

iscte

INSTITUTO
UNIVERSITÁRIO
DE LISBOA

Analyzing the Warehouse Location Decision-Making Process In the Era of E-commerce

Juan Diego Arias Romero

Master in Business Administration

Supervisor:

PhD Sofia Kalakou, Assistant Professor, Department of Marketing, Operations and General Management, ISCTE-IUL

November 2021



**BUSINESS
SCHOOL**

Analyzing the Warehouse Location Decision-Making Process In the Era of E-commerce

Juan Diego Arias Romero

Master in Business Administration

Supervisor:

PhD Sofia Kalakou, Assistant Professor, Department of Marketing, Operations and General Management, ISCTE-IUL

November 2021

ANALYZING THE WAREHOUSE LOCATION DECISION-MAKING PROCESS IN THE ERA OF E-COMMERCE

Juan Diego Arias Romero

Acknowledgements

I want to express my gratitude to my supervisor Sofia Kalakou for all her help and guidance. My sincere appreciation goes to you for all the time and learning opportunities provided during the completion of this dissertation.

To my family and all the friends that reached out to share their words of encouragement, I thank you. This work could not have been completed without your support.

Resumo

A evolução e a adoção do e-commerce mudaram a forma como as empresas tomam decisões sobre a localização de armazéns. Mudanças no comportamento do cliente impactaram a cadeia de suprimentos, resultando em tomadores de decisão reavaliando os melhores critérios para selecionar um local de armazém ideal que atenda à demanda da plataforma de e-commerce. Este estudo pretende compreender o estado atual dos critérios de avaliação das SME portuguesas na era do comércio eletrônico. A literatura deste estudo inclui comércio eletrônico, comportamento do cliente, cadeia de suprimentos de comércio eletrônico, localização de armazéns, SDD e estruturas de tomada de decisão para localização de armazéns (TOPSIS, AHP e ELECTRE). Adicionalmente, após a realização de entrevistas semiestruturadas com cinco SME portuguesas, este estudo utiliza a Análise Temática para examinar e encontrar conceitos com significado frequente que são usados para o desenvolvimento de três temas. Esses temas são: Recurso a fornecedores para armazenamento e entrega de produtos, Priorização de velocidade de entrega e proximidade com os clientes, e Consideração para melhoria na estrutura de tomada de decisão.

Palavras-chave: E-commerce, Estruturas de Tomada de Decisão, Localização de Armazéns
Análise Temática

JEL Classification: L2, M1.

Abstract

The evolution and adoption of e-commerce have changed how businesses make decisions regarding warehouse location. As a consequence, shifts in customer behavior have impacted the supply chain, resulting in decision-makers reassessing the best criteria for selecting an optimal warehouse location that fulfills demand from the e-commerce platform. This research intends to understand the current state of criteria assessment for Portuguese SMEs in the e-commerce era. The literature of this paper includes E-commerce, Customer Behavior, E-commerce Supply Chain, Warehouse Location, Same Day Delivery, and Decision-Making Frameworks for Warehouse Location (TOPSIS, AHP, and ELECTRE). Additionally, after conducting semi-structured interviews with five Portuguese SMEs, this study uses Thematic Analysis to examine and find concepts with frequency in meaning which are used for the development of three themes. These themes are: Resorting to suppliers for storage and delivery of products, Prioritizing speed of delivery and proximity to customers, and Consideration for improvement in decision-making structure.

Keywords: E-commerce, Decision-Making Frameworks, Warehouse Location, Thematic Analysis

JEL Classification: L2, M1.

Index

1. Introduction	1
1.1 General Objectives	1
1.2 Research Problem	2
2. Literature Review	3
2.1 E-commerce	3
2.1.1 Customer Behavior	4
2.1.2 E-commerce Supply Chain	7
2.1.3 Same Day Delivery	9
2.2 Warehousing for E-commerce	10
2.3 Decision Making Frameworks	12
2.3.1 TOPSIS	14
2.3.2 Analytic Hierarchy Process (AHP).....	15
2.3.3 ELECTRE	16
3. Methodology	19
3.1 Research Design & Sample	19
3.2 Data Analysis	20
3.2.1 Thematic Analysis	20
4. Results & Discussion	23
4.1 Theme 1: Resorting to Suppliers for Storage and Delivery of Products	24
4.2 Theme 2: Prioritizing Speed of Delivery and Proximity to Customers	27
4.3 Theme 3: Consideration for Improvement in Decision Making Structure	30
5. Conclusion	33
6. Limitations & Recommendations	35
7. References	36
Annex I	42

List of Tables and Figures

Table 3.1 Sample	20
Figure 3.2.1 Overview of Coding Process	22
Figure 3.2.2 Nonlinear Coding Process.....	22
Table 4.1 Concept frequency	23
Figure 4.1 Theme 1 Coding.....	24
Figure 4.2 Theme 2 Coding.....	27
Figure 4.3 Theme 3 Coding.....	30

1. Introduction

The location choice of a warehouse for inventory storage and distribution of orders is a strategic decision with utmost importance for any business. Warehouses are essential links in a business supply chain that encompass a variety of systems and operations for the efficient fulfillment of orders to the end consumer. The selection of a warehouse location is not an easy job as it requires a thorough knowledge of a business' product and strategy for the future. A bad decision in warehouse location translates into irreversible and large economic losses for businesses (Singh et al., 2018, p.344). Thus, it is essential for the individuals responsible of making these decisions to understand basic criteria assessment, or better yet, to have a profound knowledge of decision-making frameworks best suited for the selection of warehouse location.

Due to the rapid rise and development of the internet and e-commerce, every company has gained a new platform to reach and sell products and services to customers worldwide. Moreover, global crisis such as the Covid-19 pandemic have cemented the use of the internet for a wide range of activities like socializing and purchasing products. As a result, not only has consumer behavior changed in terms of purchasing habits, but the customer's perception of businesses has also shifted accordingly and will continue to change as e-purchasing experience increases (Hernández et al., 2010, p.968-969). This shift has a major impact throughout the whole supply chain, bringing new challenges for decision makers when assessing criteria for warehouse location. Given that the use of e-commerce has increased in Portugal by 24% from 2010 to 2019 (Saraiva, 2020). The rest of this study intends to analyze and learn from how firms and decision makers in Portugal are adapting to technological changes in today's business environment.

1.1 General Objectives

1. Analyze the decision-making process for warehouse location of SME's located in Portugal.
2. Identify the most important criteria currently considered by SMEs for warehouse location selection in Portugal.

This will be achieved through the collection of data from the literature review as well as interviews conducted with business decision-makers about current industry practices related to the selection of warehouse location.

1.2 Research Problem

With the accelerated growth of the internet during the past decades, businesses have found a new platform to establish themselves and their products more effectively in the market. The arrival of e-commerce has opened the possibility for companies to constantly reach out to potential customers. Moreover, the development and integration of e-commerce technology systems have improved the exchange of value, which has allowed businesses to deepen their relationships with upcoming and current customers. Despite these opportunities, the introduction of e-commerce practices has impacted customer behavior, transformed how supply chains work and affected everyday business procedures from procurement to distribution.

In the logistics sector, the selection of inventory storage location has continually been a subject of interest and thorough analysis, due to its importance in meeting customer demand. The critical relevance of product warehouses and the complexity of determining cost effective warehouse locations have only increased in light of the new e-commerce frontier.

This gives origin to the following research questions, which are formulated to understand how decision-makers navigate the selection of warehouse location to meet this modern shift in conducting commerce.

1. How does e-commerce currently influence the decision-making process of businesses choosing a location for storage and distribution?
2. What criteria do business decision-makers consider when choosing a location?
3. How do businesses modify and adapt their decision-making process related to warehouse location choice in today's current climate?

This study is divided into five sections: **Section 1.** Lays out the general objectives and research questions of this study. **Section 2.** Analyzes the fundamental concepts in literature review relating to warehouse location decision making processes in the era of e-commerce. **Section 3.** Explains the methodology, research design, sample and data analysis method used in this research. **Section 4.** Delves into the results and discussion of the analyzed data in section three, and **Section 5.** Will close the study with conclusion and limitations.

2. Literature Review

2.1 E-commerce

Throughout the years, with the continuous development and introduction of technology in our daily lives, the rapid rise and adoption of the internet has made it easier than ever to communicate, exchange and store information, and overall to have a more connected world. Internet access has provided opportunities and benefits to many countries around the globe, especially underdeveloped ones, which continue to overcome infrastructural shortfalls with the help of the Web (Owusu-Agyei et al., 2020, p.2). Over the years, the wide adoption of the internet has remarkably increased its global growth. For instance, before the year 2000, 0.19% of the Sub-Saharan African population had access to the internet. In 2018, that number grew to 26%, representing around 267 million people (WDI, 2019 as cited in Owusu-Agyei et al., 2020, p.2). Moreover, according to (Carvalho & Mamede, 2018, p.576), data released by the European Union Statistics Office on the usage and accessibility of the internet in Europe, shows that “more than 80% of people aged 16 -74 used the internet in 2016” from different types of equipment such as computers and smartphones.

In the corporate sector, through the use of the internet, businesses have gained another platform with a broader reach to connect with customers, ultimately advertising and selling products and services to them faster than ever before. Actions that once used to be considered as time consuming, like shopping, ordering food, booking a flight, renting a car, or calling a taxi, have now been reduced to fewer steps, allowing businesses to satisfy customer’s requests within seconds to minutes. This practice, where the exchange of value for products and/or services is executed and assisted by information and communication technology (ICT) devices and the internet, is called e-commerce (Carvalho & Mamede, 2018, p.572). And even though this new way of conducting commerce has presented convenient solutions for both businesses and customers alike, it has also brought upon new challenges and issues to companies and decision makers due to the constant demand that a platform like the internet has, which unlike physical retail stores, never closes its doors to the public (Dutta et al., 2019). Despite these challenges, e-commerce has grown and evolved alongside the internet, becoming its own global phenomenon. A study that measured e-commerce adoption behavior among gen-Z in Jakarta, Indonesia, which has some of the world’s most active users despite its weak ICT infrastructure and low internet penetration,

referred that “while conventional retailers exhibit a lower growth, e-commerce exhibits a higher growth with a 15% compound annual growth rate” (Lestari, 2019, p.105). Moreover, the number of Indonesia’s internet users is expected to reach 133.39 million by 2021, making Indonesia one of the biggest online markets in the world (Rita et al., 2019, p.1). Additionally, “China is growing quickly and is now the largest e-commerce market, showing 120% of compounded annual growth during 2003-2013 (Kwak et al., 2019, p.116).

Furthermore, extensive research has been conducted in the field of e-commerce. However, over time, the exponential growth of technology and innovation within the realm of online shopping has outpaced the rate at which studies are able to determine the best methods of adopting and implementing e-commerce technologies in businesses, as well as managing the risks involved. (Huang et al., 2020) refers that “Much of research efforts have served the after-the-event purpose of demonstrating the success or failure of some e-commerce explorations made by some pioneers, instead of providing vision and influential insights” (p.1). Such insights are crucial for the e-commerce supply chain decision-making process of any business, especially for those with tighter capital constraints. Companies often rush into implementing new e-commerce technologies into their operations without in-depth research to back up their choices, which does nothing for the dearth of knowledge that keeps them from better understanding the risk-reward relationship of such decisions. This lack of understanding can be linked to the claim that “most of the current literature typically has a broader focus on adopting EC technology in general across all industry sectors, there are therefore few existing studies on the adoption of EC technologies and industry readiness in a specific industrial sector” (Carvalho & Mamede, 2018, p.573).

2.1.1 Customer Behavior

Before analyzing the frameworks that decision-makers follow; it is important to understand the elements that influence the choices that businesses make regarding warehouse location. One of these factors is how customers behave. As seen in the previous section, the growth of the internet has exponentially increased over the years due to its wide adoption. This adoption in turn has elicited extensive changes in customer behavior as people incrementally participate in internet-related activities like electronic commerce. Customer behavior is set to change even more as factors like social distancing, caused by events like the COVID-19 pandemic, have cemented the use of the internet for the purchase of goods and conducting of business’s operations.

