



***(Meat)ings:
Operational and strategic challenges
of a retailer meat supply chain***

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Dissertation submitted in partial fulfilment of requirements for the degree of MSc in Business Administration, at the Universidade Católica Portuguesa, May 2014.

Abstract

(Meat)ings: Operational and strategic challenges of a retailer meat supply chain

Afonso Carrêlo

This business case is based in a 2015 project of review and analysis of the whole supply chain of the Meat Department from the major retailer in Portugal, SonaeMC. The main drivers for the existence of this project were the huge entropy within the department and the towering perishable shrinkage. We follow Célia Fialho and a final year graduating student, through four meetings to pinpoint critical issues to propose strategic and operational solutions to solve the above-mentioned issues and to improve the supply chain. The case is targeting strategy and operations management students (and similar), introducing main concepts and topics related and to present a real retailer supply chain in a change situation.

Key-words: supply chain, meat operations, forecast, change management, operational strategy.

Resumo

(Meat)ings: Desafios operacionais e estratégicos na cadeia de abastecimento de carne de um retalhista

Afonso Carrêlo

Este caso de estudo é baseado num projecto, de 2015, de revisão e análise de todo o processo da cadeia de abastecimento do Departamento do Talho, do maior retalhista em Portugal, SonaeMC. Iniciou-se o mesmo, devido à existência de uma enorme entropia dentro do departamento e da crescente quebra intrínseca.

Seguimos os passos de Célia Fialho e um estudante finalista, através de quatro reuniões para identificar problemas críticos e apresentar soluções operacionais e estratégicas para resolver os diversos problemas da cadeia. O público-alvo deste caso são estudantes de estratégia e gestão de operações (e similares), introduzindo conceitos e tópicos relacionados e apresentando um caso real de uma situação de mudança numa cadeia de abastecimento de retalho.

Key-words: cadeia de abastecimento, operações de mercado da carne, previsão, gestão de mudança, gestão de operações.

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Acknowledgments

First, I would like to express my gratitude towards my family, which has supported me through all difficulties and have given up for so much to provide me with an opportunity to thrive in life; my friends, which steered my mind with our Daedalian “Tertúlias”; Célia Fialho, David Salgado and the Meat department from Sonae, which allowed me to use them as the protagonists of this case; my thesis supervisor Prof. João Simão Pires, not only for the great advices, but also for the liberty and ideas given to write this thesis; SonaeMC, which has given me a huge opportunity to combine this thesis and the Call for Solutions program; and finally to all the Fresh Department and Call for Solutions interns, which have accompanied me through this magnificent experience in this final stage of my masters.

(Meat)ings: Operational and strategic challenges of a retailer meat supply chain

“Are you ready for the challenge?” asked David Salgado, SonaeMC’s Meat Department Director, “Our Department has the responsibility to address an ever-changing demand, while managing an extremely long and complex process, from the animal production to a final product in a store”. Next to him was Célia Fialho, a Project Manager¹, which was going to guide and work with me for the next five months.

The project consisted on an analysis of the whole supply chain of the Meat Department to identify critical issues and propose strategic solutions. It was definitely interesting and challenging, but could I handle it? I was finishing my Masters in Business Administration, with small work-experience and almost no knowledge of the food retail business, but I was never a person to back down in front of a challenge.

“So, are you ready?”

Sonae Background²

Sonae is a Portuguese company founded in 1959 as a national laminated wood society (Sociedade Nacional de Estratificados), which survived market changes, crisis and revolutions³. For the next 20 years, Sonae grew and expanded to different industries and, in 1985, opened the 1st hypermarket in Portugal. This was the foundation of **SonaeMC**, a core business food retail unit at Sonae corporation.

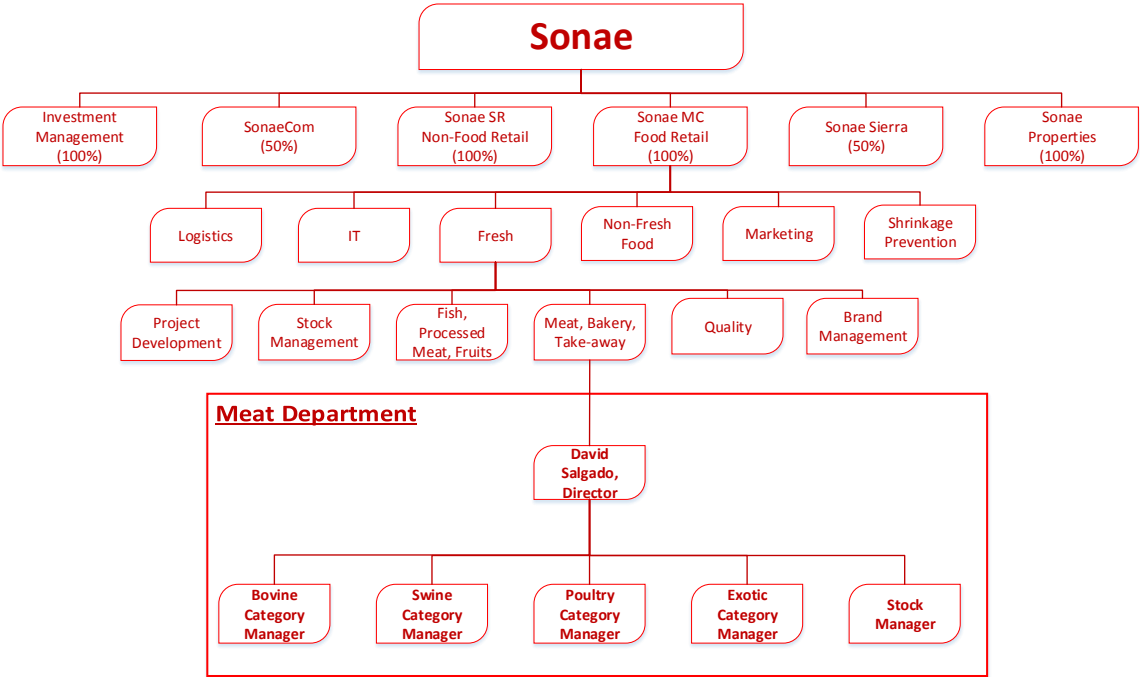


Figure 1: Detailed structure of the organization of Sonae corporation with the different business units⁴.

¹ For more information regarding the positions/titles of each member within Sonae please *vide in* table 1.
² The information displayed in this section was obtained with Sonae and can be verified with the Investors Relations department and within official documents (Annual reports and financial statements).
³ A series of countrywide nationalizations have taken place during the Portuguese revolution, which started on the 25th of April of 1974. Sonae was nationalized in 1978; after several strikes and the resignation of the administration against this measure, Sonae regained its private ownership.
⁴ Obtained from SonaeMC and not all information is disclosed in this figure, due to confidentiality agreements.

Nowadays, SonaeMC has more than 415 stores, with more than 500 thousand m² of sales area and a turnover of € 3460 M in 2014⁵. It is divided in a structure with several vertical branches; from vegetables to canned food products, each with its own Stock Management department; and with horizontal departments, like Logistics and Stock Shrinkage Prevention departments, to improve control and quality.



Figure 2: Functional representation of the Fresh department structure, with vertical branches (Meat, Bakery, Take-away and Other Departments) and horizontal branches represented with arrows.

One of these branches is the Fresh Department, focused on the sales management of the most perishable food products; within it David Salgado spearheads his own team: the Meat Department (*vide supra*, in figure 1).

Meat Department at SonaeMC⁶

As of 2014, there was a vast array of meat products (approximately 200 products), for the Portuguese market demand. These were divided through categories of species; each with a specific Category Manager, in charge of buying the best price/quantity of raw material for the final products in both self-service and service counter. Following, a typical operational process within this department will be detailed.

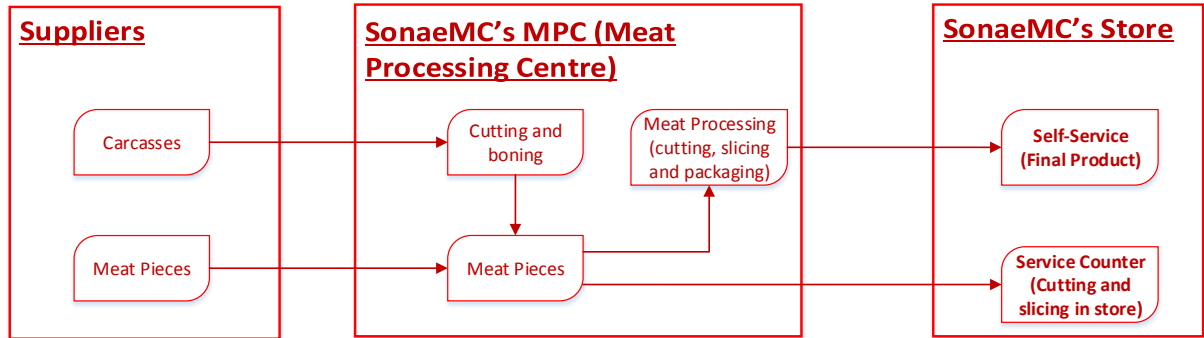


Figure 3: Simple representation of the supply chain, presenting the possible routes of the raw material until the Self-Service or the Service Counter.

⁵ Information obtained from Sonae’s Financial Report 2014. Its main competitor is Pingo Doce, with € 3181 M in 2013. These can be consulted in Jerónimo Martins 2013 Annual Report, the most updated version until the present date.

⁶ Data obtained at SonaeMC and Nielsen Homescan Market 2015 Fresh Food reports analysis.

The Category Manager negotiates with several suppliers always trying to achieve the best price/quantity, not only keeping quality in mind but also the huge demand they need to address. Due to the latter, meat (in carcass or alive) is mainly imported from European suppliers with increased production capacity, whereas Portuguese suppliers provide high quality meat, but reduced quantities.

The Category Manager buys the raw material, which might be alive or dead, in carcass or already in pieces. If alive, it needs to be slaughtered in a certified abattoir; then the carcass needs to pass through an initial process of cutting and boning in to several pieces.

Afterwards the pieces are transported to Sonae’s MPC - Meat Processing Centre, where the meat pieces destined to the self-service are processed and transformed into the final products. The pieces destined for the service counter are examined for quality and control concerns and then distributed to the stores. This centre was built to address the huge demand in Portugal while reducing costs and improving quality and control.

