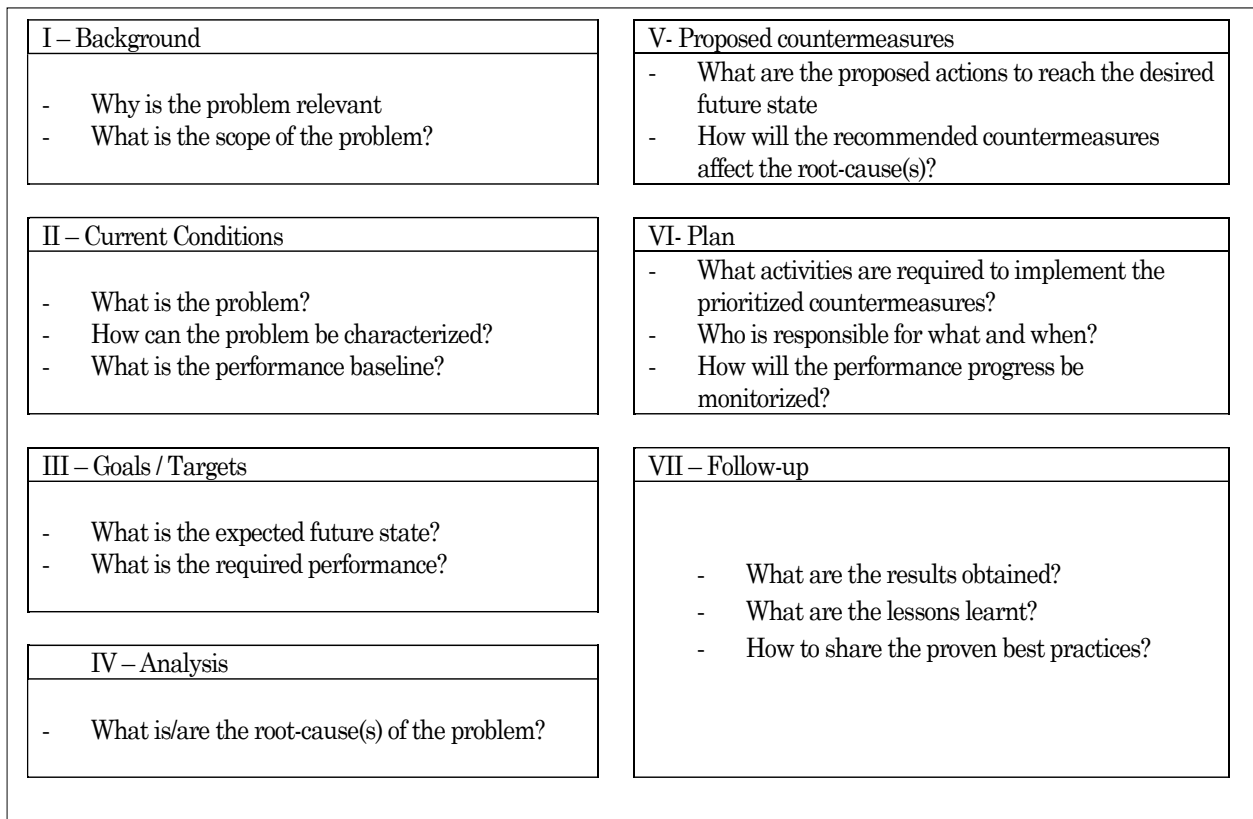


Figure 1. A3 report for problem-solving and its stages

A3 sized-paper [10]. The A3 report is broken down into seven blocks, each one corresponding to a specific stage of the problem-solving process, as depicted in Figure 1.

Lean in the Retail Sector

There are many reported examples in the literature regarding the adoption of Lean in the retail sector. Walmart and Staples have successfully designed and implemented efficient supply chains by adopting core Lean principles [11], while Mercadona’s business model is known to be organized around the customer, focusing on the elimination of everything that does not add value to the consumer [12]. Naruo and Toma [13] studied how Lean principles and concepts are successfully applied in Seven-Eleven Japan. Tesco is one of the pioneers on the adoption of Lean in retail [14]-[15], by promoting a pullmindset into their supply chain and store operational flows. The implementation of daily kaizen activities at Sonae MC, a company that owns more than 300 food supermarkets in Portugal, was reported by Imai [16].