According to Schiffman and Kanuk (1997) customer behavior can be defined as “The behavior that consumers display in searching for, purchasing, using, evaluating, and disposing of products, services, and ideas” (Mostert et al., 2002). Which includes the study of why, when, where and how often customers purchase a product (Mostert et al., 2002). It’s safe to say the analysis of customer behavior has become a key aspect for the success of any e-business. As the internet becomes one of the main platforms for businesses to sell their products, customers are progressively shopping online more as brick-and-mortar stores steadily close down. For instance, the number of online shoppers in Indonesia is expected to increase to 65 million by 2022, from 20 million in 2017 (Nurhayati-Wolff, 2020).

From the customers perspective, there is an increased sense of convenience and satisfaction from shopping online. Customers can purchase goods with a low switching cost from one to multiple online shops, and all they must do is wait for these goods to arrive, from the comfort of their own homes (Mutum et al., 2014 as cited in Rita et al., 2019, p.1). However, this does not mean things get any easier for businesses as they must develop a quality system that generates and maintains customer satisfaction, and more importantly, trust. According to Corbitt et al. (2003), “Trust is characterized by uncertainty, vulnerability and dependence. These characteristics are reflected in an online transaction, where customers cannot see the seller face to face, physically see the merchandise, or collect the merchandise upon payment” (p.204). Based on the social exchange theory, exchange relationships, which are built on the basis of trust, are avoided if the perceived risk is higher than the potential reward (Thibaut & Kelly., 1959 as cited in Corbitt et al., 2003, p.204). It is no wonder, then, why trust is suggested to be the third of the top 10 barriers and inhibitors of e-commerce (CommerceNet Report., 1999 as cited in Corbitt et al., 2003, p.204).

Aside from trust, other factors that can influence customer behavior can be classified in two categories, internal and external influences. Internal influences are a range of psychological processes such as learning, perception, attitudes, self-image, semiotics, and motivation. While external influences can be divided into five sectors: Socioeconomics, technology, public policy, and demographics; culture; sub-culture; marketing; and reference groups (Mittal, 2013). As customers adopt and get used to shopping online, this does not mean their behavior remains stable overtime. Customers’ adoption and post-adoption decisions are different because their perceptions constantly change as they acquire more experience (Hernández et al., 2010). According to (Yu et

al., 2005 as cited in Hernández et al., 2010). “Potential users of an IT are different from experienced users, since they show different determinants for acceptance, intentions and usage”.

In terms of customer’s acceptance towards technology, which in the case of e-commerce is important for the foresight of use, intention, and satisfaction; Fred Davis and Richard Bagozzi developed the Technology Acceptance Model (TAM) to analyze user’s behavior under two beliefs that influence the acceptance of IT innovations. These beliefs are perceived use (PU) and perceived ease of use (PEOU) (Dakduk et al., 2017). According to Dakduk (2017), based on a meta-analysis conducted with 88 empirical studies, it was found that PEOU has a positive and significant influence over PU, and that both considerably predict behavioral intention across different contexts of study such as e-commerce, internet, and other technological systems.

The field of customer behavior has gained importance in the context of the global COVID-19 pandemic. As social distancing measures were implemented and physical stores closed all over the world, fear started to set in and soon became a major influence in customers’ decision-making process. According to Bhatti et al. (2020), research shows that 52% of consumers avoid crowded areas and brick and mortar shopping, while 36% avoid engaging in similar activities until they get vaccinated (p.1450). This change in behavior, plus a series of lockdowns led consumers to engage in online shopping with a hedonic motivation, aside from the utilitarian and normative incentives that come from using the internet. As the opportunities for people to engage in recreative activities decreased due to quarantining, the importance of engaging in activities with hedonic motives such as online shopping, increases (Koch et al., 2020). Therefore, COVID-19 has had a significant impact on e-commerce, with online sales projected to reach \$6.5 trillion by 2023 (Jones, 2020 as cited in Bhatti et al., 2020, p.1451).

Whether this change in behavior is permanent or transient, that remains to be seen. Even though it is expected for things to get back to normal, there has been enough time during the COVID-19 pandemic for customers to build new habits and understand the conveniences that internet usage offers at a deeper level. This will only make it easier for consumers to return to old habits in the future if they find themselves in a similar environment. Regardless of what happens, this behavior has already had major managerial implications on businesses. As customers improvised their shopping behavior, businesses and decision makers had to become resilient by learning to integrate the critical functions such as logistics and warehousing with the volatile fluctuations of demand and supply (Sheth, 2020, p.281).

2.1.2 E-commerce supply chain

There is no doubt that the emergence of new technologies has changed the way in which supply chains work. By providing an online forum for the exchange of value, e-commerce has not only supported the synchronization and integration efforts, but it has also ‘fundamentally changed the way supply chains are designed, operated and maintained’ (Siddiqui & Raza, 2015, p.536).

E-commerce operations extend throughout the whole supply chain, affecting almost every business’s aspect from product production, delivery and logistics, supply and inventory management, warehousing, sales and marketing, purchase and payment, and customer service (Huang et al., 2020). Companies like Amazon have set a precedent for their fully internet/e-commerce based supply chain models, while others have developed dual channel models by merging their existing traditional operations with supply/sales channels (Siddiqui & Raza, 2015). By taking a further look into the early effects of e-commerce technologies on the supply chain management (SCM), the research study of Zairi and Al-Mashari (2002) suggests that e-commerce has brought opportunities and benefits for the retail sector. Aside from the evident opportunities such as more people having accessibility to a business’s products and service because of the internet. Supply chains have seen a reduction in transaction costs as well as improved information sharing amongst partners (Siddiqui & Raza, 2015). This access to large computer data and real time information has allowed businesses to develop supply chain models with high level of detail that can be used to make real time decisions. By providing an opportunity to integrate information and real time decision making, the internet has elevated the role of the supply chain model to a driver of corporate strategy (Swaminathan & Tayur, 2003, p.1389). However, businesses must understand the role of e-commerce in order to make the most of these opportunities and ultimately add more value to the services offered to customers. A good starting point to comprehend the state of the supply chain in the e-commerce era, is that (SCM) “is not supply-led but rather demand-led. In fact, in many texts the terminology used is Demand Chain Management rather than (SCM). This is because the whole phenomenon has changed from being focused on purchasing, converting, storing, and distributing to the triggers being pulled by the customer, and the advent of new technology has rendered that possible” (Zairi & Al-Mashari, 2002, p.62).

With this shift in mind, it comes as no surprise that e-Supply Chain Modeling/Design/Implementation is one of the topics that has received significant attention in the past two decades, with 13 studies during 2000-2006 and 29 studies during 2007-2015. This

information was exhibited on ‘Electronic Supply Chains: Status & Perspective’, which analyzed the state of e-supply chain research published during January 2000 – January 2015 AD, covering 165 articles from 47 ISI indexed journals (Siddiqui & Raza, 2015, p.544). As a part of the same study, it was determined that the topic of Performance Measurement, Evaluation and Impact received less attention, with only five studies during 2000-2006 and 14 studies during the period of 2007-2015. With more focus in the area of e-Supply Chain modeling/design than the performance measurement of the same, it is not difficult to recognize there is a shortage of insight that comes from the lack of evaluation of such e-Supply Chain models, which can negatively influence the decision making process of businesses and bring challenges to companies when integrating e-commerce into their operations down the road. Such challenges include, but are not limited to, demand unpredictability and product turbulence (Iyer et al., 2009, p.314); online security and payment gateways (Reddy et al., 2014); complex and ambiguous return processes (Heel et al., 2011, p.2); data collection and processing difficulties (Basorudin et al., 2020); capital constraints (Wang et al., 2019, p.10); high variety and variability of e-commerce orders (Huang et al., 2020, p.3).; speed of business and level of connectivity among supply chain organizations (Golicic et al., 2002, p.852); mass customization and difficulty coordinating internet with traditional distribution channels and product flows (Swaminathan & Tayur, 2003); among others.

Amid the challenges faced by companies, logistics operations “have soon become and still remain the bottleneck in e-commerce” (Huang et al., 2020, p.1). As seen in ‘A B2C e-commerce intelligent system for re-engineering the e-order fulfillment process’ study, the emerging trend of e-shopping is being identified as ‘one of the major bottlenecks’ in order fulfillment along the supply chains, as logistics service providers (LSPs) struggle with order handling inefficiencies in warehouses or distribution centers. According to (Leung et al., 2018, p.386), ‘Orders being purchased via the internet using computers or smartphones, have worsened the logistics industry’s headaches.’ This can be attributed to the fact that unlike traditional logistics orders, which generally involve only few types of stock-keeping units (SKUs), e-commerce orders ‘are significantly more wide-spread in terms of delivery location and involve a large number of SKUs, but with each SKU demanding only a very small quantity.’ Consequently, LSP’s cannot handle e-commerce orders the same way they do with traditional orders, and ‘without the order fulfillment being re-engineered for today’s e-business, there are two significant problems at the operational level, which are a lack of mechanism for data pre-processing of e-commerce orders and the

inefficiency of e-commerce order handling due to frequent and ‘discrete arrival orders’ (Leung et al., 2017, p.387).

2.1.3 Same Day Delivery

As the popularity of e-commerce grows, businesses strive for competitive advantages to differentiate themselves from competitors. By doing so, companies can become more appealing to customers, attracting more business and activity to their operations. With the integration of e-commerce as a business strategy in almost any company, one common option that e-businesses offer to their customers at the moment of purchase, in an attempt to improve their logistics competitiveness, is same-day delivery (SDD). Klapp et al. (2019) defines (SDD) as a “distribution service that prepares, dispatches and delivers orders to the customer’s location on the same day the customer places the order” (p.1). An excellent example of the latter is Amazon, which has been able to reduce delivery times considerably over the years by ‘taking advantage of cross-docking and product consolidation strategies over massive fulfillment centers’ (Ni et al., 2019, p.895). Additionally, to satisfy the demand for instant gratification, Amazon has implemented (SDD) service in more than 25 U.S. metropolitan areas as of October 2016 and has also put into effect a faster one-hour delivery service called “Prime Now” (Klapp et al., 2019). Moreover, as cited in (Xi et al., 2020), China Internet Network Information Center (2018) “reported that the number of SDD online shopping users reached 364 million, accounting for 46% of internet users in China, and that on average, each user made 34 online purchases”.

Traditional retailers have not been left behind, as they have also taken advantage of their physical stores to fulfill (SDD) orders by drawing inventory straight from retail stores due to the benefits this represents in terms of proximity and timing (Ni et al., 2019). By implementing SDD, retailers can reduce transportation and warehouse operational costs, taking advantage not only of the space available in their stores but also from vehicles of private drivers, who pick up products from shops or warehouses and deliver them to customers destinations (Alnaggar et al., 2019, p.2). This practice is called crowd shipping and store fulfillment (CSF) (Ni et al., 2019), also known as “crowdsourced delivery”, which falls under a broader emergent concept called “sharing economy” characterized by businesses relying on individuals sharing their under-utilized property. This system has been growing rapidly after the financial collapse of 2008, which put emphasis on reducing costs for businesses and reached a global revenue of \$15 billion by 2015. A perfect

example of crowdsourcing implementation is Amazon Flex, which was introduced by Amazon as an “on-demand package delivery service that hires independent freelance drivers to transport same-day delivery packages to Amazon customers” (Alnaggar et al., 2019, p.2).