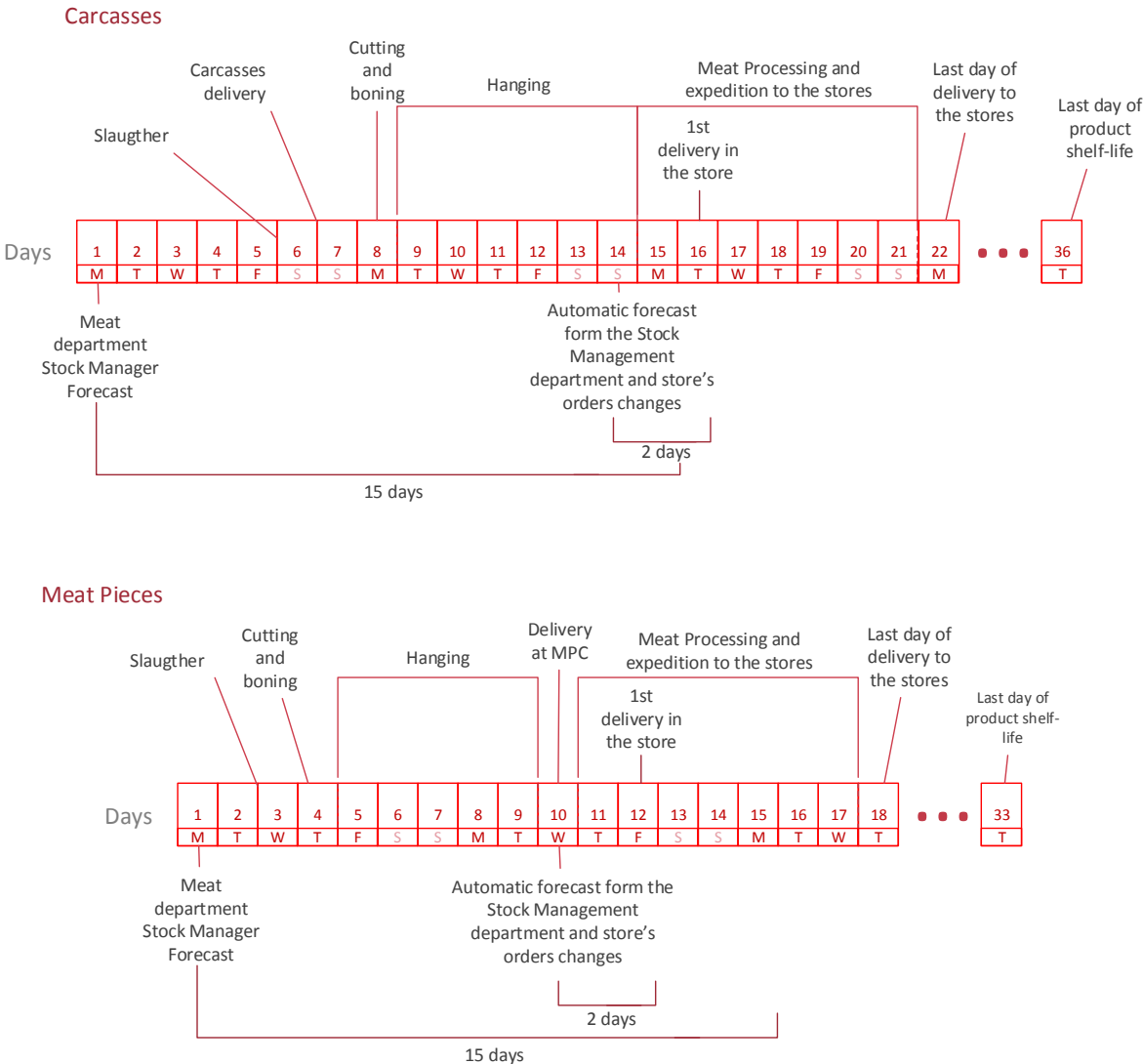


Figure 4: Timeline (days of the week and the shelf-life days) with the supply chain stages and forecasting moments for carcasses and meat pieces. Hanging is a resting period for the meat to change its biochemical properties, softening and enhancing its flavour.

For example, a Bovine with 345 Kg (average weight) will be divided in 104 pieces, which will be processed and transformed in only 59 final products (more than one piece can make the same final

product. Around 75% of the 345Kg will represent the 60 products, the rest are disposable (bones, fat, etc). The lead time of the whole process, from the supplier to the store, is between 12 and 16 days⁷ and the shelf-life of the product is 30 days (after the animal slaughter). All these factors, variables and practises change from category to category, increasing the complexity and entropy, characterized by the huge amount of administrative and operational processes⁸, within the Meat Department.

In 2015, the Meat Market in Portugal had the total size of almost € 1000 M and there is was a huge competition between SonaeMC and Pingo Doce. Although, the most prominent indicator that there was a need to act in this sector, besides the department entropy, was the perishable shrinkage⁹, which had been extremely high since 2013. Also, the first quarter of 2015 was the highest of its homologous periods accruing up to a loss of 2,89 million €. These were the driving forces to start this project; SonaeMC’s Meat Department was losing efficiency.

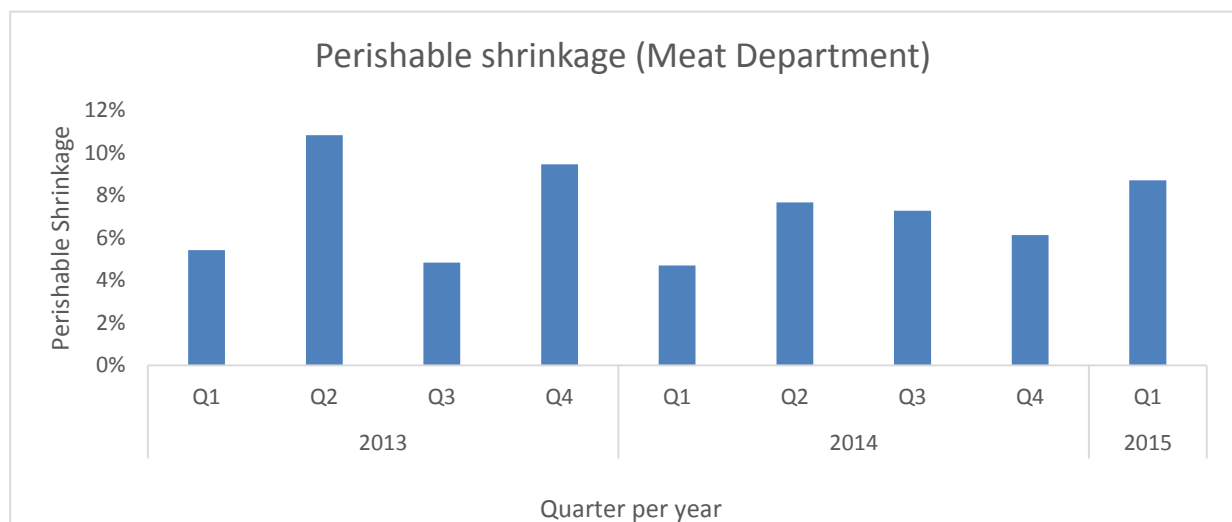


Figure 5: Perishable shrinkage in percentage per sales, per quarters from 2013 to 2015. The first quarter of 2015 (there was a loss of 2,89 Million €) was the highest in comparison to the homologous periods 2013 and 2014¹⁰.

“Kicking-off”

Célia was looking over a detailed drawing of the supply chain. Though some critical points were already identified, we were not sure about them or the way to address them. “*We need to know more, we need to hear them*”, this wasn’t Fialho’s first project; she knew that small details could be perceived while talking to the staff involved in the chain. These small details could hide big issues and opportunities.

For the past weeks, we were looking over extensive amounts of data, from sales deviations, lead times, forecast methods, production procedures to shrinkage correlations. However, it seemed that we

⁷ It depends on the market demand, because it will change the meat processing and consequently, the production lead-time.

⁸ The word entropy was used many times within Sonae to demonstrate also the disruption within the supply chain, not only regarding the products, but also information.

⁹ Perishable shrinkage is the loss of product between the production and purchase point to the stores, related to the short shelf-life of perishable products. These products are sold (or bought, depending on market prices) to by-product companies, which transforms animal waste residues into value-added products, like grease by-products, fertilizers or animal food.

¹⁰ Another indicator commonly used in SonaeMC is the number of stockouts, where there is a lack of inventory to address the current demand. These are not frequent and they are hard to track and to quantify their impact, since there is new inventory arriving to the stores, every day (eliminating the stockout).

haven't started yet. We already knew the products, the supply chain, the business, but we weren't confident enough about our findings. Nonetheless, Célia knew what the next step should be: *"We need to hear them all. Four meetings: the Meat Department, the Stock Management, MPC staff and the stores"*. In the table below there are the main participants in these meetings:

Meetings	Position/Title	Department	Functions
Meat Department	Meat Department Director - David Salgado	Meat Department	Manages the Meat Department, buying meat from the market (national and international) and supplying it to the stores.
	Project Manager - Célia Fialho	Project Development	Coordinates the development of innovation, strategy and improvement projects. In this specific case, Célia was in charge of the project for improvement of the Meat Department supply chain.
Stock Management	Category Manager	Meat Department	Buys the raw material (depending on the category), with the best price/quality available in the market (national and international).
	Meat Department's Stock Manager	Meat Department	Monitors and forecasts the stocks along the supply chain, from the Supplier to the MPC.
Meat Processing Centre	Stock Manager	Stock Management Department	Monitors and forecasts the stocks along the supply chain, from the MPC to the stores.
	MPC's Head Manager	Meat Processing Centre (within Logistics)	Manages the financial, operational and HR activities within the MPC.
The stores	MPC's Facility Manager	Meat Processing Centre (within Logistics)	Manages the operations within the MPC.
	Store Managers	Logistics	Responsible for managing all the process and activities within a store.
	Regional Operations Manager	Logistics	Supervises the logistics and operations of a region, supplying stores with the necessary products.

Figure 6: Positions/title of every participant of the four meetings below with the respective Department and detailed Function within SonaeMC.

Meat Department

Following a brief project presentation from David, the Meat Department's Stock Manager initiated the discussion explaining the overall common practices within the department. He was detailing how he was in constant contact with the Category Managers to know if the quantities of raw material available in the market are the same as the forecasted. Célia enquired *"How is the forecast going? How are we predicting the demand?"*. The only response: *"It is worth what is worth"*.

