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Organizational Ambidexterity in Biopharmaceuticals' Supply Chain Flexibility

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Masters in Management of Services and Technology

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Department of Marketing, Strategy and Operations

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Ao futuro que é incerto, mas prometedor.

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Resumo

Um dos maiores desafios desta década foi as consequências provocadas por uma das maiores disrupções mundiais na área da saúde. As cadeias de abastecimento provaram que a flexibilidade é fundamental para assegurar a saúde dos seus pacientes e as evidências de uma cadeia de abastecimento pouco flexível podem ter consequências graves na economia e no estado da saúde mundial. A situação agrava-se quando se lida diretamente com matéria-prima biológica, onde o tempo é contabilizado ao detalhe e os seus prazos de entrega têm de ser cumpridos. O papel desta dissertação é demonstrar a necessidade de introduzir novos modelos de estratégia da gestão na área e aplicar medidas que auxiliem os membros da organização e os seus envolventes a enfrentarem desafios e cenários improváveis para garantir que os pacientes nunca sejam prejudicados no final da cadeia, devido à falta de matéria-prima e materiais na produção porque fornecedores não conseguiram atender a procura. Através dos métodos de pesquisa de métodos mistos foi possível compreender a oportunidade de implementação de estratégias ligadas à ambidestria organizacional, a tensão da exploração e exploração, para adotar medidas estratégicas benéficas à flexibilidade da cadeia de abastecimento. Após os fundamentos e análise oferecida pelos questionários e entrevistas foi possível prever uma crescente preocupação em desenvolver melhores relacionamentos com os fornecedores e usufruir das relações estabelecidas. Portanto, a exploração dos fornecedores na cadeia de abastecimento revela grande importância por se tratar de um tema recente e é com esse valor que se procura induzir à discussão.

Palavras-chave: Ambidestria Organizacional, Cadeia de Abastecimento, Biofarmacêutica, Flexibilidade, Fornecedores.

Classificação JEL: M11 e I10

Abstract

One of the biggest challenges of this decade has been the consequences caused by one of the world's biggest disruptions in healthcare. Supply chains have proven that flexibility is key to ensuring the health of their patients, and evidence of an insufficiently flexible supply chain can have serious consequences on the global economy and state of health. The situation is worsened when dealing directly with biological raw materials, where time is counted in detail and their delivery deadlines must be met. The role of this dissertation is to demonstrate the need to introduce new management strategy models in the area and apply measures that assist members of the organisation and their stakeholders in facing challenges and unlikely scenarios to ensure that patients are never harmed at the end of the chain due to a lack of raw materials and materials in production because suppliers have failed to meet demand. Through the mixed methods research methods, it was possible to understand the opportunity to implement strategies linked to organisational ambidexterity, the tension of exploration and exploitation, and to adopt strategic measures beneficial to supply chain flexibility. After the foundation and analysis offered by the questionnaires and interviews, it was possible to foresee an increasing concern to develop better relationships with suppliers and enjoy the established relationships. Therefore, the exploitation of suppliers in the supply chain reveals great importance as it is a recent theme and it is with this value that one seeks to induce discussion.

Key Words: Organizational Ambidexterity, Supply Chain, Biopharmaceutical, Flexibility, Suppliers

JEL Classification: M11 and I10

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Introduction

One of the biggest battles of the early part of this decade is identified by the disruption caused by COVID-19 and has weakened segments of industries to the point of worldwide disruptions. These weaknesses were only the tip of the iceberg that highlighted the problems in the supply and distribution chains in this globalized world. Industries found themselves facing shortages of raw materials and without any kind of previous experience to defend their production structures and guarantee supply to consumers. Due to this major disruption, the inability and inflexibility in supplying this type of industry were obvious, especially in the one under study in this dissertation, the biopharmaceutical industry.

Organizational ambidexterity comes to define a new type of proposition for biopharmaceuticals to exploit the impact caused by external exploration and exploitation in a way that is beneficial to organizations (Petro, Y. et al., 2018). This type of strategy is a strategy still being explored in the literature related to healthcare industries, but it proves to be advantageous to overcome the risks faced by the dimension of supply chain disruption. One of the objectives of the literature is to encourage managers to apply methods inherent to Organizational Ambidexterity to exploit existing capabilities within the company and to apply them together with their suppliers, choosing to obtain more advantageous supply options. However, there is also the side of promoting the exploration of new opportunities in the market and studying other possible ways to expand the range of suppliers. Thus, continuing literature related to how Supply Chain Ambidexterity has the power to modify its design related to market changes and fluctuations, always in accord with the benefits given by supply chain partners (Aslam, K. H. et al., 2020) to achieve better flexibility.

At the beginning of the year 2020, it was possible to find the first signs of crisis and stock-outs in the health market, where drugs quickly found themselves unavailable to the public masses due to the high level of demand (Musazzi, U. M. et al., 2020). One of the major causes pointed out by the same authors mentioned above, is due to factors related to the supply of raw materials. This caused a chain effect, where the main objectives of the industry were to maintain its' original goals for medicine quality and efficiency (Abbasian, H. et al., 2019).

The new disruptive scenario has challenged supply chains to seek new management strategies that integrate all stakeholders associated with the production of drugs, especially

suppliers. The main concern to reduce these disruptions was to ensure that patients had the lowest possible level of risk and to avoid harming global health. The automated processes in this modern medical industry have enabled a collaborative response between production facilities and their raw material suppliers (Musazzi, U. M. et al., 2020) to ensure the resilience of supply chains and build strategies to promote flexibility. Identifying and understanding the critical points of this disruption qualitatively were some of the proposed measures and strategies to address the shortage in manufacturing processes.

Furthermore, previous research highlights the relative scarcity of empirical research compared to non-empirical studies in the area (Ali et al., 2017) combining this with the call for studies that pay more attention to factors pertaining to the human side, such as the individual or team level (Liu et al., 2017), The study pretends to contribute toward settling some of these issues.

In sum, the thesis has shown an interest to approach the following theme **“Organizational Ambidexterity in Biopharmaceuticals’ Supply Chain Flexibility”** which rose the immediate question for the research: **“How can Organizational Ambidexterity be useful to improve the Flexibility within a Supply Chain in Biopharmaceuticals?”** For a deeper understating of this recent theme of research, then it was formed the following topics for this dissertation which consists of:

- The comprehension of students, investigators, and laboratory workers regarding the supply chain environment in Biopharmaceuticals,
- The perception of Flexibility performance in the Supply Chain,
- The disruption caused by COVID-19 and its’ effects,
- The level of exploitation of Procurement,
- The importance and the exploration of Suppliers in the Supply Chain environment,
- The performance of Suppliers and relations between stakeholders.

For the methodology to further deeper the research and its’ topics will be through exploratory methods, or o known as a mixed research method. Also, in this dissertation, there’s a need to seek and encourage the promotion of practising this type of exploration and exploitation tension strategy to develop flexibility in long-term supply chains and maintain healthy performance (organisational ambidexterity). That is, although sustainability is not a word used in biopharmaceutical processes due to the nature of disposable materials, there is a need to decrease the strategy of acquiring large stockpiles of materials and formulate better strategies for other possible risk scenarios like the crisis caused by COVID-19. The information will be gathered through the usage of qualitative surveys intended for a population that is

directly related to the industry and the formulation of individual structured interviews directed to people of interest, such as investigators, laboratory workers and students in this field.

This dissertation provides support to empirical research, where there are fundamentals for the exploration of opportunities to apply one of the concepts associated with organizational ambidexterity which deals with the tension between exploration and exploitation and how to use them for benefit of improving flexibility in Supply Chain Ambidexterity. The increased level of risk of production breakdown becomes a more sensitive issue in this industry because the raw materials are living, organic materials. The cells used to manufacture medicines have short shelf lives and their nature is volatile and sensitive to changes in the environment, so the risk becomes greater and the practices of ensuring that large inventories are maintained are financially aggravated.

Therefore, there's a concern surrounding the state of the actual supply chain health and its environment after the COVID-19 crisis and its impacts on the capability to supply the biopharmaceutical industry correctly. The dissertation approaches an alternative strategy by applying fundamentals within Organizational Ambidexterity and improving the structure to provide a Supply Chain Ambidexterity. This suggests being an interesting topic to be explored based on the recent crisis of suppliers in the pharmaceutical industry and an alternative solution to the strategies applied nowadays.

The chapter dedicated to the Literature Review (Chapter II) seeks to address the main concepts linked to the study of this dissertation and to present the theories proposed by different authors. It begins with a definition of the concept of Organizational Ambidexterity and one of its main strategies, which studies the tension addressed between the two contradictory powers between the exploitation of capability and the exploration of new opportunities. Next, it addresses the topic of the structure of a supply chain and the application of the two strategies of ambidexterity and flexibility and how they impact each other. And finally, the study is based on biopharmaceutical industry research, taking the state of the supply chain and the disruptions faced after this new crisis of COVID-19.