Even though the advent of SDD and CSF has brought benefits to businesses, like cost reduction and timelier deliveries, the further development and adoption of these systems as a byproduct of e-commerce operations has affected the dynamic of traditional shopping and distribution of products. As customers use their computers and smartphones to make online purchases, with the additional option of delivery of their orders on the same day and just in a matter of hours, shopping behavior has been impacted as the need to travel to local stores decreases. According to Xi et al. (2020), who’s study examined the effects of SDD online shopping on local shopping travel on five types of stores (supermarkets, vegetable markets, convenience stores, fruit stores and restaurants) through the collection of survey data in Nanjing in 2018, “After controlling for socio-demographics, shopping responsibility, internet experiences, and shopping attitudes, we further found that the more frequently individuals use SDD online shopping, the stronger the substitution effect is”. The latter research used a quasi-longitudinal design as opposed to a cross sectional one, to avoid reaching a casual inference. A similar study by Suel et al. (2018), analyzed a one year long longitudinal grocery shopping purchase data from London shoppers to investigate the effect that online shopping has on overall shopping activity patterns and personal trips, and as a result found a potential substitution between online shopping and physical trips to the store.

2.2 Warehousing for E-commerce

Even though there are benefits that SDD and CSF can bring to e-businesses, warehouse logistics still is a fundamental part of the overall operations of any company, and one that businesses should not take lightly. As an essential component of the supply chain, warehousing acts as a buffer, moderating the flow of materials by receiving stock keeping units (SKU’s) from suppliers, which are then stored as inventory and prepared for shipment to fulfill upcoming orders from customers (Gu et al., 2007, p.1). As goods arrive to warehouses, it is the design of warehouse systems and operations that determine the efficient fulfillment of basic functions such as reception, storage, and shipment.

For some time, the organization of warehouse operations revolved around the usage of manual labor. In 2007, over 80% of warehouses in Western Europe still followed traditional low

level, picker to parts order-picking systems, which employed humans for multiple picks per route. These systems formed a large majority of picking practices in warehouses worldwide, accounting for as much as 55% of total warehouse operating expenses (Koster et al., 2007, p.1). More than a decade later, the growth in sales volume that has originated from the adoption of e-commerce, and the ever-increasing market competition, has set higher standards in supply chains that outpace the level at which traditional warehouses can perform. Modern challenges of e-commerce logistics such as small orders, large assortments, tight delivery schedules and varying workloads have set the stage for changes in warehousing operations to take place (Boysen et al., 2019, p.1). As a result, a new generation of warehouse is on the rise, capable of meeting the requirements of modern supply chains and ready to answer to customer demand more efficiently.

Besides the importance of internal warehouse operations and the progress made in basic functions with the help of automation, there is an aspect that perhaps carries more weight in relation to the impact it has on internal warehouse systems as well as on the supply chain, and that is location. In today's business environment, supply chains are essentially competing against each other for the best location set up that will reduce a warehouse transportation costs and delivery lead times. According to Singh et al. (2018), the concept of warehouse location was firstly introduced by Webber (1989), as he managed to minimize the total distance travelled between the warehouse and the customer by finding an optimal location (p.345). In Addition, Singh et al. (2018) also noted that "The major criteria taken into consideration in selecting a warehouse are proximity factors, government, labor characteristics, infrastructure and climate" (p.344). Cohesively, a study conducted by the Canadian Urban Institute in 2000 found that the location selection factors of enterprises warehouses include closeness to an airline, proximity to similar businesses, proximity to customers, proximity to suppliers, meeting existing building needs, suitable area for new constructions, competitive rental/costs, among other location requirements (Durak et al., 2017, p.66). Moreover, expanding on the closeness to an airline, Bowen (2008) determined that airports had the most significance on warehouse development followed by highway accessibility (Gingerich & Maoh, 2019, p.98). After all, according to Kalinowski (2016) "Without the means to access third-party logistics providers or highway and airway transportation systems quickly, products will never get to the customer in the required time frame. Traffic patterns also have an impact on warehousing strategies (p.15).

Aside from proximity of location, cost reduction is a frequent determinant that is present in almost any business search for establishing a warehouse. According to Kang (2018), “Weber (1929) proposed that a firm will choose the optimal location where transport costs between resource suppliers and are minimized” (p.2). Even though every organization is looking to reduce costs; operating from a single primary warehouse has its tradeoffs. According to Kalinowski (2016), organizations must consider the tradeoff of operating from one central warehouse to reduce costs instead of functioning from fewer smaller ones. While this might be true, not all businesses have the financial capabilities to expand their workforce, let alone buy or rent new warehouses. With this limitation in mind, order fulfillment methods like dropshipping are being adopted by businesses to reduce costs. (Musa et al., 2016, p.2856) defines dropshipping as “a supply chain management technique where the retailer does not keep any products in their stocks. Instead, they transfer customer orders and shipment details to the manufacturer or wholesaler who then ships the products directly to customers”. It is no wonder why this model attracts merchants as an alternative for buying or renting additional warehouses. By following this system there is little to no capital involved and products still reach a wide range of customers and are efficiently delivered to them (Busari et al., 2021, p.633). In Addition, challenges brought upon by the advancement in information technology can be addressed by adopting dropshipping, which reduces the operational bottlenecks in the transfer of product from the supplier to the user. (Hovelaque et al., 2007 as cited in Busari et al., 2021, p.630).

2.3 Decision Making Frameworks

Considering all the points previously stated, the next topic to keep in mind for the sake of any business is the proper implementation of decision-making frameworks that allow for the solution of problems in any given situation brought upon by external variables, which in this case are influenced by e-commerce.

According to Rapoport (1998) “Decision theory deals with situations in which one or more actors must make choices among given alternatives” (p.3). Rapoport (1998) explains that decision theory is based on the assumption that each choice or decision has a different outcome, and even though each actor might not have full knowledge of the consequences each decision entails, it is the ability to envisage some of these outcomes that allows actors to arrive to a final decision based on their preference of one result over another. Even though this process might sound simple based

on the description above, it is nothing like that, as even various tools such as decision tables, decision trees, influence diagrams, among others, have been developed in order to improve the decision-making process and aid actors through the complexity of different situations (Alexander et al., 2014, p.505).

A decision-making tool that is commonly used is multi-criteria analysis (MCA). According to Özcan et al. (2011) ‘multi-criteria decision making (MCDM) can be defined as the evaluation of the alternatives for the purpose of selection or ranking, using a number of qualitative and/or quantitative criteria that have different measurement units (p.1). In addition to this, MCDM can also be defined as a “sub-discipline and full-grown branch of operations research that is concerned with designing mathematical and computational tools to support the subjective evaluation of a finite number of decision alternatives under a finite number of performance criteria by a single decision maker or by a group” (Lootsma, 1999 as cited in Behzadian et al., 2012, p.1). In the context of decision theory, ELECTRE (Elimination and Choice Expressing Reality), AHP (Analytic Hierarchy Process) and TOPSIS (Technique for Order of Preference by Similarity to Ideal Solution) can be sorted as primary methods (Özcan et al., 2011, p.1).

Each of the primary methods previously stated serves to ‘guide the decision-maker depending on the structure of decision problems’ that are presented, and even though they have similarities, each one has specific qualities that differentiate them from the rest. For example, the TOPSIS method has been applied to ‘areas such as performance evaluation with the use of financial investment decisions and financial ratios problems such as flexible manufacturing systems and selection of production processes within the scope of operation management’. On the other hand, ELECTRE methods have been applied to solve the ‘issue of environmental management, environmental valuation, solid waste management system selection and water resources planning’ (Özcan et al., 2011, p.9773). Furthermore, when it comes to the number of criteria, TOPSIS and ELECTRE are suitable when there are many alternatives, which is opposite to AHP as it is used when the number of criteria is low (Singh et al., 2018, p.345). To better understand how each of the primary methodologies differentiates from one another at the core, and what their applications to warehouse location decision-making are, each methodology must be analyzed individually with more detail.

2.3.1 Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS)

Originally developed by Yoon and Hwang in 1981, TOPSIS is the second most popular method among MCDA techniques (Zyoud & Fuchs-Hanusch, 2017, p.161). This decision-making tool helps select the best alternative with a finite number of criteria (Ozturk & Batuk, 2011). Its basic concept is that the selected alternatives should have the shortest distance to the positive ideal solution i.e., the solution that maximizes the benefit criteria and minimizes the cost criteria, while at the same time having the farthest distance from the negative ideal solution i.e., the solution that maximizes cost criteria and minimizes the benefit criteria (Rafiei *et al.*, 2012, p.659). Since its conception in 1981, TOPSIS scientific research publications grew moderately before skyrocketing to 96% of its research being published after the year 2005, with 71 different countries contributing to this research. (Roghianian, 2010 as cited in Zyoud & Fuchs-Hanusch, 2017). TOPSIS is considered a compensatory method, meaning it allows the compromise between different criteria, where “a bad result in one criterion can be compensated by a good result in another criterion” (Pavić & Novoselac, 2013, p.6). This method assumes that each criterion “tends toward a monotonically decreasing or increasing utility” (Triantaphyllou, 2000; Garvey, 2008 as cited in Ozturk & Batuk., 2011).

According to Hwang and Yoon (1981), the procedure to implement the TOPSIS method starts with forming an initial decision matrix which is normalized in Step 1. In Step 2, a weighted normalized decision matrix is built (Behzadian *et al.*, 2012, p.13052). This is followed by defining positive and negative ideal solutions in Step 3. Finally, in Step 4, the separation measures for each alternative are calculated, with the procedure ending by computing the relative closeness coefficient. The result of this computation can be used to rank a set of candidates/alternatives according to the descending order of the closeness coefficient (Behzadian *et al.*, 2012, p.13052).

There is a wide range of real-world application for the TOPSIS method. These can be categorized in nine main areas, which are: Supply Chain Management and Logistics; Design, Engineering and Management Systems; Business and Marketing Management; Health, Safety and Environment Management; Human Resources Management; Energy Management; Chemical Engineering; Water Resources Management; among others. From these main areas, Supply Chain Management is the most popular topic in TOPSIS applications, which covers sub-areas such as supplier selection, transportation, and location problem. (Behzadian *et al.*, 2012, p.13053).

In the context of warehouse location decision making or any decision problems that involve spatial data, TOPSIS can be paired with other frameworks such as Geographical Information Systems (GIS) to aid in the decision-making process to select the most optimal location. Although GIS on its own can provide extensive analysis and data visualization power, its capacity has proven to be limited and it is only with the help of MCDA tools like TOPSIS that GIS can tackle real-world spatial decision problems with high complexity, where a large number of feasible alternatives must be evaluated (Ozturk & Batuk, 2011).

2.3.2 Analytic Hierarchy Process (AHP)

Developed by Thomas L. Saaty circa 1980, AHP is a decision-making tool and general theory of measurement used to derive ratio scales both from continuous and paired comparisons, which reflect the relative strength of preferences and feelings (Saaty, 1987, p.161). Together, AHP and TOPSIS are fields that have a higher research activity amidst other MCDA methods. They are also a good representation of the various applications that MCDA methods have in connection with other disciplines. AHP is widely used by researchers from the United States, given that it represents the American School in the MCDA field. Its popularity and usage have gradually increased since its introduction due to its ease of application. A bibliometric-based survey on AHP determined there was a steep rise and breakthrough on scientific research productivity related to this method after 2005, with 111 countries accounted for contributions towards research on AHP and more than 83% of research being published on this subject during the extended period of 2006-2015 (Zyoud & Fuchs-Hanusch, 2017, p.160-162).

This method relies on three basic principles that guide the decision maker when problem solving. Those principles are decomposition, comparative judgements, and synthesis of priorities. As its name implies, the decomposition principle is applied by establishing a simple problem and breaking it down into elements and levels that are independent from each other and are organized in a succeeding order. The structure in which these levels are organized works downward from the general and sometimes uncertain to the more particular and concrete, with the focus in the top level, criteria bearing on the focus in the second level, followed by sub criteria in the third level. The comparative judgements principle is applied by constructing pairwise comparisons between relative importance of elements in a given level, to a shared criterion or property in the level above.

