A Work Project presented as part of the requirements for the Award of a Master's degree in Management from the Nova School of Business and Economics.

IMPLEMENTATION OF AN ACTIVITY-BASED COSTING SYSTEM IN AN AMENITIES MANUFACTURER – MODEL'S CONSTRUCTION AND RESULTS

MARIA MIRANDA DE
SOUSA SANTOS

Work project carried out under the supervision of:

Professor Marta Almeida

10/01/2023

Abstract

The following Work Project entails the development and implementation of an Activity-Based Costing system within a Portuguese firm in the amenities' manufacturing and commercialization industry. The model was divided into two parts, one regarding product costing and the other considering order processing costs. Its main objective is to ensure the company's accurate costing and provide an easy and adaptable tool that allows for a faster and more reliable bidding process. The analysis has revealed remarkable results regarding products, lines, and clients' profitability. Furthermore, the sustainability of the firm's online store was evaluated.

Acknowledgements

I would like to show my gratitude to LM's team, specifically its CEO and Production Director, who were always helpful and supportive. I wish to extend this special thanks to Professor Marta Almeida, for her guidance and encouragement. Furthermore, I could not have undertaken this journey without my family, who have cheered and supported me every step of the way. A final thanks to my friends, with whom I have shared memorable moments.

Keywords

Activity-Based Costing; Bidding; Costing Systems; Profitability; Traditional Costing.

This work used infrastructure and resources funded by Fundação para a Ciência e a Tecnologia (UID/ECO/00124/2013, UID/ECO/00124/2019 and Social Sciences DataLab, Project 22209), POR G (G-01-0145-FEDER-007722 and Social Sciences DataLab, Project 22209) and POR Norte (Social Sciences DataLab, Project 22209).

Table of Contents

1. Introduction

Founded in 1988, company LM[1] is one of the national leaders in the industry of manufacturing and commercialization of amenities, such as shower gel and soap. Counting on the trust of more than 5000 national and international clients, LM ranks amongst the leading national amenities suppliers, serving from hotel and motel chains to restaurants and airlines. The firm also works with some resellers. In 2001, it partnered with T, a national company that has become responsible for the design and production of all products' wrapping and labelling. LM fully produces in-house its solid and liquid soaps, shower gels, shampoos, and wipes. When it comes to body lotions and conditioners, those are outsourced, and LM is only responsible for their packaging and distribution. The same happens to other amenities such as caps and shaving kits. Financially wise, LM has proved to be stable, counting on Net Margins rounding 10% as well as healthy Activity and Liquidity ratios (Appendix 11.2.). With more than 2.6M€ of regular annual sales, the firm has a Shareholder value higher than 2M€. However, with the Covid-19 pandemic and the consecutive suspension of the whole hotel industry, the firm was severely impacted, as its most significant clients were forced to shut down. Nevertheless, in 2020, despite

[1] For confidentiality purposes, when referring to the company under analysis, a fictitious name was used. The same logic was applied to its competitors and partners.

having suffered a cut of around 28% in sales, LM could sustain its financial position by shifting the focus of its production to alcohol gel and disinfectant wipes. Due to the high demand for such kinds of products and their respective market shortage, LM was able to practice high prices and take advantage of high margins. Adding to that, it has also launched its online store, broadening its business to a B2C model. As such, the company seized all opportunities, enabling it not to shut down its production. As a consequence, the firm was able to even raise its EBITDA and Net Margin, culminating in a 2020 Net Income increase of almost 9%. However, in 2021, the market for disinfectant products was balanced, and tourism was still highly constrained. As a result, LM had one of its worst financial years, dropping its Net Income by almost 97%. Finally, in 2022, with the lifting of most Covid-19 restrictions and the increasing Portuguese tourism, the firm has been able to reach pre-pandemic sales levels and even surpass them in some months.

When evaluating the firm's General Environment, it should be reinforced that the world's economy is still recovering from the massive impact of the pandemic. Moreover, even though tourism is finally going back to its average value, in 2022, a new challenge has arrived. The war between Russia and Ukraine is having an outsized impact on the global supply chain as it has been stopping the flow of goods and causing dramatic fuel cost increases and product shortages. Consequently, one can observe the rising of commodity prices worldwide. As a result, firms in this industry are facing the challenge of increasing raw materials prices as well as supply shortages, forcing them to increase their product prices and renegotiate deliveries' lead times and stock needs. The rise of environmental concerns has also been highly impacting the amenities industry. Strong regulations on both cosmetics and packaging composition have been introduced, forcing firms to change formulas and labels, as well as to tighten their quality control measures.

Analysing the industry using Porter's Five Forces framework (Porter 1979), one can classify it

as having low intensity of competition and moderate attractiveness (Appendix 11.3.). Buyers have low bargaining power, as there are mainly two firms competing in the market, and the industry presents some switching costs due to contracts and product personalization. Furthermore, the industry also faces low threat of new entrants as it requires high initial Capital Expenditure and Research & Development investments, and there is not much room to diversify. Suppliers present a moderate degree of power. On the one hand, there is an extensive range of suppliers from which to choose. On the other hand, suppliers are not highly dependent on their relationship with this specific industry's clients. There are also high switching costs with some of the suppliers, as personalized packaging requires moulds to be made, which are costly and time-consuming to produce. The intensity of rivalry can be considered low, with the two leading industry players taking advantage of their strong brand loyalty and slow industry growth. The threat of substitute products can be regarded as moderate, as buyers rather purchase all their amenities from the same supplier, which only specialized companies in this industry can offer. However, full-size products manufactured by players in other sectors can substitute amenities and present lower prices while having similar performance. Such can already be seen, for instance, with the well-known cosmetics brand *Rituals* supplying some big hotel chains.

Focusing on LM's competitive environment, a renowned French amenities group can be identified as its biggest direct competitor, encompassing 30 brands, and covering more than 70 countries. In 2018, the firm became a more significant threat, when its representative in Portugal inaugurated a new factory unit in Viana do Castelo to better accommodate the Spanish and Portuguese markets. LM counts with other director competitors, whose names were not revealed due to confidentiality reasons. Nonetheless, these are not significant for LM as they only cover a small percentage of the market. Some indirect competitors should also be considered, such as *Rituals*, *Longlife* and *Nortempresa* Perfume & Cosmetics Manufacturer.

Following an internal analysis and grounding our thoughts in a SWOT framework (Humphrey

1960) it was possible to identify LM's main strengths (Appendix 11.4.). Naturally, its strong partnership and close location to firm T gives LM a crucial competitive advantage, allowing it to be autonomous and extremely fast in developing and producing its products' wrapping and labelling. With more than 30 years of experience, LM is also considered a solid and reputable brand with a loyal customer base. A key distinguishable factor is their unique and complete machinery set, which makes them capable of packaging their whole vast portfolio of products. Moreover, LM counts with a specialized labour force made of 14 factory employees, all capable of performing any step of each production line.

Nevertheless, as mentioned before, LM is still recovering from the financial consequences of the Covid-19 pandemic. Consequently, the firm has become even more apprehensive to invest in what could be a crucial strength: the fully in-house production of two of its most important products, conditioners, and body lotions. This is one of LM's medium/long-run strategic objectives. Another weakness worth mentioning concerns the company's particular business model and its required high-safety stocks. As a result, LM suffers from occasional losses of ingredients that are out of expiration date.

In what concerns opportunities, since the pandemic, industry firms have been forced to increase their online presence. LM was no exception, having created its online store. This source of revenue has been growing significantly, with a sales increase of around 130% over the last year. If the company strategically invests in it, it might continue to be a growing opportunity. Exportation is also one of the most promising plans in the short run.

A crucial factor of LM's industry is its high dependence on tourism. If, on the one hand, tourism has been indeed booming and surpassing pre-pandemic levels, on the other hand, such reliance still constitutes a significant threat. Additionally, the industry's high exposure to seasonality and constant regulation changes are other concerns to consider. It should also not be ignored that LM's most significant competitor has opened its first factory in Portugal, which can bring

considerable threats in the future. Finally, the whole industry has been and will naturally continue to be impacted by inflation's great consequences.

2. Literature Review

2.1. Introduction to Costing Systems

To make clever decisions concerning the marketing and manufacturing of their products, decision-makers must accurately know the cost of their products. Other managerial decisions such as product design, budgeting, bidding[2], and personnel hiring will also be influenced by product costs and profitability (Cooper and Kaplan 1987; Daru 2016).

When computing product costs, a cost accumulation system is required to assign costs to cost objects. A cost object refers to the product, service, project, client, or any item for which costs are being separately measured (Kumar and Mahto 2013b). These costs can be divided into direct, those that can be precisely traced to a cost object, and indirect or overhead costs (Drury 2018). Direct costs are associated with the cost object's consumption of resources, i.e. the elements consumed in or necessary to the performing activities inherent to the cost object's existence (Kumar and Mahto 2013b; Themido et al. 2000). When it is not possible to directly measure the quantity of resources consumed by a cost object, costs must be assigned using surrogate rather than direct measures, hence following a cost allocation (Drury 2018). The basis for allocating costs to cost objects is called cost driver or allocation base. When this driver is a significant cost determinant, a cause-and-effect allocation or driver tracing is followed. When such does not happen, the term arbitrary allocation is used, which tends to result in an incorrect allocation of indirect costs. Furthermore, two systems of cost allocation exist: direct or variable costing systems, which assign only direct costs to cost objects; And absorption costing systems, which assign both direct and indirect costs. Among the absorption costing systems, one can find

[2] Since the term bidding has multiple meanings in the Finance field, when reading this Work Project, one should consider the following definition: The bidding is the act of sending a bid proposal. (i.e., "A bid proposal is a document that companies use to outline the products or services, pricing and time frame they can offer clients for completing a specific project" (Indeed Editorial Team 2020) |)

Traditional Costing (TC) and Activity-Based Costing (ABC) Systems (Drury 2018).

2.2. Traditional Costing Systems

Until the 1900s, when information processing systems were expensive and time-consuming, most companies used simplistic costing methods created to purely answer financial accounting requirements (Drury 2018).

TC systems tend to allocate indirect costs based on easily identifiable drivers, such as direct labour hours (DLH), machine hours (MH) or the number of units produced. In other words, based on broad averages that usually do not reflect causality (Kumar and Mahto 2013b; Cokins and Lawson 2006). This way, the method assumes that the respective volume consumed is the underlying driver behind manufacturing overheads (Daru 2016b). The use of these allocation methods makes the results vary depending on the allocation basis (Cokins and Lawson 2006). Contributing to an arbitrary cost allocation, all overheads tend to be allocated using the same cost driver. Besides, the traditional allocation method fails to allocate the non-manufacturing overheads associated with the cost object's production, such as General and Administrative Expenses (Daru 2016b). Critics say this method under-costs complex and low-production volume products while it over-costs simple products produced in big batches (Hughes and Paulson Gjerde 2003). Further insights on the advantages and limitations of the model will be discussed in section 2.4..

2.2.1. Plant-wide / Blanket Overhead Rates

The most simplistic TC method, the plant-wide or blanket overhead rate, attributes indirect costs to cost objects using a single overhead rate (SOR) for the entire company. (Drury 2018). In this model, total overheads are accumulated in one single cost pool (i.e., "a location to which overhead costs are initially assigned") (Drury 2018), which is then assigned to products through a single rate, based on DLH, MH, or another similar driver. This rate is then multiplied by the quantity of driver used in the production of each product. Once the resulting amount is added

to the direct cost of every produced unit, one arrives at the total product cost (Trigg, Holland, and Kundey 1997).

Naturally, some departments consume more indirect costs than others. As such, products that spend more time in those departments should account for more overheads than the ones that spend less time there. By having different rates for different departments, one could capture these differences. However, a SOR does not, due to its averaging nature. Therefore, a SOR will probably result in an inaccurate allocation of overheads, and it should only be used if all products consume departmental overheads approximately in the same proportions (Drury 2018). Happily, firms have been shifting away from this costing method (Drury 2018). In a study with several UK organizations (Al-Omiri and Drury 2007), it was reported that a plant-wide rate was only used by four per cent of the surveyed firms.

2.2.2. Departmental rates and the Two-Stage Allocation Method

When a firm has a diverse range of products that spend different proportions of time in each department, departmental rates should be used whilst following the two-stage allocation method. Accordingly, the first stage is to allocate the indirect costs to cost centres, which usually are departments but can also be smaller and more specific segments, as it will be further developed in section 2.3.. The second stage assigns the cost centres' accumulated costs to the cost objects using cost drivers (Drury 2018). A TC system tends to use a small diversity of cost drivers and assumes these significantly influence the level of overhead expenditure. The Two-stage Allocation Method is used in both TC and ABC systems. However, in the latter, a higher number and diversity of cost centres and drivers is considered (Drury 2018).

2.3. Activity-Based Costing Method

2.3.1. The emergence of Activity-Based Costing

In the late 1980s, the intensification of many industries' competitive environments forced firms to improve the accuracy of their costing systems (Turney 2010), allowing them to reduce the

oversimplified and arbitrary costing allocations resulting from more TC methods (Cokins and Lawson 2006). Such has increased demand for more relevant, consistent, and understandable management accounting techniques, namely the ABC systems (Mahal and Akram Hossain 2015). Another key factor driving the spread of ABC models was the significant rise in indirect costs resulting from the increasing factory automation felt in that period (Cokins and Lawson 2006). One aspect that should also not be disregarded concerns the increasing complexity of the firm's business models (Cokins and Lawson 2006). The higher heterogeneity in the portfolio of products/services, as well as clients, distribution, and sales channels, has further increased the need for a system that properly assigned the increasingly significant overhead costs (Cokins and Lawson 2006). By assigning their costs according to cause-effect allocations, indirect costs could consciously be considered when reaching crucial decisions (Cokins and Lawson 2006). As such, and although relatively new, ABC has become widely accepted by firms from different industries, including the public sector and medical institutions (Kumar and Mahto 2013b).

2.3.2. What is Activity-Based Costing?

According to Aronoff et al. (1998), there are two purposes behind the implementation of an ABC system:

1. To avoid cost perversion.
2. To identify and reduce activities that are not adding value to a process.

ABC is a method that assigns overheads to the different activities (i.e., single or gathering of tasks) (Kumar and Mahto 2013c) of a process flow, based on their actual consumption and considering their cause-effect associations (Cokins and Lawson 2006). After accumulating such costs by activities, one can reach the total costs in each activity cost centre (Drury 2018). Then, considering each cost object's consumption of each activity, the final product/service cost is reached. A key feature of this method is that it can be applied to a wide range of firm areas, not just the manufacturing one (Kumar and Mahto 2013b). In other words, it considers that the

efforts related to marketing, sales, and products/services delivery create a demand for organizational activities (and the other way around) that should not be disregarded (Cooper and Kaplan 1992). As such, thanks to its completeness and high levels of accuracy, it permits managers to have a much more detailed and accurate view of their firm's cost structure and behaviours. Furthermore, it allows to analyse different areas of business, profitability according to their different products/services, the impact of different customers, among others. (Gunasekaran, Marri, and Yusuf 1999). So, one can say that an ABC system is a powerful tool for both financial and non-financial decisions (Cokins and Lawson 2006).

2.3.3. How does Activity-Based Costing work?

Deepening the methodology related to the development of an ABC model, it can be said that the first, and one of the most important steps, is Data Gathering. During that phase, all required information should be collected, from identifying the different firm's activities and acknowledging the process's crucial information to acknowledging the different drivers and consumption patterns. During this step, meetings with different level managers are necessary. It might also be helpful to visit the firm's manufacturing area to conduct some observational research and informal interviews with the workforce (Cokins and Lawson 2006). According to Cookin and Lawson (2006), the data required to build an ABC system can be grouped according to three different sources:

1. People: Asking the ones constantly in contact with the firm's activity might be a helpful way to retrieve information about the process flow behaviour, the respective consumptions and the organization's structure.
2. General Ledger: Some cost data might be immediately obtained from this record-keeping system.
3. Organization's Information Technology Systems: These might provide important information regarding past production history.