For the Methodology chapter (Chapter III) the mixed research method is done based on the experience and opinion of the focus population, such as students of the area, researchers, suppliers, and laboratory workers and then, the data of the questionnaires are analysed quantitatively and then followed with the qualitative research method for the interviews. This chapter is intended to seek to understand the opinion of the stakeholders in this biopharmaceutical industry and formulate an in-depth understanding of the supply chain environment, the responsiveness of the supply chain against disruptions and moments of risk,

the behaviour of suppliers based on the experience of stakeholders and the development of the procurement area. All this information provides a more detailed view of the current situation because it comes from the knowledge of the people involved in the industry and looks at how to apply a supply chain ambidextrous strategy to solve the unexplored relationships between suppliers and customers. It sustains answers both in exploratory and qualitative manners to better, an exploratory sequential design to provide a contextualization to our qualitative research.

Finally, Data Analysis and Results (Chapter IV) is aimed at analysing the data obtained from the questionnaires and interviews and organising all opinions into topics. It analyses the sample from which the information was gathered and studied across the focus group and its opinions. Its intended purpose is to study the results obtained through the answers given by the participants and then, compile them into main problems to be solved by the strategy of exploration and exploitation in supply chain ambidexterity.

And finally, the last chapter Conclusions (Chapter V) is dedicated to the conclusion of this dissertation, where the finding is discussed, and a method of organizational ambidexterity strategy is proposed to answer the hypothesis confirmed by the qualitative research. All the main topics gathered in the chapter Data Analysis and Results are also discussed in these findings' conclusion to pronounce the limitations of the study and some recommendations for the future.

CHAPTER 2

Literature Review

2.1. Organizational Ambidexterity

The contextualization of a globalized world connected by business competitiveness, in which the focus is value creation, cost management, response capability, flexibility, innovation, and service effectiveness, invokes the possibility of several studies due to the factors inherent to the industries in which they belong (Lamberts, S.W.J., 2005). This type of environment is affected by the strategies implemented by organizations, as is the power of those decisions made through the elements involved. Therefore, the main concept of organizational ambidexterity explores the existing duality in achieving its objectives depending on internal conflicts and the current market demand (Wirtz, J. et Zeithaml, V. 2017).

The authors Raisch, S. and Birkinshaw, J. (2008) refer that many successful firms are ambidextrous because they apply it in their organizational solutions and their environments. Many of the readings on the concept focus on the fact that they mostly treat an analysis of the relationship between organizational ambidexterity and firm performance. For this dissertation, a linear view is constructed with those of the authors.

Organizational ambidexterity is a prerequisite for ensuring the longevity of success and ensuring its interpretation through developed strategies without excesses. Because the notion of organizational ambidexterity can also be described as the range of organizational competencies that enable the firm to be able to work simultaneously with two contradictory activities (Petro, Y. et al. 2018). The core of studies to get to the definition of organizational ambidexterity has grown because of studies delving into the matter. Petro, Y. et al. (2018) continues their proposal of the definition of the concept as the experiences created through the tensions within organizations and the attempt to maintain the balance between the two contradictory natures of exploration and exploitation.

Then, there is the proposition that ambidexterity is associated with ambidexterity (Petro, Y. et al. 2018), and from this notion, three reasons why they substantiate this very argument have been developed. Starting with the notion that the projects inherent in companies are all focused on long-term transformation due to scarce resources. Because this process

transformation demonstrates a constant tension developed by the need for methodological practice versus the need for flexibility.

Then, these projects are understood by their temporary nature. And finally, the third reason is indicated by the process of elements within the project that are linked by their mutual interdependence.

2.1.1. Exploitation and Exploration in Ambidexterity

Ambidexterity arises from the need to be able to describe the trade-off between exploration and exploitation (Wirtz, J. et Zeithaml, V. 2017). According to Wang, Y. et al. (2021), a company that uses ambidexterity in its strategy tends to explore new opportunities while taking advantage of existing capabilities, such as its resources, and maintaining its competitive advantage, for its exploitation. While the concept of exploration seeks to innovate and create other opportunities to develop improved flexibility, as strategies go through phases of experimentation and discovery.

These two concepts are processes within the organization that works towards expected long-term adaptability, i.e., creating a perfect balance between the two sides of the organization. Thus, organizations utilize the advantageous sides that both concepts bring. It then becomes a primary indicator for the company to measure its performance in the market and instil a sense of survival against unpredictability (Page, S. B. et al 2021).

However, according to Kowalczyk, M. et al. (2015), achieving ambidexterity excellence is a constant challenge that researchers seek to address. The elements that analyse the processes related to exploration and exploitation in ambidexterity understand that decision processes are related to conflicting demand and their fickle nature, so it is necessary to structure dimensions that are flexible to their responses and to the possible tensions that are generated by uncertainty. Naturally, organizations seek strategies that benefit from and counter the possible risks associated with the surrounding process of exploration and exploitation.

Due to the different natures coming from a company that practices Organizational Ambidexterity, according to Page, S.B. et al. (2021), it has three associated conclusions related to the need for balance between processes. To begin with, the authors state that ambidexterity is positively associated with the performance of organizations that practice it. Secondly, the use of organizational ambidexterity practice has beneficial results for the firm only when there are sufficient resources to allocate the needs for uncertainty. And finally, the authors conclude that overuse, or lack of, ambidextrous practices can lead to certain costs within its environment. It is safe to assume that it depends on what type of industry applies this strategy, the outcome can

vary and affect all elements between production and service. Specifically, when analysing a Supply Chain environment.

2.2. Strategies for Supply Chain

In this chapter, the dissertation addresses some strategies aimed at the supply chain and which are fundamental studies related to the main theme. It seeks to substantiate, based on previous studies, the effectiveness of this type of strategy and what were their impacts and results. This literature review addresses some studies on ambidexterity applied to the supply chain, the concept of flexibility in the supply chain and, finally, how flexibility is impacted through an ambidextrous supply chain.

2.2.1. Supply Chain Ambidexterity

From the same logic applied before that, an organization should benefit from the processes installed by exploration and exploitation, scholars in the field of Operations Management state that an ambidextrous supply chain is born from the possibility of developing business relationships with its suppliers (Rha, J. S., 2013). This relationship is a lever of operational strategy to contribute positively to the performance of the organization against its competitors. Or even, a way to enable the development of supply chain capabilities where there are prominent levels of exploration and exploitation (Rojo, A. et al. 2018).

Supported by the study done by the authors Rojo, A. et al (2018), to follow up on the logic implemented, supply chain ambidexterity is multi-dimensional. Where its variables are independent but complementary. Thus, it is an expected outcome from the individual actions of the elements and the result of the organizational mechanisms (Raisch, S. and Birkinshaw, J., 2008).

In studies based on the organizational ambidexterity framework, a firm's performance is associated with indicators related to financial results, technological innovation, and strategies implemented due to the state of the supply chain and ambidextrous operations. This means that one of the relevant matters to the study of Supply Chain Ambidexterity is the environmental uncertainty and ability to improve flexibility to empower productivity. The supply chain relies upon the dynamic concept (Ocicka, B. et al., 2022).

One of the ways that are studied to measure the ambidexterity of an organization's supply chain is through the performance indicator. According to author Chen, Y. (2017), one of the reasons to motivate ambidexterity is to adapt structure incentives that can tolerate early failures and respond successfully overall. Being that one of the major challenges for the supply chain

to achieve its maximum performance is to anticipate all the risks involved in its environment. Employees must be willing to take risks in the initial stages of resource exploration, always aiming for the reward of long-term success and looking for great opportunities.

As the concept of supply chain ambidexterity is still something new, few studies delve into and argue for its application in supply chain management (Ocicka, B. et al, 2022). However, studies point to the dependence of manufacturers on responding quickly to market changes that can happen suddenly (Ocicka, B. et al, 2022), as well as achieving long-term efficiency gains.

The implementation of ambidexterity in this supply chain concept aims to help exploit existing resources for business purposes. Examples of such exploitation include qualifying suppliers and seeking innovative solutions that integrate the supply chain, such as negotiating costs with the supplier and reducing the risk of compromising production, and the overall efficiency of the chain. With the advancement of studies made to supply chain ambidexterity, it was also possible to identify that, chains with these characteristics, can modify the organizational environment and spot new customers (Ojha, D. et al. 2018). Therefore, this exploration is referred to as a range of practices that seek new solutions to existing problems in the supply chain.

