

Department
of Business and Management

Course of Corporate Strategy

Similarities and differences in operations management of
pharmaceuticals companies in foreign developed and developing
countries exemplified by the case of PFIZER in Italy, UK and
China

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Academic Year 2021/2022

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Introduction

This research paper has been inspired by the tasks that the candidate has fulfilled during his internship at Angelini Pharma Russia. This opportunity has been significant not only for having watched how an international company operates in a subsidiary of a developing country, but also has offered the possibility to get a deeper understating of an industry that became increasingly relevant. The pharmaceutical is one of the top industries for R&D and knowledge intensity, very deeply connected with the changes, often related to macro-trends, that characterize the external environment in which every corporation is set in. Moreover, around pharma supply chain, flourish several satellites activities: this translates in a significant impact on the welfare and socio-economic condition of a society. Furthermore, the relevance of the industry is also intensified by that fact that, dealing with the health of people, a company's achievement can represent an upgrade in the life's quality of people who need specifics product, medical device, or treatment. A wide crowd of stakeholders can be positively influenced by an improvement in performances, operations and strategies of companies who operate in the pharma sector. The pandemic period has showed the world how much it is significant; the spread of Coronavirus has represented a challenge for every sector of the economy but the means to tackle with it have been delivered by the efforts of healthcare companies. The literature in this field has much more to say. Indeed, the continuous shifting trends characterizing the economic landscape as well as the increasingly complex environment offer several opportunities to research how companies are overcoming them. Literature a show poor evidence when it comes to exhibit practices that companies in the pharmaceutical segment have implemented or are meant to implement in order to succeed unpredictable events but also those one that have been accelerated by the Coronavirus. Sustainability, digitalization, new technologies, social impact initiatives are all need that companies are undertaking and trying to solve, but this could find a stronger validation in the literature. Based on this, the present

research has as an object the operations management: this represents one of three core functions in any organizations (Operations, Marketing, Finance) and probably the most internal. For the role they have, operations are the place where both radical or incremental transformation happens and the value adding process takes place, in every process that brings input to become output that will then delivered on the marketplace. Similarities and differences of them in the pharmaceutical industry across developed and developing countries aim to give a deep understanding of the effect that the context has on them and how operational solutions are created to face the challenges coming from the outside. What is said, lead to the key question:

“Which are the similarities and differences in operations management of pharmaceutical companies operating in foreign developed and developing countries?”

From the question descends the goals of comparing the different elements that are related to the operations management and its configuration, of a firm with international operations. The analysis aims to outline operational related implications that integrate the challenging context around pharma operations, and how they are going through this period of changes to infer some more absolute managerial guidance. To achieve this purpose, a case analysis will be conducted on a company leading in quality and betting on its science to overcome the competition: Pfizer. The company has been chosen also in relation to the development of the Comirnaty vaccine, in collaboration with BioNTech, that resulted to be the main tool in the battle against the Covid-19. Its global operations make Pfizer the proper case company. The operations management related will be assessed looking at the whole company’s performance and settings, using the available literature, updates and financial data and then comparing the translation in three different countries: Italy, China and UK. The research will try to figure out the different solutions that should be adopted in the pharma companies given the existing research, always taking up to the front the latest trends and challenges

that need to be addressed by players in the industry to increase the value delivered not only under a financial perspective, but also in term of general health conditions. There is substantial gap when it comes to their adaptation to the new strategic priorities arising from the environment. Indeed, the focus on how operations in this sector could make a change, has been enhanced by the pandemic: even though there is a progressive building of the theoretical knowledge in pharmaceutical operations, is still missing a practical point view in the implementation of those practices that integrate sustainability, flexibility, and digitalization inside the operational processes. In other words, enhance the understanding, always through a practical point of view, of how the management is dealing and should tackle with the emerging issues from the environment, especially considering the differences in developing area where the literature is not consistent as it is for developed ones. Therefore, the paper will be organized as follows: in chapter 1, operations management will be defined, based on different scholars' definitions and representation. A description of the main trends characterising this field of management will be addressed and after going through the description of pharmaceutical operations, there will be illustrated how them are declined into the industry. In chapter 2 an overview of the industry will be furnished, with figures and data of the considered market for the analysis of Pfizer. In the last chapter, the work will be wrapped up and main conclusions will be discussed. The main authors on which the work will rely on are Heizer, J., Render, B., & Munson, C. (2020), Krajewski, L. M. M., Malhotra, N., & Ritzman, L. (2021) and Nenni, M. E., Caroli, M., & Fontana, F. (2017), while for the analysis most of the data are gathered from companies' relations (Pfizer, Astrazeneca), industry reports (IQVIA, McKinsey) and specific magazine articles (Kane, P. E., & Jhonson, A. 2017, Jeffs, A. 2021).

1. THEORETICAL FRAMEWORK OF OPERATIONS MANAGEMENT OF PHARMA COMPANIES OPERATING IN DEVELOPED AND DEVELOPING COUNTRIES

1.1 Theoretical Framework of operations management for international companies

1.1.1 General concept: Operations Management

The common definition given by authors to operations is the activities who need to be performed to transform inputs into outputs, employing the most efficient and effective transformation process based on the firm's capabilities (Ivanov, D., Tsipoulanidis, A., & Schönberger, J., 2021; Krajewski, L. M. M., Malhotra, N., & Ritzman, L. 2021; Nenni, M. E., Caroli, M., & Fontana, F., 2017); Heizer, J., Render, B., & Munson, C. 2020). We can rely on the fact that “*operations*” could be seen as a system of process, linked among them and strictly related to the production of services or goods. With “*processes*” is possible to refer to all the activities that take part in the input's transformation into output, disregarding the number of inputs used to produce one or more unit of outputs (Krajewski et al., 2021). One of the main activities in this area is about managing linkages among processes which form what is defined supply chain: indeed, this is “*the interrelated series of process within a firm and across different firms that produce a service or product to the satisfaction of customers*” (Krajewski et al., 2021). Is the entire production process that lead the raw material into a series of consecutive and related transformations by which is possible to deliver goods or services to customers and satisfy their needs (Martin, 2021). It is something that basically embody the definition of firm as economic actor and that find in those definitions its core meaning of being (Krajewski et al., 2021; Ivanov et al., 2021). The field of management that takes care of how the companies integrate their processes with the ones in the upper and lower level of the supply chain is called supply chain management (Ivanov et al., 2021; APICS, 2011). The purpose is to

synchronize in the most efficient way companies' activities with the ones of suppliers to respond with the best outcome to what is requested by customers. Operations and supply chain management are highly correlated and represent one of the core functions in every company (Krajewski et al., 2021).

The “*process*” could be seen as the basic unit participating in every function or department of an organization. Working on one process, so on the particular, is possible to improve the bigger frame (Krajewski et al., 2021). Indeed, a process could be generally described: a combination of inputs processed by a sequence of following actions that deliver a certain output as final result (APICS The Association for Operations Management, 2011). Those could be delivered both to external customers, regardless of if it is the final customer or another subject in the middle of the supply chain, or internal customers, in case the output is necessary to another part of the organization to make its own operations to take place (Krajewski et al., 2021, Nenni et al., 2017).