Lack of on-shelf availability is recognized as one of the most relevant retail problems because it is proven that stockouts negatively affect customers’ purchasing behaviors [17]. According to a study reported by Ali [18], more than 15% of customers usually decide to quit their purchase and go elsewhere to purchase a

stockout product. It is curious to note that high inventory levels make instore logistics more prone to execution errors, causing shelf stockouts [19] and higher risk for product shrinkage [20]. In fresh products categories, product deterioration is the biggest concern of food retailers, not only because it negatively affects customer perception of quality but also because of the monetary loss it creates [21]. There are a number of examples of Lean improvement initiatives found in existing literature. Evans and Lindsay [22] refer to a kaizen event conducted at the retail services of Magnivision to investigate problems that continually plagued employees. Jaca et al. [23] described a project conducted at a distribution center that enhanced its productivity by removing inefficiencies from the activities taking place at the warehouse. Noda [24] explained the sustained adoption of standardized work and process improvement practices based on Lean principles by a mid-size Japanese retailer which sold foods, consumables, apparel, and general merchandise goods.

Results and Discussions

Problem Statement and Methodology

The case study was conducted in April 2019 in one hypermarket store of a multinational corporation in the retail sector located nearby Lisbon, Portugal.

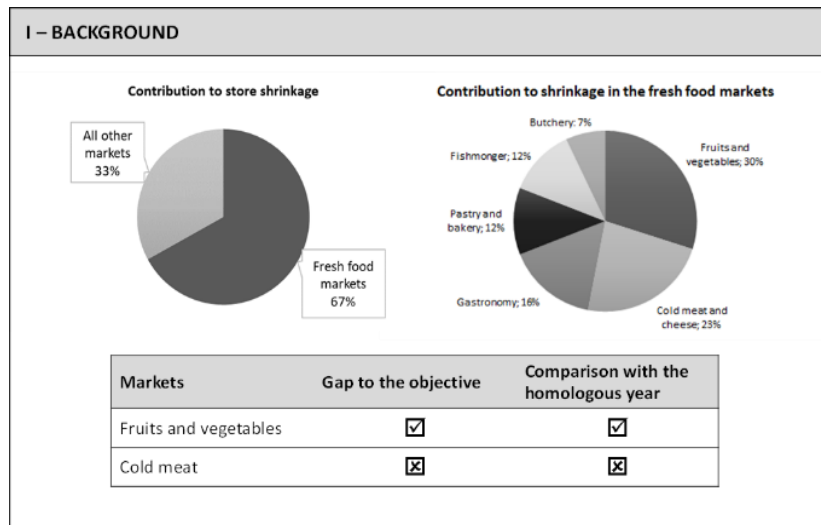


Figure 2. "Background" stage of the A3 tool

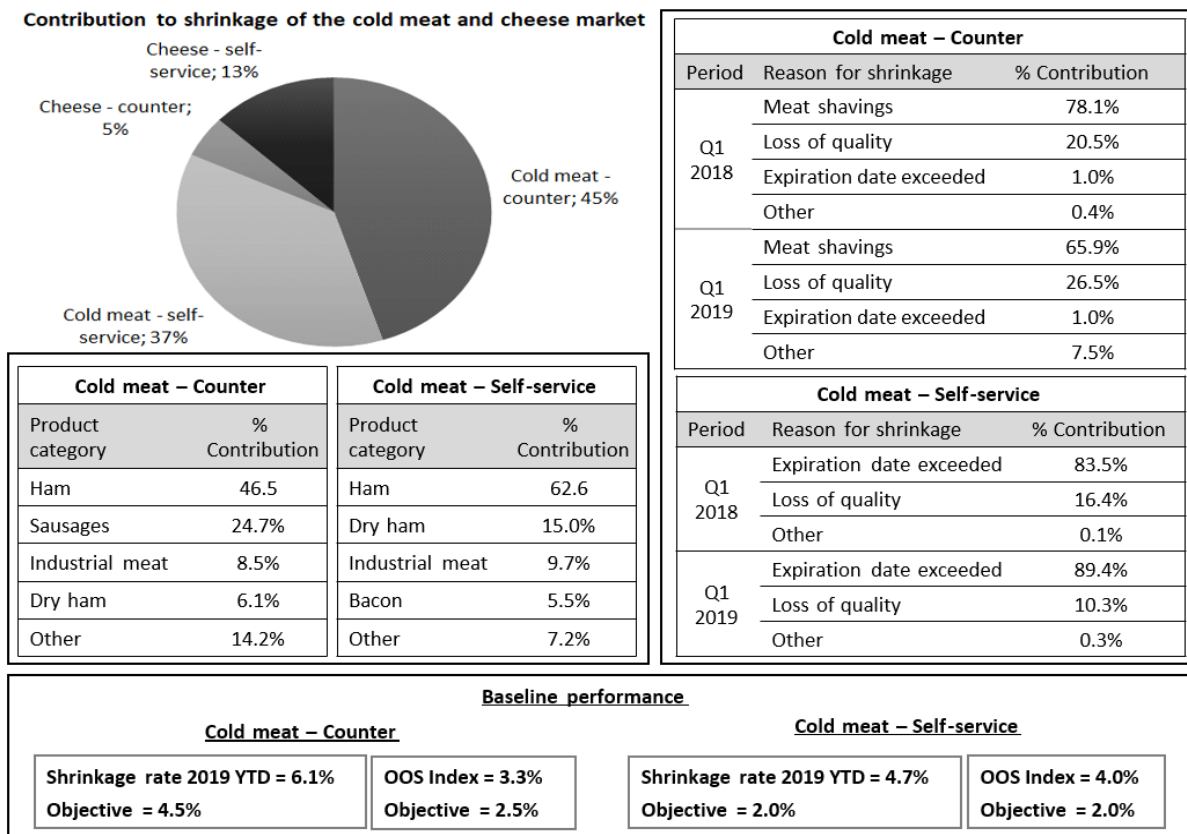


Figure 3. "Current conditions" stage of the A3 tool

The company was facing poor performances in two key operational indicators:

- 1) Shrinkage rate;
- 2) Out-of-stocks (OOS) index.

The first indicator measures the percentage of money that is lost due to shrinkage. The term "shrinkage" includes situations of food waste due to poor handling, exceeded expiration date, storage and display, among other factors. The second metric is related with product availability and it is obtained by dividing the

number of stockouts by the total number of product references for sale.

With the objective of improving both metrics, it was decided to initiate a problem-solving improvement event following the stages provided by the A3 thinking tool and exhibited in figure 1. A cross functional team was brought to participate in the initiative. Each of the seven stages that encompasses the methodology is described in the next sub-sections.