2.2.2. Supply Chain Flexibility

There's no agreement in the same definition for the concept of flexibility because authors perceive it differently (Tiwari, A. K. et al. 2015). Though, Lummus, R. R. et al (2003) purpose a definition of the flexibility of a supply chain to be portrayed as the responsiveness of an organization, considering aspects such as its speed, distribution, and volume. Understanding its essence becomes vital to achieving organizational success because the responsiveness and agility of the supply chain are defined as a component of its flexibility. That is, as material moves during the supply chain is it from the supplier to the factory and consequently to the customer, the responsiveness of this supply chain must meet consumer demand. The supply chain must be flexible to possess the ability to increase or decrease its production capacity (Lummus, R.R. et al. 2003).

So much so that it is important to define the distinct types of flexibility inherent in each supply chain depending on the industry it is in (Stevenson and Spring 2007). The same authors have defined three generic principles to define the flexibility of any supply chain mentioning that flexibility is multidimensional, as well as the different existing types having different degrees of importance in the environments where it is inserted and, finally, flexibility does not need to be demonstrated.

The involvement of analysis of the components that integrate the supply chain makes an organization flexible and in turn offers an expansive view to others involved in the supply chain (Lummus, R. R. et al 2003). It is also important to understand that supply chain flexibility is essential for several reasons. To begin with, the authors Vickery, S. et al. (1999), clarify five existing types of flexibility.

First, *product flexibility* looks at the ability to adapt non-conforming products that are complicated to distribute because it considers the specifications requested by customers. Next, there is *volume flexibility*, meaning that the supply chain must have the ability to respond quickly enough to changes in demand and be able to speed up or slow down production without compromising customer demand and without incurring large financial costs. *Product introduction flexibility* is another type of measurement because it studies the organization's ability to introduce new products and the ability to replace old products on a large scale that have undergone changes or improvements.

Next, the authors mention *access flexibility* which consists of the ability to effectively provide supply chain distribution. And finally, the *market responsiveness flexibility* measures the market needs a response.

In the same study conducted by Vickery, S. et al. (1999), the authors concluded that, given the uncertainty present in supply chains, the performance of organizations is directly correlated to the five types of flexibility measurements. However, there is a long course of studies to support this theory and with the study of suppliers and the channels involved, it can be a key element.

Supported by the same theory (Lummus, R. R. et al. 2003), they prove the development of a new flexibility model where understanding starts from supply chain agility. Supported by a study conducted, the authors identify characteristics intrinsic to agility. The main factors that contribute to agility are:

- Market sensitivity, which studies the ability to read and respond to the market.
- Virtual capability, which comes from information rather than inventories.
- Leveraged through process integration, defined by the interactive collaboration between the partners involved.
- The leveraged partnership proves that taking advantage of the competitive advantages offered by the main partners attracts greater agility.

This flexibility and agility lead to the ability of firms to anticipate and predict the changing needs of customers (Lummus, R. R. et al. 2003). As a study within the supply chain, there is a proposal to analyse the supplier network and its flexibility. That is, the supply chain also must have flexibility in getting raw materials through its suppliers to complete its final products.

Therefore, suppliers in a supply chain are also equally important and their selection even more so. The firm needs to have an advantageous margin on which it can add or remove new suppliers that meet its production needs and volume changes (Lummus, R. R. et al. 2003). In an expansion of this argument of supply chain flexibility concerning its suppliers, the authors' Gosling, J. et al. (2010), support the theory that this supply chain flexibility should be supported through two instances identified as *vendor flexibility* and *sourcing flexibility*.

The former is identified by the authors as the combination of one or more vendors present in the supply chain that can provide flexibility in either production, transportation, or storage so that there is prominent buyer/supplier elasticity given the constant changes in the supply chain. While sourcing flexibility comes from the ability to reconfigure the supply chain effectively, in the shortest amount of time and at the lowest costs. This leads to the flexibility of partnering from a firm to be able to keep up with market changes and take precautions that long-term partnerships do not lead to rigid flexibility.

It is also important to mention that another element that is essential in sourcing flexibility is adaptability, which comes from the ability of the supply chain itself to restructure and modify its networks as a strategic measure to counteract technological developments and competing products.

2.2.3. Impact of Supply Chain Ambidexterity on Flexibility

The impact of exploration and exploitation is linked to the ability of a supply chain to be flexible. One of the requirements of understanding the concept of ambidexterity is that it is a combination between operational processes and prominent levels of efficiency that are accompanied by the flexibility to improve and evolve (Adler, P. S. et al. 2013). That is why it can be argued that there is a link between these two concepts and is supported by the authors Rojo, A. et al. (2015), who explain that ambidexterity proves a crucial element within an organization because it increases its survival in the face of market uncertainty and does not only focus on the positive impact it has on the elements of the company.

Through the collective pooling of experience, flexibility is produced from the feasibility of implementing operational processes based on efficiency (exploration) and innovation (exploitation). The creativity that flows between this sharing of experiences generates a

competitive advantage over competitors (Rojo, A. et al. 2015). Experience also teaches organizations how to act in the face of conflicts within the environment and how to neutralize them. The organization can get results in the form of new market opportunities and build an influence on the market and its evolution.

The theory supported by Adler, P. S. et al. (2009) indicates that it is through conflict that there is a learning curve to introduce variation to the organization's processes, the term for which is defined by deliberate perturbations. These disruptions can be addressed by organizations in a variety of ways.

These are through unknowing the problem or working around them and seeking to understand the root of it to understand its causes and implications. Therefore, organizations need to learn through perturbations and build stable processes to confront conflicts, as these demonstrate vital signs of learning. This ability is also seen as an adaptive characteristic that promotes existing exploration and exploitation in supply chain ambidexterity (Rojo, A. et al. 2015).

The hypothesis that supply chain ambidexterity has a positive impact on supply chain flexibility is reaffirmed by the argument of Rojo, A. et al (2015). To better understand its impacts, it is necessary to observe in what context it is happening, whether in the process of adopting structures that have worked in other companies or reproducing a strategy that has had a positive impact on the structure of the business.

2.3. Biopharmaceutical Industry Research

2.3.1. Supply Chain and its Disruption

As is foreseen in every supply chain of any industry, the need to build annual forecasts indispensable no matter what the industry is. Even more so in a case as specific as the supply chain of a biopharmaceutical. As predicted by the author Francas, D. (2019), one of the primary needs to understand in this type of supply chain are the special conditions attached to biological raw materials that have short shelf lives compared to other industries, such as metallurgy in which their raw materials are not subject to these types of problems.

The supply chain is then under enormous pressure to coordinate these short shelf lives with customer demand. These kinds of raw materials are under bureaucratic pressure and regulations to be met before reaching potential customers.

Author Ma, Y. (2011), mentions the relevant difference between the two types of biopharmaceutical and pharmaceutical industries being the molecular composition rather than the chemical components present in the latter industry. This same reason leads to much tighter

regulations because, at all stages of the production process, the raw material and its follow-up need constant regulatory testing to ensure the safety of the final product. Even more so, with the aspect that there is a limitation of the technology in the face of the biological properties of the molecules. Due to the intrinsic characteristics of the industry, the interest of organizations is to achieve a 100% service level because these are drugs that can save lives. Therefore, those organizations available to approach changes and modify their strategies will be able to achieve long-term success (Moosivand, A. et al., 2017)

In addition to the regulations associated with raw materials, there are regulations regarding the level of contamination of materials used in production. So much so that one of the crucial factors is disposable materials and the use of sterile material. It is because of these factors that any change in the supply chain regime is required to be documented and approved by the regulatory entities in charge. The complexity of this supply chain is due to the uncertainty of the processes (Ma, Y. 2011) and is what makes it different from the traditional pharmaceutical industry. One of the risks to recognize from biological medicine is that it must be transported and stored at low temperatures and in controlled environments because otherwise, it compromises its effectiveness (Ibrahim, T. and Araújo, C. A. S. 2021) and its entire batch is quarantined.

The entire distribution of the molecules has added excessive costs due to the mentioned characteristics because the distribution companies and the suppliers must guarantee their effectiveness until the moment they arrive in production. Any irregularity during their transport such as temperature changes within the controlled environments, the passage between different climates, and the time and duration of loading and unloading must be documented.

The company's external relations with its suppliers and distributors must be transparent because, due to new legislations caused by the disruption of COVID-19, the demand for logistics services has seen an exponential trend (Choi, T., 2021) and the development of recent technologies that allow for this tracing of temperatures and sterilization of material are crucial moments in the production process of biological medicines.

These new legislations have also brought a still undocumented disruption in the suppliers' hierarchy logistics to the companies that work directly with COVID-19. If there is no transparency in the delivery dates of production materials it can cause a huge disruption in the supply chain and delay the final product, thus harming the consumer.