Finally, the synthesis of properties principle is applied by multiplying properties from the second level down by the priority of their corresponding criterion in the level above, and “adding for each element in a level according to the criteria it affects” (Saaty, 1987, p.166).

Even though AHP is especially used in military analysis, it is not restricted to military problems. According to Saaty, AHP has a wide range of applications that extend from something as simple as choosing a school for his child, to more complicated problems such as planning of transportation systems for the Sudan (Coyle, 2004, p.1). AHP applications can be found in other disciplines such as but not limited to: Logistics management, Sustainable and renewable energy, water resources management, agriculture, health, nuclear power, climate change, presidential elections, among others. In the case of Logistics Management, one of the best examples of comparative analysis of multi-criteria decision-making methodologies and their implementation to warehouse location is an article by Özcan et al. (2011). In this article, the decision-making problem is defined as a business operating in the retail sector, which has detected that its future warehouse performance will be inadequate in parallel to the growing rates of demand uncertainty and high product variety in the coming five years, starting from the end of 2008. To solve this problem, the company plans to make a decision about the new storage area which will provide the logistics operations completely, as needed. As a result, TOPSIS and ELECTRE were the primary methods used to solve this case study’s problem. However, the way in which the decision hierarchy of the warehouse location selection problem is laid out in this case, suggests that AHP was used to structure this decision problem’s warehouse criteria hierarchically. In the end, we can see that even though TOPSIS and ELECTRE were the primary methods used to solve this problem, AHP was still present in this solution by providing a structure for the evaluation of criteria.

2.3.3 ELECTRE

Originated in Europe in the mid-1960’s, ELECTRE is a family of outranking methods within MCDA. The first class of these methods was devised in 1965 by Bernard Roy after he was consulted by SEMA (Systems Engineering Management & Assessments), a consultancy company, to find a new system that could overcome the limitation of MARSAN (Méthode d’Analyse, de Recherche, et de Sélection d’Activités Nouvelles) (Figueira et al., 2005). During that time, a research team at SEMA intended to use MARSAN to address a real-world problem concerning the decisions dealing with the development of new activities at firms. However, this was not possible

as MARSAN had serious drawbacks. Thus ELECTRE I, the first class of the ELECTRE family, was introduced. (Figueira et al., 2005, p.134).

During the following two decades after the introduction of ELECTRE I, several other ELECTRE methods were developed. These methods can be divided in different operational categories, following a problematic and chronological order, where they are mainly used for choosing the best action among a given set of actions (Gavade, 2014). ELECTRE I, Iv and IS are suitable in relation to what is commonly referred to as Choice Problematic, which aids the decision maker in selecting the smallest set of actions in order that a single action can be easily chosen. ELECTRE II, III and IV are applicable for the Ranking Problematic, which covers the ranking of individual actions from best to worst within a set of actions. Finally, ELECTRE TRI, TRI-C and TRI-nC deal with the Sorting Problematic, with the purpose of sorting actions into predefined categories by means of comparisons, norms, or references. Even though they are different, all ELECTRE methods are comprised of two phases. The first one, called aggregation phase, sets to build one or more outranking relations through pairwise comparisons of alternatives, either between themselves or against other reference alternatives, using the concordance and non-discordance concepts within a Multi-Criteria Aggregation Procedure (MCAP). The second phase, termed exploitation procedure, constructs and presents the results expected for a given problematic by exploiting the outranking relation obtained in the first phase. (Govindan & Jepsen, 2016, p.2-3).

Aside from the variants that belong to the ELECTRE family, this method also has a wide range of applications that can be found in a variety of fields such as: Natural Resources and environmental management, Water Management, Water Resources, Waste Management, Human Resources, Business Management, Investments Decisions, Information Technology, E-commerce and m-commerce, and Logistics and Supply Chain Management among many others. In logistics and supply chain management, ELECTRE can address two of the most traditional problems in this area. These are supplier selection and facility and layout location, which includes warehouse and distribution center location. In the case of E-commerce and m-commerce, ELECTRE I was applied for the assessment of criteria in mobile commerce and near field communication (NFC). (Govindan & Jepsen, 2016, p.10-11).

To conclude, despite the literature being from different periods, there was good continuity and a consensus between them regarding the adoption and evolution of e-commerce, the role of customer behavior, warehouse location criteria and the main decision-making frameworks for warehouse location. For instance, how Durak et al. (2017) and Singh et al. (2018) agree on proximity being one of the major criteria considered by businesses. Or Özcan et al. (2011), and Singh et al. (2018, p.345) agreeing on TOPSIS, ELECTRE and AHP as the main MCDM methods.

However, some areas of the literature review expressed a lack of research in areas that would have been useful to elaborate more on the concepts in this section. This lack of research refers to a focus directed more on the “after-the-event purpose of demonstrating the success or failure of some e-commerce explorations made by some pioneers, instead of providing vision and influential insights.” (Carvalho & Mamede 2018, p.573). Or how Siddiqui & Raza (2015), determined that, on the topic of e-Supply chain, Performance Measurement, Evaluation and Impact received less attention, with only five studies during 2000-2006 and 14 studies during the period of 2007-2015 (p.544).

3. Methodology

3.1 Research Design & Sample

The focus of this research is to analyze the warehouse location decision-making processes in the era of e-commerce through the examination of empirical data. To do so, the present study was conducted by adopting a qualitative approach. Unlike quantitative research, which provides statistical relevance of how often an event occurs and generalizes its findings, qualitative research provides an opportunity to examine the phenomenon and determine its meaning while and after it happens (Williams & Moser, 2019, p.45). During this research, qualitative data was collected by carrying out 30 to 40-minute semi-structured interviews with the use of telecommunication software. The decision to use semi-structured interviews was made based on their conversational nature, which offers participants an opportunity to explore issues they deem important through the use of open responses rather than ‘yes or ‘no’ answers (Clifford et al., 2016, p.143-145). The questions used in each interview, which can be found in **Annex I**, were formulated to comprehend the structure, criteria and warehouse location decision-making processes of SMEs in Portugal and what influence e-commerce has on them.

The sample of this research was settled at five Portuguese SMEs that agreed to confidentially be part of this study, out of 20 businesses that were initially contacted. According to the Commission Recommendation from the Official Journal of the European Union (2003, p.124), “The category of micro, small and medium-sized enterprises (SMEs) is made up of enterprises which employ fewer than 250 persons”. Moreover, the same commission recommendation asserted that the staff headcount is the most important indicator of an SME and should be observed as the main criterion. As shown in **Table 3.1**, all the SMEs that form part of this study meet the staff headcount requirement, with 60% made up of 10 - 49 employees, 20% of 50 - 99 employees, and the remaining 20% composed of less than 10 employees. Additionally, each Portuguese SME also met the requirements specifically established for this study: a) SME currently has one or more warehouses for inventory storage, and b) SME has own e-commerce website, or is present in a third-party e-commerce online platform.

Table 3.1 Sample

Participant	Position	Industry	Warehouse Location	# of Employees
(P1)	Founder / CEO	Supplements	Sintra	10 -- 49
(P2)	General Manager	Home	Lisbon / Porto	50 -- 99
(P3)	Founder / CEO	Cosmetics	Alentejo	10 -- 49
(P4)	Manager	Supplements	Carcavelos	< 10
(P5)	Founder / CEO	Cleaning	Cascais	10 -- 49

3.2 Data Analysis

In order to analyze the qualitative data collected from each interview, this study adopted a manual Thematic Analysis approach. In addition, text analysis was manually conducted on the participants' responses to determine the frequency of words and phrases that could provide added support to the selection of themes presented in the results section.

3.2.1 Thematic Analysis

Thematic analysis (TA) is a method used in qualitative research for the systematic identification, analysis, and organization of patterns of meaning (themes) across a set of data (Kiger & Varpio, 2020, p.2). Once collected, data by itself is not a container of meaning. A portion of text, for example, can be filled with a collection of complex ideas without any orderly connectivity or general sense that can be easily recognized. For this to happen, a researcher's effort must be focused on the process of analysis with the objective of identifying meanings, which can be conveyed in terms of themes. Thus, TA organizes a group of repeating ideas by classifying common points of reference with a high degree of generality that unifies concepts regarding a subject of inquiry, enabling researchers to answer a study's questions (Vaismoradi et al., 2016, p.101).

The process of TA is recursive and nonlinear; and can be divided into six phases which were all implemented in this study: 1) Familiarization with the data, 2) Coding or labeling important features of data, 3) Searching for themes, 4) Reviewing themes, 5) Defining and naming themes, and 6) Writing up or 'weaving' of analytic narrative (Braun & Clarke, 2012). This method is viewed as theoretically flexible, given that its process of examination and patterning does not

adhere to any specific experiences, practices, explanatory meaning frameworks, or theory of language. It can be used on a wide range of research questions to analyze different types of data (media, transcripts of focus groups, and interviews), and can also be applied to produce data-driven to theory-driven analysis from large or small sets of data. Aside from its flexibility, TA's theoretical independence makes it stand out as an accessible method. Meaning it has a low barrier of entry and can be easily learned and used by anyone without the need of complex theoretical knowledge. Nevertheless, TA still provides the researcher with the basic and necessary skills to engage in other qualitative research methods (Clarke & Braun, 2013).

Expanding on the second phase of the TA process, according to Saldana (2016), a code is “a word or short phrase that symbolically assigns a summative, salient, essence-capturing, and/or evocative attribute for a portion of language-based or visual data”. Thus, coding is essentially an operation of identifying and labelling segments of a dataset with code. This operation has two different approaches: Inductive and Deductive coding. While Inductive coding involves a strong loyalty and development of codes directly from the data, Deductive coding entails the labelling of data by following a pre-defined list of codes or ‘coding frame’. Even though the process of coding data requires considerable time and effort, it can provide a variety of benefits such as establishing a comprehensive inventory of data that is easily accessible and retrievable, ensuring transparency and validity, and giving a voice to a research participants (Linneberg & Korsgaard, 2019).

Coding has three levels of analysis which are integral to either of the approaches previously mentioned. As shown in **Figure 3.2.1** these levels are: Open, Axial and Selective coding (Williams & Moser, 2019). In the first level, open coding focuses on identifying concepts and themes for categorization. In the second level, Axial coding refines, aligns, and categorizes the identified themes. In the third and final level, selective coding combines categories organized by axial coding into cohesive and meaning-filled expressions. It is important to understand that even though coding might look as a simple and linear process, it is anything but that. As shown in **Figure 3.2.2**, coding quickly evolves into a cyclical and evolving data loop between the three levels, where the researcher moves back and forth comparing data and applying reduction and consolidation techniques (Williams & Moser, 2019).