After having all data compiled, the two-stage allocation method should be followed (Gunasekaran, Marri, and Yusuf 1999), which according to Drury (2018), unfolds in four steps:

1. Recognition of the critical activities happening within the organization.
2. Allocation of the overhead costs to the different activities' cost centres.
3. Identification of the different activities' drivers.
4. Consideration of each cost object different activities' consumption and respective allocation of each activity's total cost.

After following these four steps, one will have an accurate picture of each cost object's value.

2.3.4. The Implementation of an Activity-Based Costing System

Successful implementations of ABC systems imply behavioural change within the whole organization (Cokins and Lawson 2006). Firstly, not only the top management but also the rest of the organization's team should be engaged in the process (Mahal and Akram Hossain 2015; Cokins and Lawson 2006). Here, communication is key, and the advantages of such exchange should be clearly transmitted (Cokins and Lawson 2006). Some experts also agree that a team of workers from different areas should be nominated to oversee the implementation (Mahal and Akram Hossain 2015). Specifically, accounting members should not be considered in this nomination (Mahal and Akram Hossain 2015). Adding to that, according to Cooper and Kaplan (1991), six critical decisions should be made before designing an ABC model:

1. Whether the new model should be combined with the currently used one or treated as independent.
2. Whether a formal decision on a model design should be taken before the actual implementation.
3. The person/s who will be in charge of building the final model.
4. The level of precision that should be used.
5. Whether the costs to consider should be based on historical values or future ones.

6. What should be the level of complexity of the first model.

One should be particularly concerned when deciding on issue four, as the precision level will depend on the trade-off between the system's cost and its extent of detail, exactness, and rigidity (Cokins and Lawson 2006). Exact and accurate models may demand levels of effort that end up not being worth it. Citing Keynes, sometimes, "it is better to be approximately right than precisely wrong".

In 1999, Gunasekaran, Marri and Yusuf developed another crucial model to understand whether ABC can be applied to specific organizations in the manufacturing and service areas (Appendix 11.5.). According to it, four aspects should be taken into account:

1. The circumstances motivating the implementation of the model.
2. The aspects hindering the model from being implemented.
3. A cost-benefit analysis evaluating whether the gains from this implementation surpass its costs.
4. The potential negative consequences (both financial and non-financial) of the model's implementation.

With these decisions and considerations in mind, a weighted decision can be followed.

As important as the implementation strategy of a system is its sustainability in the long run. For that, it must be ensured that the whole organization's team is conscious of the value and the purpose of the model. (Cokins and Lawson 2006). Furthermore, the model's data should be periodically reviewed to ensure validity (Drury 2018).

2.3.5. The impact of Activity-Based Costing on Strategic Cost Management

As said before, an ABC system helps companies allocate their costs to cost objects more consciously and precisely. But other than that, ABC might also be beneficial in its crucial strategic decisions (Drury 2018), from Pricing/Product Mix ones (Cooper and Kaplan 1992) to process re-engineering (Cooper and Kaplan 1988). A study conducted by Innes, Mitchel and

Sinclear (2000) has shown that ABC systems have been more helpful in cost management-related decisions than in the ones related to the initial purpose of the model, product costing. When it comes to Pricing decisions, for instance, ABC is a useful tool to understand which products are being over or under-costed and hence might need to have their prices readjusted. Likewise, some Product Mix considerations might be retrieved from the model conclusions. This way, firms might more accurately understand the cost impact of their customers' decisions on the volumes and heterogeneity of products ordered. Such considerations may then be pondered when pricing the respective orders (Cooper and Kaplan 1992).ABC systems might also be highly useful in Customer Profitability Reporting (Cokins and Lawson 2006). Not focusing solely on products' manufacturing costs allows firms to have a complete view of their customer's value. Based on such insights, Profit and Losses Statements might be built for individual customers. As such, one can say that the profitability of two customers ordering the same product mix might be significantly different depending uniquely on their consumer behaviour. In other words, the level of effort a customer demands from an organisation, i.e., customer service and delivery requirements highly impact its profitability (Cokins and Lawson 2006). Such reasoning was summarized by Cokins (2001) in a two-axis matrix that confronts the "Product Mix Margin'', which evaluates the net margin by customer based solely on their product consumption, with the "Cost-to-Serve'' a client during its whole customer journey (Appendix 11.6.). Ideally, all firms should focus on strategically having their customers positioned at the upper left corner, maximizing their profitability (Cokins and Lawson 2006).

Another field in which ABC insights might support important decisions regards the company's process flow of activities (Cooper and Kaplan 1988). By having a clearer view of the costs in each activity of their processes, companies might feel the need to standardise their production process or redesign it in ways that reduce lead and set-up times. Furthermore, managers might also become motivated to change their factory and headquarters' layouts to reduce materials'

handling costs and increase productivity (Cooper and Kaplan 1988).

All in all, implementing an ABC system provides decision-makers with crucial data to have more informed decisions about a firm's manufacturing and support costs and activities (Cooper and Kaplan 1988).

2.4. Comparing both Models: Advantages and Limitations

An ABC System can generate a completely different picture of product costing than the one generated by traditional systems. The main reason behind it concerns ABC's more sophisticated approach when it comes to the assignment of overhead costs (Cooper and Kaplan 1988). Nevertheless, the choice of costing systems may and should differ according to each firm's operations. For instance, ABC systems might be too complex for companies manufacturing and selling only one product, as all overheads will be incurred to support the production of that one product. In turn, firms with multiple or differentiated products should use a more sophisticated system to precisely account for their resource consumption (Hughes and Paulson Gjerde 2003). Since ABC systems were created as an attempt to update the TC ones, by increasing their complexity and accuracy, the advantages of one ended up being a response to the limitations of the other. However, as the choice of a firm's costing system can significantly impact its results, the advantages, and limitations of each of the models will be further enumerated.

2.4.1. Advantages of Activity-Based Costing / Limitations of Traditional Costing

- ABC recognizes the interdependence between cost drivers and activities and uses cause and effect allocations, contrarily to TC's arbitrary ones (Drury 2018).
- ABC considers non-manufacturing costs associated with production, enabling more accurate results and more efficient decision-making about pricing, marketing, and product design (Daru 2016b; Mahal and Akram Hossain 2015).

- ABC improves operational performance by allocating indirect costs based on each activity's actual resource consumption, while TC does not divide the firm into activities (Mahal and Akram Hossain 2015).
- ABC allows decision-makers to visualize where are the most significant costs and what is behind them, preventing the use of misleading cost information (Mahal and Akram Hossain 2015; Lockamy and Smith 2000).
- ABC allows a better view of production processes, encouraging companies to redesign products and processes by redeploying resources from a non-value to a value-added activity (Reyhanoğlu, n.d.; Mahal and Akram Hossain 2015).
- ABC allows the analysis of different product lines' profitability, increasing organizational efficiency (Mahal and Akram Hossain 2015).
- ABC systems make it easier for firms to quickly adapt to changes in demand, production processes and prices, contrarily to TC ones (Askanary 2007).

2.4.2. Limitations of Activity-Based Costing / Advantages of Traditional Costing

- TC aligns with the Generally Accepted Accounting Principles as it provides a value for the cost of goods sold, whereas ABC does not since it also considers non-manufacturing costs (Daru 2016b).
- Due to its higher complexity, an ABC system is more costly to maintain than a TC one (Askanary 2007).
- TC is widely understood, whereas ABC is still unknown by a wide range of people and, consequently, firms (Askanary 2007).
- Implementing an ABC system is much more time-consuming than a TC one (Mahal and Akram Hossain 2015).
- ABC, contrarily to TC, requires regular updates (Mahal and Akram Hossain 2015).

- Building an ABC requires building management's thinking, as overheads are not only about costs but also about processes (Reyhanoğlu, n.d.).
- ABC commonly faces employee resistance as it requires significant organizational change (Reyhanoğlu, n.d.).

2.5. Activity-Based Costing and Supply Chain Management

As mentioned in the previous section, TC systems are not constructed to connect non-value-added activities and their respective costs with the causes behind them (low raw material quality or delivery inefficiencies, for example). However, to improve both supplier and client performance, management accounting systems should measure activities as a whole, considering their causes and consequences. As such, one can conclude that TC systems are not intended to support strategic value chain management (Thomas and Mackey 2006). Furthermore, a survey conducted by *UPS Supply Chain Solutions, Alpharetta, Ga.*, described that 61% of the responding CFOs believed that supply chain management was fundamental to their success. However, from these, 62% considered that due to the fragmented supply chain control and the inability to measure supply chain costs (a consequence of the use of traditional systems) only minor improvements were possible (Thomas and Mackey 2006).

Furthermore, as aforementioned, in TC systems, product costing methods were designed for external value reporting purposes, mainly resulting in misleading cost information and, consequently, lousy decision-making (Lockamy and Smith 2000). Thus, one can clearly state that the TC systems are not the correct framework to analyse Supply Chain productivity (Lockamy and Smith 2000). In turn, ABC systems not only provide accurate, detailed, and up-to-date information on activities and processes but also report them in an easily understandable manner for decision-makers. Therefore, by shifting to an ABC system, companies will access more relevant, crucial information to better manage supply chain activities (Thomas and Mackey 2006; Kumar and Mahto 2013b).

2.5.1. Relating Literature findings with LM firm's case

LM belongs to the manufacturing industry and plays the role of an intermediate on its value chain. Moreover, in today's intense global competition, supply chain management is a crucial tool for managers to improve a firm's productivity, profitability, and performance (Kumar and Mahto 2013b). As such, it would be beneficial for LM to have an ABC system allowing them to improve the accuracy of their analysis and, consequently, decision-making. Despite still being disregarded by most SMEs, research has shown that ABC can indeed play an essential role in improving their competitiveness (Gunasekaran, Marri, and Grieve 1999). This idea was further emphasized by Bayaksogly & Kaplanogy's (2008) study that concluded that many industries are implementing a variety of techniques, such as Just-in-Time and Total Quality Management, to grow their supply chain value, with ABC being one of the most recognized models (Kumar and Mahto 2013b). Moreover, in 2006, a survey was conducted among the top 500 companies (excluding financial services) and the top 50 financial services companies of the *2001 Business & Finance listings of Irish Companies* to study the perceived success of costing systems. Here, it was possible to conclude that the relative proportions of the adoption of ABC were 18% for manufacturing companies, 3.3% for financial services firms and 6.5% for non-manufacturing enterprises (Pierce and Brown 2006). These numbers show that the advantages of an ABC system within the manufacturing sector have not been unnoticed. Along with all the previously mentioned data, several case studies on the implementation of ABC systems in manufacturing companies around the world have been documented, showing that this costing system has been increasing in popularity in the last few years (Kumar and Mahto 2013a; Rohani, Azman, and Zakaria 2015; Almeida and Cunha 2017).

3. Research Question

After the significant consequences of more than two years of fight against the Covid-19 outbreak, the world's economy is now being highly impacted by the Russia-Ukraine conflict,

which has been having unsettling outcomes on the energy, oil, wheat, and other commodities prices. According to the IMF, from a growth of 6.1% in 2021, the global economy is now expected to grow by 3.2% in 2022. Moreover, all countries are suffering from excessive levels of inflation (with Portugal reaching a 10.1% CPI annual rate in October 2022 (Instituto Nacional de Estatística 2022a)) and economic instability is felt in almost all industries. As an example, Portuguese Industrial Production Prices Index year-on-year change rate was 16.2% in October 2022 (Instituto Nacional de Estatística 2022b), culminating in firms' being highly challenged with constantly changing costs as well as extraordinarily volatile and time-consuming bidding processes.

Naturally, the problem mentioned above is amplified when companies still use TC Systems that arbitrarily allocate costs and do not account for most of their overhead expenses. This was the main reason that motivated LM to reach out for our team's help, as the CEO felt the firm's costing system was not accurate enough to provide them with the necessary tools to bear the following challenging times. As a result, the scope of this Work Project is to build LM a new, easily adaptable costing system that will allow it not only to have a more detailed and accurate view of its costs but also to retrieve crucial information about its profitability by product, product lines and customer types. Consequently, this will also culminate in a more conscious (and hopefully, faster) bidding process, with which the firm can wittingly decide on quantity discounts, order minimums and customer-specific strategies. As such, an ABC model for LM's product portfolio will be built focused on answering the following main questions:

RQ1: What is the impact of the implementation of an easily adaptable ABC system on LM's product and order costing?

RQ2: How can LM offer more reliable and faster bids bearing in mind their different types of clients and respective ordering behaviours?

4. Research Method

4.1. Phase 1: Diagnosis

In March 2022, LM's CEO contacted the team seeking a solution to the previously described problem. In fact, the firm had already worked with our team on a course project. As such, the opportunity of doing a Consulting Lab Project as our Work Project emerged.

At the beginning of April, we reunited with Professor Marta Almeida, a professor that had taught us both the Management Accounting and Strategic Costing courses, to understand the viability of the project and possible solutions to LM's concerns. After some weeks of brainstorming, it was understood that a model could be constructed to answer the firm's requests while substantially improving the efficiency of its daily operations.

On the 19th of April, we had our first meeting with LM, where the team's ideas were exposed to the firm, which showed interest and openness to their implementation. Therefore, an informal decision was made regarding our Work Project scope and the firm we would be working with.

On the 5th of September, the Work Project plan and calendar were defined during the kick-off meeting with Professor Marta. Moreover, the first official meeting with the firm was prepared, which would happen on the 6th of September. Back then, we visited the factory and observed the production processes as well as how the company's operations are designed and organized. Moreover, a more in-depth discussion was followed regarding the topics to be addressed in the Work Project, and some necessary data was collected.

After analysing and organizing all the information sent, another meeting was conducted with LM on the 23rd of September with the purpose of an in-depth explanation of their current costing model. Back then, it was immediately understood that the allocation of overheads was done traditionally, so the team grasped to briefly introduce the ABC system.

4.2. Phase 2: Activity-Based Costing Model Development

While studying the current costing model of LM, it was noted that the firms' vast range of

products produced a significant amount of costs, from which some were arbitrarily allocated, and others were not even contemplated. Moreover, different ways of handling and delivering orders, as well as some customer types with distinct consumption patterns, were identified. Naturally, these require different effort levels and resource costs from the company. Therefore, the profitability of two customers ordering the same product mix might be significantly different based on their consumer behaviour (Cokins and Lawson 2006). As such, they should not be costed equally. Hence, it was decided that the proposed costing system would be divided into two parts: product and order processing costing.

Therefore, along with a lot of research and trial and error, a draft raw version of the model was constructed. This initial system was first presented to Professor Marta, and after incorporating her feedback, the model's presentation to LM was prepared.

On the 14th of October, the draft model version was presented to the firm, which showed enthusiasm and desire to help with its development.

Until the end of November, the team was fully dedicated to the model development, which was the main scope of this Work Project and will be explained in detail in section 5. During this time, there was a lot of communication, mainly with the firm's CEO and production director, as well as some visits to the headquarters to clarify doubts, conduct interviews and ensure the model's viability. The main data collected during this process can be found in Appendix 11.18..