Authors Ibrahim, T. and Araujo, C. A. S. (2021) mention that supply chain agility is one of the biggest competitive advantages, as is supply chain integration, transparency, and optimization effectiveness. But the important contribution of procurement to ensure the operational success of biopharmaceutical companies should also be mentioned.

The authors Musazzi, U. M. et al. (2020) point out two main reasons why medicines are unavailable for patients' consumption. One of the first factors is related to the supply, such as the impossibility of distribution, production impracticability, some problem in logistics and problems with the regulation of documents or standards. The other factor mentioned by the authors is due to demand because the market is unpredictable and one can see fluctuations in the demand for certain medicines, the existence of parallel markets and the prices charged.

Kaegi, D. et al. (2021) understand that one of the biggest fears of biopharmaceuticals is the reluctance to improve the area of procurement. The reasons companies base this fear of disruption on are the costs added to the different life stages of the product and any change in their supply chain means that the biopharmaceutical is forced to go through quality control again and the regulatory laws that are bureaucratically affixed. However, the same authors state that it is time for biopharmaceutical companies to make this change.

Then, in the article by Kaegi, D. et al. (2021) a model with five transformation themes is suggested for an example biopharmaceutical company, whose main objective is that it can improve its procurement area and improve supply chain. However, only the supplier management hypothesis will be explored, which is undervalued in the impact of procurement actions. To manage supplier relationships, you must start by categorizing them by distinct levels of importance and their hierarchy within the production requirements.

The authors suggest dividing into 4 different supplier segments:

- Enterprise: refers to the three to five most important suppliers to the company. These are the relationships closest to the biopharmaceutical company, where the relationship between executives should be a process of exploration and a priority to generate new opportunities for collaboration and knowledge. These two partners should regularly discuss their partnership and identify areas of focus for the co-development of the frameworks.
- Strategic: This refers to the following 10 to 20 suppliers that are used the most by the biopharmaceutical company and that have a stable and collaborative relationship, and whose mutual interests are in harmony. They should use this collaboration through contact and meetings where projects and metrics are discussed to adjust demand levels, inventory, and other important specifications.

- Core: In this segment, the company should place the other suppliers with whom they work regularly but are not considered major or long-term partners. This exploration process should be coordinated through their performance as a vendor, using indicators that measure their ability to deliver on time and their ability to supply.
- Extended Core: In the lowest of the segments, the company should categorize suppliers that are infrequent and are required in sporadic or low-volume cases.

CHAPTER 3

Methodology

3.1. Mixed Research Methods

A study done through a mixed methodology has the benefit of presenting the practicality of applying the intended philosophies (Subedi, D. 2016). That is, the use of the two existing methods of methodology, qualitative and quantitative, is primarily aimed at organising the different existing opinions to substantiate the study in question. However, in the case of this dissertation, the sequential exploratory method will be explored, whose design has its initiation in obtaining qualitative information and then the quantitative analysis of the opinions given.

One of the main functions of qualitative research is present in the advantages associated with the sociological aspect of humanistic interaction (Maher, L. and Dertadian, G. 2017) because it will be possible to obtain information from a population demonstration of interest in the research. This type of interaction of traditional sociology relies on seeking knowledge and learnings from its participants to understand the different perspectives that exist (Vishnesky, T. and Beanlands, H. 2004) before the same paradigm and topic of study for qualitative research. While the other type of methodology that exists, quantitative research, seeks to rely on analytical conditions and narrative construction through quantitative methods.

Especially when this qualitative study method remains a source of substantive information to expand scholars' knowledge. Therefore, there is a motivation on the part of different authors to expand their contribution in the face of this research method so focused on human communication and interaction. Author Arnett, R. C. (2017) reinforces the notion of the qualitative research method being the communicative activity of study. The activity assumes responsibility for participating in this human context of there being a predisposition to listen to individual experiences and build a scholarly foundation for the research topics.

Therefore, the designation of the qualitative method is associated with responsiveness. This human science is based on the principle of constant engagement with public opinion and its ability to provide a context for debate and sharing of opinions. Especially, when the context offered needs to understand the perspectives of the individuals within the context. Author Arnett, R. C. (2017) continues his proposed definition of this method by describing it as a way of advancing the human and natural sciences and offering a platform to the target audience without having consequences for fear of rejection of their individual opinions.

Finally, the dissertation also added the quantitative methodology method to add a more objective, rigorous, and systematic analysis for the study development (Sousa, V. D. et al., 2007). The use of this quantitative method is based on the study obtained by the qualitative acquisition of information.

3.2. Questionnaire Research

One of the ways to develop an exploratory method research study is in the form of questionnaires. This same example of an instrument for qualitative research is defined as the study aggregated to the masses through the observation of its individuals (Jansen, H. 2010) and then using an exploratory sequential method design for qualitative data collection and analysed through quantitative methods.

The study through questionnaires aims to gather as much information from a given population as possible to determine its main characteristics where the preference of qualitative research has as its function the discovery of the variety inherent in the population studied. Although there are not many studies on the role of questionnaires in qualitative research, author Jansen, H. (2010), states the interpretation of the analysis for explorative purposes and other experiences.

Often these types of questionnaires are used less formally in our day-to-day life. They only serve to measure the opinion of consumers before certain specific experiences for empirical research. During the construction of the methodological model for this dissertation, this research method was chosen to provide a better understanding of the state of the biopharmaceutical industry supply chain and its key participants. The questions are made with qualitative intention (such as opinions from the participants) and measured through quantitative methods, so an exploratory sequential design can be implemented, and the data analysed. Although it is an industry where the systematization of its tools is very present in the daily life of the stakeholders, there is little interaction between individuals and sharing of opinions to seek successful solutions and intervene directly in critical moments of the supply chain.

As there are few solutions present today for exploring new opportunities and exploiting existing supply chain capabilities, the survey aims to reach out to all those involved in the biopharmaceutical industry and promote a platform for sharing experiences. The experience of contributors in the field is needed to deepen the empirical issue surrounding supply chain flexibility and promote organizational ambidexterity through such exploration and exploitation. Experience is directly related to performance, another important aspect of this dissertation because experience depends on the behaviour of suppliers and how they act in critical cases in

the supply chain. Therefore, suppliers act as an important tool to sustain a flexible supply chain and, it is from the experience of employees or individuals connected to the industry, that a greater example of experiences can be obtained to practice solutions to outdated conflicts.

3.3. Research Interview

One of the most widely used methods for studying qualitative methods is the interview (Donalek, J. G. 2005). An interview is defined as the verbal exchange between two types of actors, the interviewee, and the interviewer (Rowley, J. 2012). Its main function is to gain another individual's perspective on a particular subject to understand their point of view. The interviewee is invited to speak openly about their beliefs and experiences in the business field. It is important to note that, depending on the type of study, the interviewer must choose an interviewee suitable for the research area to represent the industry being investigated.

To substantiate the question explored in the thesis about the state of the supply chain in the biopharmaceutical industry, it was in the interest of seeking better insight into the facts and knowledge of the opinions of the chosen interviewees. The benefits of this interview have as substantiating an existing problem in the supply chain and sought to highlight the associated good and bad experiences. It should be noted that interviews can be conducted individually, in groups or in focus groups. However, for a better analysis of the existing situation in the industry, the dissertation will be based on individual interviews.

For the author Rowley, J. (2012), there is an unquestionable difference between the execution of interviews compared to questionnaires. One of the great advantages of interviews is their ease of construction compared to the construction of a questionnaire, as the latter requires a high level of clarity in the questions in order not to mislead the audience. So, to summarize, the benefit of conducting interviews is that the research objectives are the experiences and opinions of the interviewees, there may not be enough information to conduct a questionnaire and lastly, individuals may feel more receptive to an interview than other research methods.

It is important to mention that the interviews will be conducted via email, and there will be an exchange of personal interactions due to the preventive measures executed in the biopharmaceutical industry environment after the events that followed COVID-19.

3.4. Research Methods Explanation

In short, the research methods used for this dissertation rely on the participation of a questionnaire that was answered by 45 individuals who performed responsibilities directly, or indirectly, related to the biopharmaceutical industry sector. This comprehensive questionnaire has the function of seeking a broad perception of the problem surrounding the industry. It is understood that the problem of suppliers in the biopharmaceutical area also addresses the needs of other areas connected to the production of the pharmaceutical industry. Therefore, suppliers design a hierarchy of the importance of needs to meet their customers.

The questions are asked in a succinct, performance rating and written elaboration for the development of the topic by the participants. The questionnaire is made entirely anonymous so as not to compromise its participants, it consists of 10 questions (both in English and Portuguese) and prevents people who do not work in the area intended for the study from answering. Then the questionnaire is closed for those participants but allows others to move on to more in-depth questions about the current state of industry supply chains and how the stakeholders are satisfied with the current performance.