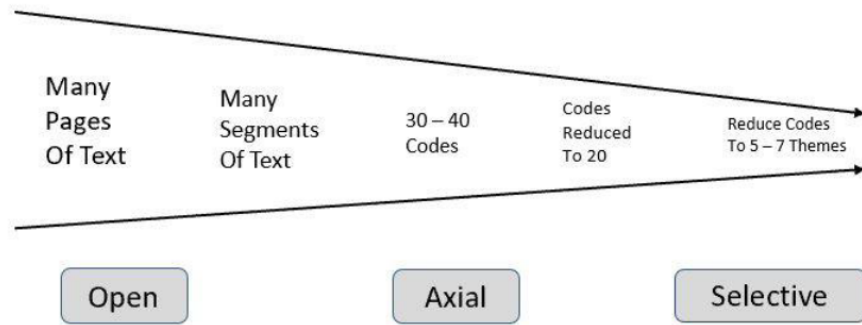


Figure 3.2.1 Overview of Coding Process: Open, Axial and Selective Coding

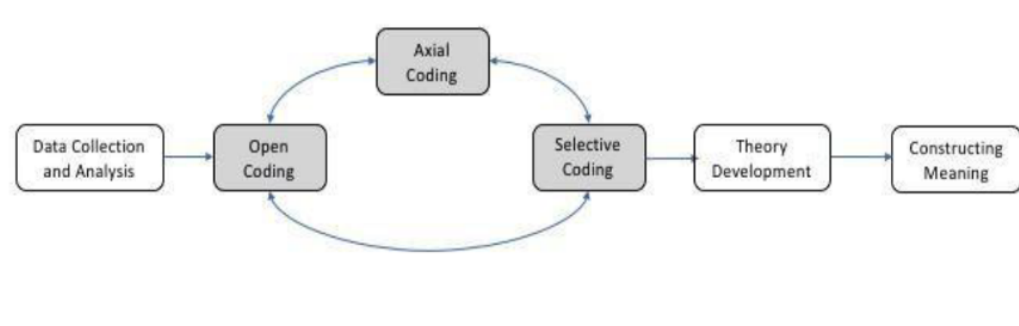


Figure 3.2.2 Nonlinear Coding Process

The labelling process followed in this study has a mixture of Inductive and Deductive coding. As explained by (Linneberg & Korsgaard, 2019), even though Inductive coding produces its codes directly from the data, its process can lack structure and become unnecessarily complex. Therefore, it was decided to include the deductive approach in this study for the sake of providing more structure and efficiency to the inductive procedure. Around 70 codes were extracted from several pages of text during open and axial coding.

Based on the codes extracted from the interview transcripts, a table showing the frequency in pattern of meaning was developed. Additionally, after following the nonlinear coding process, the data was reduced to three themes: 1) Resorting to suppliers for storage and delivery of products, 2) Prioritizing speed of delivery and proximity to customers, and 3) Consideration in improving operations structure. These themes will be explained in detail in the following chapter.

4. Results & Discussion

This section will delve into the findings of the data analysis, assuring that the general objectives of this investigation are acknowledged and the research questions are answered during the discussion. To do so, this segment will reference **Table 4.1** as it contains essential information for the explanation of the themes established later in this section.

Table 4.1 Concept frequency

Concept	Frequency
Unpredictability in demand	12
Proximity to customer	11
Speed of delivery	10
Supply chain structure instability	7
Decision-making structure	7
Cost of warehouse for decision-making	5
Accessibility to main roads and services	5
Decision-making framework awareness	4
Need to improve procedures	3

The table below represents the frequency of concepts resulting from text analysis conducted on participants' responses. Below are the themes obtained from the cyclical process of coding and refining the collected qualitative data. These themes provide an interpretation of the most prevalent open codes extracted from each interview, aiming to address the general objectives and answer this study's questions.

4.1 Theme 1: Resorting to suppliers for storage and delivery of products.

As shown in **Figure 4.1**, this theme is a result of the grouping of three axial codes/categories: Supply Chain Structure, Demand Uncertainty, and Financial Capabilities.

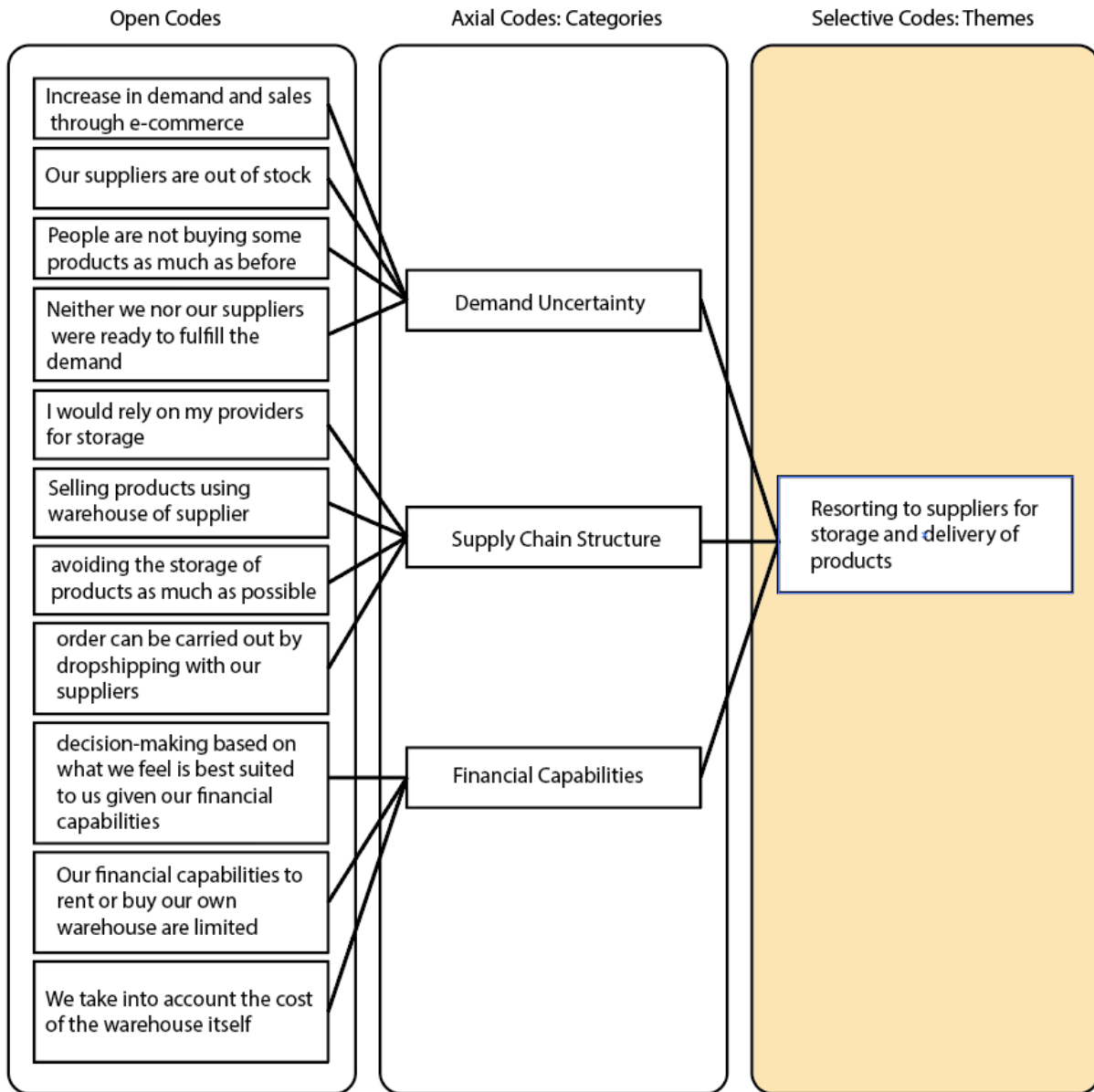


Figure 4.1 Theme 1 Coding

The Supply chain structure category contains open codes that are associated to each other based on a common characteristic referring to an alternative system in their supply chain. When

presented with question #6, which aimed to comprehend the influence e-commerce adoption has had on all Portuguese SMEs' warehouse location decision-making process, all participants referred to utilizing suppliers' warehouses for storage and delivery of their products. However, only some of them had actual experience in doing so. For instance (P2), (P3) and (P5) spoke about this practice as being part of their supply chain structure at the moment of the interview, while (P1) and (P4) spoke about it as an option to be implemented in the future. (P1) referred to it as a "tendency" while (P4) expressed a need for implementing it as stock was running out and was not resupplied. With these responses, participants are referring to a practice called dropshipping, which is defined by Musa et al. (2016) as a network design type where the retailer does not keep stock, but instead transfers it to the supplier, along with shipment and delivery. This method is also being adopted as a way to reduce cost, as there is little to no capital involved and orders still reach customers efficiently (Busari et al., 2021, p.633). Additionally, as previously stated by Hovelaque et al. (2007 as cited in Busari et al., 2021), the implementation of dropshipping reduces operational bottlenecks, addressing the challenges brought upon by IT. Given the involvement of all SMEs in e-commerce, the latter explains the interest of participants in this system (p.630)

Regarding demand uncertainty category, when asked questions #3 & #5, which inquired about Covid 19's impact on customer behavior and warehouse location decision-making (P2), (P3), (P5) saw an increase in demand, with (P5) expressing it was more than usual. (P1) expressed a decrease in demand of some products due to people not willing to spend as much money. (P4) on the other hand, did not refer to an increase or decrease in demand, but did express concern for or not being able to fulfill. This makes sense as (P4) previously expressed interest in dropshipping given that stock was running out and could not be resupplied. Taking into account that the qualitative data used in this study was collected after the global peak of the Covid-19 pandemic, it is no surprise to find these shifts in demand are triggered by a change in customer behavior, which explains why such challenges are becoming more common across all the SMEs interviewed. As shown in **Table 4.1**, Demand Uncertainty, which primarily refers to a demand phenomenon triggered by the consumer, has the highest frequency among all concepts discussed during the interviews. Following the relation of customer behavior and supply chain structure the findings in this study align with Zairi and Al-Mashari (2002) suggestion in **section 2.1.2**, noting that the state of the supply chain has essentially changed in the e-commerce change in customer behavior, which explains why such challenges are becoming more common across all the SMEs interviewed (p.62).

With a 52% rate of customers avoiding brick and mortar stores during the first stages of the outbreak, consumers were able to engage in recreative online shopping more than they did before the pandemic (Koch et al., 2020). This heightened the demand-led effect and as a consequence, it is now projected that e-commerce sales will reach around \$6.5 trillion by 2023 (Jones, 2020 as cited in Bhatti et al., 2020). Even when implementing the best practices to take advantage, some supply chain structures can still suffer from difficulties like high demand unpredictability and product turbulence (Iyer et al., 2009); variety and variability of e-commerce orders (Huang et al., 2020, p.3); speed of business and level of connectivity among supply chain organizations (Golicic et al., 2002); mass customization and difficulty coordinating internet with traditional distribution channels and product flows (Swaminathan & Tayur, 2003); among others. Even though demand uncertainty is an axial code separate to supply chain structure, it still holds some relation to it as it is an integral part of what originates challenges for the structure itself.

Finally, financial capabilities axial code contains open codes regarding the assessment of cost as a criterion for warehouse location. Presented with question #4, all participants provided varied answers. (P1) Spoke about having financial limitations as a start-up;(P2) Spoke about taking into account the cost of the warehouse depending current and future physical needs; (P3) Expressed taking account of the inherent costs of the operation; (P4) Spoke about focusing on warehouses in the exterior of cities as they are cheaper and bigger, and (P5) Expressed always choosing a warehouse that felt best given his/her current capabilities. Even though participants provided various replies, they are all referring to cost. Cost reduction is common determinants present in businesses analysis of warehouse criteria given that not all of them have the adequate capabilities to expand, like (P1) who as a founder of a start-up which has limited capital and plus is considering dropshipping to avoid storage of products as much as possible. Additionally, even though there are concepts with a higher frequency, it is still the best interest of participants to choose an optimal location for a warehouse that offers reduction in costs, aside from other important criteria as Kang (2018) suggested.

4.2 Theme 2: Prioritizing speed of delivery and proximity to customers.

As shown in **Figure 4.2**, this theme is a result of the grouping of three axial codes/ categories: Proximity & Accessibility, Delivery Speed, New Competition Online.