Stage 1 - Background

Available data from 2019 showed that two thirds of the loss money due to product shrinkage in the store was caused in the fresh food markets, especially in two of them: 1) fruits and vegetables (F&V), and 2) cold meat and cheese. On the contrary of the F&V market, the shrinkage rate results in the later market were worse when compared with the objective as well as with the results achieved in same period of the previous year. For these reasons, it was decided that the improvement team would focus in the cold meat and cheese market throughout the problem-solving event. Figure 2 depicts the described reasoning.

Stage 2 – Current Conditions

The referred market comprises the four sections exhibited in the pie chart of Figure 3. Both the cold meat and cheese items are sold in the counter and in the self-service shelves. Together, the two cold meat sections (counter and self-service) account for more than 80% of the shrinkage in this market, so they were prioritized over the cheese areas.

Data from the first quarter of 2019 revealed that the end of expiration date had the greatest impact – over 80% – in the shrinkage reported for the self-service section. The same pattern could be observed in the values corresponding to the same period of the previous year. For the counter section, the excess of meat

shavings justified the majority of the shrinkage. Meat shavings are resold trimmings that are created due to the slicing of the ham, including the remaining piece after cutting. Despite they contribute to the reduction of the overall food waste; meat shavings have a much lower economic value when compared with the ham, implying a monetary loss for the store. Loss of quality is also a relevant reason for product shrinkage in the counter. In the counter and selfservice sections, “ham” was the product category that contributed most for the overall shrinkage.

The shrinkage rate was set as be the main performance indicator to be impacted by this project; however, it was considered relevant to monitor another indicator: the out-of-stocks (OOS) index. Shrinkage reduction could not be done at the expense of loss of product availability. The performance baseline for these KPIs was estimated, revealing the existence of significant gaps between results and objectives.