4.3. Phase 3: Analysis and Recommendations

After the model creation, a series of analyses were designed. A comparison of the two model's cost differences as well as their causes and consequences was made, considering the distinct cost types and activities. Profitability per product type, format and lines was calculated, allowing to drive pricing and bidding recommendations. Plus, examples of the model's interactivity were created, displaying how easily it can be used to incorporate cost or process changes. During the meetings with the firm, a concern regarding the viability of the online store

was noticed. As such, a study was conducted to assess its potential success and evaluate the impact of hiring an extra employee dedicated to it.

4.4. Phase 4: Model Implementation in the company

The last and one of the most critical steps of this Work Project was the model's implementation in the company. Our team wanted to guarantee that the model would be correctly explained to both the production director and the CEO, ensuring that both could use and adapt it. This way, the elimination of one of the company's old costing model problems would be safeguarded: its dependence on the production director. To achieve this, a workshop was constructed where it was explained, in detail, how one could take the most advantage of the model. It is important to highlight that to avoid any possible conflicts or discomfort all numbers related to specific employee expenses were hidden and protected in the delivered model so that these could only be seen or modified by the CEO. Moreover, the whole model was translated into Portuguese, the firm's official language.

Finally, the Work Project's main analyses and recommendations were presented to the company and time was given to answer possible questions or hesitations. Fortunately, the final feedback was positive, and LM received the new model with enthusiasm and gratitude. Particularly, they were delighted not only with the increasing cost accuracy of the model but also with its interactive, change-friendly features.

5. Model's Construction

5.1. General Processes View

LM offers its clients a total of 14 standard product lines, differing in terms of perfumes as well as formats offered. The company is also specialized in personalized product lines, but due to its intrinsic complexity, for the sake of this Work Project, only standard lines will be studied.

Regarding its portfolio of products, LM fully produces in-house its liquid and solid soaps, shamps, and shower gels. In other words, the firm not only produces these intermediate goods

but also packages them. Moreover, LM is also responsible for the entire production and wrapping of both their refreshing and disinfectant wipes. However, when it comes to conditioners and body lotions, the company externally buys the respective liquids and is only responsible for their packaging. Besides these, LM also offers a range of products categorized as "others", which comprises complementary goods from bath sponges to shaving and dental kits. For these, the firm mainly acts similarly to a reseller.

Talking specifically about soaps, these are offered in different weights (12gr, 15gr, 20gr, 40gr) and formats: squared (SQ), rounded (RD) and rectangular (RT). Regarding their packaging, flow pack (FP), paper (P), and pleat wrapper (PW) options are available (Appendix 11.7.).

Moving on to liquids, there are also plenty of options depending on their dosages and packaging designs. Shower gels, shampoos and body lotions are offered in all kinds of formats: sachets (10ml), tubes (30ml), dispensers (300ml), refills (5L) and miniatures. Conditioners, however, do not have a refill option, except in Line A[3]. Regarding liquid soaps, refills and dispensers are the only available alternatives. One should notice that the miniatures' format comprises a wide range of dosages (20ml, 30ml, 35ml and 50ml) as well as designs (regular, amber-coloured, squared versions, among others) that vary according to the different product lines and are clearly identified according to an internal naming (i.e. O59, O82, among others). Furthermore, some have exclusive tops (i.e. golden tops) and specific requirements (i.e. being further packed in a cardboard box). Finally, refreshing wipes come in two formats: small and big, whilst disinfectant ones are only available in the small format (Appendix 11.7.).

All interior products[4] are produced in automatic machines (MachineRunSoap, MachineRunLiquids and MachineRunWipes). In the case of dispensers and some specific miniatures (M270, M155 and M30AMB for shower gels and shampoos and adding to those, M188, M059 and M205 for body lotions and conditioners), these are then packed using a semi-

[3]For confidentiality purposes, the names of the lines were replaced by alphabetic letters.
[4] Interior product refers to the plain soaps and liquids (i.e., before being packaged).

automatic machine, which implies slower packaging rates. The remaining miniatures, soaps and wipes are packed automatically. Refills are always filled in and labelled simultaneously in a manual machine. As such, it can be noticed that LM is equipped with a set of machinery that allows them to be self-sufficient in packing its vast portfolio of products. The process flow charts of the distinct production processes are summarised in Appendix 11.8.

5.2. The Firm's Old Costing Model

LM's costing model consisted of an Excel model developed more than ten years ago. The model itself was not interactive and, thus, not easy to adapt to market or production process changes. As such, throughout the years, specific values were added to the model in arbitrary cells without a written explanation or indication. Some of them referred to price changes, others to machines' cleaning requirements and a few had reasons that not even the production director could identify. As a result, the lack of justifications and model coherence ended up jeopardizing its credibility. Naturally, all these factors contributed to the costing system's significant dependence on the production director, the only worker aware of the tracing of these costs. There was also no clear distinction between cost types, with labour costs and overheads appearing as one. At first glance, the attribution of this value immediately seemed inaccurate, with similar products presenting totally different direct labour and overhead values.

The old costing model was divided into two Excel sheets, one regarding the intermediate product calculations and another summing the resulting values with other costs, such as packaging material, cardboard transportation boxes, as well as labour and machine costs. It should be noticed that most of the costs were computed per thousand units or per hour worked, a practice that was maintained and used in the model being proposed.

Starting with solid soaps, the intermediate product comprised all the costs incurred to produce 1000 units of the interior product. This includes the soap dough, the required portion of titanium, the respective perfume, and the cost of the labour and machinery used in the

manufacturing activity. The latter was calculated assuming 10€ for each labour and machine hour and considering the time needed to produce 1000 units of each soap format. To this, the cost of wrapping the soaps and grouping them in the cardboard boxes was added, resulting in the second part of the model. At this stage, the cost of the wrapping materials depends on the prices practised by company T, as well as the quantity needed to wrap a batch of 1000 units. The cardboard boxes' cost also depends on the supplier price and was calculated based on how many boxes were needed to store 1000 units. The labour and machinery cost of wrapping the soaps varied with the soap packaging and format options. However, it was not possible to find solid reasoning behind the attributed values (Appendix 11.9.1.).

In what concerns the liquid formats, the intermediate product regarded not only the interior product but also the manufacturing and packaging activity as well as the outsourced bottle and top costs. Despite deriving from a mix of different components in different proportions, shampoos, liquid soaps, and shower gels all yielded approximately the same total cost per litre. To have the cost of 1000 units of each format, the dosage of each bottle was multiplied by the litre price. The same calculations were done for the body lotions and conditioners, but in that case, the cost of the raw liquid was the price practised by the external suppliers. To each raw liquid, the cost of the perfume was added, resulting in the interior product. By summing the outsourced bottles and tops price, as well as the labour and machine hours' cost of the manufacturing and packaging activities, one could get the intermediate product cost. Nevertheless, again, it was not possible to find solid reasoning behind the attributed machinery and labour hourly values. In the second stage of the model, the labelling and the cardboard boxes' costs were added. Again, both these costs depended on the prices practised by firm T and the box suppliers. Here, contrarily to the soaps, no further machine nor labour hours were accounted for, as these were fully considered in the intermediate product calculations (Appendix 11.9.2.). It is worth mentioning that the sachets format was not being costed using

the same reasoning, possibly because these were added posteriorly to the model creation. The perfume cost was mistakenly not contemplated, resulting in its under costing.

For the wipes' costing, a distinct Excel model was used that had no explanations regarding the cost calculations (Appendix 11.9.3.).

Finally, one should consider the fourth category of products: "others". As aforementioned, these products are simply resold by LM. As such, the only costs incurred with them are the cost of the transportation cardboard boxes and, in some products, the cost of manually labelling them. In the firm's model, both these costs were added to the price practised by the supplier. This product category was only considered in the second part of the model (Appendix 11.9.4.).

When analysing the model, it was understood that not only a significant amount of overhead costs was being disregarded, such as insurance, mandatory taxes, and machine depreciation, among others, but also that the way the model was constructed in the first place was indeed affecting its accuracy. All in all, not only were some values being added to the wrong parts of the model, resulting in missing or double counting costs (i.e., sachets' case) but there was also no consistency or reasoning behind the allocation of most company's overheads and labour costs. Concerning pricing, the industry's low intensity of rivalry allows LM to follow a cost-plus pricing approach, a decision that was conserved on this Work Project.

5.3. The Proposed Model

5.3.1. General considerations

As previously mentioned, this Work Project resulted in a two-part costing model that aims to be a future useful tool to LM, specifically when bidding their orders and dealing with current fluctuating prices. First, one will have the Product Costing segment, in which the total cost of 240 products (coming from the 14 different product lines) will be calculated, clearly distinguishing between direct materials (DM), direct labour (DL) and overhead (OH) costs. It should be highlighted that for the products in the "others" category, the considered costs were

preserved from the old model. As these have a wide range of manual labelling possibilities, implying distinct labour and material costs, it was considered that the necessary effort to deepen these products' analysis would not be compensated by the value added to the model (Cokins and Lawson 2006). Then, the Order Processing Costing part will allow the firm to compute the cost to serve different clients, depending on their ordering behaviour, product mix and the delivery option chosen. It should also be highlighted that the model includes an assumptions tab from which all variable inputs are linked. This way, LM will be able to quickly and easily account for any cost change, a feature that not only will be particularly useful in the current economic environment but was also explicitly required by the CEO. One should note that all considered cost variables include VAT. As stated earlier, the allocation of the company's OH was followed, taking an ABC system in mind. Therefore, in total, 21 activity centres were created to accommodate the different indirect costs, considering both the respective production process flows and the possible different consumer behaviours. It is important to recall that for consistency purposes, costs were maintained using a "per thousand" or "per hour" metric. All in all, this process culminated in an interactive costing model that will allow LM to consciously understand the actual cost behind each order received by simply typing the respective quantities ordered and specifying the order's circumstances.

5.3.2. Product Costing

5.3.2.1. Direct Materials (Excel_PartOne_Tab2_2.3.)

Regarding DM, three different costs were accounted for: the interior product, the cardboard box, and the packaging material. The first one considers the cost of plain soaps and liquids. For solid soaps, it considers the cost of the soap mass, the titanium consumed, and the respective perfume added, whilst for liquids, it only considers the cost of the raw liquid and the perfume. Note that this raw liquid cost is considerably more expensive for conditioners and body lotions, as these are not produced in-house. The packaging material costs include not only the cost of

the different packaging formats (i.e. O59, O82, among others) but also the cost of the labels or the wrapping material bought from firm T. Here, special attention was required when dealing with miniatures, as these have a vast possibility of bottles and tops. Finally, the cost of the boxes in which the products are packed is considered within the cardboard box cost. At this stage, the current costing model DM's prices were considered.

It should be highlighted that for all costing allocations that required the liquids' specific measure, their actual rather than theoretic dosage was used. In other words, the amount of liquid wasted when filling the products was considered for each specific miniature type. On average, waste corresponds to 10% of the theoretic dosage, but there are some higher and lower exceptions. With regards to the previously mentioned arbitrary values being added in some products, a careful analysis was conducted to understand their relevance and tracing. Accordingly, these were accurately reallocated or eliminated. For instance, some product lines had extra costs added as DM reflecting specific production requirements. It is the case of Line C, in which some products require a change in the machine's settings that makes them 20€ costlier. Since these costs were line or product-specific, the team decided to maintain them within the DM. Moreover, when trying to identify all the costs LM incurs in its products' manufacturing, the Production Director was specifically asked about the Machine Maintenance, which we believed to be a significant overhead cost. Back then, it was understood that these were being considered within each interior product cost, and the director could no longer detect and isolate them. Consequently, one should be aware that these are also inaccurately incorporated within the DM costs in the proposed model. Another cost that was being ignored was identified: the *Sociedade Ponto Verde* Tax. It corresponds to a tariff implied by the Portuguese entity responsible for waste-packaging management. Accordingly, LM is obliged to pay a tax per kilogram of plastic and paper produced, both in the manufacturing of their products and in the cardboard boxes used for storage and distribution. As such, the charges

were respectively added to packaging materials and boxes' costs, considering the paper and plastic weights consumed by the different products. For the products in the "others" category, this cost was only added to the box costs, as LM is not responsible for its production nor packaging and hence, is not the one upon which the tax is levied.

5.3.2.2. Direct Labour (Excel_PartOne_Tab2_2.2.)

To accurately contemplate LM's DL costs, accounting records from this year's employee charges were analysed, and the following expenses were considered: base salary, meals, Christmas and vacation allowances, Social Security, work accident insurance and other employee charges/expenses. For their overtime and absence expenses, it was assumed that, on average, these would follow the same patterns. As such, the corresponding monthly values were individually considered for each one of the 14 factory employees. Then, considering the average monthly DLH worked by each of them, the €/DLH rate was attained for each worker. With those, the average €/DLH rate for the whole workforce was achieved. The distinct production processes and labour requirements needs were considered to allocate this cost to the different products. For that, four different stages were identified:

- Machine preparation: to account for the labour time required to prepare the machines before their utilization.
- Liquid/Soap Production: to account for the hour requirements during the production of the different interior products.
- Packaging: to account for the labour hours needed when packaging the products.
- Product Storing: to account for the time spent transporting the products from production to packaging machines and from packaging machines to the warehouse.

Then, the number of workers and the hours needed to produce 1000 units in the distinct stages were considered. Using the average €/DLH, it was possible to compute the total labour costs of producing 1000 units of all different product types and format

- bidding orders received via e-mail, telephone, or online store.
- Products' Pick–Up (and Order Preparation): to account for the difference in time spent preparing an order solely composed of goods from the same product line, hence relatively close to each other, versus from distinct lines.
- Order Distribution (Preparation and Delivery): To consider the time spent issuing transportation guides and extra needed documentation (required by CTT) and delivering the order (Distrib_Intern).

As a result, three different activity centres were created (Appendix 11.12.). In this part of the costing system, which was also constructed with an ABC method in mind, the cost object will correspond to the different options within each activity centre. In other words, there will be, for instance, OrderReceivement_Web and OrderReceivement_E-mail, to distinguish between these two separate ways of receiving orders.

6. Results and Analysis

It should be emphasized that for the products in the "others" category, the only cost added in the proposed model was the *Sociedade Ponto Verde* Tax. Hence, due to its minor significance in 1000 units terms, no relevant cost differences between models were detected. Consequently, for the following analyses, these products were ignored. Since Line Q is mainly composed of them, when comparing product lines, it should be disregarded.

6.1. Proposed Model Results

6.1.1. Analysis of Under/Over-costing Products (Excel_PartTwo_Tab1.1.)

Analysing the differences in cost between the two models, one can immediately see that most of the products were being under-costed, except for body lotions and conditioners that were over-costed. Starting with soaps, one can find a general pattern between lines and formats, with all soaps being under-costed by an average of 10€ in the old model (OM). This difference comes

from the inaccurate allocation of DL+ OH[5] (24%^{OM} vs 38%^{PM})[6]. Nevertheless, there were some exceptions which deserve to be noted. RD PW soaps had an under costing of roughly 21€[7]. This can be attributed to its particularly high amount of DL, as it is the only format that needs two employees for the soap mass production, a difference that was ignored in the old model. SQ20 P soaps showed an even higher variation, with an under-costing of around 174€. This format also requires three employees during its packaging, substantially increasing the DL amount. Moreover, the concentration of fixed OH caused by its small monthly production has also increased its cost in the proposed model (PM). An unexpected accuracy was found in Line N's SQ20 FP soap. Even though DL and OH costs were under-costed, 10.30€ were arbitrarily added to the soap's costing, casually resulting in the correct cost amount.