As you might expect, it also has an appearance of a question related to the disruption and disruption caused by the appearance of COVID-19, due to the logistical problems that were generated through this natural disaster. The questionnaire directs a question to try to understand how the supply chain was disrupted because of this period. And, to discover the main suppliers associated with this industry, such as: *Thermofisher Scientific*, *VWR* and *Merck/Sigma Aldrich*.

After the exploratory sequential design method developed through the questionnaire, it was necessary to develop an interview that would ferment the previous opinions and build a sure link of the existence of the need to build a solution to the supply chain flexibility based on the existing crisis. The questionnaire was the starting research method to develop the content of the interview questions because it draws on the experience and opinions of a wider population base who have identified and agreed with the critical supply chain state. Then, through the opinion of individuals with a reputation in the field and their experience, the interviews were more plausible data to add due to the lack of investigation studies surrounding the subject in question. Since it still has recent repercussions, the subject is being developed in recent years as how's the state of the supply chain.

The interviews were conducted with individuals responsible for the biopharmaceutical industry to conduct a dialogue that exemplifies their personal experiences and opinions, without ever revealing their identity for reasons of anonymity.

The interviews were conducted in an electronic format to ensure compliance with tight standards and security protocols. The stakeholders can respond frankly to the research questions and further the case study. The interviewees belong to the company where it accepted that this dissertation is studied in which their questions were related to the area where they work, but directed to the issue of supply chain flexibility, its problems, possible resolutions already executed through experience, the disruption of COVID-19 and some problems faced with current suppliers, as well as the contact relationship with them. In this way, the perspective is broadened and substantiates the argument of the need for organizational ambidexterity to exist to exploit the tension created by the firm's exploration and exploitation.

3.5. Research Investigation Questions

With this came the need to formulate research questions for the dissertation to measure the existing opinions in this industry. Based on the construction of the literature review and all the concepts addressed in the chapter of this dissertation, the main objective is to understand how organizational ambidexterity possible solutions must improve flexibility in a supply chain in the biopharmaceutical industry and formulate research questions that are addressed, both in the questionnaires and in the interviews. Therefore, in summary, the proposed questions for the continuation of this research follow:

- i. How is the state of exploration and exploitation of suppliers and their performance?
- ii. What are the types of strategies used by firms to improve supply chain flexibility?
- iii. What was the level of impact of COVID-19 on the biopharmaceutical industry and suppliers?

CHAPTER 4

Findings and Analysis

4.1. Findings

4.1.1. Through Surveys

The scope of the questionnaire seeks to establish a direct relationship with individuals working in areas related to the biopharmaceutical industry. Of the 138 correspondents, counting those involved in both the English and Portuguese questionnaires, they were briefly asked for their primary data such as age and profession to understand the demographics installed in the focus group.

Next, the questionnaire proceeds to question the same stakeholders with the core decision of this qualitative research method, asking if they have direct or indirect contact with the intended area of the study. If the respondents answer “no”, then the questionnaire ends for those individuals because they do not meet the satisfaction requirements for the target audience of this dissertation. Of all the correspondents who took intervention in the questionnaire, only 45 are individuals of interest to the study going forward and represent 33% of all participants. Therefore, only the response of these 45 individuals will be counted on to move forward with this project.

Age	Frequency	Per cent
18-24	54	39%
25-34	63	46%
35-44	15	11%
45-54	4	3%
55-64	2	1%
65+	0	0%

Table 1: Surveys' Participants Age

From the survey we sought to understand the demographic that showed interest in answering these 10 questions, having 1 supplemental question for individuals to add any information that was pertinent to the study.

Hereby, we can conclude that the installed demographic is mostly young (*Table 1*), having the highest percentage of the study, counting for 39% and 46% of the respondents between the

ages of 18-24 and 25-34 respectively. But there is also an older demographic, which is considered a smaller percentage relative to the previous demographic. There's also factual participation of individuals with older ages ranging from 35-44 (11% of the 138 participants), ages 45-54 (3% of the 138 participants), and finally 55-65 (1% of the 138 participants). But none with ages older than 65 years old.

Occupation	Frequency	Per cent
Student	42	30%
Worker	73	53%
Student and Worker	23	17%

Table 2: Surveys' Participants' Occupation

Next, the survey aimed to analyse the occupational status of its participants (*Table 2*), understanding that 30% of its respondents are students, 53% are workers, and 17% have the simultaneous role of a student worker. This question aims to understand the level of involvement of its participants and their perspective if they are related to the industry under study, and whether they are complying and overcoming the same difficulties.

Related to the Biopharmaceutical Industry	Frequency	Per cent
Yes	45	33%
No	93	67%

Table 3: Question from the survey "Have you ever worked directly, or indirectly, with the biopharmaceutical industry?"

Then, the questionnaire comes to the impasse of taking the measure to establish the dissertation's focus group and seeking to understand its main criticisms through the industry's experience and performance vis-à-vis its functions linked directly or indirectly to biopharmaceutical or similar areas. Quickly, the focus group was found to be 45 of its participants corresponding to 33% of the population size (*Table 3*). The remaining 93 participants were those who never had any interaction with the area of interest.

4.1.2. Through Interviews

Interviews are a qualitative method to present empirical social data to develop the theme of the dissertation. The participants of the interviews are 2 individuals from a national biopharmaceutical company who work in operational and production support areas. It is also important to announce that the research field of both participants is within the same national company, whose responsibilities are directly related to the research theme of the dissertation.

The first interviewee holds the position of Production and Operations Director, where he deals directly with critical production gaps and is responsible for maintaining a rotating inventory planned to meet annual needs. While the second interviewee plays the role of Production Support Team Manager, where his responsibility is to plan the preparation of equipment, either calibrations or cleaning, as well as the preparation of solutions to be used in the production line.

4.2. Analysis

In interpreting data, the dissertation seeks, in exploratory sequential design and qualitative research, to try to aggregate the focus group's (the students, suppliers, laboratory workers and those involved in the biopharmaceutical industry process) opinions into more simplified sections to find the common critical points across all their experiences.

4.2.1. Data Analysis from Surveys

In interpreting data, the exploratory sequential design tries to aggregate the focus group's (the students, suppliers, laboratory workers and those involved in the biopharmaceutical industry process) opinions into more simplified sections to find the common critical points across all their experiences. This exploratory method is used as a tool to support the fundamentals of the dissertation and to suggest possible implementations after the analysis of this data. To this end, the following survey questions were based on the indicators of performance, experience, and opinion.

Supply Chain Flexibility	Frequency	Per cent
1 – Not Flexible	0	0%
2 – Needs to be Flexible	15	33%
3 – Flexible	27	60%
4 – Bit Flexible	3	7%
5 – Very flexible	0	0%

Table 4: Question "How do you rate the flexibility of the supply chain in this industry? And why."

The topic of supply chain flexibility (Table 4) in the industry the participants are in is introduced. The main objective is to establish a reference point of supply chain flexibility and how it affects production and its stakeholders. None of the focus group respondents assumed that the supply chain was flexible, but 15 respondents (33% of the 45 accepted participants) stated that there is a need to make it flexible to suppress its needs. A large part chose to say that

the supply chain is flexible and not very dissatisfied with the state of the supply chain, which is the response of 27 respondents (or, 60% of the 45 participants). And finally, only 3 focus group participants came forward with the good flexibility option. But none prove to be satisfied with their flexibility in its entirety.

COVID-19 Impact	Frequency	Per cent
1 – Not impacted	0	0%
2 – Little impact	1	2%
3 - Impacted	4	9%
4 – Somewhat Impacted	13	29%
5 – Very Impacted	27	60%

Table 5: Question "Rate the impact of COVID-19 as a disruption in this industry in your experience?"

Next, one of the essential questions for the functioning of the supply chain today is to confirm the impact of COVID-19 on the global supply chain, not only in the biopharmaceutical and pharmaceutical industry. There is a unanimous opinion among all the participants (*Table 5*) that it is possible to state one of the topics of this research relating to, whether small or large, the impact of COVID-19 on the supply chain of the materials has been compromised.

Respondents (*Table 5*) were suggested to argue their assertion to extend the factor of the experiment. None believe that the industry hasn't been impacted by COVID-19. Only 2% (1 of 45 participants) believe that there has been a small impact on the industry while the rest believe that there has indeed been a relevant impact. One of the most alarming percentage factors is the "very impact" factor which reached 60% of the respondent's opinions or 27 of the respondents. It is also important to mention that the data aggregated in the open question, following up on this question, was aggregated in a simplified way to discuss the main problems and make an association with the complications and ramifications of the conflicts.

To continue the thought process of the dissertation, it was in the research interest to further explore the topic of procurement exploitation within the supply chain area. This question (*Table 6*) aims to examine the state of exploration and the tension applied in it with existing capability practice and whether there is an opportunity to explore other types of innovation for the supply chain.