Stage 3 – Goals/Targets

This step involved the definition of SMART (Specific, Measurable, Achievable, Relevant to business, Timebounded) goals for both KPIs, which in this case was equivalent to recast the initial objectives. They were included in the third room of the A3 report (Figure 4).

III – GOALS / TARGETS			
Cold meat – Counter		Cold meat – Self-service	
Shrinkage rate 2019 YTD = 6.1%	OOS Index = 3.3%	Shrinkage rate 2019 YTD = 4.7%	OOS Index = 4.0%
Objective = 4.5%	Objective = 2.5%	Objective = 2.0%	Objective = 2.0%
RECAST OBJECTIVE= 4.8%	RECAST OBJECTIVE= 2.5%	RECAST OBJECTIVE= 2.0%	RECAST OBJECTIVE= 2.5%

Figure 4. “Goals/Targets” stage of the A3 tool.

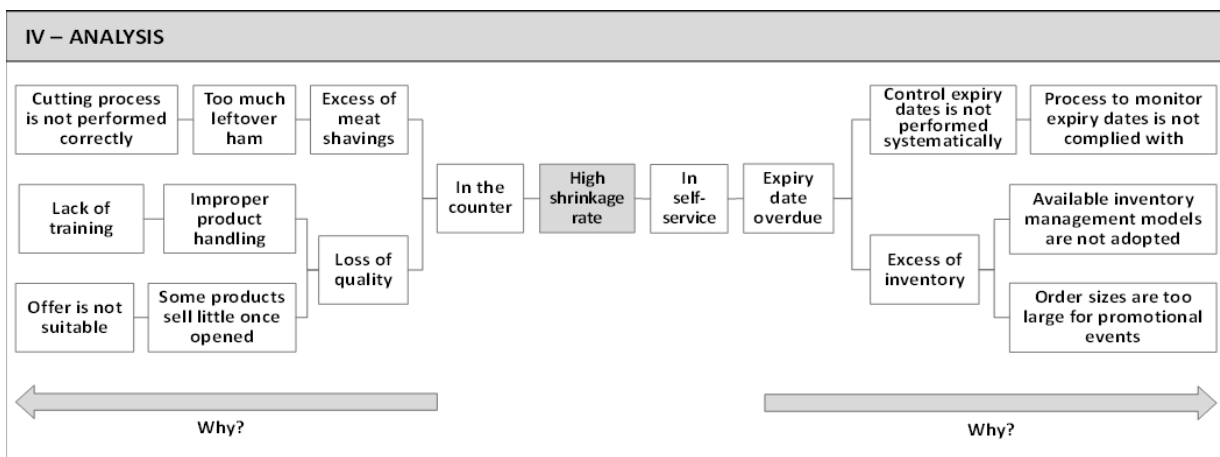


Figure 5. “Analysis” stage of the A3 tool

Stage 4 – Analysis

This stage involved the conduction of analysis to determine the root-causes that explain the high shrinkage rate in the two sections of the cold meat market. By consecutively answering the questions “why” it was possible to construct a tree diagram illustrated in Figure 5. The root-causes appear at the leaf-level of the tree.

Stage 5 – Proposed countermeasures

Countermeasures were suggested to respond to each of the root-causes identified in the previous stage. They are indicated in the fifth section of the A3 report, and available in Figure 6.

To reduce the amount of cold meat shavings generated in the ham cutting process, there was a consensus on the need to establish a simple and visual standard to

train people and standardize the best practices in such task. It was also decided to specify a minimum weight allowed for the leftover ham not only for operators to become aware about the importance of not wasting product, but also to define a threshold to assess the conformity of the process result. Also in the counter, it was found that there was around a dozen of products with low levels of demand, so the risk of these products get degraded quickly, once opened, was significant. The countermeasures to face this fact focused on a complete revision of the set of products available for customers in the counter area.

In the self-service area, the main reason for shrinkage was the expiration date, mainly due to incorrect practices of not adopting the prescribed procedures for inventory management and expiry dates control. Hence, all the improvement actions defined for the self-service shelving area aimed to deal with these causes.