Body lotions and conditioners go through the same production processes. As such, these only differ in the DM part, with the conditioner's raw material being more expensive than body lotion. So, the same conclusions can be driven for both products. In general, miniatures were being over-costed by around 48€. Even though their packaging is made in a semi-manual machine and at lower rates per hour (due to the higher viscosity of the products), a proper reason for such high values of DL+OH (188€^{OM} vs 140.67€^{PM}) was not found, especially when half of the production process is outsourced. The only exception was format 270, which was under-costed by 81.34€, clearly caused by the given low amount of DL+OH (60€), for which, again, an explanation was not found. Refills were being over-costed by around 725€, resultant from an over-allocation of DL+OH (18%^{OM} vs 12%^{PM}). Contrarily, dispensers and sachets were being under-costed by around 70€ and 3.7€, respectively. Tubes were also being under-costed by 137€, as the correct and high amount of DL (143.99€^{PM}) was not being considered. Such happens not only because tubes are produced at a low rate (250u/h) but also because its

[5] In the old model, DL and OH costs appeared together as one. As such, even though in the proposed model these costs were calculated separately, for comparison purposes, the sum of both costs (DL+OH) was used.
[6] All the comparing values displayed in parentheses showcase DL+OH as a percentage of total costs.
[7] All cost amounts displayed in this section represent the per 1000 units value.

packaging machine needs two employees to be operated.

Shampoos, shower gels, liquid soaps, and shower gel/shampoos within the same line all present the same DM prices, with costs varying only with the different formats. As such, the same conclusions can be extended to all products. Sachets were being under-cost, with a difference of around 12.99€. Here, not only DL+OH was too conservative (26%^{OM} vs 44% ^{PM}) but also the perfume cost in DM calculation was being forgotten, leading different lines to have the same cost. Tubes were under-costed by 39€ due to the considered small quantities of DL+OH (20%^{OM} vs 31% ^{PM}). Refills were being under-costed by 1930€, driven by a considerable difference in DL+OH (8%^{OM} vs 31%^{PM}), probably because the old model did not consider the increasing cost caused by the manual packaging of these formats. The same happened with dispensers, which have semi-manual packaging, and were being under-costed by around 340€. Line G was incorrectly calculated, as the body lotion's raw material cost was being used. Moreover, the packaging material was being considered for only one instead of the usual 1000 units. Regarding miniatures, most of them showed an under-costing of less than 10€, driven by the disregard of some DL+OH costs. Miniature 205 was under-costed by 15.24€ as the given DL+OH was smaller than for the other miniatures, with no apparent reasoning. In Line C, these products were also all mistakenly considering body lotions' raw material costs, resulting in a lower under-costing or even over-costing of products.

Finally, wipes were also being under-costed due to inaccurate DL+OH costs (18%^{OM} vs 46%^{PM}), causing significant differences in costs, especially for the bigger size (UC= 27.05€^{OM}). Additionally, Line P's kits were all over-costed because cardboard boxes and DL+OH costs were being double counted. Specifically, they were already being included in the corresponding kit's products' costs. Furthermore, the shampoo from this line was also wrongly costed, as it was mistakenly considering the raw material cost of body lotion.

Finally, it is important to note that even though total DM costs were calculated following the

old model's reasoning (when it had a logical sense), all products' DM costs suffered a slight increase caused by the consideration of the *Sociedade Ponto Verde* Tax.

6.1.2. Analysis of the resulting activity centres (Excel_PartTwo_Tab1.2)

To compare the average monthly total OH per activity centre, the average monthly total variable OH needed to be computed. For that, the average monthly product mix and the machine's power were utilised. This way, it was possible to conclude that the activity centre with the highest average monthly total OH is the *Packaging Semi-Automatic*. On the one hand, it is the one with the highest variable OH, as it has a substantially high monthly production, hence it consumes much energy. On the other hand, it also has an extensive amount of fixed OH due to the great area occupied in the factory. Contrarily, *Packaging Refills* is the centre with the lowest average monthly total OH costs. As it is a manual activity, it has no variable OH and does not account for any machine depreciation. It is also a smaller centre, which is reflected in lower fixed OH. It is interesting to note how the *Warehouse* is the activity centre with the highest average monthly fixed OH costs, despite not having any machines. Such happens due to its vast area occupied ($377m^2$), which is reflected in significant building depreciation and mandatory insurance costs. With this analysis, it can also be concluded that a total of 6126.60€ monthly fixed costs were not being considered in the old model (80% of total OH).

6.1.3. Analysis of the Order Processing costs (Excel_PartTwo_Tab1.3.)

As mentioned, the company did not account for the cost differences implied by the different ordering behaviours. As such, the CEO, Administrative Officer and Transportation Agent's monthly expenses were being disregarded from their costing model. Some crucial direct costs were also not being accounted for, namely: the E-commerce fee, the vehicle's fuel, depreciation, and insurance. After allocating all order-related costs, one can conclude that for the firm, the costliest way of receiving an order is through the telephone. Moreover, picking up products from multiple lines is more expensive than from a single line, and internal distribution

is the most expensive delivery method.

6.2. Online Store Analysis (Excel_PartTwo_Tab4.)

During one of the meetings with LM, the CEO showed some concern about the viability of their online store. In 2022, the online sales revenue increased by around 103%, proving that there is online demand to be served. However, the firm's total capacity is reaching its limit, with the employees recurrently working overtime. As such, to further invest in the website, an extra administrative employee would need to be hired, an expenditure that LM still considers risky. Adding to that, if the firm indeed decides to bet on its online presence, a higher marketing investment would have to be made to ensure a higher website reach. An in-depth study of their online store viability and possible marketing campaign strategies would have room to be the scope of a Work Project. Nevertheless, even though this project's scope is the construction and implementation of the new costing system, a brief individual analysis of the future of LM's online store was considered valuable. For that, the first step was to research how much the firm should be investing in marketing and what would be the correspondent expected return on revenues. It was concluded that, according to some studies, B2B firms tend to, and should, invest between 2% and 5% of their total sales revenues in marketing (Horvath 2022). It should be noted that currently, LM's advertising strategy only comprises digital marketing. Moreover, it was found that the average industry standard points towards an online marketing ROI of 5 (Glover 2022). When comparing these values with LM's current situation, it was concluded that the average online marketing investment corresponds only to 0.23% of its previous year's total revenues, a value far from the suggestive interval. Since a jump from 0.23% to 2% in just one year was considered too ambitious, the following analysis will consider that in 2023, LM will invest 1% of 2022 total revenues in Online Marketing (30169.88€).

Having all the above in mind, three scenarios were created to understand the impact of such an investment. Each scenario reflects a different possible return: an optimistic scenario, pointing

towards an ROI of 7; an average one, assuming an ROI of 5; and a pessimistic one, that assumes an ROI of 2.49. Firstly, for accuracy purposes, total sales revenues were divided into the two possible sales channels: offline and online. Such division was only possible from 2020 onwards, as it was the year in which the online store was created. After this, it was possible to compute the average growth rates of both offline and online total sales revenues. With that, it was possible to forecast what would be, per se, LM's online and offline sales revenues in 2023. In other words, these correspond to the 2023 forecasted revenues if the firm continues to invest the same proportions in online marketing. The additional total sales revenues arising from the higher online marketing investment were calculated, assuming each scenario's ROI. It cannot be disregarded that this investment will naturally also indirectly impact the offline channel, as some new customers will come across LM and eventually contact them to further place an offline order. To account for that, 20% of the additional total sales revenues were reflected as offline sales revenue increase, and only 80% were assumed to impact the online sales revenues. Ultimately, it was possible to forecast 2023 total sales revenues as well as the respective portions that correspond to the online and offline channels.

With these values, it was finally possible to analyse whether this higher investment in online marketing would end up being profitable. For that, one needs to reach the average monthly total order costs, which already account for both the products and the order processing costs. The considered product's margin (52%) corresponds to the average profit margins of the products currently available at the online store. To account for the cost of hiring the new employee, it was assumed that his/her salary would be the same as the current Administrative Officer's. Considering all of this, it was possible to have the forecasted 2023 monthly online sales profit for all three scenarios. The monthly online marketing investment was subtracted from the correspondent value. After doing so, 2023 monthly online store profits of 3117.88€, 1718.13€ and -41.95€ were reached for the optimistic, average, and pessimistic scenarios, respectively.

7. Limitations

When constructing and analysing the proposed costing model, some limitations emerged. Firstly, it should be noted that little literature on the implementation of ABC systems can be found. This constitutes a limitation as there was no concrete guidance or examples on how to construct a new costing system from scratch.

Moving to the model itself, and starting with DM, it should be mentioned that detailed quantities and prices of the liquids and soaps' components were not disclosed to us. According to the Production Director, the liquid soaps, shampoos, and shower gels had different components in different amounts but ended up yielding the same cost per litre. For the soaps and outsourced liquids, he also considered it not worth specifying each component's cost. As such, in the proposed model, these costs were preserved. Furthermore, machine maintenance was already included in the raw material costs. Even though a split of these values was asked, the production director considered it difficult to do and asked to maintain it together. Naturally, one should be aware that these might jeopardize the validity of the DM costs. Still in the DM calculation, as stated before, some values were arbitrarily added to some products. Some had a reliable justification and thus were considered in the correct place. To reduce complexity, those that were line/product-specific were maintained as DM. Others had no proper justification and, as such, were disregarded.

It should also be noted that the daily (and consequently, monthly) firms' production is extremely variable, as it depends both on the products that need to be re-stocked and on the orders received. As such, the followed strategy for allocating the fixed OH costs, which considers the average monthly production over the last ten months as the firm's monthly product mix, might reduce the model's accuracy. Nonetheless, by regularly updating the units produced, the firm will be able to reduce this model's flaw. Moreover, for some costs, only the 2021 annual values were available, and consequently, those were the ones considered.

Specifically for the fuel cost, the 2019 yearly value was used, as the CEO recognizes this as the best estimate for the 2022 cost. As such, the firm was advised to update these to the most recent values at the beginning of the next financial year. Regarding the basic equipment depreciation, the accountant could not deliver the detailed depreciation per machine, only the total value. Therefore, the model assumes that all machines depreciate at the same rate, even though we are aware that this is not the reality. Moreover, building insurance and depreciation were allocated based on square meters. As LM did not have a proper building plant with the detailed equipment's location, its positioning was drawn in the firm's regular building plant, and the respective scale was used to get the area occupied by each machine (Appendix 11.11.).

Regarding the products in the "others" category, it was considered that the necessary effort to deepen our analysis of these products' category and the value they would add to the model would end up not being worth it (Cokins and Lawson 2006).

As explained before, the order processing cost part of the model relied on data retrieved from staff interviews. As such, one should be aware that despite conducting interviews with the working staff (namely, the Production Director, the CEO, the Administrative Officer, and the Transportation Agent) is one of the most accurate ways of retrieving data, there is always the risk of having biased answers that might compromise some data's reliability. Also, on the order processing costing part, the average number of monthly orders had to be used to compute the monthly effort units for each order behaviour. As can happen with the fixed OH allocation, the per-order cost assumes a fixed number of orders, which might lead to either doubling or miscounting OH.

Regarding the subsequent model analysis, some limitations can also be recognised. Starting with the profitability per customer type, the developed personas and their correspondent order mixes are only the best estimates one can have. Naturally, LM has a highly variable portfolio of clients that consume different volumes and mixes of products. Moreover, for comparison

purposes, specific product lines had to be chosen, which might not reflect each client's choice. Furthermore, the online store profitability analysis was based on the research paper's results on the usual amount of revenues invested by B2B firms in marketing and the commonly expected online marketing campaigns' ROI. Even though different scenarios were created to reduce possible inaccuracies, one should still consider that each company and industry behaves differently. As such, the driven results might not totally represent LM's reality.

8. Recommendations

After developing the proposed costing model and conducting the previous analyses, some recommendations were collected to give to the firm.

First and most important, our team is highly confident that the firm should indeed shift its costing model to the proposed one. Even though the adaptation might initially be time-consuming, we truly believe this Work Project is an opportunity for LM to simultaneously increase its costing accuracy and have a faster bidding process. It is also important to emphasize that this tool will reduce the considerable amount of time spent adapting the model to the constant price changes. Nevertheless, we would like to highlight the importance of the model's regular updates. LM should ensure a frequent update of the model's variable inputs. Moreover, as mentioned in section 7, the current incorporation of the machine maintenance expenses in the raw materials' cost compromises this data reliability. As such, we would like to recommend the segregation of these costs and the accurate allocation of machine maintenance. It should be noted that the team has shown its willingness to help the firm in such a task.

The proposed order processing costing has enabled a clearer view of the impact of each client's buying behaviour. Notably, it was understood that orders made through the telephone are too time-consuming, which is significantly reflected in its correspondent order processing cost. As such, the firm should invest in shifting its clients' ordering method to e-mail. Moreover, the correspondent order-type cost cannot be ignored when deciding which clients to offer the

internal delivery to. The firm should attempt to group these deliveries based on the client's location to maximize cost-effectiveness. Strategically, it could also limit the delivery offer exclusively to contractual clients in an attempt to increase customer retention.

From the profitability analysis, some key pricing recommendations can also be retrieved. First, the firm should ensure that the product's price per litre/kg decreases as its dosage increases. As seen before, this is not a reality in some lines, such as Line A which has dispensers being costlier than 30ml miniatures, per litter speaking. Besides, some action is required to deal with the model's impact on all product's profit margins, apart from the "Others'' category. Naturally, there is an urgent need to increase the prices of the 31 products that currently show negative profit margins (Appendix 11.17.). Moreover, if LM wants to maintain its usual product margins in the]20%-30%] range, the price increase should be applied to more products. Since it was not possible to identify a specific margin strategy (neither per product type nor format), we would like to suggest that the firm chooses a consistent approach and applies it. A range of margins should be chosen for each product line, depending on its financial purpose. A smaller margin interval should be used if the firm wants a specific line to be its cash cow, meaning it wants to sell higher quantities by setting lower prices. Contrarily, if the company wants to strategically position a line in a more premium standard, higher prices should be settled, even if that implies lower quantities sold. In that case, the margin range should be higher. Following the same reasoning, higher margin ranges could also be applied to unique lines and products.

The results of the conducted online store profitability study also led to some suggestions. Considering the current financial situation of the firm, with revenues already surpassing the pre-pandemic year (2019), we believe that 2023 would be a good time to invest in the online store. The forecast shows great values for the firm, with the average scenario yielding a monthly profit for the online store of 1718.13€. Even with the pessimistic scenario, which seems unlikely, as it would imply an ROI smaller than what the company currently has, the monthly

loss (41.95€) would not be a big concern as it will expectably be recovered after some months. As such, and even though a more detailed analysis could be performed, we believe that LM should increase its marketing investment and confidently hire the required employee.

9. Conclusion

As previously explained, the scope of this Work Project was the construction of an easily adaptable ABC system that would answer the proposed Research Questions. Wrapping up, the new model allowed us to identify the firm's inaccurate costing that ignored or incorrectly allocated a substantial portion of its costs and, consequently, led products to be over or under-costed. As a result, profitability was being affected, with some products yielding negative margins. During the model's construction, the team was particularly concerned with guaranteeing its easy adaptation to cost changes. As such, with the proposed solution, LM will have a clearer view of its costing structure, and it will be able to easily and correctly cost and, hence, price its products. The further incorporation of the order processing costs also allowed the association of different costs to different ordering behaviours. Adding all of this with the integration of a bidding tool resulted in a complete costing model that will allow LM to have a faster and more reliable pricing and bidding process. Finally, we believe that the firm's next steps should pass through the implementation of the previously given recommendations.