Exploitation of Procurement	Frequency	Per cent
1 – Not explored	1	2%
2 – Needs Improvement	18	40%
3 – Explored	26	58%
4 – Exceeds Improvement	0	0%
5 – Well Explored	0	0%

Table 6: Question "Rate the exploitation of the Procurement area in the biopharmaceutical industry."

Only one respondent stated that there is no exploration of procurement in this area, which pondered a few moments of reflection to seek his such negative opinion (Table 6). Whereas most of your questionnaire participants present a unanimous opinion and experience. Considering that 40% or 18 of its participants believe that the area needs to be explored to gain competitive advantage and the remaining 56% represent the opinion that it is an area that is already explored but does not fully meet the existing needs. This suggests a deeper thought to try to understand the lack of interest in this very important department to assist the production and supply chain. One of the open-ended question questions sought to categorize the industry's top vendors and understand why most of the industry relies so heavily on these major market players. Since, if this supplier encounters an inventory shortage, it will chain affect the entire supply network connected to them. Thus, causing a cascading effect.

The stakeholders themselves, then, were approached to evaluate their suppliers' responsiveness and their ability to solve unforeseen problems (Table 7). The goal of this question is to seek to understand the level of performance of these suppliers to ensure that products reach their customers without significant delays or influencing production status. Because a collective experience will obtain enough data to analyse the state of the market.

Suppliers' Performance in Solutions	Frequency	Per cent
1 – Awful	0	0%
2 – Bad	3	7%
3 – Not Bad	32	71%
4 – Good	10	22%
5 – Very Good	0	0%

Table 7: Question "How would you describe the ease of solving unforeseen problems with your current suppliers?"

Considering that some participants in this questionnaire (*Table 7*) are also employees within supplier companies for materials, it was also possible to get an inside view of these same companies. Without a demonstration of great displeasure towards the suppliers, none of the respondents evaluated the suppliers' provision of solutions very negatively. However, there is a small percentage of 7% (3 out of 45 respondents) of those who are frustrated with the way these suppliers handle unforeseen problems.

The other part, 71%, which refers to 32 participants, are satisfied indifferently and consider this solution to unforeseen problems as average. While the remaining 22%, or 10 of the participants, evaluate the suppliers as good helpers in critical moments.

To conclude the survey, the participants were given an optional and voluntary choice to add some relevant content to the study of this dissertation. Although one of its participants put in context the specification of this questionnaire, it refers to the cause that few participants will have the opportunity to elaborate and foment their general opinions. The same participant admits that few will be able to answer without speculation.

Therefore, there was a need to form a focus group to advance these very technical issues embedded in the labour market, or even research because it is encountering the same problems in research laboratories. Meanwhile, in sum, most of the participants who chose to fill this small suggestion area, also mentioned the competition existing between the international and national supply chain due to its accessibility but compromising the organizations due to the suppliers' pricing practices and their quality.

4.2.2. Data Analysis from Interviews

Interviewee 1 – Director of Production and Operations

To analyse further the study of qualitative research through interviews, it was possible to interview a Director of Production and Operations of a Portuguese biopharmaceutical company and offer a platform to explore the topic in question and especially the problems surrounding it. It is important to get the experience of individuals in the industry and get a real perspective on the critical moments of drug production.

According to this interviewee (see Appendix 2), the main challenges facing suppliers are directly linked to delivery times. There is a constant concern on the part of Production to ensure that the materials arrive on the intended dates. One of the examples given by the same interviewee mentions the incident by a particular supplier, in which the delivery date was pulled from month to month and endangered the guarantee of the production line. One of the proposed solutions from the shared experience was to contact the supplier and ensure the importance of

meeting delivery deadlines, i.e., transparency of commitment. Another challenge mentioned is the response time by suppliers, where there is a need for a platform intended for technical issues and sometimes the response time is quite long.

The same interviewee (see Appendix 2) shows a good understanding of the importance of the company's relationship with its suppliers. Due to their experience, the interviewee understands that the dimension related to innovation and technology influences the suppliers he works directly with. The specificity of the materials becomes a challenge for him because they narrow the range with the possible number of suppliers he can turn to. However, the reality of the company shows something in common with other companies in the same industry, the suppliers find it very difficult to meet delivery deadlines and to commit to respecting them.

Having the position and the responsibilities to fulfil, one of the questions tried to understand what the most relevant characteristics of a supply chain are, and the quality of the product and its transport, short delivery times, and meeting the agreed deadlines were mentioned. These characteristics contribute to the successful performance of the company because it is possible to assume the quality of production and compliance with deadlines agreed with the customers themselves. It is necessary to ensure that the raw materials have certain characteristics “quality (purity), potency, and sterility” as quoted.

Finally, the interviewee shared the experience of the impact of COVID-19 on the supply chain that was unprepared and proved to lack flexibility because the need to purchase disposable personal protective equipment and, specifically, raw materials and disinfectants were all constrained for industries that worked directly with the production of the virus vaccines. This problem persists these days and one of the solutions was to increase the level of stored inventory, or volume flexibility, to guarantee future months of production.

Interview 2 – Production Support Team Manager

The last experience shared through an interview for this research was the opinion of a manager responsible for the biomedicine production support team. To better interpret the interest of his experience, the interviewee works directly with the material needed for production, such as ensuring the sterility of the material, disposables, uniforms, solutions, etc. and has direct contact with the supply chain such as establishing relationships with suppliers. The interviewee (see Appendix 3) mentions that there is a lack of communication between organizations and suppliers, the latter being one of the biggest culprits for the lack of communication. Attempts at contact prove futile because there is no return and the lack of

inventory to be able to supply the company. One of the interesting comments to reveal is that this interviewee has no specific experience to rely on for solving the problems.

The same interviewee mentions that the current relationship of the main suppliers is distinguished by their national or international headquarters. Therefore, the comment reveals that there is a greater concern on the part of national suppliers in establishing lasting relationships with their customers. Many of them opt for face-to-face meetings to seed this partnership and to better understand the organization's needs and develop a better service. None of these suppliers was prepared to maintain their performance in product and volume flexibility due to short-term increases in demand and sacrificed their level of excellence. As mentioned by the interviewee (see Appendix 3) having a quick service, seeking to meet customer needs, and inventory control are all factors in keeping the customer satisfied.

Finally, the importance and delicate nature of biological raw materials and the inability to extend deadlines due to time constraints are mentioned. The lack of material has a negative association because it has a direct impact on the effectiveness of the raw material. Therefore, the interviewee mentions that the measures implemented to ensure that there is no inventory shortage were long-term planning and purchasing of the material considering the shelf life of the raw material.

4.3. Discussion and Categorization

After all the opinions and experiences obtained from the questionnaires and interviews, it was necessary to aggregate all the information into some interesting topics to discuss in the conclusion. This is because to apply an organisational ambidexterity strategy in the supply chain it is necessary to understand what the most critical problems are and formulate an exploration and exploitation of capabilities and search for new opportunities. So, we can categorize the results as follows:

- *Missing Materials*

One of the main problems encountered through this questionnaire and interviews is the constant lack of materials in production. Many of the raw materials, consumables, and own equipment are in shortage and sometimes out of stock both in the organization and at suppliers. This problem causes the industry to be unable to produce and may lead to its possible collapse by bringing its operations area to a halt. In the healthcare industry.

One of the case studies, Mekel, C. et al. (2013), refers to a specific case where a company encountered a problem with material shortages and an inventory shortage. The chaotic situation meant that patients dependent on these drugs were at risk of not getting the right medication,

and prescriptions were not allowed by doctors because there was not enough supply for the existing demand. This problem caused the management team to explain to its consumers the displeasure caused by the impossibility of delivering the medications and committed itself not to repeat the same mistake. Following the logic of this dissertation, one of the solutions found was directed at its main supplier.

Many of the answers obtained in the question of identifying the main problems that lead to the critical points of production advanced the same concern of the lack of products. Workers from a national biopharmaceutical company, who chose to remain anonymous for confidentiality reasons, advanced this issue of concern and expressed the need for essential materials such as alcohol and masks. Materials that are used daily by everyone in this field, whether in a research laboratory or the factories themselves and their employees.

Also mentioned by your stakeholders that the impact of COVID-19 developed and aggravated a problem that had been lingering due to logistical issues. With the shutdown of all production globally, many of the raw materials and consumables became unavailable for immediate delivery to sectors that were not related to the front line against COVID-19 or investigations related to it. This spike in demand among all biopharmaceutical producers brought a surplus to the existing short supply. No company within this industry was prepared for the disruption this would cause in the supply chain and chose to practice unconventional measures such as ordering excess inventory.