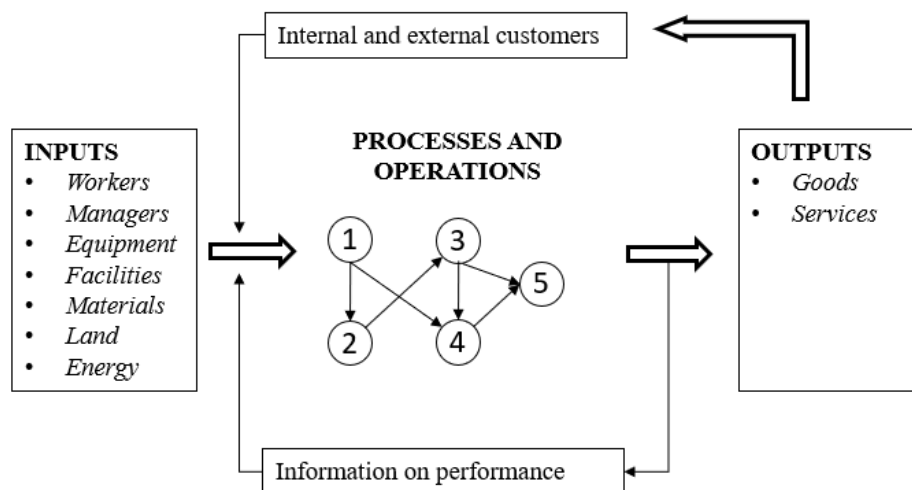


Figure 1 Process view of operations from Krajewski et al., 2021

The strength of the process definition is that it is applicable at every level: it stands if we refer to a particular activity of a business unit, a department, or the whole firm. Looking at this framework is possible to take apart the different elements, work precisely on them and improve efficiency or/and effectiveness from a

managerial point of view. In the chart, the smaller arrows represent the contribute those customers and information could give to the whole transformation process, becoming inputs of it when they are well integrated in the effective operations. Looking at the firm under a process-based perspective helps to understand how it works on a macro-level and pinpoint the core elements, endorsing the centrality of cross functional coordination to achieve outstanding results (Heizer et al., 2020; Krajewski et al., 2021). Then is required consider how processes combined deliver value: the concept of supply chain is yet used. To do so we refer to two main categories of processes: support and core.

- Core processes: “*set of activities that delivers value to external customers*” (Krajewski et al., 2021). The theory on which this work relies on consider 4 main core processes that fall into the definition:
 - Supplier Relationship Process: activities that take care to the relationship with suppliers and, therefore, related to the inflow of material and service inputs
 - New service/product Development Process: consider the design and development of new/service and products given changing request from the environment
 - Order Fulfilment Process: deals with the production and the shipping of the output
 - Customer Relationship Process: activities that, as it happens for suppliers, concerns about the relationship with customers
- Support processes: it is a process who is functional to the effectiveness for core ones. Indeed, it is itself a source of crucial inputs for the fulfilment of core business activity. (Krajewski et al., 2021).

The operations could be then classified in different ways. To the purpose of this chapter, we can refer to the volume – variety matrix of Hayes ad Wheelwright (1984). Indeed, these two dimensions can be described as follow:

- Volume: is literally how many goods produced or service provided in a given period of time. When the volume is high there should be high standardization in term of outputs, a systemic planification of production with the focus on lowering the costs as much as possible.
- Variety: high variety implies a highly differentiate outcome. Each product or service is different and requires a different transformation process. Costs increase as well as the managerial complexity. c

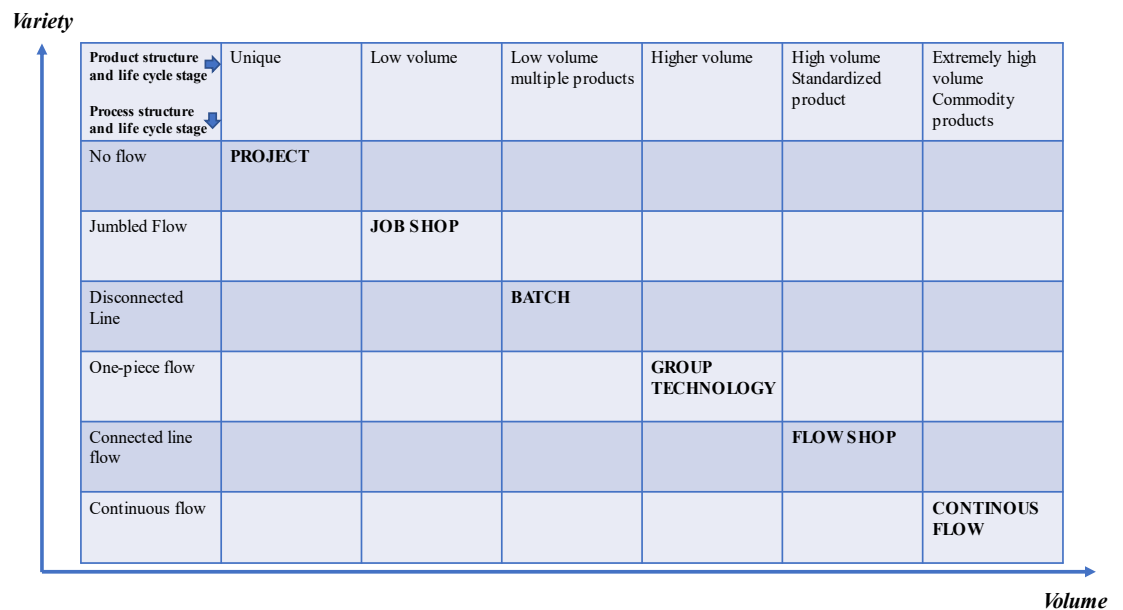


Figure 2 Adaptation of Hayes – Wheelwright matrix (1984)

Based on the adaptation of Nenni et al., 2017, we can classify different type of processes that imply different type of operations accordingly, which are all placed on the diagonal of the diagram since any other option above or below it, would means less efficiency and greater costs with the same conditions:

- Project: characterized by the maximum level of variety and minimum of volume. The production process is highly customized, need to fit exactly what the customer is asking for, so also the resources involved are flexible given that the product or the service it is unique.
- Job Shop: similar to the project, it has a slightly higher degree of volume and therefore resources could be grouped based on their skills. The production here is organized in a completely different way.

- Batch: the production process delivers higher batch. Is not a standalone production; every batch is composed by many units all equals among them.
- Group technology: well balanced between the two dimensions. The peculiarity stands on the fact that in every group there are all the resources necessary to fulfil a sequence of operations on a set of products: the resources could work on the products without the need of having the batch complete, in the so-called one-piece flow process.
- Flow shop: the production process is made of a fixed related steps logically related among them. Is also known as mass production and is the classical line production of manufactured goods.
- Continuous: the variety is at the lowest level; the volume is at its maximum that results in a continuous in time production process. The standardization of the process is maximised and therefore automatization is a key mean for this process.

Is worth to mention that with the AI and the diffusion of IT, mass customization is becoming a viable way to maximise the value for each customer while considering the costs need. Companies strive to adapt and improve the management of operations to increase their competitiveness or properly developing advantages usually working on two different dimensions: efficacy or effectiveness of a process (Heizer et al., 2020; Ivanov et al., 2021; Krajewski et al., 2021).

All the definitions that we can find in literature seem to have some converging points. Indeed, is not possible to speak about “*operations*” if we are not dealing with the transformation process from inputs to outputs with the scope of creating the highest possible value to be delivered. The theoretical definition of operations management does not depend on whether the outcome are goods or services; the processes are different in their application, but the science is common (Nenni et

al., 2017). Is possible to wrap up referring to some specific features that are worth to be highlighted, according to the authors Nenni et al. (2017):

- Operations management is a field that deals with many heterogeneous problems in the same organization. Therefore, the managerial skills required should be coherent with the multi-functional challenges that can arise.
- Operation managers need to be systemic. Challenges should be managed considering to overall implication that they could have on all the other function. The cross-functional coordination is critical.
- Operations management is a dynamic field both in theory and practice. It could be considered as an “*open system*”, standing on the term used by Nenni et al. (2017), since the internal and external environment and its evolution have a strong influence on its progress and changing. Adaptation is a key word.

Operations management have the scope to improve, under the guidance of the overall strategy by the firm, each single process that concerns this area. Is important to stress that unique way of this relationship: an organization need to improve itself working on the specific processes, but it is not said that the improve of these ones will lead to better performances since particular processes could serve opposite purpose (Nenni et al., 2017).

1.1.2 A framework for the operations management

Operations management has a fundamental role in every organization's performance. We can refer to the circular relationship designed by Krajewski et al. (2021) in their book, where the operations function oversees the transformation process that occur on those inputs provided by the work of the finance function. The third major function is marketing, who has the role to convert the outputs from the operation into revues. These three firm's pillars are assisted by the action of supporting function (such as accounting, information systems, HR and engineering). The integration between the different activities is guided by strategy

designed in the upper level of management and the perfect match among them guarantees the good performances of the overall firm. Processes is what links indissolubly these functions and working on the singular performance of each little part is possible to improve the whole (Krajewski et al., 2021; Martin, 2021).