The results of this Work Project also contribute to Academic Literature, as few studies showcasing the results of ABC models' development and implementation in SMEs were found. In fact, this limitation has already been perceived in other dissertations. Gunasekaran, Marri and Yusuf (1999), for instance, have stated that despite the significant research on ABC's theoretical implementations, there are few articles illustrating real case experiences.

10. References

Almeida, A., and J. Cunha. 2017. ‘The Implementation of an Activity-Based Costing (ABC) System in a Manufacturing Company’. In *Manufacturing Engineering Society International Conference 2017*, 13:932–39. Elsevier B.V. https://doi.org/10.1016/j.promfg.2017.09.162.

Al-Omiri, Mohammed, and Colin Drury. 2007. ‘Organizational and Behavioural Factors Influencing the Adoption and Success of ABC in the UK’. https://www.researchgate.net/publication/290846828_Organizational_and_behavioural_factors_influencing_the_adoption_and_success_of_ABC_in_the_UK/citations.

Askanary, Davood. 2007. ‘Why ABC Is Not Widely Implemented?’ *International Journal of Business Research* VII: 93–98.

Cokins, Gary. 2001. ‘Measuring Costs across the Supply Chain’. https://www.researchgate.net/publication/292658233_Measuring_costs_across_the_supply_chain.

Cokins, Gary, and Raef Lawson. 2006. ‘Implementing Activity-Based Costing’. www.imanet.org.

Cooper, Robin ;, and Robert S Kaplan. 1987. ‘How Cost Accounting Distorts Product Costs’. In . Harvard Business School Press.

Cooper, Robin, and Robert S. Kaplan. 1988. ‘Measure Costs Right: Make the Right Decisions’. *Harvard Business Review*, 1988.

Cooper, Robin, and Robert S Kaplan. 1992. ‘Activity-Based Systems: Measuring the Costs of Resource Usage’. *Accounting Horizons* 6 (3).

Daru, Mahesh U. 2016a. ‘Upgrading of Traditional Costing through Activity Based Costing’. *International Journal of Research in Management*. Vol. 06. www.indusedu.org.

———. 2016b. ‘Upgrading of Traditional Costing through Activity Based Costing’.

International Journal of Research in Management 06 (June): 23–26. www.indusedu.org.

Drury, Colin. 2018. 'Cost Assignment'. In *Management and Cost Accounting*, 10th ed., 44–81. United Kingdom: Cengage.

Glover, Jordan. 2022. 'Digital Marketing ROI Statistics and Guide | 2022'. 2022. https://www.websitebuilderexpert.com/grow-online/digital-marketing-roi-statistics/.

Gunasekaran, A, H B Marri, and R J Grieve. 1999. 'Activity Based Costing in Small and Medium Enterprises'. In *Computers & Industrial Engineering*, 37:407–11.

Gunasekaran, A, H B Marri, and Y Y Yusuf. 1999. 'Application of Activity-Based Costing: Some Case Experiences'. *Managerial Auditing Journal* 16 (6): 286–93. http://www.emerald-library.com.

Horvath, Jessica. 2022. 'What Is an Average Marketing Budget for a Small Business? | BDC'. 2022. https://www.bdc.ca/en/articles-tools/marketing-sales-export/marketing/what-average-marketing-budget-for-small-business.

Hughes, S B, and Kathy A Paulson Gjerde. 2003. 'Do Different Cost Systems Make a Difference?' *Management Accounting Quarterly* 5: 22–30. https://digitalcommons.butler.edu/cob_papers.

Humphrey, Albert. 1960. 'SWOT Framework'.

Indeed Editorial Team. 2020. 'How to Write a Bid Proposal | Indeed.Com'. 2020. https://www.indeed.com/career-advice/career-development/how-to-write-a-bid-proposal.

Instituto Nacional de Estatística. 2022a. 'Harmonised Index of Consumer Prices (Portugal and the Euro Area) Difference Estimated Difference Euro Area (Annual Rate of Change) Portugal (Annual Rate of Change)'. https://doi.org/10.0.

———. 2022b. 'Industrial Production Prices Index October 2022'.

Kumar, Nitin, and Dalgobind Mahto. 2013a. 'A Comparative Analysis and Implementation of Activity Based Costing (ABC) and Traditional Cost Accounting (TCA) Methods in an

Automobile Parts Manufacturing Company: A Case Study'. *Global Journal of Management and Business Research Accounting and Auditing* 13 (4): 28–38.

———. 2013b. 'Current Trends of Application of Activity Based Costing (ABC): A Review'. *Type: Double Blind Peer Reviewed International Research Journal Publisher: Global Journals Inc* 13 (3). http://ssrn.com/abstract=2764035Electroniccopyavailableat:https://ssrn.com/abstract=2764035Electroniccopyavailableat:http://ssrn.com/abstract=2764035.

———. 2013c. 'Current Trends of Application of Activity Based Costing (ABC): A Review'. *Type: Double Blind Peer Reviewed International Research Journal Publisher: Global Journals Inc* 13. http://ssrn.com/abstract=2764035Electroniccopyavailableat:https://ssrn.com/abstract=2764035Electroniccopyavailableat:http://ssrn.com/abstract=2764035.

Lockamy, Archie, and Wilbur Smith. 2000. 'Target Costing for Supply Chain Management: Criteria and Selection'. *Industrial Management & Data Systems* 100 (5): 210–18. http://www.emerald-library.com.

Mahal, Ishter, and Md Akram Hossain. 2015. 'Activity-Based Costing (ABC)-An Effective Tool for Better Management'. *Research Journal of Finance and Accounting* 6 (4). www.iiste.org.

Pierce, Bernard, and Richard Brown. 2006. 'Perceived Success of Costing Systems: Activity-Based and Traditional Systems Compared'. *The Journal of Applied Accounting Research* 8 (March): 108–61.

Porter, Michael. 1979. 'Porter's Five Forces of Competitive Position Analysis'.

Reyhanoğlu, Metin. n.d. 'Activity - Based Costing System "Advantages and Disadvantages"'. Ankara: Ankara University.

———. n.d. 'Activity - Based Costing System "Advantages and Disadvantages"'. Ankara:

Ankara University.

Rohani, Jafri Mohd, Alifah Azman, and Mohammad Hazim Zakaria. 2015. 'Development of Activity Based Costing in Fabrication Company: A Case Study'. *Jurnal Mekanikal Dis* 38: 44–52.

Themido, I., A. Arantes, C. Fernandes, and A. P. Guedes. 2000. 'Logistic Costs Case Study - an ABC Approach'. *Journal of the Operational Research Society* 51 (10): 1148–57. https://doi.org/10.1057/palgrave.jors.2601031.

Thomas, Michael, and James Mackey. 2006. 'Supply Chain: Monitoring Strategic Contracts with Activity-Based'. *Management Account Quarterly* 8: 1–10.

Trigg, Rodger R., Rodger G. Holland, and Gary E. Kundey. 1997. 'Activity Based Costing or Traditional Costing: Are They Really Different?' *Proceedings of the Academy of Accounting and Financial Studies* 2: 86–89.

Turney, Peter B B. 2010. 'Activity-Based Costing An Emerging Foundation for Performance Management'. *Cost Management* 24 (4): 33–43. www.costechnology.com.

11. Appendix

11.1. Abbreviations' List

Abbreviation	Meaning
ABC	Activity-Based Costing
APM	Average Profit Margin
B2B	Business-to-business
B2C	Business-to-consumer
CEO	Chief Executive Officer
CFO	Chief Financial Offer

CPI	Consumer Price Index
CTT	Correios, Telégrafos e Telefones
DL	Direct Labour
DLH	Direct Labour Hours
DM	Direct Material
EBITDA	Earnings before Interest, Taxes, Depreciation and Amortization
FP	Flow Pack
IMF	International Monetary Fund
KW	Kilowatt
M O59	Miniature Format Type O59
M 205	Miniature Format Type 205
M 188	Miniature Format Type 188
M 270	Miniature Format Type 270
M 155	Miniature Format Type 155
M 30AMB	Miniature Format Type 30AMB
M O82	Miniature Format Type O82
MH	Machine Hours
OH	Overheads
OM	Old Model
P	Paper
PM	Proposed Model
PW	Pleat Wrapper
RD	Rounded
ROI	Return On Investment

RT	Rectangular
SME	Small and Medium-sized Enterprises
SOR	Single Overhead Rate
SQ	Squared
SWOT	Strengths, weaknesses, opportunities, and threats
TC	Traditional Costing
u/h	Units per Hour
UC	Under-costing
VAT	Value-added Tax

11.2. LM's financial information

11.2.1. LM's Income Statement

	2021	2020	2019
Sales	€ 1,704,303.00	€ 2,055,986.73	€ 2,842,304.74
Subsidies	€ 4,655.00	€ 13,850.01	€ -
As a % of Sales	0.27%	0.67%	0.00%
Change on inventory production	€ (66,005.55)	€ 142,981.56	€ (76,261.39)
As a % of Sales	4%	7%	3%
COGS	€ 808,098.64	€ 1,003,419.23	€ 1,418,995.51
As a % of Sales	47.4%	48.8%	49.9%
Change in COGS	-24.2%	-41.4%	-6.7%
Supplies and External Services	€ 331,047.95	€ 312,634.88	€ 469,895.41
As a % of Sales	19.4%	15.2%	16.5%
Labour Costs	€ 403,958.79	€ 417,971.62	€ 404,381.93
As a % of Sales	23.7%	20.3%	14.2%
Change in Labour Costs	-3.4%	3.4%	2.7%
Other Income	€ 51,314.22	€ 46,024.31	€ 46,460.55
As a % of Sales	3.0%	2.2%	1.6%
Other Expenses	€ 27,432.32	€ 23,222.31	€ 45,916.88
As a % of Sales	1.6%	1.1%	1.6%
EBITDA	€ 123,728.97	€ 501,594.57	€ 473,314.17

Depreciation and Amortization	€ 112,236.72	€ 140,520.51	€ 142,033.96
Operational Result	€ 11,492.25	€ 361,074.06	€ 331,280.21
Interest Received	€ -	€ -	€ -
Interest Paid	€ -	€ 396.03	€ 3,093.16
EBT	€ 11,492.25	€ 360,678.03	€ 328,187.05
Taxes	€ 1,432.98	€ 75,742.39	€ 66,600.00
Net Income	€ 10,059.27	€ 284,935.64	€ 261,587.05

11.2.2. LM's Balance Sheet

	2021	2020	2019
Total Assets	€ 2,720,818.25	€ 2,613,830.73	€ 2,682,522.86
Current Assets	€ 1,772,637.13	€ 1,573,531.45	€ 1,495,957.00
Non-current Assets	€ 948,181.12	€ 1,040,299.28	€ 1,186,565.86
Total Equity	€ 2,236,210.12	€ 2,337,814.27	€ 2,052,878.63
Total Liabilities	€ 484,608.13	€ 276,016.46	€ 629,644.23
Current Liabilities	€ 474,591.79	€ 276,016.46	€ 554,644.23
Non-current Liabilities	€ 10,016.34	€ 00.00	€ 75,000.00
Equity + Liabilities	€ 2,720,818.25	€ 2,613,830.73	€ 2,682,522.86

11.2.3. LM's financial ratios

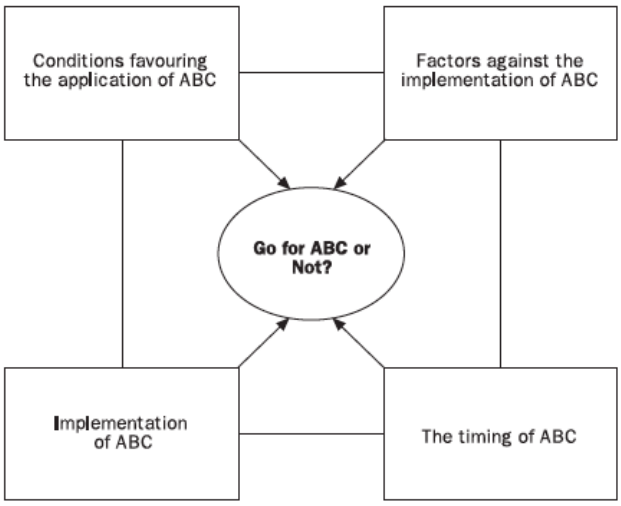
	2021	2020	2019
NWC	€ 1,298,045.34	€ 1,297,514.99	€ 941,312.77
Solvency Ratio	4.61	8.47	3.26
Financial Autonomy Ratio	0.82	0.89	0.77
EBITDA Margin	7.26%	24.40%	16.65%
Net Margin	0.59%	13.86%	9.20%
ROA	0.00	0.14	0.12
Change EBITDA	-75.33%	5.97%	3.93%
Change operational result	-96.82%	8.99%	-14.74%
Change Net Income	-96.47%	8.93%	-13.71%
Change in Sales	-17.11%	-27.66%	3.89%

11.3. Porter's Five Forces framework (Porter 1979)

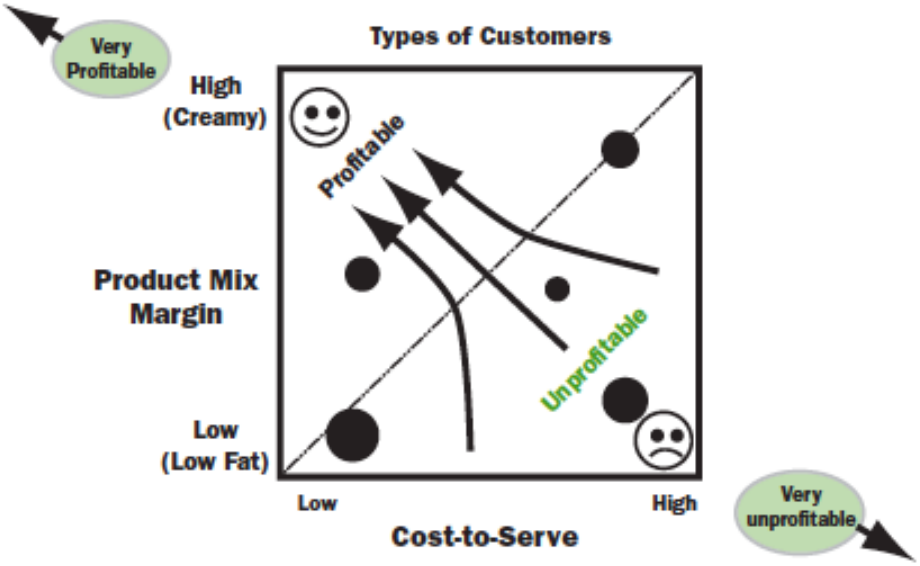
11.4. SWOT framework (Humphrey 1960)

11.5. A conceptual model for the decision to implement ABC (Gunasekaran, Marri, and Yusuf 1999)

Strengths: • Some of their machines have unique, rare, and value-adding technology, such as the tube's machine • Partnership with firm T • Strong brand name and reputation. • Loyal customer base • Diverse portfolio of products. • Only Portuguese factory with the whole needed machinery to fully produce all formats of soaps, shower gels and shampoos • The whole manufacturing staff is taught to operate all the different machines of the different processes	**Weaknesses:** • Still recovering from the huge financial impact of the Covid-19 pandemic • Lack of resources and capital to stop outsourcing and invest in the in-house production of conditioners and body lotions • Their business model implies high safety stocks
Opportunities: • Tourism has been following an increasing trend • Increasing focus on their online business • Growing exportation levels	**Threats:** • High dependence on tourism • High exposure to seasonality • Increasing presence of their most direct competitor in Portugal • Industry regulations are high and constantly changing • Inflation