- *Delivery Time Inconsistency*

The cascading effect from excess demand to short supply has harmed the expected delivery date of materials. As many companies in the industry and the like were essentially looking for the same materials to continue to perform their functions, it led to the collapse of the logistics network itself. The suppliers played a mediating role between their consumers and the material factories to try to establish a contact in business relations to appease the discontent installed in their consumers. Often the main suppliers are in daily or weekly contact with their customers, but they cannot avoid the hierarchical form of supply.

One of the solutions practised by most producers in biopharmaceuticals was to respond to this problem with an excessive inventory stockpile. In the event of a similar situation occurring and without management strategies exploited by biopharmaceuticals, many operators found themselves forced to carry out unconventional and financially debilitating processes within the company. Because, in addition to the rising prices of this poorly regulated market and the practice of exorbitant pricing by international competitors for having a competitive advantage,

companies have been forced to place large inventory orders to combat inconsistent delivery dates.

One of the most important issues to combat this critical problem is that even the suppliers themselves cannot give precise dates for the delivery of the material and it becomes a vicious cycle.

- *Product Spoilage*

One of the processes to perform any exercise in biopharmaceuticals needs Good Manufacturing Practices (GMP). This concept, according to author Mostafa, E. (2017), consists of the basic measures of production, process, and packaging of any biopharmaceutical product. This process has as a measure to certify that the biological product guarantees safety, purity, and potency. Therefore, many factors can influence the microbiological status of raw materials due to their sensitive nature. The products inherent to the industry depend on several factors that influence their market potential. One of the factors that expose the downside of stockpile orders is a simple fact that these are organic raw materials. There is no scientific way to ensure that products maintain their viability infinitely.

Therefore, expiration dates are too short to ensure that all GMP standards are met. In addition, the materials associated with the construction of the drugs also have volatile expiration dates that are a major problem for the industry. Financially, it becomes unfeasible to order large batches of materials because spoilage is inevitable.

It is also important to ensure that the process of moving raw materials is never compromised. These are costly processes on a monetary level because many materials are transported under special conditions, such as the case of packaging and storing microbiological cells, and any changes in their behaviour are quarantined to dispense with their use because it can compromise the effectiveness of the drug.

- *Internal Politics*

The bureaucratic processes associated with the biopharmaceutical industry are a major impediment to establishing more partnerships with more suppliers. Only compliance with GMP standards ensures that the core of suppliers is small, and they become vital to the smooth running of production. the type of process is associated with the approval of suppliers with the identified standards, where the relationship is established by way of partnership. However, the supply hierarchy becomes a competitive barrier for small companies compared to larger companies. This causes a small disruption and a big problem to supply also small competitors, which are sometimes essential in the market.

- *Productivity Efficiency*

One of the proposed problems post-COVID-19 pandemic is remote work. One of the correspondents in the questionnaire mentions the disruption caused to the supply chain after the remote work policies because it is an experience coming from the impact caused by COVID-19. Workers are a labour force in short supply and with the possibility of this work method, they cause a new dynamic in the production methodical process in a biopharmaceutical company. Even mentioning the loss of control by the supply chain, the existing variance causes instability of worker turnover.

Employees have the freedom to establish their wills, without compromising their organizational goals. However, with the nature of the face-to-face work required to contribute to the supply chain coordination function, it becomes a less appealing type of work for the masses. The effectiveness of productivity is compromised by these aspects as well as all the problems mentioned above. This volatile nature and fickle variance become a challenge for scholars and field workers.

The decline of the task force at the time of the COVID-19 epitome is demonstrating the gravity of the current day. Factories cannot guarantee productivity because there is a shortage of materials, and there are no skilled workers because field expertise has been assigned to other branches with urgency, namely hospitals and virus research. And this productivity effectiveness has also been affected due to the protocols applied in differentiation between national and international trades due to the standards they require to ensure compliance with the installed standards.

CAPÍTULO 5

Conclusion

5.1. Synthesis and Final Aspects

Throughout the construction of this dissertation, it is possible to substantiate the suggestion of a new strategy within the internal system. The management measures in this industry are outdated and ill-prepared to foresee, or worse, come up with effective solutions to combat disruptions in the industry's supply chain. An organization needs to have a clear picture of its business plan and actively follow its business vision (Al-Fawaz, K. et al., 2008). To do this, it should seek to install secure management support that is in constant interaction with the different elements of the organization.

The concept of Organizational Ambidexterity identifies the dimensions of technology, processes, behaviours, and knowledge (Petro, Y. et al., 2018) to be exploited by organizational competencies. In the biopharmaceutical industry, a major breakdown and lack of preparedness of its stakeholders for disruption as chaotic as the nature of COVID-19 was identified. The instability caused referred to unconventional practices in this industry and the lack of management expertise proved a problem of interest to be explored.

To start a strategy implementation process to improve the flexibility of a supply chain in this kind of industry one must also take an interest in procurement from the data gathered. Suppliers are important elements in the business success cycle for any organization and maintaining good relationships and business networks within the circle are considered a competitive advantage. The authors Al-Fawaz, K. et al. (2008) argue that the first step in the successful strategy implementation of any project is conceptualizing its objectives and detailing ways to achieve them. These same objectives should be composed in the view of perspective, cost, and time.

Considering these aspects mentioned above, the implementation of an ambidexterity strategy in a national company, which decided to remain anonymous for the development of this thesis, will be the analysis of the critical points found in the qualitative research of the data.

It was possible to state with the survey and interviews that all the stakeholders involved do understand the importance of a good environment in the supply chain and its' actual problematic state.

One of the major problems that the biopharmaceutical industry, be it national or international, is the fact that there is an excessive demand and the impossibility of suppliers maintaining a healthy supply chain to ensure that their customers are satisfied, based on the answers obtained through the research methods. By the answers given in both research methods, it was possible to conclude a lack of exploration and exploitation of suppliers and how poorly those were performing. In other words, the lack of flexibility becomes a major problem to be solved. So, one of the suggestions for implementation to increase the efficiency of the department responsible for direct contact with suppliers is to establish a very transparent decision structure with clear rules about buying and selling materials (Kaegi, D. et al., 2021), since the strategies applied to increase flexibility were to order in large quantities disregarding the costs associated.

After the COVID-19 crisis and its worldwide disruption, the answers given in the qualitative research proved a significant impact and it caused a lack of availability of raw materials and production materials. The different lead times of materials needed for production will have to be analysed depending on the information given/updated by suppliers, which makes previsions harder to make. A mapping that integrates a solution as simple as looking for a secondary supplier, which also is accredited by the same standards as the main supplier, is one of the solutions offered. Something as simple as a search for national suppliers of face masks can lead to a new loyal relationship in which it is possible to negotiate the cost of the material through a planned purchase. However, this is unlikely when you are dealing with international suppliers and there are larger companies in the market.

The access to answers given by the focus population it was confirmed, that there's a need for a dedicated procurement team to achieve levels of flexibility in the supply chain using the tension present in exploration and exploitation in organizational ambidexterity since it's still badly exploited. Using this opportunity-seeking strategy of ambidexterity supply chain and utilizing existing capabilities relates to the organization's interest in management because it can segment priorities. Where the maturity can be exploited in existing opportunities and contribute to the exploration tension where changes can cause more benefits to the company.

In the same thought of exploring the existing tension of exploration and exploitation in organizational ambidexterity, implementing this concept in supplier management has the advantage of exploring the existing capabilities of its suppliers and categorizing them by interest and dependence based on their importance. The main suppliers in a national company located in Portugal must be explored for their level of complexity of materials supplied and

explore an aspect where lead times are shorter than the intentional suppliers that exist as an option.

In this case, the segmentation of suppliers by order of performance and capability of building a transparent relationship with these same suppliers and the stakeholders. This way, the distribution hierarchy made as a measure of urgency by the suppliers becomes visible to the company and it can build more detailed forecasts of its materials. The right decisions are guaranteed by experience, and the implementation of new strategies that seek to solve the major problems of flexibility in the supply chain are overcome by the expressed opinion of those involved.

5.2. Limitations and Further Research

For future reference, one of the important aspects to substantiate the argument of this practice of exploring and exploiting tensions in supply chain ambidexterity and flexibility would be the construction of a quantitative methodology with logistics management processes. The first limitation is about how little knowledge there is on the theme of this dissertation and the severity of its long-term extension, yet it is possible to witness its conflicts today.

It is an area with little scientific study related to management, so biopharmaceuticals would benefit from the inputs studied by existing strategic practices and possible solutions for the relief of the chaotic behaviour of disruption. Also, the industry could benefit from a detailed study of the internal situation of biopharmaceutical suppliers and the damage caused financially to the companies' economies. Many of the scientific articles are recent and there is speculation about possible future scenarios. The future is still uncertain, and the scarcity of materials continues, seeing the gravity of establishing order in the supply chains. For these reasons, it is of interest to broaden the research and compare the different arguments of the researchers.