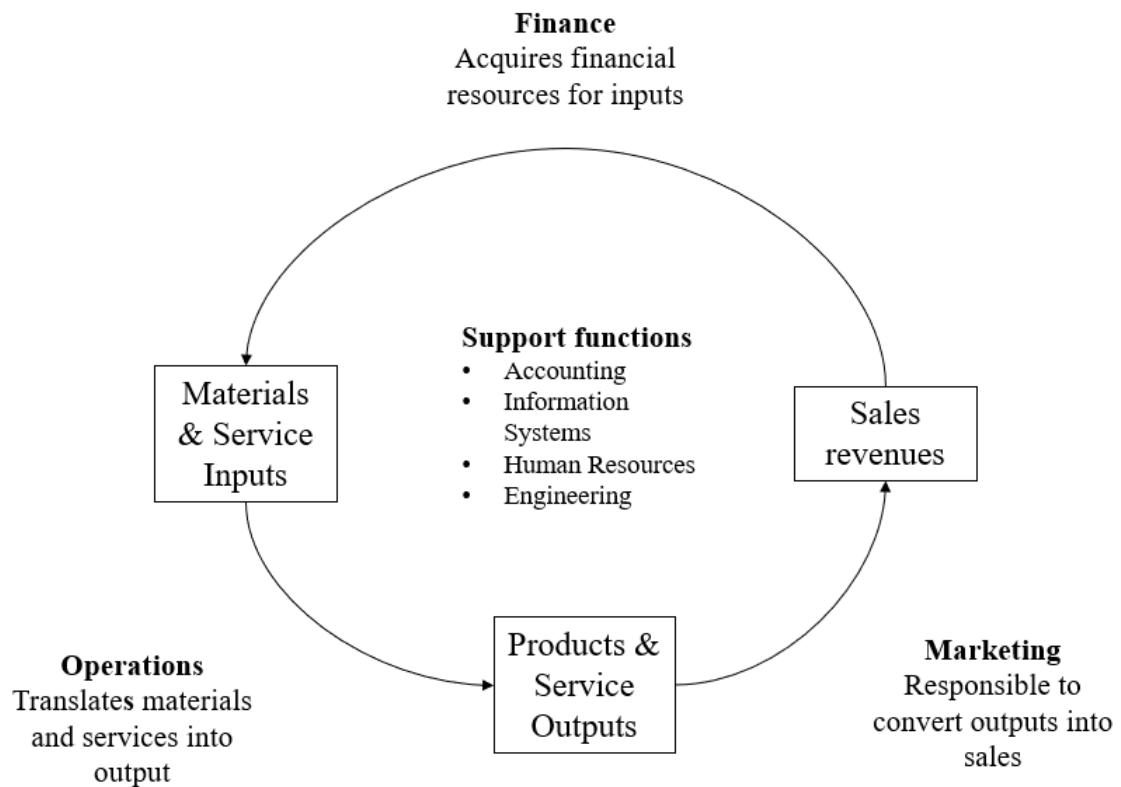


Figure 3 The organizations core and support functions, from Krajewski et. al, 2021

Standing on the definition provided previously, operations management is strictly committed to the direction drafted by the company's head in the mission and the strategy that provides guidance on how to reach it (Heizer et al., 2020).

- **Mission:** is the statement which provides the reason why a corporation comes to existence, the ambition followed by the organization who through its operations would like to achieve. Every function is indeed functional to the achievement of the mission and serves what it states.
- **Strategy:** is the path described by the top management to achieve the mission. A strategy is declined in every function and department, which adapt it to their own plan. Nevertheless, consistency among the

strategies of the different part of an organization is beneficial: indeed, that is what is stated by the multi contingency approach of Burton et al. (2020).

In the literature are mentioned different dimensions on which a strategy could be focused on to pursue its objectives, that also proved the main field of competition for that company: operations are carried out accordingly (Heizer et al., 2020). The success of a strategy and its implementation is related to the gain of the so-called competitive advantage, the feature that pose an organization above the others allowing it to outperform them (Heizer et al., 2020).

Given the premises, to the purpose of this work would be adopted the model of Pycraft adapted by Nenni et al. (2017). The reason of it, is because this model takes into consideration the due premises discussed previously. This model considers 4 different steps inside the operations management:

1. Strategy
2. Configuration
3. Planning and Control
4. Improving

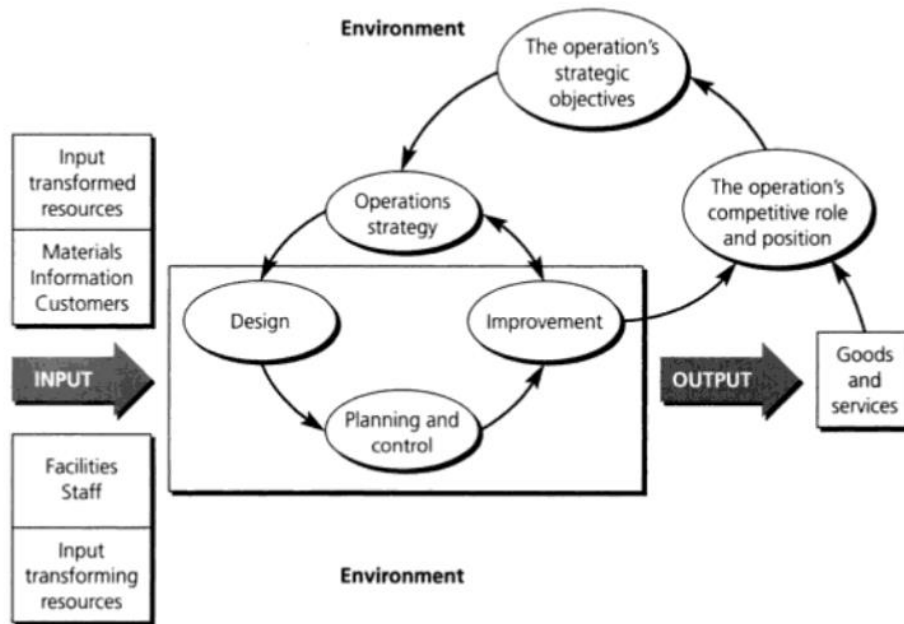


Figure 4 Operations Management model of Pycraft M. (2000)

1st Phase: Operations Strategy

During the strategy definition phase, there is the settlement of guidelines, or rather the direction that will guide the operational decisions in the long term. The authors Nenni et. al. (2017) defines operations strategy:

- *“The set of long-term decisions that define how the organization chose to answer to the market’s needs by producing goods or delivering services”*

The underlying rationale that operations strategy follows is the maximisation of the added value delivered to customers: this imply that the value changes based on all the factors related to the customers behaviour and market characteristics. On the other side, the strategy cannot overlook the resources’ availability who constitutes the starting point for each activity included in the transformation processes. Operations strategy in intrinsically linked to the resource side from an internal point of view and the market’s conditions on the external one (Nenni et. al. 2017).

It also keeps an intimate relationship with the science of business strategy: they go together and influence each other. It should lay the foundation for operative

decisions that follow the business strategic decision consistently and efficiently (Nenni et al., 2017). Slack et al. (2007) translates this scope along 5 different dimensions/objectives/directions that operations management and its strategy pursue:

- Quality → The specifics of the products or the quality of the service; higher it is, higher the satisfaction/the preference for that service or good will be. Impact not only on revenues, but also on costs when quality is consistent with the standards of the firm.
- Speed of action → is the timeframe that goes from the order that the customer perform and the delivery time when he or she receive it. Impact on costs trying to lower stock.
- Affability → Respect what is said with customer: reliability in the customer relationship. It increases efficiency and costs.
- Flexibility → It translates in the ability to answer quickly to the market's stimuli. Being flexible does have magnitude on cost savings and it could represent a source of competitive advantage quite important.
- Cost → All the previous dimensions have an impact here. Cost is the most relevant dimensions when dealing with efficiency and so operation management: it is the direct factor affecting it.

How these dimensions are treated depends on a set of conditions and is extremely variable depending on the market. It needs to be stressed the perfect coherence that should subsists between the strategy set at the corporate level and the operative one: a misalignment can jeopardize every business' effort (Nenni et al., 2017). This core activity needs to be continued in time, since the conditions are always changing and so the relative strategy, with the commitment to perfectly match capabilities with priorities (Krajewski et al., 2021).