11.6. Product Mix Margin vs Cost-to-Serve Matrix (Cokins 2001)



11.7. Products available formats and respective production and packaging machines

Product Type:	Available Formats:	Production Machine:	Packaging Machine:
Soap	RT12 Flow Pack	Machine Running Soaps	Packaging Soaps Flow Pack 1
	RT15 Flow Pack		Packaging Soaps Flow Pack 1
	SQ15 Flow Pack		Packaging Soaps Flow Pack 2
	SQ20 Flow Pack		Packaging Soaps Flow Pack 2
	SQ40 Flow Pack		Packaging Soaps Flow Pack 2
	SQ20 Paper		Packaging Soaps Paper
	RD20 Pleat Wrapper		Packaging Soaps Pleat Wrapper
	RD40 Pleat Wrapper		Packaging Soaps Pleat Wrapper

Product Type:	Available Formats:	Production Machine:	Packaging Machine:
Shower Gel	Sachets	Machine Running Liquids	Packaging Liquids Sachets
	Refills		Packaging Liquids Refills (Manual)

	Tubes		Packaging Liquids Tube
	Dispensers		Packaging Liquids Semi-Automatic
	M O82		Packaging Liquids Automatic
	M O59		
	M 205		
	M 188		
	M 270		Packaging Liquids Semi-Automatic
	M 155		
	M 30AMB		

Product Type:	**Available Formats:**	**Production Machine:**	**Packaging Machine:**
Shampoo	Sachets	Machine Running Liquids	Packaging Liquids Sachets
	Refills		Packaging Liquids Refills (Manual)
	Tubes		Packaging Liquids Tube
	Dispensers		Packaging Liquids Semi-Automatic
	M O82		Packaging Liquids Automatic
	M O59		
	M 205		
	M 188		
	M 270		Packaging Liquids Semi-Automatic
	M 155		
	M 30AMB		

Product Type:	**Available Formats:**	**Production Machine:**	**Packaging Machine:**
Shower Gel/Shampoo	Sachets	Machine Running Liquids	Packaging Liquids Sachets
	Refills		Packaging Liquids Refills (Manual)
	Tubes		Packaging Liquids Tube
	Dispensers		Packaging Liquids Semi-Automatic
	M O82		Packaging Liquids Automatic
	M O59		
	M 205		
	M188		
	M 30AMB		Packaging Liquids Semi-Automatic

Product Type:	**Available Formats:**	**Production Machine:**	**Packaging Machine:**
Body Lotion	Sachets	Production Outsourced	Packaging Liquids Sachets
	Refills		Packaging Liquids Refills (Manual)

	Tubes		Packaging Liquids Tube
	Dispensers		Packaging Liquids Semi-Automatic
	M O59		
	M 188		
	M 270		
	M 30AMB		
	M 205		

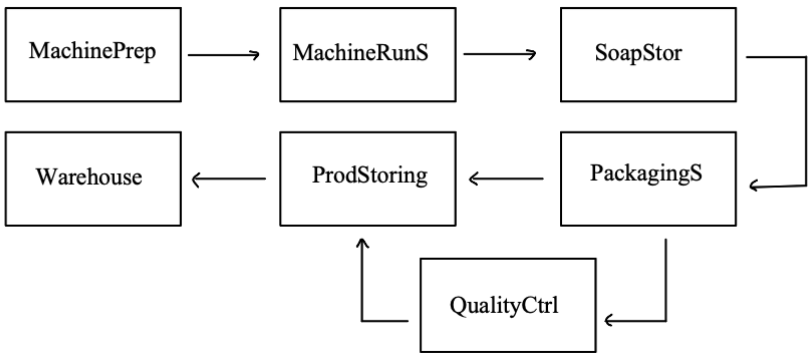
Product Type:	**Available Formats:**	**Production Machine:**	**Packaging Machine:**
Conditioner	Refills	Production Outsourced	Packaging Liquids Refills (Manual)
	Tubes		Packaging Liquids Tube
	Dispensers		Packaging Liquids Semi-Automatic
	M O59		
	M 270		
	M 30AMB		
	M 188		

Product Type:	**Available Formats:**	**Production Machine:**	**Packaging Machine:**
Liquid Soap	Refills	Machine Running Liquids	Packaging Liquids Refills (Manual)
	Dispensers		Packaging Liquids Semi-Automatic

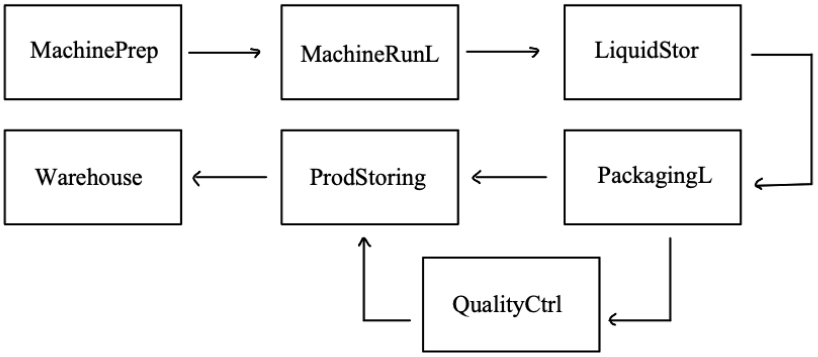
Product Type:	**Available Formats:**	**Production Machine:**	**Packaging Machine:**
Wipes	Small	Machine Running Wipes	Packaging Wipes
	Big		

11.8. Process Flow Charts

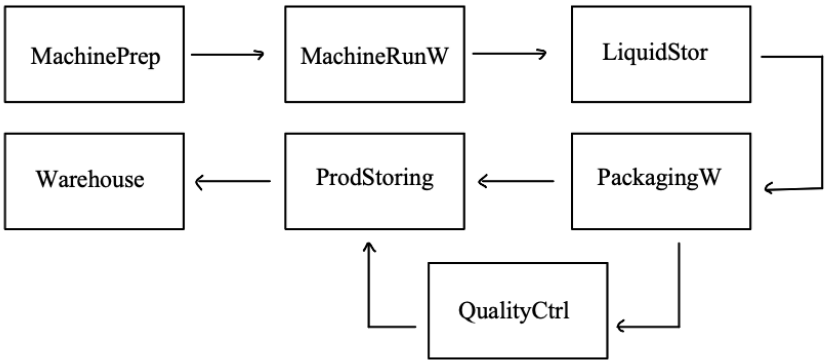
11.8.1. Soaps Production



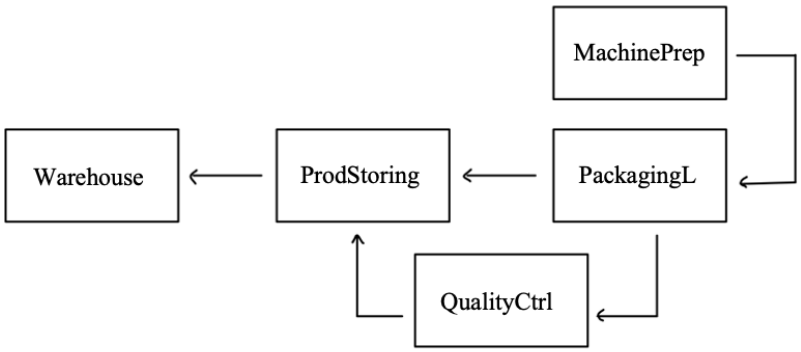
11.8.2. Shower gel, Shampoo, Liquid Soap, Shower gel/Shampoo Production



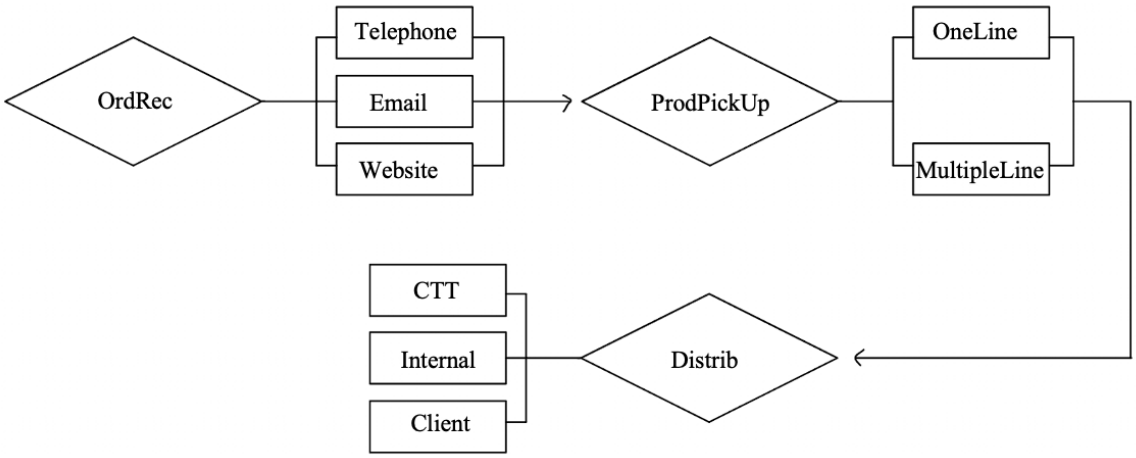
11.8.3. Wipes Production



11.8.4. Body Lotion and Conditioner Production



11.8.5. Order Processing



11.9. Old Costing Model

As previously explained the old costing model was divided into two excel sheets. The first one comprises the intermediate product calculations and the second sums the resulting value with other costs, such as packaging material, cardboard transportation boxes, and other labour and machine costs.

11.9.1. Soaps

Excel sheet 1

		PREÇO MAQ/M.OB/MP						CUSTO POR MIL S/ PF			
MOD.	SB NU = QTD	UN/H	€Mo+Mq/h	€MASSA		€KG_TIT		€MQ.MO/MIL	€MASSA/MIL	TIT (0,4%)/MIL	€ S/ PF MIL
RT	12	6500	20	1.89		10		3.076923077	22.68	0.48	26.23692308
RT	15	6500	20	1.89		10		3.076923077	28.35	0.6	32.02692308
RT	20	6000	20	1.89		10		3.333333333	37.8	0.8	41.93333333
RT	25	5000	20	1.89		10		4	47.25	1	52.25
QD	15	6500	20	1.89		10		3.076923077	28.35	0.6	32.02692308
QD	20	6000	20	1.89		10		3.333333333	37.8	0.8	41.93333333
QD	40	4000	20	1.89		10		5	75.6	1.6	82.2
RD	20	5000	40	1.89		10		8	37.8	0.8	46.6
RD	40	3000	40	1.89		10		13.33333333	75.6	1.6	90.53333333

% PF ->	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	2.5
	PF DV	PF GT	PF MD	PF OQ	PF JM	PF FG	PF BB	PF AL	PF EK	PF OF
RT 12	28.9825	29.482	29.7793	29.002	32.15	29.81	29.88	30.32	30.07	44.5
RT15	35.4589	36.083	36.4549	35.483	39.41	36.49	36.59	37.13	36.81	54.9
RT20	46.5093	47.341	47.8373	46.541	51.78	47.89	48.01	48.73	48.32	72.4
RT25	57.97	59.01	59.63	58.01	64.56	59.69	59.85	60.75	60.23	90.4
QD 15	35.4589	36.083	36.4549	35.483	39.41	36.49	36.59	37.13	36.81	54.9
QD20	46.5093	47.341	47.8373	46.541	51.78	47.89	48.01	48.73	48.32	72.4
QD40	91.352	93.016	94.008	91.416	101.9	94.1	94.36	95.8	94.97	143
RD 20	51.176	52.008	52.504	51.208	56.45	52.55	52.68	53.4	52.98	77.1
RD40	99.6853	101.35	102.341	99.749	110.2	102.4	102.7	104.1	103.3	152
PREÇO PF	14.3	16.9	18.45	14.4	30.78	18.6	19	21.25	19.95	61

Excel Sheet 2

encomendar	€ embalagem		€/CX	UN/CX	€/MIL	SOMA DIREITA	CX CARTÃO	M.OBRA/MAQ	MAT.EMBALAG	PROD.INTERM
50	9.4	Sab.40gr (quad.)flow pack	22.69	cx 200	113.472	113.472	3.1	11.5	7.52	91.35
100	2.72	Sab.20gr (red.)pliss	29.32	cx 400	73.296	73.296	1.5	14.6	6.02	51.18

11.9.2. Liquids

Excel Sheet 1: Shower Gel, Shampoo, Liquid Soap, Shower gel/Shampoo

		PREÇO MAQ/M.OB/MP						CUSTO POR MIL S/ PF			
MOD.	LIQ	UN/H	€Mo+Mq/h	€GC	€FR	€TP		€MQ.MO/MIL	€LIQ/MIL	FR+TP	€ S/ PF MIL
O82	22	3000	90	0.73	29	21.5		30	16.06	58.075	104.135
O59	33	3000	90	0.73	30	21.5		30	24.09	59.225	113.315
188	40	2700	90	0.73	30	14.5		33.33333333	29.2	51.175	113.7083333
205	35	3000	78	0.73	43.8	20		26	25.55	73.37	124.92
30AMB	40	1000	47	0.73	37.6	20		53	29.2	66.24	148.44
155	55	1000	47	0.73	45	72.5		47	40.15	135.125	222.275
270	40	1000	60	0.73	97.7	20		60	29.2	135.355	224.555
BN	33	1000	48	0.73	130			48	24.09	130	202.09
F300	330	100	22	0.73	190.5	263.9		200	240.9	522.56	963.46
5L-UN	5.5	50	22	0.73	0.52			0.44	4.015	0.54	4.995

% PF	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
	PF DV	PF GT	PF MD	PF OQ	PF JM	PF FG	PF BB	PF AL	PF EK	PF OF
F082	106.023	106.37	106.57	106.04	108.2	106.6	106.6	106.9	106.8	112
F059	116.146	116.66	116.968	116.17	119.4	117	117.1	117.5	117.3	125
F188	117.14	117.76	118.136	117.16	121.1	118.2	118.3	118.8	118.5	128
F205	127.923	128.47	128.795	127.94	131.4	124.9	128.9	129.4	129.1	138
30AMB	151.872	152.5	152.868	151.9	155.8	148.4	153	153.5	153.2	163
F155	226.994	227.85	228.364	227.03	232.4	228.4	228.5	229.3	228.9	242
F270	227.987	228.61	228.983	228.01	231.9	229	229.1	229.7	229.3	239
BN	204.921	205.44	205.743	204.94	208.2	205.8	205.9	206.3	206	214
F300	991.774	996.92	999.991	991.97	1024	1000	1001	1006	1003	1084
5L	5.4669	5.5527	5.60385	5.4702	6.011	5.609	5.622	5.696	6.098	9.86
PREÇO PF	14.3	16.9	18.45	14.4	30.78	18.6	19	21.25	19.95	61

Excel Sheet 1: Body Lotion

		PREÇO MAQ/M.OB/MP						CUSTO POR MIL S/ PF			
MOD.	LIQ	UN/H	€Mo+Mq/h	€BL	€FR	€TP		€MQ.MO/MIL	€LIQ/MIL	FR+TP	€ S/ PF MIL
O82	22	1000	47	1.4	29	21.5		47	30.8	58.075	135.875
O59	33	1000	47	1.4	30	21.5		47	46.2	59.225	152.425
188	39	1000	47	1.4	30	14.5		47	54.6	51.175	152.775
205	35	1000	47	1.4	43.8	20		47	49	73.37	169.37
30AMB	39	1000	47	1.4	37.6	20		47	54.6	66.24	167.84
155	55	1000	47	1.4	45	72.5		47	77	135.125	259.125
270	40	1000	60	1.4	97.7	20		60	56	135.355	251.355
BN	33	1000	48	1.4	130			48	46.2	130	224.2
F300	330	100	50	1.4	190.5	263.9		270	462	522.56	1254.56
5L-UN	5.5	25	50	1.4	0.52			2	7.7	0.54	10.24