	ROOT-CAUSE	PROPOSED COUNTERMEASURES
COUNTER	The cutting process of the ham is not performed correctly.	<ul style="list-style-type: none"> • Create visual procedure for “cutting ham”. • Train employees in the cutting procedure. • Specify a minimum weight allowed for the leftover ham.
	Lack of training in product handling.	<ul style="list-style-type: none"> • Create visual standards in product handling procedures. • Train people in the handling procedures.
	Offering in the counter is not suitable.	<ul style="list-style-type: none"> • Do not offer the least sold items in the counter, instead offer them in the self-service area. • Review the overall product offering with the company’s Product Manager.
SELF-SERVICE	Available inventory management models are not adopted.	<ul style="list-style-type: none"> • Train the Market Manager in using the existing inventory management models.
	Order sizes are too large for promotional events.	<ul style="list-style-type: none"> • Supervise the ordering process prior any promotional event. • Apply demand forecast models to define order sizes.
	Process to monitor expiry dates is not complied with.	<ul style="list-style-type: none"> • Perform daily work planning to ensure one person is allocated to perform this process.

Figure 6. “Proposed countermeasures” stage of the A3 tool

	COUNTERMEASURES	WHO IS RESPONSIBLE FOR	DUE DATE
COUNTER	• Create visual procedure for “cutting ham”.	• Miguel	• Week 17 of 2019
	• Specify a minimum weight allowed for the leftover ham.	• Miguel	• Week 17 of 2019
	• Train operators of the counter in the cutting ham procedure.	• Miguel	• Week 17 of 2019
	• Create visual standard regarding product handling.	• Miguel	• Week 18 of 2019
	• Train operators in the product handling procedures.	• Miguel	• Week 18 of 2019
	• Review product offering in the counter with Product Manager.	• Maria	• Week 17 of 2019
SELF-SERVICE	• Analyze with product references should be available in the self-service area.	• Maria	• Week 17 of 2019
	• Perform daily work planning to allocate one person to control expiry dates	• José	• Week 16 of 2019
	• Train the Market Manager in using the existing inventory management models.	• Joana	• Week 18 of 2019
	• Apply demand forecast models to plan order sizes for promotional events.	• José	• Week 18 of 2019
	• Supervise the ordering process prior any promotional event.	• Joana	• Week 18 of 2019