When we talk about operations strategy, we refer to the activity of planification of the operations both in the short and the long term to realize the strategy's decisions made at the corporate level. It takes into consideration processes that

involve external actor that interact with the firm, creating the first idea of supply chain (G. R. G. Benito et al., 2011; Krajewski et al., 2021). At this stage is decided the target market and how the firm should behave given the external environment. Subsequently every firm perform in different ways a market analysis to identify a well-defined competitive field. Based on that, the firm can match with it its competitive priorities to work on and affirm itself in the before-defined marketplace (Krajewski et al., 2021).

2nd phase: Design

It could be seen as the structural basis for the effective implementation (Nenni et al., 2017). The model proposed by Nenni et al. (2017) set two area of decisions when it comes to the design of operations:

- Structural decisions → long term decisions which require large funds and capital because they set how operations will be carried out in the future and so how they will realize the transformation process: high dependency with their effectiveness. We could point out:
 - Where to locate facilities
 - Size of production implants
 - Level of vertical integration inside the supply chain
 - Technological process involved
- Infrastructural decisions → With respect to the structural decisions, they need a smaller economical effort, so their time span is also short-medium term. These are typical related to the organization and management of all the production factors.

3rd phase: Planning

From Nenni et al. (2017): “*the management’s function who aims to select the objectives of an organization and set strategies, policies, programmes and projects required to accomplish those objectives*” (Nenni et al., 2017).

Planning operation is a managerial activity that could be translated in the following output:

- Create the production's order
- Give those order to the different production's units
- Planning the required inputs in order to satisfy the market segment
- Set the sequence of working phases and assign them to every unit

Those output are the results of a decision process that pursue objectives such as:

- Minimum cost
- Appropriate level of remaining stock
- Increased efficiency level (less resources required for same or even more output)
- Market satisfaction

4th phase: improvement

The environment in which every firm is called upon to compete is becoming increasingly complex and uncertain: improvement is becoming necessary to survive. Focus on the production process could represent a way to improve performances under different perspectives, adopting the right moves. The model offered by Nenni et al. (2017) find some common features among the different ways in which a firm could improve its performances, as a sort of principles that lead all the improving actions of a firm.

Indeed, operations must be improved always aiming at improving also the condition for customers. This is by far the first and most important driver, since increasing the value delivered to customers, is possible to capture a bigger value back. This process of research, in improving conditions for customers and improving itself, should be continuous in time (Deming 1982) that is coherent with the idea every firm is an “*open system*”. The ambition then is to have processes the work 100% effectively, with the minim error possible because it has

impacts on efficiency and effectiveness both as a dimension for organization's purposes (Burton et al. 2020).

1.1.3 International operations

Globalization is a phenomenon that has characterized the last decades with increasing meaningful effect on every day's operation for each corporation. We can summarize the concept of globalization referring to a more interconnected and smaller world than the managers were used to (Haniff & Caldwell, 2019; Petersen, B., & Welch, L. S. 2002). Borders are blurred compared to the past: the incredible development of capital markets have allowed companies to raise capital more easily and all kind of investors to do that almost from everywhere; people and goods can travel in different locations thanks to new means of transport, enhancing the world trade and expanding supply chain among countries. The technological improvement has made the business' world much more linked. The result is a wider environment to be managed and to which structure an organization, develop strategy, and realize operations (Haniff & Caldwell, 2019; Heizer et al., 2020).

Going international is not a simple process and companies justify such a significant improvement usually referring to some strategic management reason (Heizer et al., 2020).

- Improve the supply chain: operating globally offer the opportunity to have operations where there are unique resources to be exploited
- Reduce costs and exchange rate risk: costs could represent a driver to move internationally, both referring to tackle the risk of exchange rate fluctuation or lowering operative costs
- Improve operations: international operations benefit the management learning process of innovation and, on the other hand, allow managers to quickly adapt to the needs of foreign markets
- Understand markets: international competition offers possibilities to gain knowledge both for good's production and service delivering.

Improvement is a continuous process that gain from the practice in different social, economic and cultural environments.

- Improve products: being in different location enhance the process of correction and improvement thanks to a deeper knowledge coming from markets themselves
- Attract and retain global talent: companies who operate globally can attract high skilled human capital.

International operation, to wrap up, pose challenges and opportunities an organization/corporation that could leverage them to work on its competitive advantages (Heizer et al., 2020).

International business scholars have focused about operations in foreign markets widely in the last decades. Benito, G. R., Petersen, B., & Welch, L. S. (2009) evidence a lack of “*longitudinal studies*” in this field of research because collect reliable data could be tough. This has been translated in some difficulties for researchers in developing frameworks of company’s decision about foreign operation modes and their development in time (Benito, G. R. G., Petersen, B., & Welch, L. S., 2011; G. R. Benito et al., 2009; Petersen & Welch, 2002). Moreover, as sustained from the same authors, the studies have always been affected by a narrow vision on operations modes, not considering the complex way in which companies are used to bond them in new solutions for their scope. When we refer to “*foreign operation mode*”, the underlying meaning is “*a company’s way of operating in foreign markets*” (G. R. G. Benito et al., 2011; G. R. Benito et al., 2009). Often this has been included in the idea of entry mode choices for company, but literature agrees that they should be analysed differently (G. R. Benito et al., 2009; Petersen & Welch, 2002). We can take the definition of G. R. Benito et al. (2009): “*foreign operation modes are the organisational arrangements that a company uses to conduct international business activities. Foreign operation modes relate to the activities performed in particular location at a given time*”. This definition goes over the entry mode definition of an

international company, focusing on how operations are structured in the period upcoming the proper entry. The field of research in company's operation into a foreign market has been stressed, especially willing to integrate what literature has been saying on internationalization strategies and entry modes in foreign market. The empirical evidence showed that established frameworks were used to see foreign operation mode as unique despite companies are used to combine them in different way to enhance their competitiveness in each market they serve (G. R. G. Benito et al., 2011; G. R. Benito et al., 2009). Different modes are bound together, determining every time a different result according to the multiple contingencies affecting this linkage among modes (G. R. Benito et al., 2009).

Petersen and Welch (2002) have identified in their study four types of multiple foreign operations modes:

- Unrelated Modes: describe the way in which an international company operates when is usually committed in different industries. Disregarding the organizational structure, different countries have different operations to be carried out, therefore the each one of them is dealt independently.
- Segmented modes: operations are structured always considering the same industry, but the segments served varies. Consistently another country will be treated as a new segment or a sum of them; segmentation is a powerful tool to organize and structure organization effectively even in the same country.
- Complementary modes: in this case the operations among countries are carried out to support each other, enhancing the overall cross-country efficiency. In term of segmentation there is an alignment but realizing different activities along the value chain. There is an effort in coordination among subsidiaries and the headquarter that make this combination of modes significantly performing.

- Competing modes: the foreign countries have the same marketization of the home business units, but the activities performed are almost the same creating a sort of internal competition that could enhance performance.

In the literature of foreign operations modes however there are empirical evidence on how modes packages could represent a framework to which refer, even though the complexity of the current environment pushes companies to dynamically adapt those one into new solutions, exploiting advantage and disadvantages of each market served to increase the penetration (Petersen & Welch, 2002).

Morschett, D., Schramm-Klein, H., & Zentes, J. (2015) refer to a typical classification for foreign operation mode, more related to the idea of market entry modes. The main figures are export modes, contractual modes and investment equity modes. These three modes are the main point of a spectrum which has “*vertical integration*” as a dimension, where export modes reflect the lowest level and investment modes such as fully controlled subsidiaries have the highest. Then each modes have a sequence of strategic choices that shape the way in which operations are be carried out, from the location to the extent of cooperation with external actors. According to Morschett et al. (2015) when it comes to the structure of foreign operations, international companies must deal with two main drivers:

- Location: how to locate the operative process is crucial because is a key step to understand where and how the value delivered to the final customer is. The idea is that when deciding where to locate production facilities, several factor should be considered, such as market factors, cost-related factors and country risk.
- Degree of cooperation – span of hierarchy: adding value to the final product is strictly related on how the firm decide to settle itself in a new market. Usually, it could go both trying a cooperative approach with incumbent in the markets or betting on the direct control of facilities and operations.