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Attachments

Appendix 1. Questionnaire

Supply Chain and Suppliers in Biopharmaceuticals

Summary: Hello, my name is Inês Faria and I'm a 2nd-year student of the master's in management of Technologies and Services, at ISCTE-iul. My dissertation topic is focused on the exploration of the current suppliers of a biopharmaceutical company to identify the existence of flexibility and critical points in the supply chain and logistics to avoid possible production delays. For this, it will use a strategy model suggested by organizational ambidexterity that focuses on exploring new opportunities to maintain its competitive advantage. In this case, the suppliers.

Questions:

1. Age
2. Occupation
3. Have you ever worked directly, or indirectly, with the biopharmaceutical industry?
4. How do you rate the flexibility of the supply chain in this industry? Being, 1 not very flexible and 5 very flexible.
5. Identify the main problems that lead to critical production points in the supply chain view.
6. What was the impact of COVID-19 as a disruption in this industry, in your experience?
 - 6.1. Why? (Concerning the previous answer)
7. Rate the exploitation of the Procurement area in the biopharmaceutical industry. Being, 1 little explored and 5 very well explored.
8. Having experience with the area, what are the main material suppliers you can identify?
9. How would you describe the ease of solving unforeseen problems with your current suppliers? Being, 1 the suppliers are not helpful, and 5 the suppliers' service is exemplary.
10. What other reasons would you like to add to this study?

Appendix 2. Director of Production and Operations

Perguntas para a entrevista

Sumário: O meu tema de dissertação foca-se na exploração (exploration) dos atuais fornecedores de uma biofarmacêutica para identificar a existência de flexibilidade e pontos críticos na cadeia de abastecimento e logística para evitar possíveis atrasos na produção. Para isso, irá ser usado um modelo de estratégia sugerido pela ambidestria organizacional que se foca na exploração de novas oportunidades para manter a sua vantagem competitiva. Neste caso, os fornecedores.

Olá, o meu nome é Inês Faria e sou aluna de 2º ano do Mestrado de Gestão das Tecnologias e Serviços no ISCTE-iul. Esta entrevista é realizada no âmbito da minha tese para pesquisa qualitativa de dados, onde o tema é “Ambidestria Organizacional e a Flexibilidade nas Cadeias de Abastecimento de Empresas Biofarmacêuticas”.

1. Poderia contar qual papel desempenhava e as suas funções que praticava na empresa?

“A pergunta está no passado, pelo que não sei se a pergunta se aplica a algum período temporal específico. Neste momento sou o Diretor de Produção e Operações de uma Biofarmaceutica Nacional.”

2. Ligado ao Procurement (relações com os fornecedores), quais foram os principais desafios enfrentados por si?

“Neste momento, os principais desafios são o cumprimento por parte dos fornecedores dos prazos de entrega. Também o tempo de resposta de alguns fornecedores a dúvidas técnicas é, para alguns fornecedores, bastante longo.”

3. Consegue mencionar uma experiência anterior para a resolução destes eventuais conflitos previstos? Exemplifique sem mencionar nomes por motivos de confidencialidade.

“Um material produzido apenas por um fabricante e necessário para um processo de fabrico, cuja data de entrega foi se alterando mês após mês, colocando em risco a continuidade da produção. Foi necessário escalar o assunto junto do fornecedor, referindo a importância do cumprimento dos prazos de entrega assumidos de forma a obtermos um compromisso por parte do fornecedor quanto às datas de entrega assumidas.”

4. Como descreve a relação atual com os principais fornecedores da empresa?

“Alguns mais difíceis do que outros. Tendo a GenIbet uma variedade de fornecedores muito grande, há relações boas e outras menos boas. Devido ao tipo de tecnologia e

inovação com que trabalhamos, por vezes, por falta de alternativa, não podemos abdicar de trabalhar com alguns fornecedores e a gestão destes fornecedores por parte da empresa requer uma atenção e dedicação muito grande por parte da empresa.”

5. Como identifica o desempenho dos fornecedores?

“Mais uma vez, sendo a variedade grande, temos fornecedores com bom e outros com menos bom desempenho. Neste momento, praticamente todos os fornecedores estão com dificuldades em ter prazos de entrega razoáveis e a cumprir os prazos de entrega assumidos”

6. Quais são as características mais relevantes da cadeia de abastecimento para si?

“Qualidade (do produto e do transporte), prazos de entrega curtos, cumprimentos dos prazos assumidos.”

6.1. Porquê? Referente à pergunta anterior.

“Aspetos relevantes para o que produzimos (qualidade) e para o cumprimento dos compromissos assumidos com os nossos clientes.”

7. Agora falando em matérias-primas, quais são as principais preocupações quando lidam com a matéria biológica?

“Qualidade (ex. pureza), potência, esterilidade.”

8. Quais foram as principais disrupções que o COVID-19 trouxe para o seu trabalho?

“Dificuldade na aquisição de equipamento de proteção individual, bem como de muitos materiais e matérias-primas e desinfetantes (ex. álcool) que estavam a ser canalizados apenas para a produção de vacinas para o COVID-19.”

9. Que medidas de prevenção foram feitas para assegurar a chegada dos materiais necessários à produção?

“Aumentar os stocks armazenados para permitir ter em stock quantidades para mais meses.”

Muito obrigada pela atenção!

Appendix 3. Production Support Team Manager

Perguntas para a entrevista

Sumário: O meu tema de dissertação foca-se na exploração (exploration) dos atuais fornecedores de uma biofarmacêutica para identificar a existência de flexibilidade e pontos críticos na cadeia de abastecimento e logística para evitar possíveis atrasos na produção. Para isso, irá ser usado um modelo de estratégia sugerido pela ambidestria organizacional que se foca na exploração de novas oportunidades para manter a sua vantagem competitiva. Neste caso, os fornecedores.

Olá, o meu nome é Inês Faria e sou aluna de 2º ano do Mestrado de Gestão das Tecnologias e Serviços no ISCTE-iul. Esta entrevista é realizada no âmbito da minha tese para pesquisa qualitativa de dados, onde o tema é “Ambidestria Organizacional e a Flexibilidade nas Cadeias de Abastecimento de Empresas Biofarmacêuticas”.

1. Poderia contar qual papel desempenhava e as suas funções que praticava na empresa?

“Sou responsável pela equipa de suporte à produção de biomedicamentos, que é composta por 7 operadores, que garante todo o material estéril, descartáveis, fardamento, soluções, descarte de resíduos para as operações da empresa, além da limpeza e desinfecção das salas limpas e áreas comuns.”

2. Ligado ao Procurement (relações com os fornecedores), quais foram os principais desafios enfrentados por si?

“A falta de retorno às tentativas de contato, como ligações e e-mails, e falta de estoque.”

3. Consegue mencionar uma experiência anterior para a resolução destes eventuais conflitos previstos? Exemplifique sem mencionar nomes por motivos de confidencialidade.

“Não consigo mencionar nenhuma experiência específica.”

4. Como descreve a relação atual com os principais fornecedores da empresa?

“Aqueles que tem distribuidores em Portugal, por termos mais contato, até mesmo presencial, percebemos mais disponibilidade e, conseqüentemente, mais envolvimento com as nossas preocupações, e sempre fazem o possível para cumprimento de prazos e a manutenção de estoque. Muitos querem conhecer a empresa, perceber nossas necessidades atuais e futuras, para um melhor atendimento.”

5. Como identifica o desempenho dos fornecedores?

“Os fornecedores da área farmacêutica não estão preparados para lidar com aumento de demanda a curto prazo, poucos são os que querem entregar um serviço de excelência.”

6. Quais são as características mais relevantes da cadeia de abastecimento para si?

“Rapidez no atendimento, preocupação com a satisfação do cliente, manutenção do estoque.”

6.1. Porquê? Referente à pergunta anterior.

“Porque quando temos fornecedores com estas características temos um cliente satisfeito, o que garante o sucesso para ambas as partes.”

7. Agora falando em matérias-primas, quais são as principais preocupações quando lidam com a matéria biológica?

“Material biológico não espera. Por isso, o tempo é precioso. Faltar material e não ter um fornecedor envolvido e preocupado com isso é extremamente preocupante.”

8. Quais foram as principais disrupções que o COVID-19 trouxe para o seu trabalho?

“Rotura de estoque, o que impactou no planeamento e entrega de lotes.”

9. Que medidas de prevenção foram feitas para assegurar a chegada dos materiais necessários à produção?

“Planeamento mais a longo prazo e aquisição de material atempadamente, desde que garantida a validade longa destes materiais.”

Muito obrigada pela atenção!