% PF ->	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
	PF DV	PF GT	PF MD	PF OQ	PF JM	PF FG	PF BB	PF AL	PF EK	PF OF
F082	137.763	138.11	138.31	137.78	139.9	138.3	138.4	138.7	138.5	144
F059	155.256	155.77	156.078	155.28	158.5	156.1	156.2	156.6	156.4	165
F188	156.121	156.73	157.092	156.14	160	157.1	157.2	157.7	157.4	167
F205	172.373	172.92	173.245	172.39	175.8	169.4	173.4	173.8	173.6	182
30AMB	171.186	171.79	172.157	171.21	175	167.8	172.3	172.8	172.5	182
F155	263.844	264.7	265.214	263.88	269.3	265.3	265.4	266.1	265.7	279
F270	254.787	255.41	255.783	254.81	258.7	255.8	255.9	256.5	256.1	266
BN	227.031	227.55	227.853	227.05	230.3	227.9	228	228.4	228.2	236
F300	1282.87	1288	1291.09	1283.1	1316	1291	1292	1297	1259	1375
5L	10.24	10.798	10.8489	10.715	11.26	10.85	10.87	10.94	10.9	12.3
PREÇO PF	14.3	16.9	18.45	14.4	30.78	18.6	19	21.25	19.95	61

Excel Sheet 1: Conditioner

		PREÇO MAQ/M.OB/MP						CUSTO POR MIL S/ PF			
MOD.	LIQ	UN/H	€Mo+Mq/h	€CO	€FR	€TP		€MQ.MO/MIL	€LIQ/MIL	FR+TP	€ S/ PF MIL
O82	22	1000	47	1.74	29	21.5		47	38.28	58.075	143.355
O59	33	1000	47	1.74	30	21.5		47	57.42	59.225	163.645
188	39	1000	47	1.74	30	14.5		47	67.86	51.175	166.035
205	35	1000	47	1.74	43.8	20		47	60.9	73.37	181.27
30AMB	39	1000	47	1.74	37.6	20		47	67.86	66.24	181.1
155	55	1000	47	1.74	45	72.5		47	95.7	135.125	277.825
270	40	1000	60	1.74	97.7	20		60	69.6	135.355	264.955
BN	33	1000	48	1.74	130			48	57.42	130	235.42
F300	330	100	50	1.74	190.5	263		270	574.2	521.525	1365.725
5L-UN	5.5	25	50	1.74	0.52			2	9.57	0.54	12.11

% PF ->	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
	PF DV	PF GT	PF MD	PF OQ	PF JM	PF FG	PF BB	PF AL	PF EK	PF OF
F082	145.243	145.59	145.79	145.26	147.4	145.8	145.9	146.2	146	151
F059	166.476	166.99	167.298	166.5	169.7	167.3	167.4	167.9	167.6	176
F188	169.381	169.99	170.352	169.4	173.2	170.4	170.5	171	170.7	180
F205	184.273	184.82	185.145	184.29	187.7	181.3	185.3	185.7	185.5	194
30AMB	184.446	185.05	185.417	184.47	188.3	181.1	185.5	186.1	185.8	195
F155	282.544	283.4	283.914	282.58	288	284	284.1	284.8	284.4	298
F270	268.387	269.01	269.383	268.41	272.3	269.4	269.5	270.1	269.7	280
BN	238.251	238.77	239.073	238.27	241.5	239.1	239.2	239.6	239.4	247
F300	1394.04	1399.2	1402.26	1394.2	1427	1403	1403	1408	1405	1487
5L	12.5819	12.668	12.7189	12.585	13.13	12.72	12.74	12.81	12.77	14.1
PREÇO PF	14.3	16.9	18.45	14.4	30.78	18.6	19	21.25	19.95	61

Excel Sheet 2: All liquids

encomendar	€ embalagem		€/CX	UN/CX	€/MIL	SOMA DIREITA	CX CARTÃO	M.OBRA/MAQ	MAT.EMBALAG	PROD.INTERM
100.000	8.6	Frasco 30ml Gel de Banho	29.48	cx 230	128.17	128.17	2.6		8.6	116.97
100.000	8.6	Frasco 30ml Champô	29.48	cx 230	128.17	128.17	2.6		8.6	116.97
100.000	8.6	Frasco 30ml Body lotion	38.47	cx 230	167.28	167.28	2.6		8.6	156.08
100.000	8.6	Frasco 30ml Condicionador	41.05	cx 230	178.50	178.4981	2.6		8.6	167.30
5.000	49.95	Garrafão 5L Sabonete Liquido 1UN	5.85	un 1	5.85	5.85	0.2		0.04995	5.60
5.000	52.9	Doseador 300ml Gel/Champô	21.51	cx 20	1,075.72	1,075.72	22.83		52.9	999.99

11.9.3. Wipes

DESINFETANTE com complexo preço normal								
TOALHETE PEQUENO (80X60mm) - TECIDO NORMAL (200 X 110 mm)								
		PREÇO POR			CONSUMO P/ 1000		CUSTO P/ 1000	
CPLX	MENOS 50KG	11,50 €	P/ KG		1,2	KG	13,80 €	
TECIDO		0,10 €	P/ m2		25	m2	2,50 €	
2AL		1,25 €	P/ Litro		2,4	Litro	3,00 €	
CARTÃO		0,37 €	P/ caixa		2	caixa	0,74 €	
MAQUINA		20,00 €	P/ hora		0,2	hora	4,00 €	
					DESINFETANTE		24,04	€ / 1000

refrescante com complexo preço normal								
TOALHETE PEQUENO (80X60mm) - TECIDO NORMAL (200 X 110 mm)								
		PREÇO POR			CONSUMO P/ 1000		CUSTO P/ 1000	
CPLX	MAIS 50KG	11,50 €	P/ KG		1,2	KG	13,80 €	
TECIDO		0,10 €	P/ m2		25	m2	2,50 €	
2REFR		0,62 €	P/ Litro		2,4	Litro	1,49 €	
CARTÃO		0,37 €	P/ caixa		2	caixa	0,74 €	
MAQUINA		20,00 €	P/ hora		0,2	hora	4,00 €	
					REFR. STD LOUSANI		22,53	€ / 1000

refrescante com complexo preço normal								
TOALHETE GRANDE (120X60mm) - TECIDO GROSSO 50GR (150 X 170 mm)								
		PREÇO POR			CONSUMO P/ 1000		CUSTO P/ 1000	
CPLX		11,50 €	P/ KG		1,8	KG	20,70 €	
TECIDO		0,14 €	P/ m2		35	m2	4,90 €	
2REFR		0,62 €	P/ Litro		4	Litro	2,48 €	
CARTÃO		0,37 €	P/ caixa		4	caixa	1,48 €	
MAQUINA		20,00 €	P/ hora		0,7	hora	14,00 €	
					GRANDE		43,56	€ / 1000

11.9.4. Products of the “others” category

encomendar	€ embalagem		€/CX	UN/CX	€/MIL	SOMA DIREITA	CX CARTÃO	M.OBRA/MAQ	MAT.EMBALAG	PROD.INTERM
	4.16	Kit dentes saqueta - cx100	19.00	cx 100	190.03	190.03	6.16	22	6.24	155.63
	4.16	Kit barbear saqueta - cx100	12.14	cx 100	121.40	121.40	6.16	22	6.24	87.00
	4.16	Lenços embalados - cx100	6.96	cx 100	69.57	69.57	6.16	23	5.408	35.00

11.10. Product Costing Activity Centres’ description

Activity Centre Name:	Abbreviation:	Purpose:
Machines' Preparation	MachinePrep	To accumulate the cost of checking DM requirements, transport them to the machines and set the machines up.
Machine Running Soap	MachineRunS	To accumulate the cost of having the soap's assembly machine running.
Machine Running Wipes	MachineRunW	To accumulate the cost of having the wipes' mixer machine running.
Machine Running Liquids	MachineRunL	To accumulate the cost of having the liquids' assembly machine running.
Liquid Storage	LiqStor	To accumulate the cost of having the liquids stored before packaging.
Soap Storage	SoapStor	To accumulate the cost of having the soaps breathing before packaging.
Packaging Soap Flowpack	PackagingSFlow	To accumulate the cost of packaging and labeling soaps in the Flow Pack format.
Packaging Soap Paper	PackagingSPaper	To accumulate the cost of packaging and labeling soaps in the Paper format.
Packaging Soap Pleat Wrapper	PackagingSPleatW	To accumulate the cost of packaging and labeling soaps in the Pleat Wrapper format.
Packaging Wipes	PackagingWipes	To accumulate the cost of packaging wipes.
Packaging Liquids Sachets	PackagingLSachets	To accumulate the cost of packaging liquids in the Sachets format.
Packaging Liquids Refills	PackagingLRefills	To accumulate the cost of packaging and labeling liquids in the Refills format.
Packaging Liquids Tube	PackagingLTube	To accumulate the cost of packaging and labeling liquids in the Tubes format.
Packaging Liquids Semi-Automatic	PackagingLSemiAut	To accumulate the cost of packaging and labeling liquids using the semi-automatic packaging machines (can be used for dispensers and/or specific miniatures).
Packaging Liquids Automatic	PackagingLAut	To accumulate the cost of packaging and labeling liquids using the automatic packaging machines (can be used for miniatures).
Product Storing	ProdStoring	To accumulate the cost of

		transporting the products from production to packaging machines, and from packaging machines to the warehouse.
Quality Control	QualityCtrl	To accumulate the cost of having an external certified lab checking and controlling the quality of the in-house produced goods
Warehouse	Warehouse	To accumulate the cost of having an area dedicated to warehouse.

11.11. LM's factory plant

11.11.1. Activity Centre's positioning in the factory

11.11.2. Resulting area occupied in the factory, in m^2, per Activity Centre

Activity Centre:	Area occupied (in m^2):	As a % of Total Area:
Machine Running Soaps	40.45	6.22%
Machine Running Wipes	4.21	0.65%
Machine Running Liquids	37.92	5.83%
Soap Storage	32.02	4.93%
Liquid Storage (both machines considered)	42.14	6.48%
Packaging Soaps Flow Pack 1	12.36	1.9%
Packaging Soaps Flow Pack 2	12.36	1.9%
Packaging Soaps Paper	7.58	1.17%
Packaging Soaps Pleat Wrapper	5.90	0.91%
Packaging Wipes	4.49	0.69%
Packaging Liquids Sachets	4.49	0.69%
Packaging Liquids Refills	9.83	1.51%
Packaging Liquids Tubes	15.45	2.38%
Packaging Liquids Semi-Automatic	15.45	2.38%
Packaging Liquids Automatic	28.65	4.41%
Warehouse	376.69	57.95%
Total Area occupied (in m^2)	649.99	

11.12. Data collected to construct the model

11.12.1. Machines hourly consumption (KW/h)

Machine Considered:	Machines' Power per Hour :
Machine Running Liquids	8.2 KWh
Machine Running Soaps	12.5 KWh
Machine Running Wipes	3 KWh
Packaging Soap Flow Pack	4 KWh
Packaging Soap Paper	6.5 KWh
Packaging Soap Pleat Wrapper	2.5 KWh
Packaging Liquids Automatic	7.5 KWh
Packaging Liquids Semi-Automatic	6 KWh
Packaging Liquids Tubes	13.5 KWh
Packaging Liquids Sachets	4.7 KWh
Packaging Wipes	4.7 KWh

11.12.2. Machines considered per Activity Centre

Activity Centers:	Machines considered per Activity Center:
Machine Running Liquids	1
Machine Running Soaps	1
Machine Running Wipes	1
Packaging Soap Flow Pack	2
Packaging Soap Paper	1
Packaging Soap Pleat Wrapper	1
Packaging Liquids Automatic	1
Packaging Liquids Semi-Automatic	2
Packaging Liquids Tubes	1
Packaging Liquids Sachets	1

Packaging Wipes	1
Liquid Storage	2

11.12.3. Soaps manufactured and packed per hour

Soap Format:	Units manufactured per hour:
RT12	6500
RT15	6500
SQ15	6500
SQ20	6000
SQ40	4000
RD20	5000
RD40	3000

Soap Type:	Units packed per hour:
FP RT12	5000
FP RT15	5000
FP SQ15	4000
FP SQ20	4000
FP SQ40	3000
PW RD20	1500
PW RD40	1300
P SQ20	1000

11.12.4. Liquids manufactured and packed per hour

Liquid Category:	Liquid dosage and type:	Litres manufactured per hour:
Shower Gel/Shampoo/Liquid Soap	All formats	150
Body Lotion/Conditioner	All formats	There is no manufacturing of these, they are outsourced

Liquid Category:	Liquid dosage and type:	Units packed per hour:
Shower Gel & Shampoo	20 ml – MO82	3000
	30 ml – MO59	3000

	30 ml – M188	2700
	30 ml – M205	3000
	30 ml – M30AMB	250
	50 ml – M155	250
	35 ml – M270	250
	30 ml – Tube	1000
	300 ml – Dispenser	100
	5000 ml – Refill	50
	10 ml - Sachet	2500
Body Lotion	10 ml – Sachet	2500
	5000 ml – Refill	25
	30 ml – Tube	250
	300 ml – Dispenser	100
	30 ml – MO59	250
	30 ml – M188	250
	35 ml – M270	250
	30 ml – M30AMB	250
	30 ml – M205	250
Conditioner	5000 ml – Refill	25
	30 ml – Tube	250
	300 ml – Dispensers	100
	30 ml – MO59	250
	35 ml – M270	250
	30 ml – M30AMB	250
	30 ml – M188	250
Liquid Soap	5000 ml – Refill	50
	300 ml - Dispenser	100
Shower Gel/Shampoo	10 ml – Sachet	2500
	5000 ml – Refill	50
	30 ml – Tube	1000
	300 ml – Dispenser	100
	20 ml – MO82	3000
	30 ml – MO59	3000
	30 ml – M205	3000
	30 ml – M188	2700
	30 ml – M30AMB	250

11.12.5. Wipes manufactured and packed per hour

Wipes' Format:	**Wipes mixed per hour:**
Small	5000
Big	1428

Wipes' Format:	**Wipes packed per hour:**
Small	5000
Big	2500

11.12.6. Number of employees required in each product's manufacturing, per product type and format

Manufactured product:	Number of employees required:
Soaps: RD20 & RD40	2
Soaps: RT12, RT15, SQ15, SQ20 & SQ40	1
Liquids (all formats produced in-house)	1
Wipes (all formats)	1

11.12.7. Number of employees required in each product's packaging, per product type and format

Packed product (format):	Number of employees required:
Soaps: Pleat Wrapper	1
Soaps: Paper	3
Soaps: Flow Pack	2
Sachets	1
Miniatures (with packaging rate > 1000 units/hour)	4
Miniatures (with packaging rate ≤ 1000 units/hour)	1
Tubes	2
Dispensers	1
Refills	1
Wipes (all formats)	1

11.12.8. The time needed to set up machines and store products, in minutes per hour, per Activity Centre

Activity Centre:	Time needed to Set-up Machine (minutes/hour):	Time needed to store products (minutes/hour):
Machine Running Soaps	10	5
Machine Running Liquids	10	10
Machine Running Wipes	5	5
Packaging Soaps Flow Pack	10	5
Packaging Soaps Pleat Wrapper	10	5
Packaging Soap Paper	10	5
Packaging Liquids Automatic	5	5
Packaging Liquids Semi-Automatic	20	10
Packaging Liquids Tubes	10	5
Packaging Liquids Sachets	10	5
Packaging Liquids Refills	10	5
Packaging Wipes	7	5

11.12.9. Plastic/Paper consumption for products' packaging, in grams, per product type and format

Product's Type and Format:	Plastic/Paper consumption per unit produced (g):
Soap Flow Pack RT12	0.5
Soap Flow Pack RT15	0.5
Soap Flow Pack SQ15	0.5
Soap Flow Pack SQ20	0.5
Soap Flow Pack SQ40	0.5
Soap Pleat Wrapper RD20	0.5
Soap Pleat Wrapper RD40	0.5
Soap Paper SQ20	1.3
Liquids Miniature O82	5.5
Liquids Miniature O59	5.5
Liquids Miniature 188	6
Liquids Miniature 205	5.5
Liquids Miniature 30AMB	5.5
Liquids Miniature 155	8
Liquids Miniature 270	6
Liquids Tube	7
Liquids Dispenser	30
Liquids Refill	160
Liquids Sachet	1
Wipe Small	1.2
Wipe Big	1.8

11.12.10. Paper consumption for products' cardboard boxes, in grams, per product formats

Products' Format:	Paper consumed per cardboard box used (g):
All soaps and liquids (except sachets' format)	300
Sachets, wipes and "others" category	250

11.12.11. Price list example

Price lists similar to the one below were disclosed for all the existing lines. The online store

prices were taken off the website.