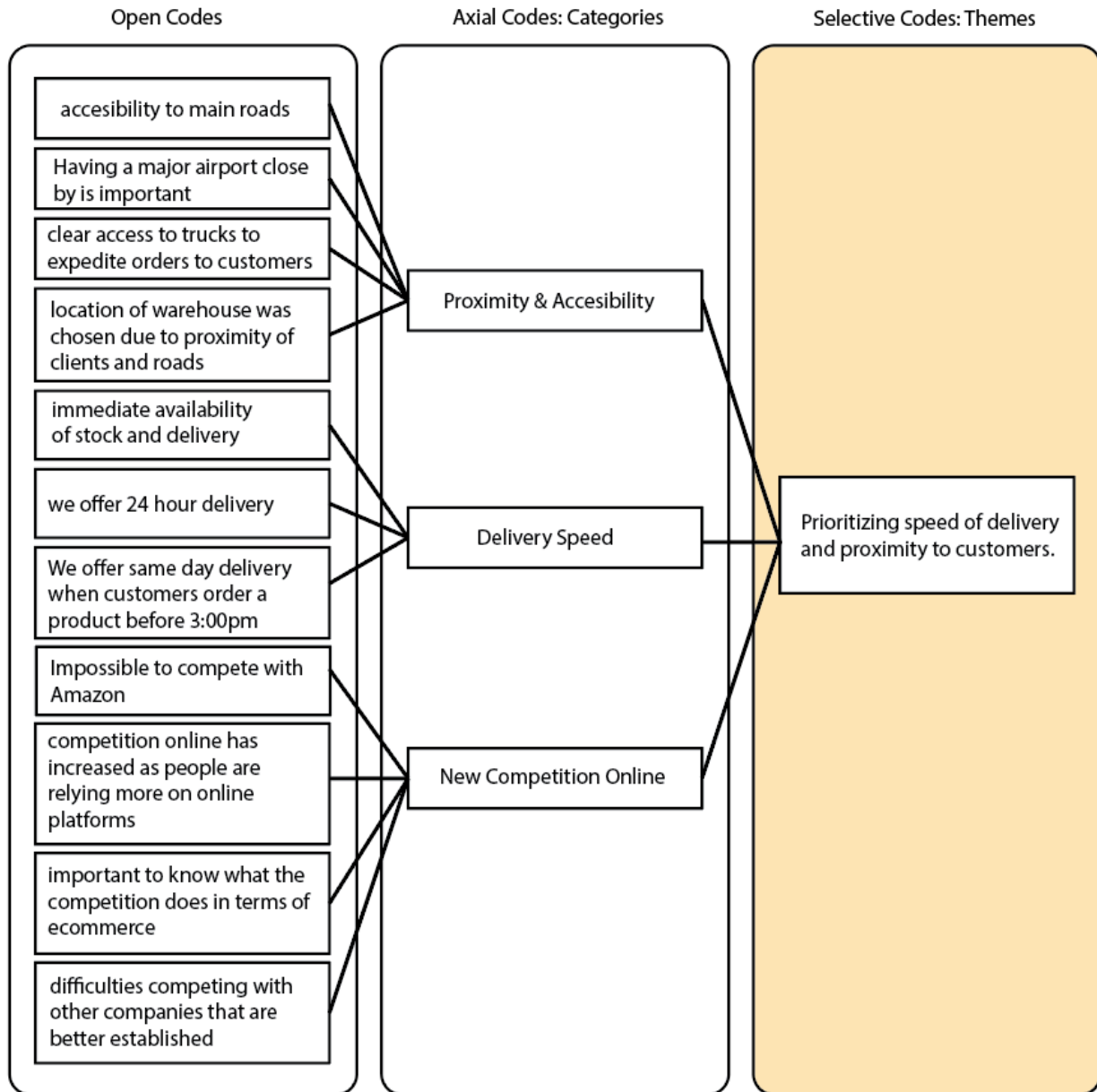


Figure 4.2 Theme 2 Coding

All participants presented a high inclination for Proximity as desirable criteria for warehouse location, often combining it with accessibility in the same response. This is no surprise, as proximity is the second concept with the highest occurrences during the interviews (**Table 4.1**).

When presented with questions #1 & #4, (P1) Expressed proximity to roads, customers and airports is important; (P2) Spoke about transport from warehouse to customer, referring to proximity and speed of delivery in the same sentence; (P3) Expressed that proximity to customers and the ability to dispatch orders quickly are both important to them; (P4) Noted relevance in proximity to consumer as well as accessibility to main roads, trucks, post offices and anything necessary to send products to customers; (P5) Said proximity of clients and main road are the two main criteria for choosing location for warehouse. Proximity and accessibility are often combined in most of the previous replies. This is not strange as accessibility only helps a business perform better. One thing is to be close, but another is to have access to tools that allow companies to give a better service. After all, as noted by Kalinowski (2016) “A major customer service objective is on-time shipping and delivery. This makes accessibility to logistics providers and solid logistics infrastructure a must-have”. Without access to LSPs, highways, airports, products would never arrive to the customer. Additionally, Bowen (2008) determined that airports had the most significance on warehouse development followed by highway accessibility (Gingerich & Maoh, 2019, p.98). This explains (P1) expressing interest in having a warehouse near a major airport. As for the high frequency of proximity as a warehouse location criterion in the interviews, this finding aligns with Singh et al. (2018) as he noted that one of the major criteria to be taken into consideration in warehouse selection are proximity factors. Moreover, study conducted by the Canadian Urban Institute in 2000 supports this claim, as it found that the location selection factors of enterprises warehouses include closeness to an airline, proximity to similar businesses, proximity to customers, proximity to suppliers.

The concept of delivery speed had the third highest frequency during interviews Even though it was already mentioned alongside proximity and accessibility, there were no specifics as to how participants considered it important. However, when presented with question #8 (P1) said they offered Same Day Delivery (SDD), specifying that if the customer ordered before 3:00pm, a driver would leave the warehouse and personally deliver the product to the customer; (P2) mentioned that specific ranges in their e-commerce store were immediately available for delivery. (P2) did not mention (SDD) as part of their offer to the customer; (P3) & (P5) noted they offered a minimum of 24-hour delivery, with (P5) offering a maximum of 48 hours; and (P4) would look into warehouse locations if they offered faster deliveries as people are starting to use e-commerce more. Aside from dropshipping, we see that participants are also speed of delivery for competitive

advantage. For instance (P1)'s offer of SDD for incoming orders before 3:00pm will be more appealing to customers, especially for those looking for instant gratification. We can see that Amazon for example, offers this service in 25 states in the USA. Moreover, the China Internet Network Information Center (2018) reported a number of SDD online shopping users of 364 million, which accounts for 46% of internet users in China, as reported in section 2.1.3. However, this SDD offer was not mentioned by any of the other participants. In the case the SDD system is not practiced as much in Portugal, this represents a great competitive advantage for who is willing to do so, as it has been proven that the more frequently SDD is used, the substitution effect from offline to online shopping just gets stronger (Xi et al., 2020).

Regarding the new competition, there were only four out of five participants referred to this topic. When presented with question #6, (P1) said the online competition increased they noticed people relying more on online platforms; (P2) expressed there was importance in knowing what the competition does in terms of e-commerce, warehouse, and logistics; (P3) mentioned their online store started a year a half ago from the day of the interview. Because of this (P3) had difficulties competing with other companies online as they were better established than their online store. (P4) did not mention anything about competition. (P5) brought up Amazon, saying that they could never imagine getting to their level as it would be impossible and too much competition. What the majority of these participants describe is valid. Competitiveness of e-commerce businesses is not an area of study that has been around that long (Internet retailer, 2012 as cited in Sahin, 2012, p.14). So, it is understandable that businesses will face competitive difficulties, especially if their business is not in the online space, like (P3). When comparing classical firms to e-companies, the line there are no geographic boundaries online. Additionally, since customers are overexposed to this competition, they can acquire whatever they want, from whoever they want. Not only is this making harder on businesses to keep customers attention, but also much more valuable to get customers loyalty and trust (Sahin, 2012).

4.3 Theme 3: Consideration for improvement in decision-making structure.

As shown in **Figure 4.3**, this theme is a result of the grouping of three axial codes/ categories: Decision Making Structure, Decision Making Frameworks Awareness and Need to improve procedures.

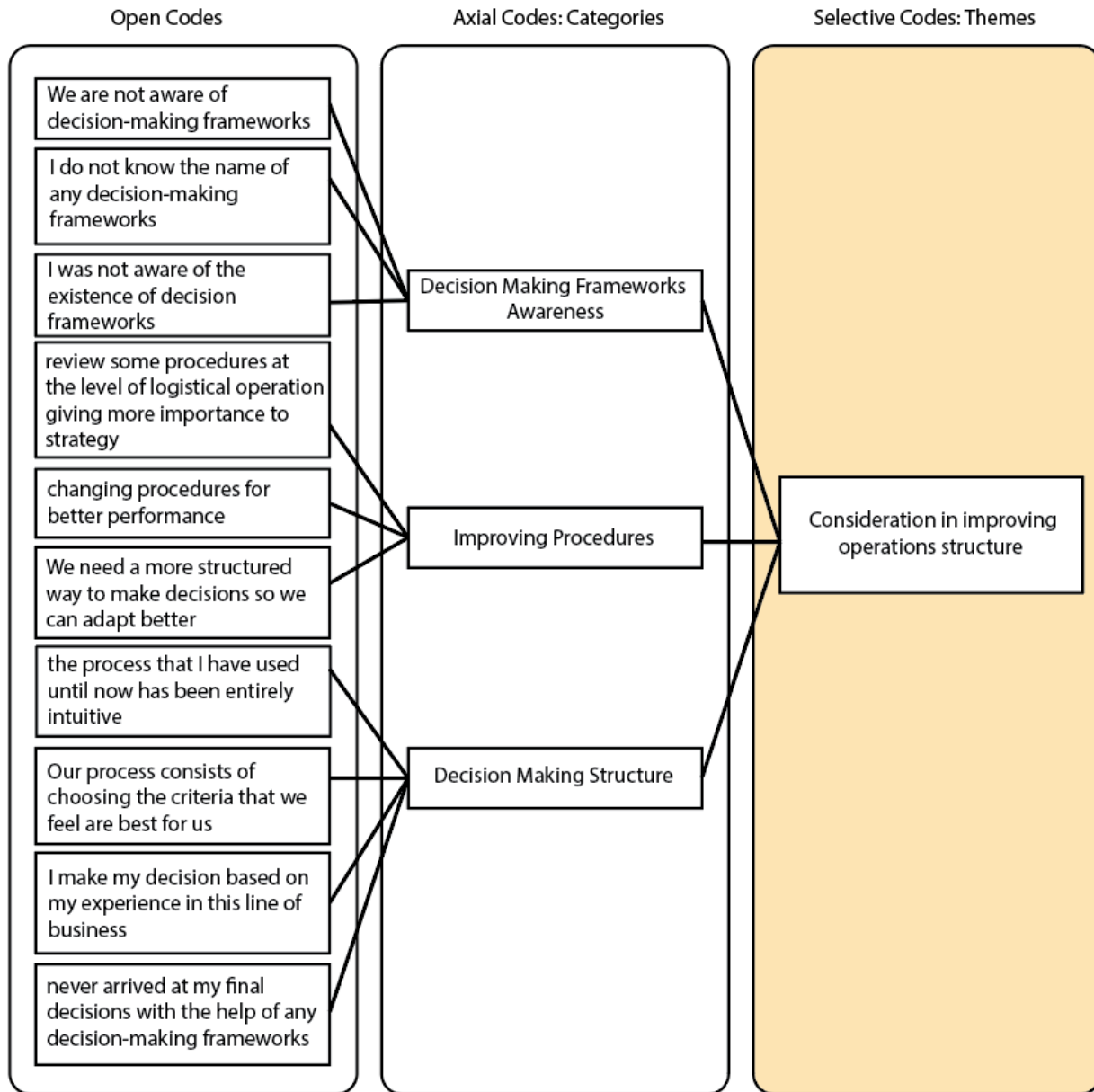


Figure 4.3 Theme 3 Coding

Regarding decision-making structure and awareness of decision-making frameworks, it is appropriate to analyze participants answers involving these two topics together as they are closely

related. When presented with questions #1 and #2 (P1) expressed his/her decision-making process was based on their experience in the line of business, by analyzing what they he/she though was most important at each given moment. In addition (P1) was not aware of decision-making frameworks; (P2) noted their process involves knowing the company's business, its product, customer and having a well-defined strategy for the future. (P2) was aware of decision-making frameworks but decided not to use there was no previous experience in doing so; (P3) described his/her process as entirely intuitive, adding that they have never arrived at a final decision with the help of any frameworks. Which explains why (P3) was not aware that decision frameworks existed; (P4) expressed they never used any tools for decision-making as the only criteria they always considered was cost and location. (P4) did not know the name of any decision-making frameworks; (P5) explained that heir process consisted of choosing the criteria they felt was best for them and added that he/she was not aware of decision-making frameworks. All participants except for one, were not aware of decision-making frameworks. That explains why the concept of decision-making framework awareness was not that frequent during the interviews as it sits in the lower end of the spectrum of **Table 4.1**. Even though (P2) was the only participant aware of decision-frameworks, he/she still decided not to use them for lack of experience. From the replies provided during the interview, it can be inferred that participants do not have a defined structured for decision making as they did not mention any of the main decision-making frameworks listed by Özcan et al. (2011) which can be found in **section 2.3**.