"So there is no way to know the performance of the forecasting program?" insisted, while sensing that this might be one of the small details that could have a big influence in the whole process (for more details *vide supra*, figure 4).

"Forecasting program? I use my head. Besides, I don't think a computer could be able to cope with so many variables: temperature, price changes, promotions, competitor's promotions, the raw material

market... And everything predicted two weeks in advance to be able to slaughter the animals, order the pieces and process the meat”, answered the Stock Manager in a apprehensive way.

From the other side of the table, a Category Manager supporting these statements, explained that the raw material market was extremely volatile: *“We buy carcasses or meat pieces. To produce the final product A, we can use the meat piece B or C, and we substitute them according to the availability on the market”*. While shuffling through the company documents, Célia asked again *“With so many animals and products, how do you know which meat piece substitutes which? Do you have any specific table of substitutes?”*. Another simple answer emerged: *“No, we just know it by heart”*.

As the meeting went on many issues were mentioned especially related to the department entropy, from the huge quantity of mails received from the stores and the MPC, to the sudden promotion changes. The last compels the entire department to change their orders and occasionally, they cannot be changed (henceforth, the Category Manager orders unnecessary raw material from the suppliers).

“Also, I think there is point for improvement. It is not enough to keep track of our performance only through sales and perishable shrinkage. Maybe we need more performance indicators to ensure that we are being more efficient with lead-times, productivity and quality”, stated David. The Category Manager intervened “that will only bring us more calculations and more indicators to disrupt us from our jobs. More indicators will only bring us more entropy to the department!”.

Célia detected a resistance to change and to cease an incoming discussion: *“We will look into it. This meeting was really helpful”*.

The first meeting was over. On the next day we were going to meet with a Stock Manager from the Stock Management Department, to understand and hear their part of the situation.

Stock Management

The first issue raised was again the forecast. This department was responsible for the maintenance of an automatic forecasting systems that generates orders 48h in advance. *“It is different from the method used in the Meat Department, because they forecast from the supplier to the MPC, this system forecast from the MPC to the stores”*.

“Both are forecasting the customer demand, right? Why don’t we change this procedure?” Célia and I were surprised, there were two predictions for the same thing and definitely they should have different results. The answer was: *“Well, maybe yes... But, we have been doing this for so long, that changing this would cause many disturbances in the department and probably some individuals would need to be relocated...”*.

The meeting was a little tense, but the Stock Manager changed the subject pointing out another problem. The system used by several departments is outdated. His department uses it to retrieve data for analysis, the Meat Department to enter the orders for the suppliers and also to create and delete products, and the stores to register the existing stock. It is called Retek and was created a long time ago, for canned tuna products only. Now, it is used for a huge variety of products and was never updated. *“It doesn’t work as well with perishable food and it takes us too much time to use”*.

“What about the performance indicators? How do you measure your work in this department?”, the Stock Manager responded they focus on stocks and that *“Our objective is to prevent Shrinkage and*

stockouts... I know that sometimes that has an impact on sales, but that is the message that comes from above”.

Meat Processing Centre

These meetings proved to be quite interesting, some dots could be connected and some opportunities were starting to appear.

The Head Manager from the MPC started explaining what happens to the meat when it arrives at the facilities. One of the biggest problem is when they have to change the production line, due to the numerous promotion changes: *“It is understandable that to adapt to the market we need to change suddenly, but this sudden change has a huge impact in our facilities... The same machine that produces pork chops can’t produce sliced ham...”*¹¹.

David, which was seated next to the Facility Manager, acquiesced *“yes, we can’t use a fishing rod to catch a wild boar. But, the promotions come from above and they believe that they increase our sales... And remember our CEO: “Our mission is to increase sales!””*¹².

“Well, yeah. But our mission is sales, while maintaining productivity...” refuted the Head Manager, *“We focus on the production and that’s it...”*. David was displeased with the counter, which generated a discussion regarding the real mission and objective of SonaeMC. Célia halted the discussion redirecting their attention to the supply chain issues and not the strategy. She knew that this disagreement was an important issue, but that wasn’t going to be settled there.

The Facility Manager immediately added another problem, the Retek System was not synced with CSB¹³. The orders generated in Retek are not transferred to CSB, hence the Category Manager has to send them by mail, clogging their mail inbox. Furthermore, some products that were deleted in Retek, continue to exist in CSB *“and sometimes we produce them without knowing they are not in the system anymore...”*.

The Head Manager continued *“Exactly! That plus the unexpected promotional changes, causes an increase in our stock. Then, we need to “push”¹⁴ and send more meat products into the stores than ordered before its shelf-life expires. That is why we have a service level above 100%...”*.

“Above 100%?!” questioned Célia. The reply was *“Yes, if we deliver more than the requested, the service level is, in average, higher than 100%...”*.

“In average, only averages say nothing... If I have my head in the oven and my feet in the freezer, my temperature will be, in average, normal” replied David proving his point with a simple, yet explanatory

¹¹These promotion sudden changes have an impact not only on the quantity received in the MPC from misplaced orders, but also in the capacity of production line, since different types of product have different types of machinery. Changing the machinery takes time.

¹²As presented in Sonae’s Corporate statements (2014), Sonae’s real mission is “To create long-term economic and social value, bringing the benefits of progress and innovation to an ever increasing number of people” and SonaeMC’s strategic focus is “SonaeMC is food retail market leader in Portugal with a number of distinctive formats, which offers a varied range of high quality products at the best prices(...). SonaeMC will continue to focus on leadership and profitability, by consolidating market leadership in Portugal; exploring new adjacent business opportunities; managing the business as a cash flow generator and searching for international opportunities”.

¹³Is the MPC operational system, adapted to the production in the facility and used for calculating the amount of human power needed, production capacity available and to manage the production lines and machinery placement (maximizing the production).

¹⁴“Push”, is considered the delivery of product to the stores with no order in existence, by the stores or by the system. An example of a “push”, can be seen in figure 7, Meat Piece SKU 4583472, where there were no boxes orders, but there was a delivery.

example. Probably there were some misused indicators and Célia asked for a detailed table with the service levels, which revealed some details of the problem:

Meat Piece SKU	Boxes Ordered	Boxes Delivered	Service Level (per order) (Boxes Delivered/Boxes Ordered)
2671857	5	4	80%
2817637	3	3	100%
9458173	3	4	133%
4583472	0	2	-
3458274	1	1	100%
9038451	3	0	0%
3458713	2	4	200%

Figure 7: Boxes Ordered by the stores (or the automated system) from the MPC, and the boxes delivered, by the respective meat piece product (identified by the SKU). The service level per order, is measured by the boxes delivered divided by the boxes ordered. The final value for the total service level of this department is calculated by the average of all values obtained in the service level, resulting in 102% of service level.

“Averaging all these numbers will give us 102% of service level. Do you think this is the best way to measure the service level?” enquired Célia.

The Head Manager, dissatisfied with the question reacted *“How could there be any other way to do it? Definitely, there is no alternative”*. Célia did not want to ignite another conflict and since a new batch of raw material was arriving to the MPC, the Head and Facility Manager needed to return.

The stores

In the final meeting, besides David, Célia and me, there were two Store Managers and one Regional Operations Manager (in charge of the logistics of a region). This was the longest meeting, many subjects were discussed, related and non-related to the project.

“...Yes, I know there is a shrinkage loss at the counter service, but we have to understand why it happens” uttered the Regional Operations Manager. The answer came from a Store Manager: *“The array of products... It’s huge. A butcher can’t be cutting and selling meat while searching amongst 60 different SKUs¹⁵...”*.

This statement sparked a discussion related to the cost and sales of each product and the possibility of reducing the array of products. Logistic-wise it was a difficulty nevertheless, it was SonaeMC’s policy to deliver the broadest selection of products to the consumer.

“Well, we can’t have the cake and eat it too¹⁶ we need to change something for sure” completed David while ensuring that something would be done to solve this problem.

Subsequently, Célia asked if there were many *“pushes”* and deliveries in excess to the store. The response was a unanimous yes: *“Every time we make an order of x boxes and we always receive more than x...”*

“You make orders? Isn’t it an automatic system?”

¹⁵SKUS stands for Stock Keeping Unit. It is a code associated to a product to assist in logistics and in the sale process.

¹⁶ For curiosity purposes, has David said in Portuguese: *“Querer o sol na eira e a chuva no nabal”* – *“Wanting the sun to shine on the threshing floor, while it rains on the turnip field”*.

“Well, yes. However, each store has the possibility to correct the system, which they do every day...” answered one of the Store Managers. Célia was impressed: *“If the stores change a forecast, they are making their own forecast, right? Thus, there are three forecasting methods for the same demand...”*.

The Store Managers remained in silence, thinking about what they heard, until one concluded: *“Actually, there are around 200 stores selling meat in Portugal. Each store has one staff member responsible for changing the orders from the store to the MPC... There are no procedures regarding how this changes can be made, therefore each store has its own forecasting method...”* (vide supra, figure 4).

The aftermath

A couple of days later, Célia Fialho was delving around the notes taken during the meetings. This was a tiresome process, but it was bearing fruits. There was plenty of room for improvement and the most important critical questions were undeniably found:

- From a strategic point-of-view, what can be said about the conflict around *“Our mission is to increase sales!”*? Also, is there any resistance to change?
- From an operational and supply chain management perspective:
 - a) Which problems can be identified in the supply chain process?
 - b) *“Forecasting program? I use my head. Besides, I don’t think a computer could be able to cope with so many variables”* Is there any other way?

“So, what do you think?”

Case Analysis and Teaching Notes

Case Synopsis

This business case is based in a 2015 project of revision and analysis of the whole supply chain of the Meat Department from the major retailer in Portugal, SonaeMC. The reason for this project existence was the huge entropy within the Meat Department and the towering perishable shrinkage. We follow Célia Fialho and a final year graduating student, through four meetings to pinpoint critical issues to propose strategic and operational solutions to solve the above-mentioned issues and to improve the supply chain.

Target Audience

Focused on broad operational, change management and corporate strategic issues, presented as a short, simple easy-reading case. There are two main targets:

1. Strategy students taking courses as Change Management, Managing Organizations or similar.
2. Operation and logistics students taking course as Operations Management, Supply Chain Management, Logistics or similar.