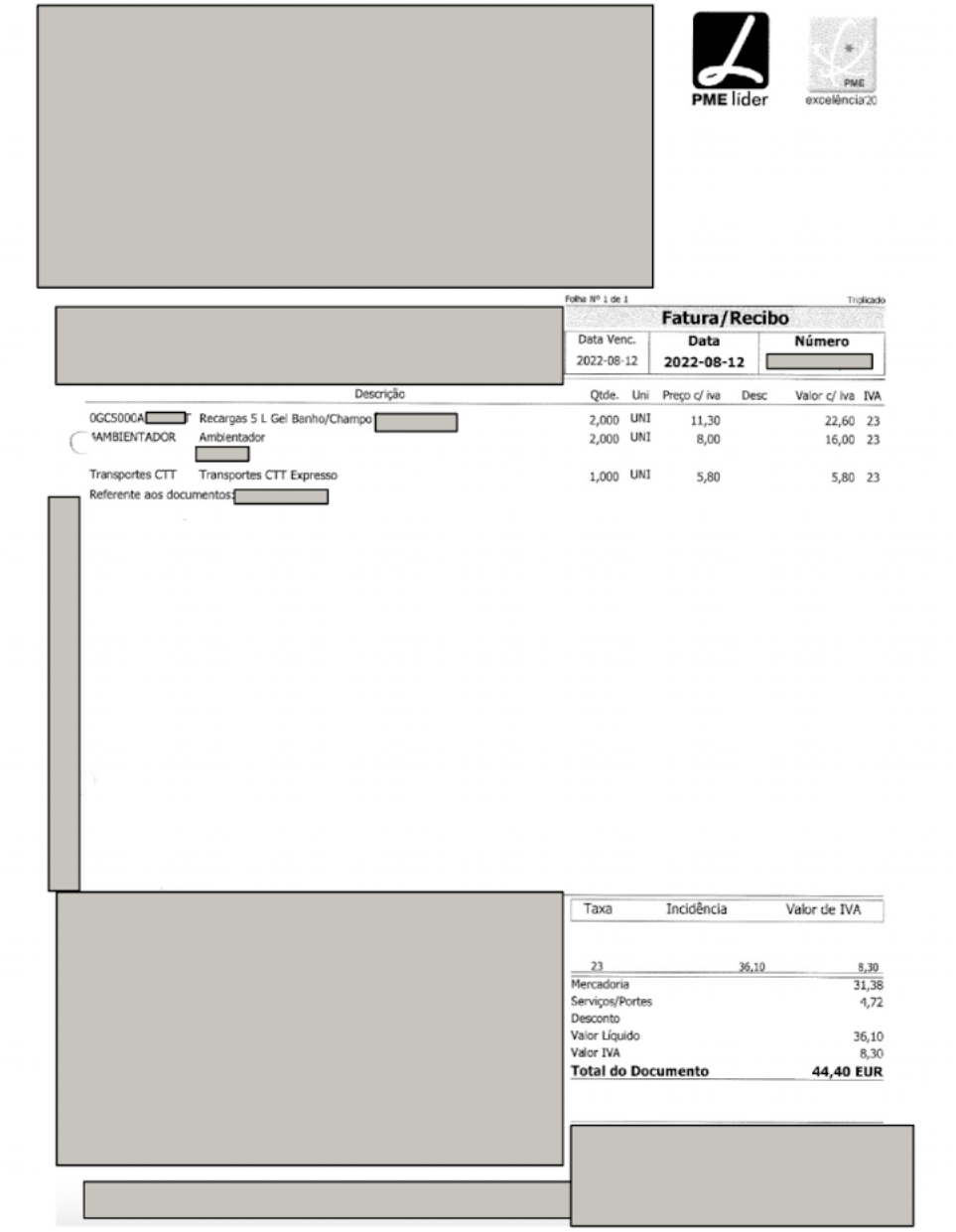
REFª	PRDUTOS / GRAMAGENS / EMBALAGENS	QUANTIDADE CAIXA	PREÇO CAIXA	PREÇO UNITÁRIO
0S20PLLAV	SABONETE 20 GRS (REDONDO) EMBALAGEM PLISSADA BRANCA	400	41,00	0,102 €
0S20PLLAV-FL	SABONETE 20 GRS (REDONDO) EMBALAGEM PLISSADA FLORAL	400	49,00	0,123 €
0S20PAPELLAV	SABONETE 20 GRS (QUADRADO) EMBALADO RÓTULO DE PAPEL	300	42,50	0,142 €
0S20CARTLAV	SABONETE 20 GRS (QUADRADO) EMBALADO CAIXA DE CARTOLINA	250	56,50	0,226 €
0CH30LAV	CHAMPÔ EM FRASCO 30 ML	220	54,00	0,245 €
0GB30LAV	GEL DE BANHO EM FRASCO 30 ML	220	54,00	0,245 €
0BL30LAV	BODY LOTION EM FRASCO 30 ML	220	66,00	0,300 €
0CO30LAV	CONDICIONADOR EM FRASCO 30 ML	220	71,00	0,322 €
0GC50LAV	GEL DE BANHO / CHAMPÔ EM FRASCO 50 ML	160	48,00	0,300 €
0SL300LAV	DOSEADOR 300 ML DE SABONETE LÍQUIDO	20	42,00	2,100 €
0SL5000LAV	RECARGA 5 LITROS DE SABONETE LÍQUIDO	1	----	8,800 €
0CH300LAV	DOSEADOR 300 ML DE CHAMPÔ	20	42,00	2,100 €
0CH5000LAV	RECARGA 5 LITROS DE CHAMPÔ	1	----	8,800 €
0GB300LAV	DOSEADOR 300 ML DE GEL DE BANHO	20	42,00	2,100 €
0GB5000LAV	RECARGA 5 LITROS DE GEL DE BANHO	1	----	8,800 €
0BL300LAV	DOSEADOR 300 ML DE BODY LOTION	20	53,00	2,650 €
0BL5000LAV	RECARGA 5 LITROS DE BODY LOTION	1	----	16,800 €
4SUPORTEPLAS	SUPORTE EM ABS DE PAREDE - BRANCO OU PRETO	1	----	2,800 €
4SUPORTECROMADO	SUPORTE EM ABS DE PAREDE - CROMADO	1	----	11,900 €
0KHLAV	KIT DE HIGIENE COM 3 COTONETES, 3 DISCOS FACIAIS, 1 LIMA E 1 TOUCA EM CAIXA DE CARTOLINA	420	193,00	0,456 €

11.12.12. Units produced in the first 10 months of 2022, per Product's Format and Type

Products' Format and Type:	Units produced in the first 10 months of 2022:
Soaps	
Soap Flow Pack RT12	1.252.000
Soap Flow Pack RT15	1.052.600
Soap Flow Pack SQ15	1.100.000
Soap Flow Pack SQ20	340.000
Soap Flow Pack SQ40	10.000
Soap Paper SQ20	20.000
Soap Pleat Wrapper RD20	1.080.000
Soap Pleat Wrapper RD40	6.000
Shower Gel	
Sachets	485.000
Refills	2.450
Tubes	39.000
Dispensers	2.700
Miniatures	1.433.000
Shampoo	
Sachets	625.000
Refills	1.650
Tubes	36.000
Dispensers	2.300
Miniatures	1.354.000
Body Lotion	
Sachets	9.800
Refills	315
Tubes	23.000
Dispensers	1.200
Miniatures	329.000
Conditioners	
Refills	411
Tubes	8.000
Dispensers	760
Miniatures	97.000
Liquid Soaps	
Refills	2.440
Dispensers	5.500
Shower Gel/Shampoo	
Sachets	270.000
Refills	4.600
Tubes	13.700
Dispensers	7.200
Miniatures	475.000
Wipes	
Big	28.500
Small	5.020.000

11.12.13. Online Store Revenues

To reach the online store's monthly and yearly revenues, every single invoice (similar to the one below) had to be summed.



PME líder

PME excelência 20

Folha Nº 1 de 1 — Triplicado

Fatura/Recibo

Data Venc.	Data	Número
2022-08-12	**2022-08-12**	

Descrição		Qtde.	Uni	Preço c/ iva	Desc	Valor c/ iva	IVA
0GC5000A	Recargas 5 L Gel Banho/Champo	2,000	UNI	11,30		22,60	23
1AMBIENTADOR	Ambientador	2,000	UNI	8,00		16,00	23
Transportes CTT	Transportes CTT Expresso	1,000	UNI	5,80		5,80	23

Referente aos documentos:

Taxa	Incidência	Valor de IVA
23	36,10	8,30

Mercadoria	31,38
Serviços/Portes	4,72
Desconto	
Valor Líquido	36,10
Valor IVA	8,30
Total do Documento	**44,40 EUR**

11.12.14. Total Monthly and Yearly Sales Revenues

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Janeiro	79.935,94 €	97.324,44 €	70.660,07 €	108.966,17 €	109.334,34 €	115.519,54 €	155.192,21 €	180.591,98 €	150.561,39 €	183.124,36 €	65.354,86 €	92.579,88 €
Fevereiro	89.088,19 €	73.848,98 €	82.005,36 €	76.871,17 €	76.918,44 €	98.634,37 €	124.568,53 €	150.556,67 €	183.652,17 €	160.154,87 €	25.306,02 €	150.235,83 €
Março	125.995,40 €	113.690,33 €	163.742,20 €	133.629,40 €	177.540,83 €	178.296,54 €	231.880,99 €	208.475,83 €	210.825,72 €	192.480,60 €	65.114,12 €	238.582,41 €
Abril	126.834,73 €	103.860,30 €	143.999,30 €	156.497,67 €	144.611,68 €	167.250,94 €	193.566,21 €	209.450,36 €	238.303,43 €	185.361,52 €	67.462,49 €	245.242,42 €
Maio	174.359,31 €	145.904,78 €	150.684,34 €	180.531,06 €	168.753,23 €	232.325,67 €	296.113,74 €	325.220,32 €	328.975,77 €	269.323,57 €	137.585,90 €	329.356,31 €
Junho	185.561,92 €	162.953,49 €	152.943,47 €	178.356,61 €	220.153,47 €	252.299,00 €	261.817,67 €	305.721,59 €	275.769,00 €	238.413,15 €	180.909,02 €	287.483,88 €
Julho	178.254,77 €	175.311,44 €	221.864,49 €	292.599,21 €	282.299,63 €	261.577,29 €	332.874,19 €	350.083,64 €	362.186,89 €	274.417,15 €	256.396,15 €	426.588,82 €
Agosto	128.344,32 €	118.906,05 €	113.854,59 €	131.219,79 €	144.754,50 €	166.443,67 €	169.749,08 €	201.516,73 €	202.034,98 €	120.786,52 €	151.567,40 €	213.463,80 €
Setembro	181.929,97 €	138.132,43 €	172.471,97 €	166.189,43 €	180.010,98 €	242.979,20 €	258.921,19 €	258.309,88 €	286.517,18 €	170.248,87 €	240.030,57 €	392.194,35 €
Outubro	160.235,65 €	159.900,64 €	205.191,12 €	187.293,38 €	223.339,07 €	185.327,97 €	279.063,52 €	237.939,28 €	262.019,80 €	137.957,85 €	190.109,84 €	252.736,90 €
Novembro	104.940,80 €	97.510,80 €	105.990,08 €	139.405,73 €	150.103,71 €	152.902,17 €	177.055,53 €	121.295,54 €	189.847,85 €	73.469,82 €	220.048,32 €	235.761,76 €
Dezembro	123.427,11 €	71.344,34 €	88.264,16 €	86.197,11 €	99.121,75 €	115.775,98 €	161.612,83 €	170.345,03 €	148.718,18 €	50.634,25 €	113.437,40 €	
Total	1.658.908,11 €	1.458.688,02 €	1.671.671,15 €	1.857.756,73 €	1.976.921,63 €	2.169.331,74 €	2.642.415,69 €	2.719.506,85 €	2.839.412,36 €	2.056.372,53 €	1.713.322,09 €	2.864.226,36 €

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Janeiro	21,75%	-27,40%	54,21%	0,34%	5,66%	34,34%	16,37%	-16,63%	21,63%	-64,31%	41,66%
Fevereiro	-17,11%	11,04%	-6,26%	0,06%	28,23%	26,29%	20,86%	21,98%	-12,79%	-84,20%	493,68%
Março	-9,77%	44,02%	-18,39%	32,86%	0,43%	30,05%	-10,09%	1,13%	-8,70%	-66,17%	266,41%
Abril	-18,11%	38,65%	8,68%	-7,59%	15,68%	15,73%	8,21%	13,78%	-22,22%	-63,60%	263,52%
Maio	-16,32%	3,28%	19,81%	-6,52%	37,67%	27,46%	9,83%	1,15%	-18,13%	-48,91%	139,38%
Junho	-12,18%	-6,14%	16,62%	23,43%	14,60%	3,77%	16,77%	-9,80%	-13,55%	-24,12%	58,91%
Julho	-1,65%	26,55%	31,88%	-3,52%	-7,34%	27,28%	5,17%	3,46%	-24,23%	-6,57%	66,38%
Agosto	-7,35%	-4,25%	15,25%	10,30%	15,00%	1,99%	18,71%	0,26%	-40,22%	25,48%	40,84%
Setembro	-12,11%	24,86%	-3,64%	8,32%	34,98%	6,56%	-0,24%	10,92%	-40,58%	40,99%	63,39%
Outubro	-0,21%	28,32%	-8,72%	19,25%	-17,02%	50,58%	-14,74%	10,12%	-47,35%	37,80%	32,94%
Novembro	-7,08%	8,70%	31,53%	7,67%	1,86%	15,80%	-31,49%	56,52%	-61,30%	199,51%	7,14%
Dezembro	-42,20%	23,72%	-2,34%	14,99%	16,80%	39,59%	5,40%	-12,70%	-65,95%	124,03%	-100,00%
Total	-12,07%	14,60%	9,94%	7,57%	9,73%	21,81%	2,92%	4,41%	-27,58%	-16,68%	

<u>Disclaimer: The remaining necessary data for the model's construction was directly incorporated in the proposed model excel file.</u>