	Export	Contractual Cooperation	Equity Cooperation	Wholly owned Subsidiary
Control	Low/Medium/High	Low	Medium	High
Resource Commitment	Low	Low	Medium	High
Flexibility	High	Medium	Medium-Low	Low
Knowledge Dissemination Risk	Low	High	Medium	Low

Table 1 Characteristics of Selected Foreign Operation Modes, Morschett et al., 2015

The way in which operations could be structured is well represented by the table. As usually, there is a trade-off to deal with when it comes to the decision in term of international operations. Companies operating in different countries face is the trade-off between control or “*benefits of integration*” – resource commitments or “*cost of integration*” (Morschett et al., 2015). Higher control over foreign operations means more expenses to maintain this control, which increase the risk of carrying on operations in a determined country (Morschett et al., 2015). Less the company is committed to foreign operations, less is the risk that it faces. There are other dimensions that relates to this trade off then. How many resources are involved in the operative processes, determines the extent of flexibility of a company: higher is the amount of resources committed, more difficult will be to change (Morschett et al., 2015). Another factor to consider is that what Morschett et al. (2015) denominate “*dissemination risk*”, which is the risk coming from the expertise, knowledge heritage that a company could develop and becoming a key source of competitive advantage: having less control translates in an increased difficulty to protect this value.

The importance on how to conduct foreign operations has been widely explored by many researchers, especially relating to the field of internationalisation strategy and strategic management (Haniff & Caldwell, 2019; G. R. G. Benito et al., 2011; Morschett et al., 2015). The importance is even more stressed by the fact that foreign operations could not be changed easily and usually are a long-term decision (Morschett et al., 2015). On this time span many companies,

working on their flexibility, could gain competitive advantages, becoming leader of their sectors of markets. Literature judge positively when foreign operations modes changes over time, in a continuous process of adapting to the new challenges coming out form the environment, both internal and external (G. R. Benito et al., 2009; Morschett et al., 2015). G. R. Benito et al. (2009) accents the importance of combination of different modes, highlighting the importance of incremental improvement rather than radical changes when it comes to international activities.

1.2 Literature review of Operations Management for international pharma companies

1.2.1 Trends and challenges in operations management

All the economies are facing a period of radical changing, characterized by a strong uncertainty and instability because of considerable changing trends. Covid 19 has caused, for a significant period, the disruption of entire cross border value chains, while at the same time impacting the demand side: this happened without changing the pre-existing paradigms of performance focused on new indicators such as the sustainability of the business, stressing the capabilities of companies among all the industries (Trabucco & De Giovanni, 2021). The digitalization era is offering a huge number of great opportunities to improve organizations: on the other side, it poses important challenges, with different degree of strength among all the industries and firms are called to face them at the best of their capabilities. There are companies that are reinventing business models; low-cost producer, very fast earners of market shares and they generates an enhancement of competition (Grant, 2016). Another shaping trend for the future is about social forces and the crisis of capitalism: people do not perceive corporation as they were in the past. There is big pressure to move from a shareholder capitalism to a stakeholders' capitalism: company need to combine some social value, some environmental value, and some economical value (Grant, 2016). The difficulties in how to combine the positive financial results with good environment

performance is clearly stated in literature (Liu & De Giovanni, 2019). Managers oversee this goal because this is what required and there are several reasons why it should be the considered, for instance the climate change problem (Martin, 2021).

Given the pressures coming from the environment, it started to become increasingly important the goal to “*Operational excellence*”, a managerial philosophy that pursue the increase of delivered value via practices such Lean thinking, Six Sigma or Total Productive Maintenance are (Ivanov et al., 2021b, Martin, 2021). It represents the operative translation of the ambidexterity concept, in which efficiency is combined with effectiveness and the target is to have maximum quality with the lower possible costs (Burton et., al. 2017). “*Operational excellence*” incorporates the definition the above-mentioned practices because it has the specific goal to produce over performance with a financial manifestation that can guarantee a growth strategy (Ivanov et al., 2021b). Ivanov et al., (2021b) point out how should be translated this excellence when it comes to supply chain and operations management. It is a combination of elements: a sum of decisions to improve performances according to the corporate strategy; a mindset that pursue new innovative solutions for product and services maximising the each process’ value along the supply chain; a systematic approach that aims to efficiency-effectiveness combination (Ivanov et al., 2021b, Martin, 2021). The research conducted by De Giovanni and Cariola (2021) gives validation to the fact that being lean for a company does have a meaningful impact in the short-term results for the environment while it does benefit the economic ones on the long one. Despite the investments that the lean approach requires, there is a clear link between its implementation and the capability of operate in a sustainable way, which do have an impact on reputation and long-term result of a company (De Giovanni & Cariola, 2021).The literature review performed by Seyedghorban, Z., Samson, D., & Swink, M. (2021) gives important empirical evidence on the fact that “*supply risk*” and “*sustainability*” are nowadays the most

appealing topics in researchers agenda, in a consistent way with the business development. Researchers and practitioners in operations management seem to be aligned in focusing on long-term objectives, adjusting studies and choices on the long-term design of the supply chain (Seyedghorban et al., 2021). Sreekumar, M. D., Chhabra, M., & Yadav, S. (2020) came up with three clear scenarios that are characterising the manufacturing as well as they will do it in the future: “*Global teamwork, digitally boosted environment, data driven operations*”. The topic of how digitalization is intertwined with environmental practices has been disclosed by Cardinali and De Giovanni (2022). Is relevant to the scope of the paper mention that digital technologies do not come without externalities on the CSR practices of a company (Cardinali & de Giovanni, 2022). In an environment increasingly concerned on different parameters, increasing the overall performance through digital solutions needs to be sustained by the investment into environment friendly activities (Cardinali & de Giovanni, 2022). Sustainability concerns should increase at the increasing of the demands, since it usually corresponds to environmental issues (Liu & De Giovanni, 2019).

The Internet of Things (IoT) increases exponentially the solutions to accomplish process faster and better as well the data driven performance can do to enhance financial result. - The challenges that the current environment is posing to the economic actors are ranging in a wide span of innovative solutions as well that could be adopted, from the AI to the blockchain technology, and these "*require the development of new managerial paradigms*" (Naclerio & de Giovanni, 2022). IoT allows to develop smart factories in which processes are interconnected and that turns into an increase in effectiveness and flexibility while maintaining control over the single process (Sreekumar et al., 2020). This analysis seems to be consistent with the 4 pillars mentioned by Ivanov et al. (2021b) to exploit the technology's advancements for supply chain and operations management: “*infrastructure, data engineering, and communication technologies*”. Industry 4.0 represents an outstanding source of opportunities and challenges at the same time,

because of an increased competition. Indeed, IoT is offering the chance to manage complex systems of operations thanks to their digitalization of processes. In this framework, is also becoming relevant in the literature the opportunity arisen by the adoption of elements of the circular economy to strengthen the transformation processes (Maranesi & De Giovanni, 2020). Krajewski et al. (2021) grouped in a framework different technology belonging to Industry 4.0 that have a disruptive effect on business models:

- Smart manufacturing technologies: fulfil to assist operations in achieving digitalization and automatization. Scholars mention two important elements: “*Manufacturing execution systems*”, that record and store data about all the transformation process with the aim of its optimization and “*Artificial Intelligence*” that comprehend all the technologies that allows machine’s asset to learn from execution (Krajewski et al., 2021).
- Smart Product technologies: those technologies that make a product digital as well, enabling it to send data to the manufacturer or predicts its performance
- Smart supply technologies: technologies in charge of integrating in a digital environment the different actors having a role along the value chain: they enable the communication from the companies with all the supply chain stakeholders and the operations in which there is a monitoring interest to improve performance (Krajewski et al., 2021).
- Base technologies: they laid at the base of the other technologies enabling them to work and be installed, creating interconnectivity among them.