There are no pre-requisites for the analysis of this business case, since it could be presented as an introduction to several themes (above-mentioned) and as a cause for discussion within class.

Learning Objectives

The case is supposed to be an introduction to different themes further developed by the professor and also to instigate the debate within class. The main objectives are to:

- a. Approach simple supply chain themes from a strategic and an operational point-of-view;
- b. Be introduced to main concepts and topics of operations and supply chain management;
- c. Be acquainted with real retailer supply chain in a change situation;
- d. Identify and understand the causes for operational common complications.

Teaching Plan

After reading the case, the analysis should be based on a discussion steered by the “The aftermath” questions. It should take around 60 minutes and it should be divided in two parts, one approaching the first strategy-wise question and another to tackle the operations and supply chain management question. At the end of each part there will be a wrap-up with questions to initiate debate around the main ones within class and with proposals for solutions (based on the literature suggested).

1. From a strategic point-of-view, what can be said about the conflict around “*Our mission is to increase sales!*” Also, is there any resistance to change (20 minutes)?

Sonae’s Mission is a noble statement “to create long-term economic and social value” through progress and innovation. Yet, within the SonaeMC’s profile we can observe that the strategy to address this mission is by focusing on profitability and market leadership, hence there might be a miscommunication between the top management and the employees, because the mission and strategy is not focused entirely on sales or productivity (as referred by David and the Head Manager in the Meat Processing Centre meeting).

Campbell & Yeung, (1991) explained that a company’s mission is an “*organization’s character, identity and reason for existence*”, suggesting that not only the purpose, but also the values and future vision of a company should be portrayed in the mission statement. Also demonstrating the importance of the existence of a “right” mission, Klemm et al., (1991) suggested that “*If the mission can link the employees’ values with the company’s values then each individual employee will find a sense of mission*” and Bartkus et al., (2000) that “*if stakeholders are able to align their individual objectives with those of the firm, the result would more likely be an intrinsically motivated stakeholder group*”. Furthermore, Swales & Priscilla, (1995) have studied the impact of discourse linguistics within a mission statement, comparing two international corporations, and suggested that corporate culture is represented by the way a mission is written and communicated.

The Stock Management Department focuses on stocks disregarding sales and the Meat Department focuses on sales, disregarding stocks or MPC’s production.¹⁷ There is a clear misalignment between departments in terms of objectives without a common goal and a possible confusion between mission and objective. For Collis & Rukstad, (2008), mission is the “Why we exist?”, values are the “What we believe in and how to behave?” and Vision is the “What we want to be?”. After these definitions, we require the strategic thought, based on the objective (the end to achieve), the scope (where to act)

¹⁷ As said by the Stock Manager “*Our objective is to prevent Shrinkage and stockouts... I know that sometimes that has an impact on Sales, but that is the message that comes from above*”, by David “*And remember our CEO: “Our mission is to increase sales!”*” and the reply of the MPC’s Head Manager: “*But our mission is sales, while maintaining productivity...*”.

and the advantage (the means to act). Again, probably there was a misconception between the objective and the mission, even though should the objective of a major retailer be focused on sales? Should it be more consumer-focused, trying to achieve higher quality with low prices? There is, perchance no right answer, although “*Words do lead to action*” (Collis & Rukstad, 2008) and this statements might not deliver the best alignment between the firm and the stakeholders’ objectives and could create a rift between the company and the employee. A misleading mission and a misaligned objective through the company on a stressful situation may pose as a cause of resistance in a change situation.

In this specific case, SonaeMC’s Meat Department is experiencing an analysis from a Project Manager (Célia Fialho), to induce (and already inducing) a change. A resistance to change could appear in the future when the solution implementation start, however it can already be perceived through the simple answers¹⁸. After a thorough analysis of the literature about the change phenomenon Li & Tippett, (2002), found that there is a consensus on the existence of a decline in performance (“death valley”) after a new implementation, succeeded by a return to normality. The authors also suggest that for a manager to reduce the “death valley” he necessitates to understand the change, communicate the expectations, establish handholds and encourage the employees. Nevertheless, the reasons for this consistent decrease in performance might have been summarized by Von Glinow & McShane, (2010): resistance to direct costs (not only financial, but also human resources) and to break routines, need to save face¹⁹, fearing the unknown and the existence of incongruent organizational systems and team dynamics. These are simple motives why employees could be in resistance, hence the real question is how to avoid these fears?

Folger & Skarlicki, (1999) see corporate justice as one solution. They subdivided the latter in distributive justice, having a fair reward system; in procedural justice, having fair procedures used to determine outcomes; and in interactional justice, where the managers interact and communicate the company’s vision, strategy, goals and planned changes evenly with the employees. From another perspective, resistance to change can be perceived through employee background conversations and resistance can be tampered by understanding and solving the issues presented in them (Ford et al., 2002). While studying a change situation in an airline company, Pieterse et al., (2012) also found that the discourse of the top managers can be a cause of resistance to change if they don’t address the problem in a constructive way and if they have an unaligned discourse amongst them.

Employee’s attitude is extremely important in this situation, only improved when there is trust in management; this can be achieved through the already above-mentioned solutions, transparency and a positive and constructive organizational culture (Smissen et al., 2013; Smollan, 2013). These papers also corroborate the need for a well-planned mission statement and a set of objective, vision and a communication of it, to ease change resistance (*vide supra*).

Wrapping-up:

- Could a company mission (specifically SonaeMC) be focused on sales?

¹⁸These are “*It is worth what is worth*”(Meat Department’s Stock Manager), “*But, we have been doing this for so long, that changing this would cause many disturbances in the department and probably some individuals would need to be relocated...*”(Stock Manager) or “*How could there be any other way to do it? Definitely, there is no alternative*” (Head Manager).

¹⁹Sense of dignity, where someone avoids humiliation or embarrassment, keeping his reputation and respect of other people.

Focusing on the literature above-mentioned, statements based on sales or production can't transmit any value, vision or any "raison d'être" for any employee and probably will induce the latter to focus on what is not important, forgetting about quality or the client or the "benefits of progress and innovation" (which is within Sonae's mission). These statements could also represent a miscommunication between the top management and the rest of the company leading to a disconnection between the company and the employee and a probable cause for resistance to change. On the other hand, having a clear mission and different objectives across the company will only be a cause for disorder and conflict between departments, hence there is a need to define what a mission, objective and strategy is and how to address it. As a personal recommendation, the Collins & Rukstad, (2008) "Hierarchy of Company Statements" is a simple and understandable structure, based on clear questions:

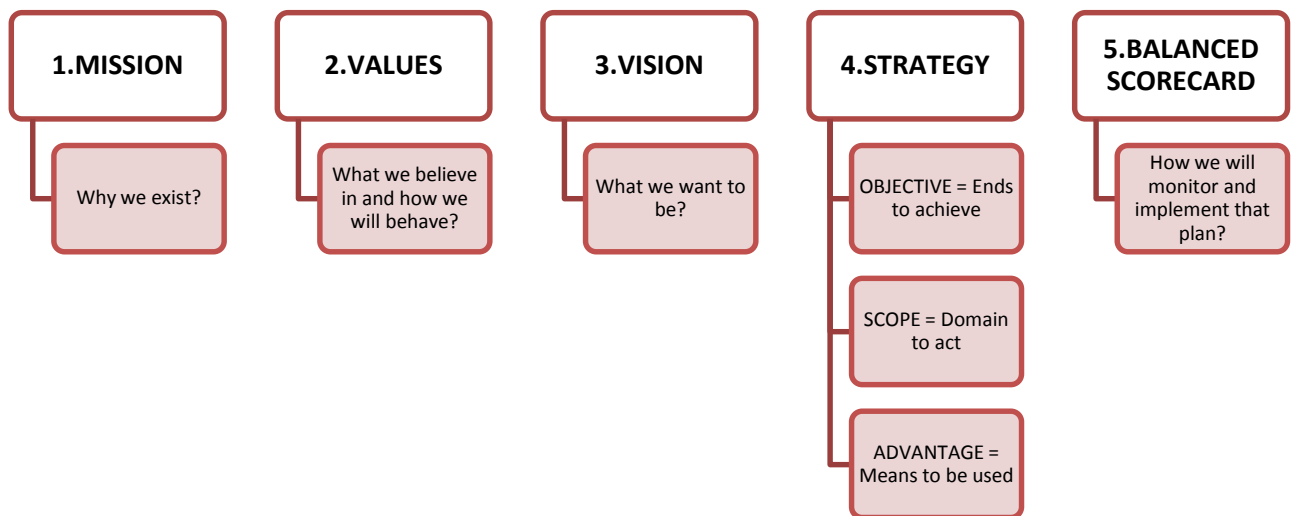


Figure 8: Diagram representing the "Hierarchy of Company Statements" from Collins & Rukstad, (2008).

- Why do employees resist change (specifically at Sonae)?

Employees can resist change due to the several reasons as presented in the literature, although in this specific case some particular reasons can be identified. Reasons besides the clear division between departments (different objectives) are the fear of losing face and the fear of the unknown. As an example, we have the resistance to change (or to reflect about) the forecasting method ("*I don't think a computer could be able to cope with so many variables*" and "*It is worth what is worth*", by Stock Manager) and the MPC's services level ("*How could there be any other way to do it? Definitely, there is no alternative*", by Head Manager). Other factor could be caused by to the fact that this project could break their old routines, leading the employees to change their habits and to force them to adapt to new procedures, which they may not approve or distrust ("*But, we have been doing this for so long*", by the Stock Manager and "*that will only bring us more calculations and more indicators to disrupt us from our jobs. More indicators will only bring us more entropy to the department!*", by the Category Manager). And last, but definitely not least, the resistance to direct (human resources) costs ("*(...) changing this would cause many disturbances in the department and probably some individuals would need to be relocated...*").

- How to counter change resistance within a company?

Although there might not be a clear solution to change resistance (unless the problem is evident), probably the best solution to counter resistance at SonaeMC (and in any other company) could be to better communicate the present situation of the company and the problem itself, explaining the

reasons behind the project, reinforcing the idea that there has to be an efficient communication between the top management and the employees.

2. From an operational and supply chain management perspective (40 minutes)

a) Which problems can be identified in the supply chain process (15 minutes)?

From these four meetings, many problems could be identified and the most relevant will be discussed here with proposals for solutions, with a final focus on the forecasting.