In terms of the improvement of procedures, participants mentioned this in relation to covid-19, e-commerce, and newfound lack of awareness towards decision making frameworks. When presented with question #7 which aimed to understand the adoption of risk mitigation measures, (P1) Expressed to have realized the need of a more structures decision making process, so they can adapt better and faster to the rapid changing environment of e-commerce; (P2) noted they would review e-commerce at the level of logistical operations, giving more importance to strategy; (P3) spoke about improving performance inside of the company by implementing remote work during and after Covid 19. (P4) and (P5) would not change anything in how the reacted to the pandemic and how they respond to their e-commerce issues. Even though e-commerce has presented challenges for the participants of this study, Zairi & Al-Mashari (2002) suggests this technology has brought opportunities that could be useful to firms. For instance, the access to large computer data and real time information has allowed businesses to improve supply chain models with a high

level of detail that can be used to make real time decisions. (Swaminathan & Tayur, 2003). Depending on what challenges each SME faces, this opportunity can be used to improve procedures brought by the unpredictability of ecommerce as well as help mitigate risks in the future.

5. Conclusion

The objective of this study is to analyze the decision-making process for warehouse location of SME's located in Portugal and identify the most important criteria currently considered by SMEs for warehouse location selection in Portugal.

This study used a combination of inductive and deductive approaches belonging to Thematic Analysis in order to examine qualitative data collected from semi-structured interviews with five Portuguese SMEs. During the process of examination, coding was used cyclically to label portions of data from the interviews into open codes based on their frequency in meaning. Open codes were later categorized in three axial codes and finally three themes were selected to best represent the axial codes / categories in the analysis. These three themes, directly address the objectives and research questions established in the introduction.

After conducting the analysis previously mentioned, it is concluded that e-commerce had a major influence on the decision-making process of businesses when choosing a location for storage and distribution. This influence resulted in a response pattern across all participants regarding to the selection of suppliers' warehouses for storage and deliver of orders, better known as dropshipping. In Theme #1, three out of the five participants referred dropshipping as a practice they already had implemented in their supply chains along with already owning a warehouse. The rest, however, were considering implementing this practice in their supply chains as a substitute for the future.

In terms of criteria., it was determined in Theme #2 that the most important criteria considered by businesses when selecting a warehouse location is proximity to customers, with a concept frequency of eleven occurrences, delivery of speed with ten occurrences, and cost and accessibility with five occurrences each throughout the interview. Additionally, participants considered the following alternatives for future warehouse location: Cascais, Porto, Alentejo, Lisboa and Sintra.

Finally, with Theme #3, it was settled that all the participants in this study did not follow a structured decision-making process and were not aware of decision-making frameworks. None of the participants could refer to a specific decision-making framework by name. As most participants explained, their decision-making processes were based on intuition and experience. In terms of how they modified and adapted their decision-making processes in today's climate. The most common theme that addressed this question is resorting to suppliers for storage of product.

Additionally, one participant considered reviewing and adding more structure to their decision-making processes with their newfound awareness of decision-making frameworks.

6. Limitations and recommendations

Even though the findings in this study address the general objectives and research questions established in the introduction, there are some limitations that should be considered.

First and foremost, the most evident limitation has to do with the size of the sample. Being five the total number of participants included in this study, this leaves the door open to more research, with a higher number of participants.

Finally, is geographical limitation. Given that the SMEs that are part of this study are all Portuguese, the results of this dissertation cannot be indicative of the procedures firms in other countries practice. Which will also vary depending on culture and technological development.

7. References

- Alexander, A., Walker, H., Naim, M. (2014). Decision Theory in Sustainable Supply Chain Management: A Literature Review. *Supply Chain Management: An International Journal*, 505. <https://www.emerald.com/insight/content/doi/10.1108/SCM-01-2014-0007/full/html>
- Alnaggar, A., Gzara, F., Bookbinder, J.H. (2019). Crowdsourced delivery: A review of platforms and academic literature. *Omega*, 2. <https://doi.org/10.1016/j.omega.2019.102139>
- Basorudin, M., Rahman, K., Ratu, N.Y., Ikhsan, E., Perwitasari, W.S. (2020). The Challenges and Opportunities of E-commerce Data Collection in Indonesia Compared to BRICS Countries. Handbook of Research on Innovation and Development of E-commerce and E-business in ASEAN. IGI Global. DOI:[10.4018/978-1-7998-4984-1.ch007](https://doi.org/10.4018/978-1-7998-4984-1.ch007)
- Behzadian, M., Otaghsara, S.K., Yazdani, M., Ignatius, J. (2012). A State-Of-The Art Survey of TOPSIS Applications. *Expert Systems with Applications*, 1, 13052. <https://doi.org/10.1016/j.eswa.2012.05.056>
- Bhatti, A., Akram, H., Khan, A.U., Basit, H.M. (2020). E-commerce trends during covid-19 Pandemic. *International Journal of Future Feneration Communication and Networking*, 1450-1451. <https://www.researchgate.net/publication/342736799>
- Boysen, N., Koster, R., Weidinger., F. (2019). Warehousing in the E-commerce Era: A Survey. *European Journal of Operational Research*, 1. <https://doi.org/10.1016/j.ejor.2018.08.023>
- Braun, V., & Clarke, V. (2012). Thematic analysis. In H. Cooper, P. M. Camic, D. L. Long, A. T. Panter, D. Rindskopf, & K. J. Sher (Eds.), *APA handbook of research methods in psychology, Vol. 2. Research designs: Quantitative, qualitative, neuropsychological, and biological*, 57–71. <https://doi.org/10.1037/13620-004>
- Busari, S.A., Aminu, S.O., Zakariyah, H. (2021). Drop Shipping in the Supply Chain: Fiqh Perspective. *The Imporance of New Technologies and Entrepreneurship in Business Development: In the Context of Economic Diversity in Developing Countries*, 630-633. DOI:[10.1007/978-3-030-69221-6_48](https://doi.org/10.1007/978-3-030-69221-6_48)
- Carvalho, M., Mamede, H. (2018). The impact of e-commerce on the success of microenterprise retail sector of the Pinhal Interior Norte sub-region of Portugal. *Procedia Computer Science*, 576. <https://doi.org/10.1016/j.procs.2018.10.077>
- Clarke, V., Braun, V. (2013). Teaching Thematic Analysis: Overcoming Challenges and Developing Strategies for Effective Learning. <https://www.researchgate.net/publication/269928387>

Clifford, N., Cope, M., Gillespie, T., French, S. (2016). Semi-structured Interviews and Focus Groups. *Key Methods in Geography*, 143-145.

Commission Recommendation: Concerning the Definition of Micro, Small and Medium-Sized Enterprises. (2003). *Official Journal of the European Union*, 36
<https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2003:124:0036:0041:en:PDF>

Corbitt, B.J., Thanasanki, T., Yi, H. (2003). Trust and e-commerce: a study of consumer perceptions. *Electronic Commerce Research and Applications*, 203-205.
[https://doi.org/10.1016/S1567-4223\(03\)00024-3](https://doi.org/10.1016/S1567-4223(03)00024-3)

Coyle, G. (2004). The Analytic Hierarchy Process (AHP). *Practical Strategy*, 1.
<https://training.fws.gov/courses/references/tutorials/geospatial/CSP7306/Readings/AHP-Technique.pdf>

Dakduk, S., Horst, E., Santalla, Z., Molina, G., Malavé, J. (2017). Customer Behavior in Electronic Commerce: A Bayesian Approach. *Journal of Theoretical and Applied Electronic Commerce Research*, 12(2), 2-6.
DOI: 10.4067/S0718-18762017000200002

Dutta, P., Suryawanshi, P., Gujaranthi, P., Dutta, A. (2019). Managing risk for e-commerce supply chains: an empirical study. *IFAC Conference Paper Archive*.
<https://doi.org/10.1016/j.ifacol.2019.11.143>

Durak, I., Yildiz, M.S., Akar, Y.O., Yemenici, A.D. (2017). Warehouse Site Selection in Retail Sector: Application AHP (Analytical Hierarchy Process) and Vikor Methods, 66.
<https://www.researchgate.net/publication/343975553>

Figueira, J., Mousseau, V., Roy, B., Greco, S. (2005). Electre Methods. Multiple Criteria Decision Analysis: *State of the Art Surveys*, 134
DOI:[10.1007/0-387-23081-5_4](https://doi.org/10.1007/0-387-23081-5_4)

Gavade, R.K. (2014). Multi-Criteria Decision Making: An Overview of Different Selection Problems and Methods. *International Journal of Computer Science and Information Technologies* 5(4).
<http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.433.1775&rep=rep1&type=pdf>

Gingerich, K., Maoh, H. (2019). The Role of Airport Proximity on Warehouse Location and Associated Truck Trips: Evidence from Toronto, Ontario. *Journal of Transport Geography*, 98.
<https://doi.org/10.1016/j.jtrangeo.2018.11.010>

Golicic, S.L., Davis., D.F., McCarthy, T.M., Mentzer, J.T. (2002). The impact of e-commerce on supply chain relationships. *International Journal of Physical Distribution & Logistics Management*, 32(10), 852.

DOI:[10.1108/09600030210455447](https://doi.org/10.1108/09600030210455447)

Govindan, K., Jepsen M.B. (2016). ELECTRE: A Comprehensive Literature Review on Methodologies and Applications. *European Journal of Operational Research*, 10-11

<https://doi.org/10.1016/j.ejor.2015.07.019>

Gu, J., Goetschalckx, M., McGinnis, L.F. (2007). Research on Warehouse Operation: A Comprehensive Review. *European Journal of Operation Research*, 1.

<https://doi.org/10.1016/j.ejor.2006.02.025>

Heel, B., Lukic, V., Leeuwis, E. (2014). Cross-Border E-commerce Makes the World Flatter.

<https://www.bcg.com/publications/2014/post-parcel-sales-channel-transformation-cross-border-e-commerce>

Hernández, B., Jiménez, J., Martín, M.J. (2010). Customer Behavior in electronic commerce: The moderating Effect of e-purchasing experience. *Journal of Business Research*, 968-969.

<https://doi.org/10.1016/j.jbusres.2009.01.019>

Huang, G.Q., Koster, R., Yu, Y. (2020). Editorial: Online-to-Offline ecommerce operations management (EOM). *Transportation Research Part E: Logistics and Transportation Review*, 1.

<https://doi.org/10.1016/j.tre.2020.101920>

Iyer, K.N., Germain, R., Claycomb, C. (2009). B2B e-commerce supply chain integration and performance: A contingency fit perspective on the role of environment. *Information & Management*, 314.

<https://doi.org/10.1016/j.im.2009.06.002>

Kalinowski, N. (2016). Warehouse Strategy: How Can Organizations Determine the Idea Warehouse Location Strategy to Optimize Business Results?, 15

<https://minds.wisconsin.edu/bitstream/handle/1793/75156/KalinowskiNicole.pdf?sequence=5&isAllowed=y>

Kang, S. (2018). Warehouse Location Choice: A Case Study in Los Angeles, CA. *Journal of Transport Geography*, 2.