Trying to resume these premises, is possible to affirm that the environment in which the organizations are called upon to move is becoming every day more turbulent, dynamic, and unpredictable. Consequentially, this situation has been translated in companies dealing with different needs and challenges to maintain their competitiveness. OM is deeply committed in implementing its core activities while pursuing ambidexterity, the highest efficiency combined to the best

effectiveness (Burton et al., 2020). Heizer et al., (2020) identify three main drivers when it comes to the design and so the main value that operations management processes seek: “*design for efficiency*”, where the focus is to maximise the outcome from the available resources; “*design for resilience*” where the way in which activities are carried out is thought in order to manage every possible risk in the best possible way; then the increasingly important “*design for sustainability*” in which the main objective is to avoid impact on natural environment. The processes improvement from an internal perspective rather external than have been showed by De Giovanni (2012) as significantly more meaningful to target results embedding a triple bottom line approach, and this necessarily pass-through changes or improvements of the operational processes. The consideration is that nowadays every firm should try to work on all of them to be competitive. Indeed, the disruption occurred in all the fields related to management by several factors related to the effects of globalization and digitalization have significantly enlarged the scope of operations, including over the traditional costs, time and quality targets to resilience and sustainability as well.

1.2.2 Operations management in the pharma industry

The pharmaceutical industry has a key role into the health care systems of each country. This implies a serious commitment in scientific research and development because the final product has the purpose to improve people’s health condition. In the theory is reported the definition of drug manufacturing as “*the process of industrial-scale creation of pharmaceutical drugs by pharmaceutical companies.*” (The Pharmaceutical Manufacturing Process - Steps, Tools and Considerations, n.d.). Considering a wider horizon, “*The pharmaceutical research aims to find those molecules that can be further converted into medicines able to deal with certain types of disease or improve the life’s quality of patients*” (Come Nasce Un Farmaco, n.d.). In the last decades, due to the advancement in

technology, the field of pharmaceutical research has made meaningful steps forward.

The manufacturing process of a drug starts in labs thanks to the work of researchers, who explore the biological process underlying a disease to find the best treatments. The comprehension of the disease laid the foundation for the following steps of the process, that has its progress in the identification of the target that should be hit by the medicine (Torjesen, 2021). Then the focus is shifted on the product itself, looking for that molecule or chemical compound able to deal with the disease. Indeed, standing on the pharmaceutical theory, the manufacturing process generally starts with the identification of the drug's target, that is the biological process or mechanism that the underlying drug is meant for (Torjesen, 2021, Pfizer, n.d.-a). The process is long and complicated: indeed, before obtaining an active pharmaceutical ingredient considered valid, there is a screening among different compounds (Farmaci (come si sviluppa un nuovo farmaco), 2018; Torjesen, 2021). Different approaches are used to test molecule at the beginning of their lifecycle, in the early stages of a drug: there could be attentive research on the molecule and its interaction with the receptor it is intended to stimulate, or drugs could be also obtained using the biotechnology (Farmaci (come si sviluppa un nuovo farmaco), 2018; Come Nasce Un Farmaco, n.d.). Nowadays is becoming increasingly diffused the practice of lab's synthesis, compared to the past where compounds were searched into nature: this is a physiological outcome of new technologies, studies, and advancement in research (Torjesen, 2021). The following step is the trial of substances that before being clinical and tested on human, must follow a strict procedure: there is the so called pre-clinical phase, that uses virtual models and experimentation on living organisms. Every country has its own procedure and authorities in charge of controlling that every company complies with the strict regulation that the production of drugs has (Torjesen, 2021; Come Nasce Un Farmaco, n.d.). The positive assessment of all the research conducted in this phase and the approval

for the clinical trial application (CTA) represents that barrier to access tests on humans (Torjesen, 2021). The pre-clinical phase can be performed in two different ways: in vitro and in vivo. The scope is to understand how the API interacts with its target and consequently collect data on the medicine's performance, especially related to its security. When is in vivo, the experimentation is done testing the drug on animals (Torjesen, 2021). Also, when it comes to the marketisation of the product, there are rules to comply with. Generally, around the world, is always the same regulatory authority that allow a company to put the product in the market, such EMA in Europe (Torjesen, 2021). The authorisation to market must have a strong information back up on the drug especially relating on its effects and performance (Torjesen, 2021). Even with the authorisation, a post marketing surveillance is always required and granted by the companies (Torjesen, 2021). An important concept when dealing with Pharma operations is the patent issue. Patenting is a key feature of the pharmaceutical industry: it allows the unique use of a discovered molecule or compounds by the company who has the intellectual property over it for a certain period (Torjesen, 2021). The rationale of this rule is to guarantee to companies the possibility to recover from the huge investment in R&D it takes to develop a drug; make profit over it does also have a key role in further innovations and drugs development.

In a Deloitte report (2020), researchers have investigated the strategic priorities of biopharma leaders, given the trends affecting environment and industry. These results came up with 3 main drivers: improve their R&D activities, a road towards digital transformations and boost the presence around the globe of the company.

The analysis brought to:

- *Covid 19 effect*: Covid 19 has accelerated a process that was already happening, meaning specifically the race towards new drug's development and the growing in investments in doing so more efficiently through the digitalization of processes.

- *Challenges*: three challenges to deal within the upcoming future: “*changing consumer behaviour, cyberthreats and accelerated technology advances*”
- *Next frontier*: from the results collected by Blair, A., Ford, J., & Naaz, B. (2020), “*customized treatments, non-pharmacological intervention and prevention and early detection*” represent the future of the industry and most of their respondents admit work on the last one.

The companies operating in such a sector are deeply influenced by the context and that is why there is the need to set the right investments and take the good strategic decisions to lead the future. The pandemic period affected the pharmaceutical production process entirely, from the suspension of the drug’s supply chain did not relate the virus, to stopping the traditional work of representatives through in person visits. This has caused the explosion of macro trends that were already taking place such changes in regulations increased volatility and trade uncertainty. On the other hand, companies boosted the number of collaborations, especially in term of research to develop the vaccine. New contingencies have brought companies to explore the opportunities offered by the co-operation in a competitive context, opening to new possible business models and drug’s development process. One of the main outcomes pointed out by the research of Blair, A., Ford, J., & Naaz, B. (2020), is the changing in consumer behaviour and the impact this is having in the operations of pharma companies. The asymmetry of information about producer and patient is becoming irrelevant thanks to the extensive sharing of data and information, creating health care ecosystems in which companies need to work with data as well to be protagonist. That is why “*patient centric strategies*” have become a priority: companies should not only embrace a patient-centric approach but be prepared to participate in an emerging ecosystem where “*philanthropies dedicated to particular diseases, patient advocacy groups, health plans, health systems and physicians, regulators, competitors, and technology and wellness companies are all better connected so that the patient is at the centre*” (R. Myers et. al., 2020). Nevertheless, it should

be mentioned that De Giovanni (2019) explores the trade-off related to the customization and servitization of the product delivered and its attractiveness toward the final user against the economic impact a shift in the operational structure could have, and it should be considered when dealing with the underlying topic. Moreover, there is a need when it comes to an adequate return in innovation. R&D have been always a huge expense for pharma companies and how much of these investments come back in term of revenues has been addressed as an issue. Standing on Deloitte (2020) report, in the last than years this return decreased from 10.1% to 1.85, an average of 0.83% per year. This is a negative trend that need to be handled by a turnout of R&D productivity. (M. Steedman et al., 2020.)

1.3 Similarities and differences in operations management of pharma companies operating in foreign developed and developing countries

1.3.1 Developed and developing countries

Countries could be categorised in different ways when it comes to the degree of development. Indeed, this measure could be performed on different dimensions and there is not a formal definition between developed and developing countries, although in commonly accept to have this distinguish (Developing Countries 2022, n.d.; Nielsen, 2011). The definition of what is meant by development of a country has changed through the years and is still different among different global actors. A remarkable result consisted in gradually approaching to a shared view among economists on considering that started different dimensions going beyond the only income related issue (Developing Countries 2022; What Is Developing Countries | IGI Global, n.d.). Nevertheless, per capita income as always been considered a good benchmark for assessing development, whose reflect an approach to taxonomy based on simplicity.