One of the first problems identified was the lack of specific rules and procedures, regarding the absence of meat pieces substitution table and dearth of promotional changes procedures on the production. These may perhaps lead to inefficiencies through the supply chain, which could be averted via technology. Even before 2000, Shu et al., (1982) and McGuffog & Wadsley, (1999) have identified the need to automatize simple business procedures and have defined that computerized methods should be used to reduce human activity, reducing also human error and time-inefficiencies. Despite that, there is a need to use broad information in operations management, and the way information is treated and analysed requires it to be from within the supply chain process (Karmarkar & Apte, 2007). In accordance, the integration of internal activities²⁰ within the supply chain leads to an higher visibility²¹, if “regularly and systematically collecting various types of supply and demand information” (Williams et al., 2013). Overall, a better definition and integration of the information between departments (in specific the substitution tables and the promotional changes between the MPC and the Meat Department) is required and could be hastened with not only technology, but a better definition of the procedures itself.

Another issue found was the sudden promotional changes, which creates not only entropy, but also affects the production procedures. Ettouzani et al., (2012), identified specific problems related to the promotions within the retailing industry. These were the timescale, when late changes to promotions occur, impacting the accurate promotional forecasting, order phasing and network planning (suggested also by Grewal et al., 2011); and the promotional process, which could be unaligned through the supply chain, leading to poor on-shelf-availability. Herein, to cause less entropy, promotions could be decided in anticipation, since meat is bought 15 days before it is in the stores. Also, the promotional process should not be different from the supply chain normal process or at least it should have only small divergences.

The non-updated Retek (as the Stock Manager said: “*It doesn’t work as well with perishable food and it takes us too much time to use*”) and the lack of syncing with CSB (“some products that were deleted in Retek, continue to exist in CSB”) creates many difficulties not only on the Stock management side, but also on the production side, at MPC. It is important to understand that a highly integrated and effective supply chain that can respond to the changing environment increases business performance, hence managers need to provide the right technological infrastructures to enable supply chain processes to be implemented in a highly collaborative and integrated, interdepartmental manner (Prajogo & Sohal, 2013; Williams et al., 2013). The solution appears to be clear: update and sync both

²⁰ “The extent to which internal functional teams (e.g., operations, purchasing, logistics, sales, marketing, finance, engineering, information technology) work together to accomplish supply chain planning and execution” (Williams et al., 2013). In this case we are focusing between the different departments within SonaeMC.

²¹ (Williams et al., 2013) defined “supply chain visibility as access to high quality information that describes various factors of demand and supply”.

systems or create a new unified one. The best solution has to be measured from a utilitarian perspective balancing the financial weight and the efficiency gains.

“Maybe we need more performance indicators to ensure that we are being more efficient with lead-times, productivity and quality”, said David and if there is a need to monitor the whole supply chain, then there need to be several KPIs²² along the process. A KPI has the objective to *“fill the gap between planning and execution”*, providing feedback to solve occurring problems (Chae, 2009). Based on a 115 Italian manufacturing companies Toni & Tonchia, (2001), found KPIs should measure four specific dimensions, as cost/productivity (linked with the financial results of the company), time (measuring lead-times), flexibility (time for process modification) and quality (supplier’s or customer perceived quality). On the same line, Chan, (2003) has made an extensive analysis through many industries (including retail industry) and suggest that a *“good supply chain relies on its performance”*, and not only costs performance, but also (and specifically for customer-oriented companies) quality, flexibility, visibility, trust and innovativeness. From another perspective Grover, (2015) focused on different subjects to evaluate the supply chain performance: transport optimization, information technology optimization, inventory optimization, and resource optimization. Concluding, below there is a table with examples of KPIs that could be used along the supply chain (in this case by David to measure SonaeMC’s Meat supply chain):

²² Key Performance Indicator.

Category (or supply chain process)	KPI	Author
Forecast	Forecast volatility	(Chae, 2009)
	Forecast error (vide infra in section 2.b)	(Chae, 2009)
Production	Inventory days of (finished goods) supply at the manufacturing site (in this case: MPC)	(Chae, 2009)
	Inventory days of raw material supply	(Chae, 2009)
	Distribution cost	Chan, (2003) (focused on cost); Grover, (2015) (transport and resource optimization)
	Manufacturing cost (Labour costs also included)	Chan, (2003) (focused on cost); Grover, (2015) (Resource optimization)
	Inventory cost	Chan, (2003) (focused on cost); Grover, (2015) (Inventory optimization)
	Warehouse cost	Chan, (2003) (focused on cost)
	Overhead cost	Chan, (2003) (focused on cost)
Quality	Customer satisfaction	Chan, (2003)
	Lead Time	Chan, (2003); Grover, (2015) (Inventory optimization)
	Stockout Probability	Chan, (2003)
	Quality of packaging material	Grover, (2015) (resource optimization)
Flexibility	Process change time	Chan, (2003)
	Customer satisfaction	Chan, (2003)
	Labour input (e. g. number of tasks worker can perform)	Chan, (2003)
Trust	Service level (delivery accuracy measure, for more information see below)	Chan, (2003); Grover, (2015) (transport optimization)

Figure 9: Table with the KPIs that could be analysed and used along the Meat Supply Chain, with the respective authors. These were simplified and grouped together in categories.

Concerning a specific KPI, the service level above 100%, this is a misused one since it has no interpretation. The problem is that the measurement is the average of all boxes delivered/boxes ordered (*vide in figure 7*). Per order there will be above and below 100% service level values which in average could have an approximate number to 100%, presenting a false perfect level. To clarify:

Meat Piece SKU	Boxes Ordered	Boxes Delivered	Service Level (per order)
2671857	2	3	150%
2817637	4	2	50%

Figure 10: Table illustrating the problem of this KPI, with the Meat Piece SKU, boxes ordered, delivered and the respective service level (per order).

As David said: *“In average, only averages say nothing...”*, especially when they are used incorrectly. If we average the values above, there is a service level of 100%, although both orders were not perfectly delivered. The proposition to solve this problem is to change the measurement, limiting it to a max of 100% (assuming that the optimum level is when the Boxes Ordered are the same as the Delivered):

$$Service\ Level = 1 - \left(\frac{|Boxes\ Ordered - Boxes\ Delivered|}{Boxes\ Ordered} \right)$$

This will give us an overall reflection of the real situation and the service level of the table above would fall from the perfect 100% to 50%. Here is an example based on the table in the Meat Department meeting:

Meat Piece SKU	Boxes Ordered	Boxes Delivered	Service Level (Boxes Delivered/Boxes Ordered)	<u>Service Level (New formula)</u>
2671857	5	4	80%	<u>80%</u>
2817637	3	3	100%	<u>100%</u>
9458173	3	4	133%	<u>67%</u>
4583472	0	2	-	-
3458274	1	1	100%	<u>100%</u>
9038451	3	0	0%	<u>0%</u>
3458713	2	4	200%	<u>0%</u>

Figure 11: Table with Meat Piece SKU, boxes ordered, delivered and the respective service level (per order) and the service level with the new formula (underlined values).

The proposed new KPIs regarding the service level are underlined in the table above, which in average will give us a service level below from the original 102% of 58%. Also, to have a better picture of the problems there is a need to understand if there are Boxes lacking or in excess. A proposal is the measurement of a ratio of the total Boxes Delivered in excess, lacking and pushes divided by the Total Boxes Ordered. The KPIs proposed can be seen below:

<u>Service Level Average</u>	<u>Ratio Boxes Lacking</u>	<u>Ratio Boxes in Excess</u>	<u>Ratio Pushes</u>
58%	24%	29%	12%

Figure 12: 58% as the service level, and with 24%, 29% and 12% of Boxes lacking, in excess and "pushes", respectively. These are the KPI proposed to have simple a thorough analysis of the MPC's service level.

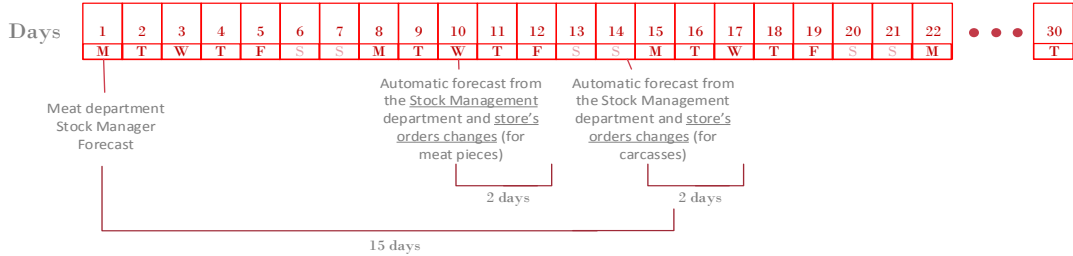
Furthermore, the huge array of products problem was raised within the stores meeting, and it is a specific problem because Sonaemc's policy is to deliver the broadest selection of products to the consumer. Consequently, there is a need to find the optimal balance between the array of products (and the consumer perception related to it) with the cost of shrinkage loss at the counter service (a variable to consider in this assertion, linked to the shrinkage loss, is the effort and error frequency of the butcher).

Postliminary, through the meetings there was a critical point which could be easily identified: the forecast. Not only the non-existent method in the beginning of the supply chain, but also the several different players also forecasting along the process (Stock Manager, stores and Meat Department Stock Manager; for more information please *vide in* figure 7). This huge entropy generates a "Bullwhip effect"²³, which is mainly caused by the lack of correct information transfer or communication, through the supply chain (Lee et al., 1997; Fransoo & Wouters, 2000). Chen et al., (2000), have demonstrated that this phenomenon is due, in part, to the effects of demand forecasting. In further detail, the

²³Forrester, (1968), refers to "bullwhip effect" as the increasing variability of demand further upstream in the supply chain.

authors specify that updating periodically the forecast (in terms of mean and variance) and sharing the results with the whole chain will decrease this effect. With more than one forecasts (with no connection between them), the “Bullwhip effect” is a true menace for the business, hence focusing on only one forecast method upstream could be necessary. Especially the first one, since it is the prediction used to buy the raw material. The proposal is as follows:

Forecasting Methods “As is”



Forecasting Methods “To be”

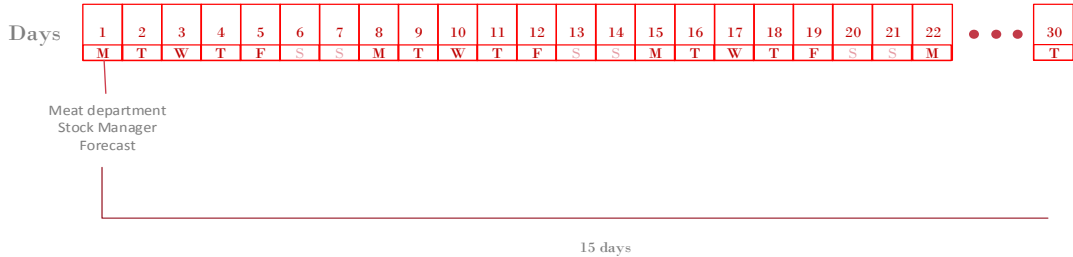


Figure 13: The "As is" supply chain with several forecasting methods and the "To be" proposal, with only one forecasting method.