Figure 7. “Plan” stage of the A3 tool

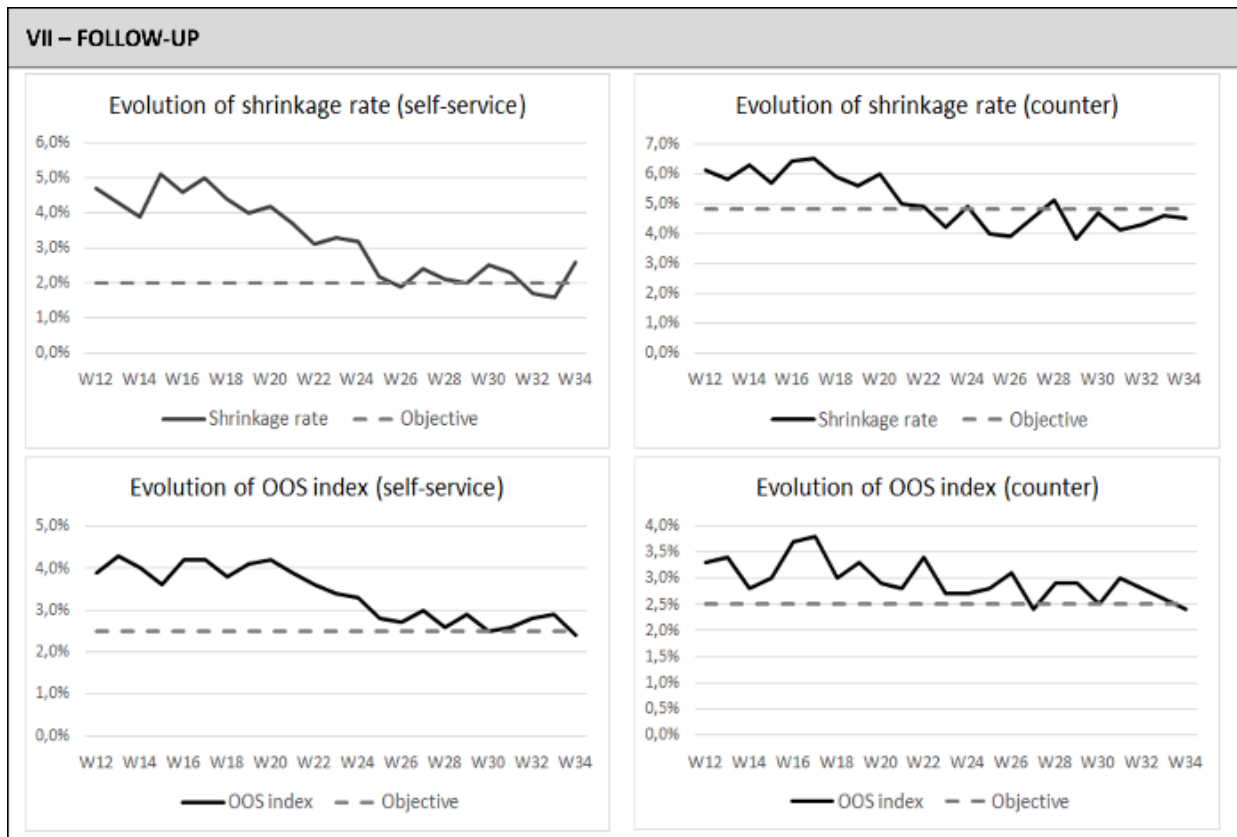


Figure 8. "Follow-up" stage of the A3 tool

Stage 6 – Plan

This stage consisted of defining deadlines as well as responsibilities to implement the countermeasures proposed previously. The plan was summarized in table format and inserted in the A3 thinking tool. (Figure 7).

Stage 7 – Follow-up

In this stage the effectiveness of the countermeasures was verified by monitoring the evolution of the two KPIs of interest: 1) Shrinkage rate, and 2) Out-of-stocks (OOS) index. As can be observed in Figure 8, there was a very positive trend in the operational performance reported by the counter and the selfservice sections, specially from week 22. Less shrinkage means less food waste, while fewer stockouts implies more availability of products for the customer. To sustain these results, the new procedures were standardized, training sessions were held to more effectively and quickly institute these same standards, and a control plan was put in practice to periodically measure, monitor, and evaluate not only the performance but also the compliance with the new procedures.

Problem-solving report

Figure 9 exhibits the full A3 report that merges all the seven stages in a single sheet, functioning as a simple

and visual communication tool. This feature turned out to be very useful in providing a standard and logical procedure for other operational teams of the stores to conduct improvements in their markets.

Conclusion

This paper described a case study on the application of the structured problem-solving methodology provided by the A3 thinking tool to improve the operational performance in the cold meat market of a supermarket retail store. Food waste is a typical problem that exists in all fresh food markets, including in this one. It can be tracked by monitoring the value of the shrinkage rate, which is an indicator that measures the percentage of wasted food due to factors that imply the withdrawal of the product from sale. The main purpose of the Lean problem-solving initiative was to decrease the shrinkage rate in the two sections that comprise the cold meat market: 1) counter, and 2) self-service shelves.

The out-of-stocks (OOS) index was also adopted as a key performance indicator for the improvement initiative. It provides an indication about the percentage of products that are not available on the shelves or in the counter to be sold to the customer. It was possible to verify an improvement in the value of the OOS index, mainly in the self-service shelving