<https://doi.org/10.1016/j.jtrangeo.2018.08.007>

Kiger, M.E., Varpio, L. (2020). Thematic Analysis of Qualitative Data: AMEE Guide no. 131. *Medical Teacher*, 2

<https://doi.org/10.1080/0142159X.2020.1755030>

Klapp, M.A., Erera, A.L., Toriello, A. (2018). The Dynamic Dispatch Waves Problem For Same-Day Delivery. *European Journal of Operational Research*, 1-2.

<https://doi.org/10.1016/j.ejor.2018.05.032>

Koster, R., Le-Duc, T., Roodbergen, K.J. (2007). Design and Control of Warehouse Order Picking: A Literature Review. *European Journal of Operation Research*, 1.
<https://doi.org/10.1016/j.ejor.2006.07.009>

Koch, J., Frommeyer, B., Schewe, G. (2020). Online Shopping Motives during the COVID-19 Pandemic-Lessons from the Crisis. *Sustainability*, 12(24), 2-6
DOI:[10.3390/su122410247](https://doi.org/10.3390/su122410247)

Kwak, J., Zhang, Y., Yu, J. (2019). Legitimacy building and e-commerce platform development in China: The experience of Alibaba. *Technological Forecasting & Social Change*, 116.
<https://doi.org/10.1016/j.techfore.2018.06.038>

Linneberg, M.S., Korsgaard, S. (2018). Coding Qualitative Data: A Synthesis Guiding the Novice.
DOI:[10.1108/QRJ-12-2018-0012](https://doi.org/10.1108/QRJ-12-2018-0012)

Lestari, D. (2019). Measuring e-commerce adoption behaviour among gen-Z in Jakarta, Indonesia. *Economic Analysis and Policy*, 105.
<https://doi.org/10.1016/j.eap.2019.08.004>

Leung, H.K., Choy K.L., Siu K.Y., Ho G.T., Lam H.Y., Lee K.M. (2018). A B2C e-commerce intelligent system for re-engineering the e-order fulfillment process. *Expert Systems With Applications*, 386-387.
<https://doi.org/10.1016/j.eswa.2017.09.026>

Mittal, A. (2013). E-commerce: It's impact on consumer Behavior. *Global Journal of management and Business Studies*, 3(2), 131-138.
http://ripublication.com/gjmbs_spl/gjmbsv3n2spl_09.pdf

Mostert, P., North, E., Plessis, P.J. (2002). Chapter 2: Consumer Behavior Theory. *Buying Behaviour of south African internet users*, 36-39. Pretoria: University of Pretoria.

Musa, H.B., Bin, M.S., Li, S.C., Jabar, J., Khalid, F.A. (2016). Drop-Shipping Supply Chain: The Characteristics of SMES Towards Adopting It. *The Social Sciences*, 2856.
https://researchmgt.monash.edu/ws/portalfiles/portal/288661411/288653544_oa.pdf

Ni, M., He, Q., Liu, X., Hampapur, A. (2019). Same-Day Delivery with Crowdshipping Fulfillment Daily Operations. *Transportation Research Procedia*, 895, 912.
<https://doi.org/10.1016/j.trpro.2019.05.046>

Nurhayati-Wolff, H. (2020). *Numbers of online shoppers in Indonesia in 2017 and 2022*.
<https://www.statista.com/statistics/971411>.

- Owusu-Agyei, S., Okafor, G., Chijoke-Mgbame, A.M., Ohalehi, P., Hasan, F. (2020). Internet adoption and financial development in sub-Saharan Africa. *Technological Forecasting & Social Chang*, 2.
<https://doi.org/10.1016/j.techfore.2020.120293>
- Özcan, T., Çelebi, N., Esnag, S. (2011). Comparative Analysis of Multi Criteria Decision Making Methodologies and Implementation of a Warehouse Location Selection Problem. *Expert Systems with Applications*, 1, 9773.
<https://doi.org/10.1016/j.eswa.2011.02.022>
- Ozturk, D., Batuk, F., (2011). Technique For Order Preference by Similarity To Ideal Solution (TOPSIS) For Spatial Decision Problems.
<https://www.isprs.org/proceedings/2011/gi4dm/pdf/pp12.pdf>
- Pavić, Z., Novoselac, V. (2013). Notes on TOPSIS Method. *International Journal of Research in Engineering and Science*, 6.
<https://www.researchgate.net/publication/285886027>
- Rafiei, F.M., Mollaverdi, N., Ashrafzadeh, M. (2012). Application of Fuzzy TOPSIS Method for the Selection of Warehouse Location: A Case Study. *Interdisciplinary Journal of Contemporary Research In Business*, 659.
<https://www.researchgate.net/publication/265521806>
- Rapoport, A. (1998). An Overview of Decision Theory. *Decision Theory and Decision Behavior*, 3. Springer.
- Reddy, N.A., Divekar, B.R. (2014). A Study of Challenges Faced By E-Commerce Companies In India And Methods Employed To Overcome Them. *Procedia Economics and Finance*, 553-560. [https://doi.org/10.1016/S2212-5671\(14\)00220-2](https://doi.org/10.1016/S2212-5671(14)00220-2)
- Rita, P., Oliveira, T., Farisa, A. (2019). The impact of e-services quality and customer satisfaction on customer behavior in online shopping. *Heliyon*, 1.
<https://doi.org/10.1016/j.heliyon.2019.e02690>
- Sahin, C. (2012). Competitiveness of E-commerce Companies: An Integrated Approach. *International Journal of eBusiness and eGovernment Studies*, 14.
<https://www.researchgate.net/publication/233871787>
- Saldana, J., (2016). *The Coding Manual for Qualitative Researchers* (3rd ed). London, Uk. Sage.
- Saraiva, A. (2020). Why Portugal is so behind in e-commerce in relation to the rest of Europe?
<https://www.researchgate.net/publication/340378231>.
- Saaty, R.W. (1987). The analytic hierarchy process - what it is and how it is used. *Mathematical Modelling*, 161, 166.
[https://doi.org/10.1016/0270-0255\(87\)90473-8](https://doi.org/10.1016/0270-0255(87)90473-8)

Siddiqui, A.W., Raza, S.A. (2015) Electronic Supply Chains: Status & Perspective. *Computers & Engineering*, 536, 544.

<https://doi.org/10.1016/j.cie.2015.08.012>

Singh, R.K., Chaudhary, N., Saxena, N. (2018). Selection of Warehouse Location for a Global Supply Chain: A Case Study. *IIMB Management Review*, 344-345.

<https://doi.org/10.1016/j.iimb.2018.08.009>

Sheth, J. (2020). Impact of Covid-19 on consumer behavior: Will the old habits return or die? *Journal of Business Research*, 281

<https://doi.org/10.1016/j.jbusres.2020.05.059>

Swaminathan, J.M., Tayur, S.R. (2003). Models for Supply Chains in E-Business. *Management Science* 49(10), 1389

DOI:[10.1287/mnsc.49.10.1387.17309](https://doi.org/10.1287/mnsc.49.10.1387.17309)

Suel, E., Daina, N., Polak, J.W. (2018). A hazard-based Approach to Modelling the Effects of Online Shopping on Intershipping Duration. *Transportation*, 415-428.

<https://doi.org/10.1007/s11116-017-9838-3>

Vaismoradi, M., Jones, J., Turunen, H., Snelgrove, S. (2016) Theme Development in Qualitative Content Analysis and Thematic Analysis. *Journal of Nursing Education and Practice*, 101

<http://dx.doi.org/10.5430/jnep.v6n5p100>

Wang, Y., Yu, Z., Jin, M. (2019). E-commerce supply chains under capital constraints. *Electronic Commerce Research and Applications*, 10.

<https://doi.org/10.1016/j.elerap.2019.100851>

Williams, M., Moser, T. (2019). The Art of Coding and Thematic Exploration in Qualitative Research. *International Management Review*, 45

<https://docplayer.net/128657287-The-art-of-coding-and-thematic-exploration-in-qualitative-research.html>

Xi, G., Cao, X., Zhen F. (2020). The impacts of same day delivery online shopping on local store shopping in Nanjing, China. *Transportation Research Part A*, 35-36.

<https://doi.org/10.1016/j.tra.2020.03.030>

Zairi, M., Al-Mashari, M. (2002). eCommerce-enabled Supply Chain management: *A proposed Model Based on Retailing Experience*. *Journal of King Saud University - Computer and Information Sciences*, 62

[https://doi.org/10.1016/S1319-1578\(02\)80004-0](https://doi.org/10.1016/S1319-1578(02)80004-0)

Zyoud, S.H., Fuchs-Hanusch, D. (2017) A Bibliometric-Based Survey on AHP and TOPSIS Techniques. *Expert Systems With Applications*, 161-162.

<https://doi.org/10.1016/j.eswa.2017.02.016>

Annex I

1. What is your decision-making process for warehouse location?

Expected Inputs:

Identification of alternatives, analysis, classification, evaluation, selection among alternatives.

Contributions to conclusions:

Understand what the current decision-making process of SMEs is.

2. Are you aware of decision-making frameworks for warehouse location?

Specifically which decision - making frameworks have you used for warehouse location?

Expected Inputs:

Multiple Criteria Decision Making (MCDM) Tools, Decision theory, decision tables, decision trees, influence diagrams.

Contributions to conclusions:

Understand if decision makers are aware of decision-making frameworks and if they use them when it comes to selecting a location for a warehouse.

3. How did the coronavirus (COVID-19/SARS-CoV-2) outbreak impact your supply chain and decision-making process for inventory storage?

Expected Inputs:

Supply chain simultaneous disruption propagation; disruption in supply, demand and logistics infrastructures, employee layoffs, adoption of social distancing measures.

Contributions to conclusions:

Understand the impact that a global crisis such as Covid-19 has on these businesses' warehouse location decision-making processes

4. What criteria and alternatives do you take into consideration when assessing the best possible locations to rent, buy or build a warehouse to store inventory? Follow up: Taking into account the coronavirus outbreak, what additional criteria do you consider in your decision-making process?

Expected Inputs:

Labor costs, Transportation Costs, Handling Costs, Skilled Labor, Availability of labor force, Land Availability, Modes of Transportation, Telecommunication Systems, Proximity to Customers, Proximity to Suppliers, Lead times and responsiveness.

Contributions to conclusions:

Understand what the criteria are and that decision makers considerate the most at the moment of selecting a warehouse in Portugal

5. How did COVID-19 change customer behavior towards your business? What effect did this change have on your decision-making process for warehouse location?

Expected Inputs:

Hoarding behavior, increase in e-commerce sales, decrease in physical store sales, Stock running out.

Contributions to conclusions:

Understand the influence that Covid has on e-commerce and customer behavior.

6. What impact has the evolution and adoption of e-commerce in Lisbon had on your decision-making process for warehouse location?

Expected Inputs:

Demand unpredictability, Variety and variability of e-commerce orders, order handling, complex return processes, capital constraints.

Contributions to conclusions:

Understand the impact that e-commerce has on Lisbon's businesses' decision-making frameworks.

7. What measures have you adopted to mitigate risks brought upon by e-commerce and natural disasters such as a global epidemic?

Expected Inputs:

Alternate transportation modes, emergency inventory pre-positioning.

Contributions to conclusions:

Understand how businesses mitigate risks for e-commerce as well as future health crisis.

8. Do you offer same-day delivery (SDD)? If so, are these orders dispatched from your primary warehouse, or secondary inventory storage points closer to higher populated areas in Lisbon (retail stores, etc.)?

Expected Inputs:

Same day delivery offered, 24 Hour delivery, using stores for storage, Primary Warehouse, Secondary Storage Point.

Contributions to conclusions:

Understand if SMEs offer SDD or Express delivery as competitive advantage.