In the picture we can see only one forecasting method performed by the Meat Department Stock Manager, since he is in the beginning, the rest of the supply chain will adjust to that initial forecast, instead of being constantly changing depending on the different forecasts. There will be less changes, regarding stock and these will be beforehand established (since the forecast won't change) and consequently, the “Bullwhip effect” will decrease, reducing also the entropy along the chain.

Still, so that the “To be” framework could be implemented the initial forecasting method needs to change and the sentence “Forecasting program? I use my head. Besides, I don't think a computer could be able to cope with so many variables” needs to be engaged.

Wrapping-up:

For all these issues there are many possible solutions. Although, here are the problems identified with the respective proposed solutions:

Problem identified	Proposed solutions
Lack of specific rules and procedures (table of substitution, promotional change)	Defining and creating procedures (if needed, with the use of technology)
Sudden promotional changes	Plan promotions 15 days in advance. Align the promotional process with the supply chain
Non-updated Retek and the lack of syncing with CSB	Update and sync both systems or create a new unified one (balancing the financial weight and the efficiency gains)
Lack of KPIs	Development of simple KPIs for the supply chain adapted to the meat market (<i>vide supra</i>)
Misused service level KPI (above 100%)	Definition of a new and clear KPI, which could present an immediate image of the situation
Huge array of products	Find the optimal balance between the array of products and the cost of shrinkage loss
Several Forecasting methods (increased "Bullwhip effect")	Only one Forecasting method

Figure 14: table with the problems identified through the supply chain and the proposed solution.

b) *"Forecasting program? I use my head. Besides, I don't think a computer could be able to cope with so many variables" Is there any other way (25 minutes)?*

Gigerenzer & Gaissmaier, (2011), in their study about *"Heuristic Decision Making"*, they infer that heuristics could be a good tool to be used in decision making (alongside with statistics and logical procedures), as an example, in forecasting. Heuristics is not right or wrong, it's only a tool which through the use of computational automation, the heuristic thought could be brought to reality (Petropulos et al., 2013; Burke et al., 2013). Looking at the sentence above, it is possible to suppose that there is a heuristic judgement that could be transposed to a computer algorithm, reducing the human error and time spoiled with the forecasting process.

Following this idea, there are some suggestions on methods and forecasting systems that could be used, not only to unearth a better forecast method, but also to analyse and identify different variables that need to be taken in consideration. There is no consensus concerning the finest way to compare forecasting methods (Eksoz et al., 2014), although the most common criteria of selection is the forecast precision, or the forecast error (Yokuma & Armstrong, 1995).

The calculation of the forecast error can be measured by the MSE (Mean Squared Error), MAE (Mean Absolute Error) or MAPE (Mean Average Percentage Error)²⁴. Even though, if the sample is not normally distributed or asymmetric, the average cannot be used to reflect the most accurate error. This fact can change, by switching the Mean with the Median in each calculation (and if the sample has a normal distribution, the Mean is equal to the Median) (Armstrong & Collopy, 1992; Gu & Wu, 2003).

In the subsequent sections we will explore relevant analysis and methods to be used when performing a forecast, and also variables that need to be considered in this market.

i. **Forecasting analysis and methods**

In 2001, Alon et al. compared several forecasting methods for the USA retail market; amongst them were *Artificial Neural Networks (ANN)*, *Adjusted-Trend Exponential Smoothing*, *ARIMA model* and

²⁴For more information regarding these methods *vide* for each of them the following literature: MSE (Wallach & Goffinet, 1989), MAE (Kassam, 1978) and the most used MAPE (Makridakis, 1993; Goodwin & Lawton, 1999).

*multivariate regression*²⁵. ANN captured certain patterns and market trends, achieving the lowest forecast error (calculated with MAPE). However, the authors suggest to, before any decision to change a forecasting method, perform a cost/opportunity study, since some methods (e.g. ANN) require a huge (and costly) computation power. Aburto & Weber (2007), developed a hybrid method combining ANN with ARIMA model, attaining a lower forecast error than the stand-alone methods.

Another hybrid method was presented by Lee et al. (2011) with promising results, in Taiwan. The analysis was performed for 120 fresh (perishable) products from a chain with 75 convenience stores, for six months. The forecast model is a developed version of ANN, called ECFM (*Enhanced Cluster and Forecast Model*), a reorganization and pattern recognition algorithm based on non-linear adjustments. The main setback with this method (and similar methods), alongside the need for a massive computation capacity, is the data training²⁶ time and costs.

Particularly for the meat market, Wang & Bessler (2003) assessed several methods, as AIDS, Rotterdam, AIM, DGM e VECM²⁷. The sample used was the meat consumption, reflected on sales, of bovine, poultry and swine from 1975 to 1997. The results reveal that VECM and DGM, were more accurate than the others, even though for the swine meat, the AIDS had a lower forecasting error. It is noticeable that each product (and meat piece) needs to be analysed independently to achieve the most suited forecast.

Ali et al. (2009) have inspected another extremely important variable: promotions. They compared four different methods for 76 weeks for 168 products from a European retailer. The methods were *Exponential Smoothing with Lift Adjustment*, a *Trend-Adjusted Exponential Smoothing* variant²⁸; *Stepwise Linear Regression*, a multivariate linear regression with pre-established variables changing in accordance with specific criteria; *Support Vector Regression*, a simple algorithm which adjusts linearly to the information obtained; and a *Regression Tree*, algorithm that divides the obtained information in several clusters and adjusts linearly, using only the data with the least error. The *Regression Tree* had the best results, but in promotional weeks, the *Exponential Smoothing with Lift Adjustment* systems as surpassed all other. The authors concluded that the best solution would be a hybrid one, where the *Regression Tree*, would work for regular weeks and the *Exponential Smoothing with Lift Adjustment*, for promotional weeks.

Henceforth, here are the most developed forecast systems that should be analysed, not forgetting that the best forecasting system is the one with the optimum opportunity/cost relation in relation to the forecast error (*Median Average Percentage Error* suggested, *vide supra*). Moreover, linking and using hybrid methods could be the best solution and it is necessary to analyse all the possibilities to achieve the best result.

²⁵*Artificial Neural Networks*, represents a series of algorithms built to identify patterns and trends, adjusting themselves through the time series. The first ANN, was identified by Rosenblatt, in 1958. *ARIMA model (AutoRegressive Moving Average)*, is a non-linear regression method, with various (assessed and optimized) parameters (Makridakis & Hibon, 1997). *Multivariate regression*, simple linear regression with several selected variables.

²⁶Time and processing costs associated with the adjustment (learning and training) of the program to the data obtained.

²⁷AIDS (*Almost Ideal Demand System* (Deaton & Muellbauer, 1980)), Rotterdam model (Barnett, 1979), AIM (*Asymptotically Ideal Model* (Yue, 1990)), DGM (*Directed Graphical Models* (Murphy, 2001) e VECM (*Vector Error Correction Model* (Engle & Granger, 1987)) are forecasting systems constructed with economic variables, like the product price, considering its elasticity, and the consumer utility function. These models need an above-average computation capacity, specifically the last two models.

²⁸Holt's forecasting method for data without seasonality or tendencies (Holt, 2004).

ii. Relevant forecasting variables

There are several variables, depending on the forecasting method and the operations and characteristics of the business. In this part, are presented some relevant variables which can be used not only for the retail business, but also for the meat market.

An interesting variable is the weather, having a positive impact on meat sales when temperature rises (*e.g.* summer seasonality), thus studying the correlation between these two might prove worthy for the forecast (Starr-McCluer, 2000; Agnew & Thornes, 1995).

Respectively, the stores localization has a similar importance, as identified by Wood & Reynolds (2012), when interviewing 40 analysts and marketers involved in the UK's major retailers store localization process. The authors summarized that, within the retail sector, studies and projects taking in consideration the type of customer per localization were more efficient (sales-wise), especially when considering campaigns and promotions. Li & Liu (2012), in a study with the major retailers in the USA (Wal-Mart and K-Mart), improved a model (Huff model) relating geographic location with sales and taking into account clusters, competition, attractiveness and accessibility. Another model, developed for a fast-food chain, from 2002 to 2005 in the USA also, applied other factors as brand awareness, endogenous localization and spatial competition (Pancras et al., 2012). This model was able to predict sales developments, counting with the opening and closure of competitor's stores and the cannibalization effect (if prejudicial or beneficial) in the vicinities. More recently, Newing et al. (2014) improved an existing model for sales forecast, based in spatial location (Spatial interaction modeling-SIM) in the UK. The variables used in it were the brand awareness, type of consumer (segmentation)²⁹ and demand seasonality (affected by tourism and special day, *e.g.* Christmas). In 52 weeks of study, it was possible to predict sales with a 5% forecast error.

In addition, Huang et al. (2014) cross-examined promotions and important dates (*e.g.* Christmas and Easter), measuring the promotional strength for each situation looking into competition prices and their promotional strength. Ramanathan & Muyldermans in 2010, built a structural equation modelling (SEM)³⁰ system, quantifying the promotional influence, seasonality and customer preferences for the soft drink market. The authors highlighted that this development could be used on other business units, like the Meat Department.

While referring to the product itself, Srinivasan et al., (2005a), within the soft drinks market, have identified several forms of product cannibalization, while proposing a forecast model based on *ARIMA*. The authors found that drivers of this effect could be the product characteristics, like price, product characteristics and type of package (Srinivasan et al., 2005b). Hailu et al. (2014), regarding the promotional effects on Swine meat in Canada, revealed that many promotions would cannibalize other products in and outside the same category, presenting the huge variety of possibilities with this effect. It was also mentioned that certain products suffered the opposite effect (halo effect), increasing its sales. Furthermore, Oracle has developed in 2014, an automatic process to detect cannibalization and halo effects among retail products, based on sales data, prices, promotional strength and seasonality (Wang & Gaidarev, 2014).