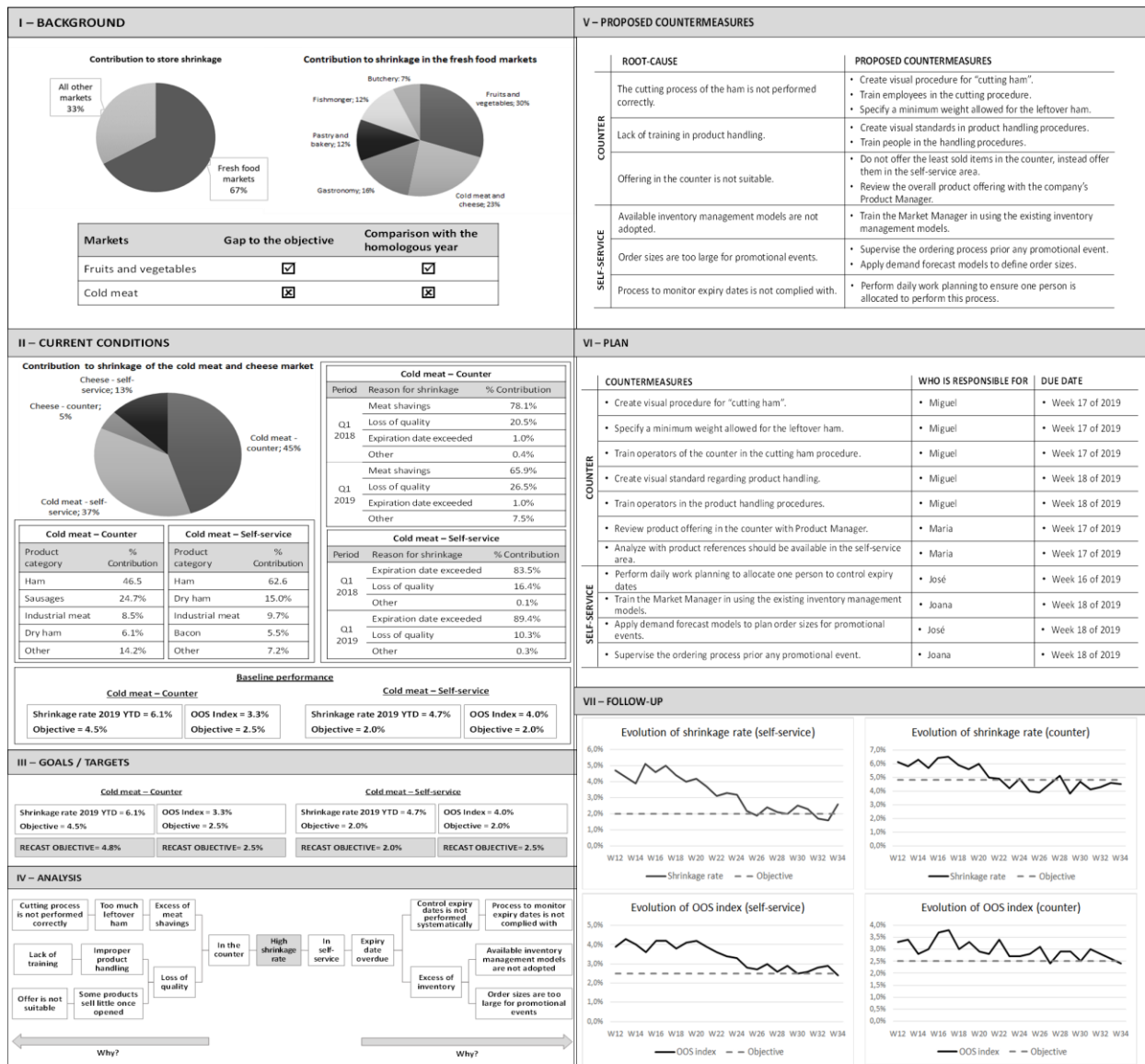


Figure 9. The complete seven A3 problem-solving stages for the case study

section, thus meaning that shrinkage reduction was not achieved at the expense of a lack of product, quite the contrary.

The case study demonstrated the practical applicability of the A3 thinking tool for problem solving situations in the retail business.

References

1. Arnheiter, E. D., and Maleyeff, J., The Integration of Lean Management and Six Sigma, *The TQM Magazine*, 17(1), 2005, pp. 5-18.
2. Oakland, J. S., *Total Quality Management and Operational Excellence: Text with Cases*, 4th Edition, Routledge, New York, 2014.
3. Flor Vallejo, V., Antony, J., Douglas, J. A., Alexander, P., and Sony, M., Development of a

Road Map for Lean Six Sigma Implementation and Sustainability in a Scottish Packaging Company, *The TQM Journal*, 32(6), 2020, pp. 1263-1284.

4. Gutpa, S., and Jain, S.K., A Literature Review on Lean Manufacturing, *International Journal of Management Science and Engineering Management*, 8(4), 2013, pp. 241-249.
5. Goetsch, D. L., and Davis S., *Quality Management for Organizational Excellence: Introduction to Total Quality*, 9th Edition, Pearson, Boston, 2020.
6. Manos, A., Hoshin Promotion, Six Sigma Forum Magazine, 9(4), 2014, pp. 7-14.
7. Snee, R., and Hoerl, R., Time for Lean Six Sigma 2.0?, *Quality Progress*, 50(5), 2017, pp. 50-53.
8. Worley, J. M., and Doolen, T. L., Organizational Structure, Employee Problem Solving, and Lean