Involving more dimensions require an index able to integrate several indicators, both reflecting economic and social status of a country. From the description given by the United Nations Development Program: *“The health dimension is assessed by life expectancy at birth, the education dimension is measured by mean of years of schooling for adults aged 25 years and more and expected years of schooling for children of school entering age. The standard of living dimension is measured by gross national income per capita. The HDI uses the logarithm of income, to reflect the diminishing importance of income with increasing GNI. The scores for the three HDI dimension indices are then aggregated into a composite index using geometric mean.”* (Human Development Index (HDI) | Human Development Reports, n.d.). Nielsen (2011) in his review, states the heterogeneity in term of approach to construct an indicator of country’s development, due for several reason such as the lack of guidance in the economic theory about the topic. On the other side, is worth to be mentioned that different classification among international organizations usually lead to similar results, looking at IMF, UNDP and the World bank (Nielsen, 2011). Despite clarity could be enhanced, there seem to be a consistency at least on a qualitative level when it comes to divide countries in developed and developing even though the sub-classification is still a field that need more attention from researchers and practitioners.

In the literature there is the referral to a developed country when its level of industrial or economic development is tendentially high: this usually translate in favourable conditions under a political, social, economic and environmental perspective. United Nations rely on a measure called the human development index to mark the line of this distinction. As reported in (Developing Countries 2022, (n.d.) different factors are taken into in this index: economic growth, life expectancy, health, education, quality of life”. This index has its max value in 1.0, while to be considered developed it should be above 0.8 (Nielsen, 2011; What Is Developing Countries | IGI Global, n.d.). It is commonly accepted the gross national income (GNI) per capita to have an approximate idea to the quality

standards of living in a country. The benchmark for 2022 given by the world bank is \$12,696: higher than these nominal incomes, economies and their relative countries are considered developed, while all those who stand below are considered developing even though are classified into different groups: upper-middle income, lower-middle income and low income (Developing Countries 2022, n.d., WDI - Home, n.d., Developing Countries | ISI, n.d.). In worth mentioning that several parameters could be considered, and the definitions provided, although are commonly accepted, could be widened considering for example significant parameters such as the gross domestic product (Developed Country, 2021). Developing countries are as defined as “*nations that have low living standards, undeveloped industrial base, and low Human Development Index (HDI). [...] Countries which are economically and socially trying towards betterment by economic and social maintenances and proper policy implementation*” (What Is Developing Countries | IGI Global, n.d.).

1.3.2 Theoretical outcomes for in operations management agenda for pharma companies with subsidiaries in developed and developing countries

The pharmaceutical operations are witnessing important changes due to the changes in the environment. The trends regarding innovative solutions to daily processes, new technologies, data driven approach and sustainability concern are pushing companies in the industry to re-adapt their processes and meet renewed needs. Referring to industry disruption, we should point out Industry 4.0 as all the innovations brought by the shaping trends in the industry previously mentioned.

According to the latest research the similarities across the industry are converging on some touchpoints. Operations needs to be holistic (Dukart et al., 2022). In a context where challenges are increasing, properly leverage the manufacturing assets needs a comprehensive view of the operations and how there are linked across different sites (Dukart et al., 2022). At the same time, the complexity is increasing in the internal environment as well. Different value chains are managed

in the same site as the product's portfolio become bigger: the companies need to create a specific manufacturing strategy for each of them to result more effective, while trying to keep the costs low (Dukart et al., 2022, Schrader, 2021). The strategy definition is shifting from being based on a total landed cost approach to consider several additional dimensions such as sustainability. Performance could not more be related just to the financial result. Consistently to that, manufacturing as inner process of operations assume importance to implement those requests (Schrader, 2021). We can refer to digital manufacturing as all the improvements brought using digital means in this process, from high level technologies to analysis of big amount of data with advanced software (Jeffs, 2021, Schrader, 2021). The combination of them lead to the connection of different part of the processes, enhancing automation and flexibility: 94% of pharma manufacturing practitioners have been able to handle the pandemic period thanks to these applications (Jeffs, 2021). On his side flexibility dimensions apply to several part of an organizations and enhance it to manage unexpected needs or contingencies. In manufacturing it translates in adopting rapidly solutions that could translate in an advantage (such as the optimization of the asset utilization or adapting the production capacity to new needs). In this field, the traditional batch manufacturing is being replaced by continuous process. This practice has gradually become widely diffused in pharma operations because of its ability of improving the productivity. Compared to the traditional batch manufacture, the continuity ensures a "*production cycle with no hold times*" (Jeffs, 2021), lowering costs and error, embracing a lean perspective. Overall, produce a new drug is complex due to the strict regulations, segmentation of patients and harsh scientific research underlying the process: about the 10% of drugs manage to go through all the phases (Jeffs, 2021). In the industry there has been an increasing attention to the use of artificial intelligence to increase the efficiency of all process (Jeffs, 2021, Schrader, 2021). Data processing, that involves several activities such as collecting, manipulating, or organizing should stand next to every process of the value chain. The data analysis is offering to companies also a perfect instrument

to improve the decision-making process: data allow to perform simulation and explore scenarios that could give to the management indications on which actions should be undertaken (Dukart et al., 2022). Moreover, new digital solutions could represent the solutions for the shortcomings they could cause by being employed: for example, blockchain technology has been appointed in the literature as a possible way to overcome the problem related to the quality control on the data integrity about new medical treatments related information (Volpentesta, T., Miozza, M., & Satwekar, A., 2022). On the other side, between developing and developed countries, differences exist and have an impact in how companies organize themselves to achieve such targets. Developing countries have a substantial problem in tackling counterfeit products and guarantee big companies from the generics' threat. This is usually due to the unstable socio-economical condition or poor regulatory framework, so results in different risk management approach to mitigate operational risks and different choices in term of product portfolio since for instance is it more difficult to protect top innovative brands (Enyinda, C. I., Mbah, C. H. N., & Ogbuehi, A., 2010). The pitfalls in the patent protection makes developing countries highly dependent form the imports of high value drugs. The operations of a pharmaceutical company are so configured to consider this factors that could affect its output (Smith, R. D., Correa, C., & Oh, C., 2009). The conditions of developing countries have enhanced in the past the entrance by acquiring generic producers: this practice has been more diffused to build R&D capabilities, lowering the cost burden of the investments by focusing on bring together several resources (Smith et al., 2009). Another difference that came up from the work of Usman Awan, M., Raouf, A., Ahmad, N., & Sparks, L. (2009) is that among other several critical factors, "*top management commitment*" is the most determinant to implement total quality management practices and developing countries lack this commitment in the major part. This, with lack of technologies, governments efforts and economic condition jeopardize the development of tools and capabilities that can sustain this manufacturing approach.

At the end, we have pointed out some tendencies leading the practices into the industry, while on the other side divergences persists due to socio-economic factors and structural implication. Recovering the research gap, the second chapter will go through the analysis of Pfizer to see how the previous arguments are effectively translated in practice and if which match could be found in the company's operational choices.

2. OPERATIONS MANAGEMENT OF PHARMACEUTICALS COMPANIES IN FOREIGN DEVELOPED AND DEVELOPING COUNTRIES EXEMPLIFIED BY THE CASE OF PFIZER IN ITALY, UK AND CHINA

2.1 Pharmaceutical industry overview in developed and developing markets

2.1.1 Industry overview

The pharmaceutical industry is deeply characterized by some trends, recently accelerated by the pressures of the environment and massive changes occurred after the pandemic period. The EFPIA (2021) reports furnish a first useful outlook to the industry:

- Emerging countries are witnessing a rapid expansion in term of market size and research environment, referring more precisely to Brazil, China, and India.
- The US market is still the main one. Two empirical evidences about that: 49.0% of global sales of this industry were in US during 2020 and as well as 63.7% of new medicines launched from 2015 to 2020.
- In Europe there is a significant fragmentation of the market which translated in a remarkable parallel trade harming the industry revenues and therefore, eroding resources for R&D expenses.