²⁹Ibragimov & Ibragimov, (2007) suggests that income distribution is correlated with sales in the meat market, supporting the study of the segmentation variable.

³⁰For more information relative to SEM, *vide in* (Anderson & Gerbing, 1988)

The impact of new products entering the market is, likewise, important and an example of how to predict it is using online information related to retail products from search engines (Kulkarni et al., 2012). Nonetheless, to be able to use and dissect this amount of information, it is necessary to have an extensive Big Data Management system³¹. Related to the supply chain, huge amounts of information are used for better accuracy and efficiency, unravelling trends, computing and adjusting variables to experiment new and test old forecast methods (Waller & Fawcett, 2013; Chen et al., 2013).

Wrapping-up:

- Could the forecast be automatic?

Forecast can always be automatic (or manual), the difference between them is the accuracy and the cost/opportunity for using it. Within the Meat Department, if the Stock Manager uses his “head”, he has a heuristic to forecast the market. The key idea that a student could take from this question is that this heuristic thought could be transposed to reality with automation, tested with statistics and compared with other forecasting measures to understand which one is superior. In addition, an automatic system could reduce human error and the time spent on the process.

- Which forecast method and variables should be used?

Using the MdAPE (or other error analysis, although it has to be adapted to the sample), it is possible to compare different forecast methods, always taking in attention the cost/opportunity between them. The best method should be the one with the highest accuracy and cost/opportunity. For a compilation of methods in existence within the academic literature see the table below:

Forecast Method	Authors
ANN (<i>Artificial Neural Network</i>)	(Rosenblatt, 1958; Alon et al., 2001)
ARIMA model	(Makridakis, 1993; Makridakis & Hibon, 1997)
Multivariate regression	(Alon et al., 2001)
ECFM (<i>Enhanced Cluster and Forecast Model</i>)	(Lee et al., 2011)
AIDS (<i>Almost Ideal Demand System</i>)	(Deaton & Muellbauer, 1980)
Rotterdam	(Barnett, 1979)
AIM (<i>Asymptotically Ideal Model</i>)	(Yue, 1990)
DGM (<i>Directed Graphical Models</i>)	(Murphy, 2001, 2006)
VECM (<i>Vector Error Correction Model</i>)	(Engle & Granger, 1987)
Trend-Adjusted Exponential Smoothing	(Holt, 2004)
Stepwise Linear Regression	(Ali et al., 2009)
Exponential Smoothing with Lift Adjustment	(Ali et al., 2009)
Support Vector Regression	(Basak et al., 2007; Smola & Scholkopf, 2004)
Regression Tree	(Crawford, 1989)

Figure 15: Table with several forecast methods found in academic literature, with the respective authors

These could be used by the professor to introduce the main concepts around the forecast error, while explaining the use of a median and not the mean.

³¹As a curious note, Zaslavsky et al. (2013) stated that “Big data consists of hidden gold (high-valued data) mixed with dirty (noise, erroneous and raw) data” and that for the extraction of the “golden data” you need not only a great team, but also significant computation capacity.

Related to the variables needed to be taken in consideration, there must be a study to understand the impact of each in the demand. For the most relevant variables in this industry within the academic literature see the table below:

Variables	Authors
Weather conditions	(Starr-McCluer, 2000; Agnew & Thornes, 1995)
Store Location (considering competition)	(Wood & Reynolds, 2012; Li & Liu, 2012; Pancras et al., 2012; Newing et al., 2014)
Client Type (segmentation)	(Ibragimov & Ibragimov, 2007; Newing et al., 2013)
Promotions, special dates and seasonality (considering competition)	(Huang et al., 2014; Ramanathan & Muyldermans, 2010; Hailu et al., 2014; Wang & Gaidarev, 2014)
Prices, cannibalization and halo effect (considering competition)	(Srinivasan et al., 2005a, 2005b; Kulkarni et al., 2012; Hailu et al., 2014; Wang & Gaidarev, 2014)

Figure 16: Table with several variables used in the forecasting methods, found in the academic literature, with the respective authors

It is required a huge amount of computation to adjust and identify the most relevant variables, and also to compare all the forecast methods, therefore an answer could be the use of *Big Data management* (considering cost/opportunity, since there could be high equipment costs).

Concluding remarks

It is suggested that the student, despite having the academic tools, never forget to be equipped with a pragmatic judgment. In any business situation, a logical filter is necessary to distinguish what is needed or not. From a strategic point-of-view, any change can encounter resistance, which should be addressed as a sensitive matter and with a clear communication of the reasons behind it and expected outcomes. Furthermore, from an operational perspective, there will always be entropy along the supply chain, even though, knowing the main issues and reasons behind it is one step ahead for reducing it.

Bibliography

- Toni, a. De & Tonchia, S. (2001). Performance measurement systems - Models, characteristics and measures. *International Journal of Operations & Production Management*. 21 (1/2). p.pp. 46–71.
- Aburto, L. & Weber, R. (2007). Improved supply chain management based on hybrid demand forecasts. *Applied Soft Computing*. 7 (1). p.pp. 136–144.
- Agnew, M. & Thornes, J. (1995). The weather sensitivity of the UK food retail and distribution industry. *Meteorological Applications*. [Online]. 2. p.pp. 137–147.
- Ali, Ö.G., Sayin, S., van Woensel, T. & Fransoo, J. (2009). SKU demand forecasting in the presence of promotions. *Expert Systems with Applications*. [Online]. 36 (10). p.pp. 12340–12348. Available from: <http://dx.doi.org/10.1016/j.eswa.2009.04.052>.
- Alon, I., Qi, M. & Sadowski, R.J. (2001). Forecasting aggregate retail sales : a comparison of artificial neural networks and traditional methods. *Journal of Retailing and Consumer Services*. [Online]. 8 (3). p.pp. 147–156. Available from: [http://dx.doi.org/10.1016/S0969-6989\(00\)00011-4](http://dx.doi.org/10.1016/S0969-6989(00)00011-4).
- Anderson, J.C. & Gerbing, D.W. (1988). Structural Equation Modeling in Practice: A Review and Recommended Two-Step Approach. *Psychological Bulletin*. 103 (3). p.pp. 411–423.
- Armstrong, J.S. & Collopy, F. (1992). Error measures for generalizing about forecasting methods: Empirical comparisons. *International Journal of Forecasting*. 8 (1). p.pp. 69–80.
- Barnett, W. a (1979). Theoretical Foundations for the Rotterdam Model. *The Review of Economic Studies*. 46 (1). p.pp. 109–130.
- Bartkus, B., Glassman, M. & Bruce McAfee, R. (2000). Mission statements: Are they smoke and mirrors? *Business Horizons*. 43 (6). p.pp. 23–28.
- Basak, D., Pal, S. & Chandra Patranabis, D. (2007). Support Vector Regression. *Neural Information Processing – Letters and Reviews*. 11 (10). p.pp. 203–224.
- Burke, E.K., Gendreau, M., Hyde, M., Kendall, G., Ochoa, G., Özcan, E. & Qu, R. (2013). Hyper-heuristics: a survey of the state of the art. *Journal of the Operational Research Society*. [Online]. 64 (12). p.pp. 1695–1724. Available from: <http://www.palgrave-journals.com/doi/10.1057/jors.2013.71>.
- Campbell, a & Yeung, S. (1991). Brief case: mission, vision and strategic intent. *Long range planning*. 24 (4). p.pp. 145–147.
- Chae, B. (Kevin) (2009). Developing key performance indicators for supply chain: an industry perspective. *Supply Chain Management: An International Journal*. 14 (6). p.pp. 422–428.
- Chan, F.T.S. (2003). Performance Measurement in a Supply Chain. *The International Journal of Advanced Manufacturing Technology*. 21 (7). p.pp. 534–548.
- Chen, F., Drezner, Z., Ryan, J.K. & Simchi-Levi, D. (2000). Quantifying the Bullwhip Effect in a Simple Supply Chain: The Impact of Forecasting, Lead Times, and Information. *Management Science*. 46 (3). p.pp. 436–443.
- Chen, J., Chen, Y., Du, X., Li, C., Lu, J., Zhao, S. & Zhou, X. (2013). Big data challenge: A data management perspective. *Frontiers of Computer Science*. [Online]. 7 (2). p.pp. 157–164.
- Collis, D.J. & Rukstad, M.G. (2008). Can You Say What Your Strategy Is? *Harvard Business Review*. 86 (4). p.pp. 82–90.
- Crawford, S.L. (1989). Extensions to the CART algorithm. *International Journal of Man-Machine Studies*. 31 (2). p.pp. 197–217.
- Deaton, A. & Muellbauer, J. (1980). An almost ideal demand system. *The American economic review*. [Online]. 70 (3). p.pp. 312–326. Available from: <http://www.jstor.org/stable/1805222>.
- Eksoz, C., Mansouri, S.A. & Bourlakis, M. (2014). Collaborative Forecasting in the Food Supply Chain: A Conceptual Framework. *International Journal of Production Economics*. [Online]. 158. p.pp. 120–135. Available from: <http://linkinghub.elsevier.com/retrieve/pii/S0925527314002485>.
- Engle, R.F. & Granger, C.W.J. (1987). Co-Integration and Error Correction : Representation , Estimation , and Testing Published by : The Econometric Society Stable URL : <http://www.jstor.org/stable/1913236> . yet drift too far apart . Typically economic theory will propose forces which tend to. *Econometrica*. 55 (2). p.pp. 251–276.
- Ettouzani, Y., Yates, N. & Mena, C. (2012). Examining retail on shelf availability: promotional impact and a call for research. *International Journal of Physical Distribution & Logistics Management*. 42 (3). p.pp. 213–243.
- Folger, R. & Skarlicki, D.P. (1999). Unfairness and resistance to change: hardship as mistreatment. *Journal of Organizational Change Management*. 12 (1). p.pp. 35–50.
- Ford, J.D., Ford, L.W. & McNamara, R.T. (2002). Resistance and the background conversations of change. *Journal of Organizational Change Management*. 15 (2). p.pp. 105–121.
- Forrester, J.W. (1968). Industrial Dynamics-After the first decade. *Management Science*. [Online]. 14 (7). p.pp. 398–415. Available from: <http://www.jstor.org/stable/2628888> .Fransoo, J.C. & Wouters, M.J.F. (2000). Measuring the bullwhip effect in the supply chain. *Supply Chain Management: An International Journal*. 5 (2). p.pp. 78–89.
- Gigerenzer, G. & Gaissmaier, W. (2011). Heuristic decision making. *Annual review of psychology*. 62. p.pp. 451–482.
- Von Glinow, M. & McShane, S. (2010). *Organizational Behavior: emerging knowledge and practice for the real world*. 5th Ed. McGraw-Hill/Irwin.
- Goodwin, P. & Lawton, R. (1999). On the asymmetry of the symmetric MAPE. *International Journal of Forecasting*. 15 (4). p.pp. 405–408.