- Implementation, *International Journal of Lean Six Sigma*, 6(1), 2015, pp. 39 - 58.
9. Shook, J., *Managing to Learn: Using the A3 Management Process to Solve Problems, Gain Agreement, Mentor, and Lead*, Lean Enterprise Institute, Boston, MA, 2008.
 10. Amos, A., Taylor, K., Johnson, K., Comitz, E., Adams, R., Tracton, G., Chera, B., Marks, L., and Mazur, L., Assessing the Quality of the A3 Thinking Tool for Problem-Solving, in: Ahram, T., and Karwowski, W. (Eds.), *Advances in The Human Side of Service Engineering. Advances in Intelligent Systems and Computing*, 494, Springer, Cham, 2017, pp. 49-61.
 11. Myerson, P., Lean Retail, in: Netland, T. H., and Powell, D. J. (Eds.), *The Routledge Companion to Lean Management*, Routledge, New York, NY, 2017, pp. 413-421.
 12. Morcillo-Bellido, J., and Duran, A., Supply Chain Sustainability in Spanish Major Retailer Through Strategic Alliances and Lean Practices, in: Viles, E., Ormazábal, M., and Lleo, A. (Eds.), *Closing the Gap Between Practice and Research in Industrial Engineering*, Springer, 2018, pp. 11-18.
 13. Naruo, S., and Toma, S., From Toyota Production System to Lean Retailing: Lessons from Seven- Eleven Japan. In: Olhager, J., and Perrson, F. (Eds.), *Advances in Production Management System*, Springer, Boston, MA, 2007, pp. 387-395.
 14. Smith, L., and Sparks, L., Tesco's Supply Chain Management, in: Fernie, J., and Sparks, L. (Eds.), *Logistics & Retail Management: Emerging Issues and New Challenges in the Retail Supply Chain*, Kogan Page, Philadelphia, PE, 2009, pp. 143-171.
 15. Womack, J. P., and Jones, D. T., *Lean Solutions: How Companies and Customers can Create Value and Wealth Together*, Free Press, New York, NY, 2005.
 16. Imai, M., *Gemba Kaizen: A Commonsense Approach to a Continuous Improvement Strategy*, McGraw-Hill, 2nd Edition, New York, NY, 2012.
 17. Domingo, T. M., *The Adoption of Lean Techniques to Optimize the On-Shelf Availability of Products and Drive Business Performance in the Food Industry: A South African Manufacturing and Retail Case Study*, M.Sc. thesis, Cape Town Univ., Cape Town, South Africa, 2013.
 18. Ali, D. H., Assessment of the Effect of Out-of-Stock on Customers Purchasing Behavior, *International Journal of Transportation Engineering and Technology*, 5(2), 2019, pp. 25-29.
 19. Chuang, H., Oliva, R., and Liu, S., Examining the Link Between Retailer Inventory Leanness and Operational Efficiency: Moderating Roles of Firm Size and Demand Uncertainty, *Production and Operations Management*, 28(9), 2018, pp. 2338-2364.
 20. Bertolini, M., Ferretti, G., Vignali, G., and Volpi, A., Reducing Out of Stock, Shrinkage and Overstock through RFID in the fresh food supply chain: Evidence from an Italian Retail Pilot, *International Journal of RF Technologies*, 4(2), 2013, pp. 107-125, 2013.
 21. Saucedo, F., Fenneteau, H. and Codron, J. M., Department Upkeep and Shrinkage Control: Two Key Variables in Optimizing the Performance of Fruit and Vegetables Departments, *International Journal of Retail & Distribution Management*, 42(8), 2014, pp. 733-758, 2014.
 22. Evans, J. R. and Lindsay, W. M., *An Introduction to Six Sigma & Process Improvement*, 2nd Edition, CENGAGE Learning, Stamford, CT, 2015.
 23. Jaca, C., Santos, J., Errasti, A., and Viles, E., Lean Thinking with Improvement Teams in Retail Distribution: A Case Study, *Total Quality Management & Business Excellence*, 23(3-4), 2012, pp. 449-465, 2012.
 24. Noda, T., Integration of Lean Operation and Pricing Strategy in Retail, *Journal of Marketing Development & Competitiveness*, 9(1), 2015, pp. 50-60.