- Grewal, D., Ailawadi, K.L., Gauri, D., Hall, K., Kopalle, P. & Robertson, J.R. (2011). Innovations in retail pricing and promotions. *Journal of Retailing*. [Online]. 87 (SUPPL. 1). p.pp. S43–S52. Available from: <http://dx.doi.org/10.1016/j.jretai.2011.04.008>.
- Grover, N.A.N. (2015). Measuring retail supply chain performance: theoretical model using key performance indicators (KPIs). *Benchmarking: An International Journal*. [Online]. 22 (1). Available from: <http://dx.doi.org/10.1108/BIJ-05-2012-0034> Downloaded.
- Gu, Z. & Wu, J.S. (2003). Earnings skewness and analyst forecast bias. *Journal of Accounting and Economics*. 35 (1). p.pp. 5–29.
- Hailu, G., Vyn, R.J. & Ma, Y. (2014). The Demand for Pork Products in Canada: Discount Promotions and Cannibalization. *Agribusiness*. [Online]. 30 (4). p.pp. 470–492.
- Holt, C.C. (2004). Forecasting seasonals and trends by exponentially weighted moving averages. *International Journal of Forecasting*. 20 (1). p.pp. 5–10.
- Huang, T., Fildes, R. & Soopramanien, D. (2014). The value of competitive information in forecasting FMCG retail product sales and the variable selection problem. *European Journal of Operational Research*. [Online]. Available from: <http://dx.doi.org/10.1016/j.ejor.2014.02.022>.
- Ibragimov, M. & Ibragimov, R. (2007). Market demand elasticity and income inequality. *Economic Theory*. 32 (3). p.pp. 579–587.
- Ii, P.D.E. & Tippett, D.D. (2002). The 'death valley' of change. *Journal of Organizational Change Management*. 15 (3). p.pp. 273–291.
- Karmarkar, U.S. & Apte, U.M. (2007). Operations management in the information economy: Information products, processes, and chains. *Journal of Operations Management*. 25 (2). p.pp. 438–453.
- Kassam, S. (1978). Quantization Based on the Mean-Absolute-Error Criterion. *IEEE Transactions on Communications*. 26 (2). p.pp. 267–270.
- Klemm, M., Sanderson, S. & Luffman, G. (1991). Mission statements: selling corporate values to employees. *Long range planning*. 24 (3). p.pp. 73–78.
- Kulkarni, G., Kannan, P.K. & Moe, W. (2012). Using online search data to forecast new product sales. *Decision Support Systems*. [Online]. 52 (3). p.pp. 604–611. Available from: <http://dx.doi.org/10.1016/j.dss.2011.10.017>.
- Lee, H.L., Padmanabhan, V. & Whang, S. (1997). Information Distortion in a Supply Chain: The Bullwhip Effect. *Management Science*. 43 (4). p.pp. 546–558.
- Lee, W.-I., Shih, B.-Y. & Chen, C.-Y. (2011). A hybrid artificial intelligence sales-forecasting system in the convenience store industry. *Human Factors and Ergonomics in Manufacturing & Service Industries*. [Online]. 22 (3). p.pp. 188–196.
- Li, Y. & Liu, L. (2012). Assessing the impact of retail location on store performance: A comparison of Wal-Mart and Kmart stores in Cincinnati. *Applied Geography*. [Online]. 32 (2). p.pp. 591–600. Available from: <http://dx.doi.org/10.1016/j.apgeog.2011.07.006>.
- Makridakis, S. (1993). Accuracy concerns measures: theoretical and practical concerns. *International journal of forecasting*. 9. p.pp. 527–529.
- Makridakis, S. & Hibon, M. (1997). ARMA models and the Box–Jenkins methodology. *Journal of Forecasting*. [Online]. 16 (January). p.pp. 147–163.
- McGuffog, T. & Wadsley, N. (1999). Insight from industry The general principles of value chain management. *Supply Chain Management: An International Journal*. 4 (5). p.p. 218.225.
- Murphy, K.P. (2001). An introduction to graphical models. *Rap. tech.* (May). p.pp. 1–19.
- Murphy, K.P. (2006). *Directed graphical models*. p.pp. 1–21.
- Newing, a, Clarke, G. & Clarke, M. (2013). Identifying seasonal variations in store-level visitor grocery demand. *International Journal of Retail* [Online]. Available from: <http://www.emeraldinsight.com/journals.htm?articleid=17090983&show=abstract>.
- Newing, A., Clarke, G.P. & Clarke, M. (2014). Developing and Applying a Disaggregated Retail Location Model with Extended Retail Demand Estimations. *Geographical Analysis*. [Online]. p.p. n/a–n/a. Available from: <http://doi.wiley.com/10.1111/gean.12052>.
- Pancras, J., Sriram, S. & Kumar, V. (2012). Empirical Investigation of Retail Expansion and Cannibalization in a Dynamic Environment. *Management Science*. (July 2014).
- Petropoulos, F., Nikolopoulos, K., Spithourakis, G.P. & Assimakopoulos, V. (2013). Empirical heuristics for improving intermittent demand forecasting. *Industrial Management & Data Systems*. 113 (5). p.pp. 683–696.
- Pieterse, J.H., Marjolein, C.J.C. & Homan, T. (2012). Professional discourses and resistance to change. *Journal of Organizational Change Management*. 25 (6). p.pp. 798–818.
- Prajogo, D. & Sohal, A. (2013). Supply chain professionals. *International Journal of Operations & Production Management*. [Online]. 33 (11/12). p.pp. 1532–1554.
- Ramanathan, U. & Muyltermans, L. (2010). Identifying demand factors for promotional planning and forecasting: A case of a soft drink company in the UK. *International Journal of Production Economics*. [Online]. 128 (2). p.pp. 538–545. Available from: <http://dx.doi.org/10.1016/j.ijpe.2010.07.007>.
- Rosenblatt, F. (1958). The perceptron: A probabilistic model for information storage and organization in *Psychological Review*. [Online]. 65 (6). p.pp. 386–408.
- Shu, N.C., Lum, V.Y., Tung, F.C. & Chang, C.L. (1982). Specification of Forms Processing and Business Procedures for Office Automation. *IEEE Transactions on Software Engineering*. SE-8 (5).
- Smissen, S. Van Der, Schalk, R. & Freese, C. (2013). Organizational change and the psychological contract: How change influences the perceived fulfillment of obligations. *Journal of Organizational*

- Change Management*. [Online]. 26 (6). p.pp. 1071–1090.
- Smola, a J. & Scholkopf, B. (2004). A tutorial on support vector regression. *Statistics and Computing*. [Online]. 14 (3). p.pp. 199–222.
- Smollan, R.K. (2013). Trust in change managers: the role of affect. *Journal of Organizational Change Management*. [Online]. 26 (4). p.pp. 725–747.
- Srinivasan, S.R., Ramakrishnan, S. & Grasman, S.E. (2005a). Identifying the effects of cannibalization on the product portfolio. *Marketing Intelligence & Planning*. 23 (4). p.pp. 359–371.
- Srinivasan, S.R., Ramakrishnan, S. & Grasman, S.E. (2005b). Incorporating cannibalization models into demand forecasting. *Marketing Intelligence & Planning*. 23 (5). p.pp. 470–485.
- Starr-McCluer, M. (2000). *Effect of weather on retail sales*. Washington, DC: Federal Reserve Board of Governors.
- Swales, J.M. & Priscilla, S.R. (1995). Discourse and the projection of corporate culture: the Misson Statement. *Discourse & Society*. 6 (2). p.pp. 223–242.
- Wallach, D. & Goffinet, B. (1989). Mean squared error of prediction as a criterion for evaluating and comparing system models. *Ecological Modelling*. 44 (3-4). p.pp. 299–306.
- Waller, M. a & Fawcett, S.E. (2013). Data Science, Predictive Analytics, and Big Data: A Revolution That Will Transform Supply Chain Design and Management. *Journal of Business Logistics*. 34 (2). p.pp. 77–84.
- Wang, Z. & Bessler, D. a. (2003). Forecast evaluations in meat demand analysis. *Agribusiness*. [Online]. 19 (4). p.pp. 505–523. Available from: <http://doi.wiley.com/10.1002/agr.10074>.
- Wang, Z.M. & Gaidarev, P. (2014). *Retail Sales Forecast System with promotional cross-Item effects Prediction; Patent: US 2014/0351011 A1*.
- Williams, B.D., Roh, J., Tokar, T. & Swink, M. (2013). Leveraging supply chain visibility for responsiveness: The moderating role of internal integration. *Journal of Operations Management*. [Online]. 31 (7-8). p.pp. 543–554. Available from: <http://dx.doi.org/10.1016/j.jom.2013.09.003>.
- Wood, S. & Reynolds, J. (2012). Leveraging locational insights within retail store development? Assessing the use of location planners' knowledge in retail marketing. *Geoforum*. [Online]. 43 (6). p.pp. 1076–1087. Available from: <http://dx.doi.org/10.1016/j.geoforum.2012.06.014>.
- Yokuma, J.T. & Armstrong, J.S. (1995). Beyond accuracy: Comparison of criteria used to select forecasting methods. *International Journal of Forecasting*. 11 (4). p.pp. 591–597.
- Yue, P. (1990). *A Microeconomic Approach to Estimating Money Demand: The Asymptotically Ideal t*. (1988). p.pp. 36–51.
- Zaslavsky, A., Perera, C. & Georgakopoulos, D. (2013). Sensing as a Service and Big Data. *arXiv preprint arXiv:1301.0159*.