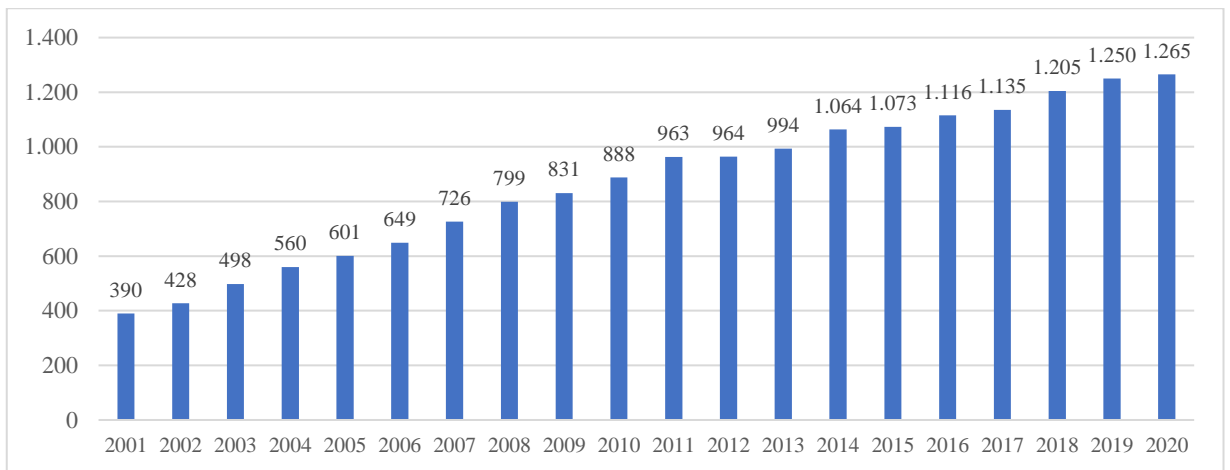


Figure 5 Revenue of the worldwide pharmaceutical market from 2001 to 2020 (in billion U.S. dollars), IQVIA 2021

The pharmaceutical markets have remarkably increased its size in the last years: in almost 20 years, from 390.2 billion dollars in 2001 it has reached almost 1.265 trillion in 2020, and this give us a clear idea of how the environmental factors of these decades, such as the advancement in technology, are impacting the pharmaceutical business (IQVIA, 2021).

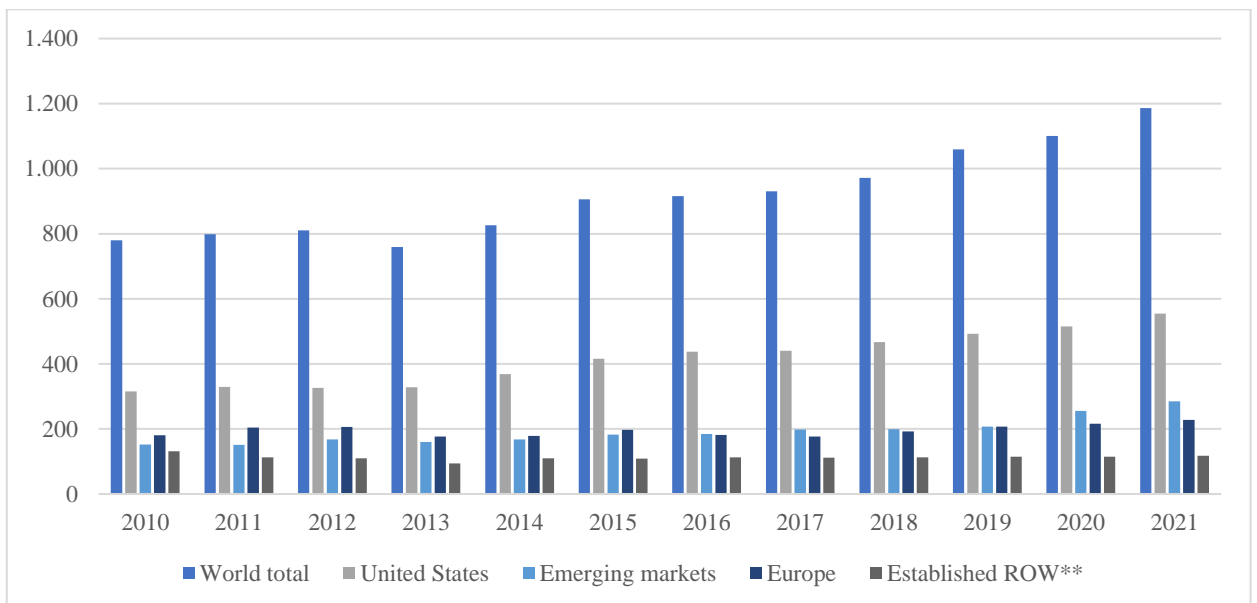


Figure 6. Global pharmaceutical sales from 2017 to 2021, by region* (in billion U.S. dollars), AstraZeneca 2022

Analysing the market by macro areas, is possible to see how a major part of the world total has been always represented by the US market. In term of revenues, US has a size of about 550 bln registered in 2021, while the European size of the market was about 230 bln (AstraZeneca, 2022). In the emerging markets are considered Brazil, India, Russia and China and the main results that could be then

widened is about the most remarkable increase when it comes to the revenues associated to this region. Emerging economies are becoming increasingly appealing for main players of the pharma markets (AstraZeneca, 2022).

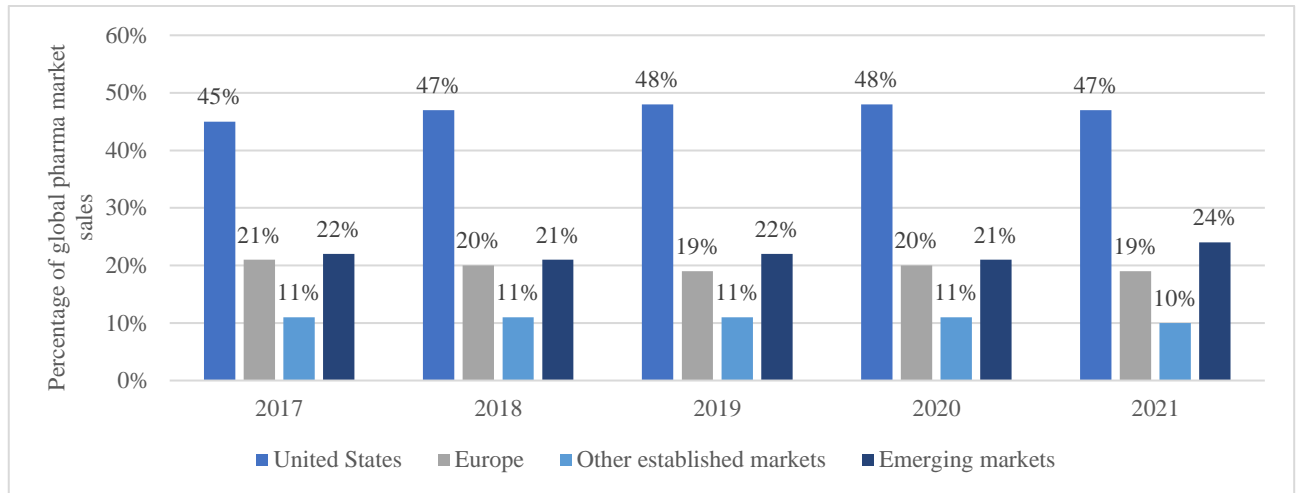


Figure 7 Distribution of the total global pharmaceutical market sales from 2017 to 2021, by submarket, AstraZeneca 2022

Little variation has been recorded in the last years over the distribution of global pharmaceutical market sales by regions. Also considering this visualization, the expansion's trend of emerging markets is confirmed: indeed, in between the 2017-2021, the distribution increased from 22% to 24% (3pp just from 2020 to 2021) while for US it moves from 45% to 47%. This is even more evident comparing European region with the developing countries, where these one has overtaken the first one (AstraZeneca, 2022).

	2015	2016	2017	2018	2019	2020
Brazil	14%	6%	9%	10%	1%	12.1%
Great Britain	10%	-7%	4%	4%	3%	6.7%
Germany	6%	4%	5%	6%	2%	6.7%
United States	12%	6%	2%	5%	4%	6%
Spain	16%	3%	3%	3%	0%	5.9%
Canada	6%	0%	5%	4%	3%	5.6%
France	0%	3%	1%	1%	-2%	3.4%
Italy	13%	6%	4%	5%	-2%	-0.5%
Japan	6%	12%	-1%	-2%	4%	-1.9%
China	7%	0%	4%	4%	4%	-2.4%

Table 2. Growth rate of top 10 national pharmaceutical markets worldwide from 2015 to 2020, adapted from IQVIA 2021

IQVIA (2021) furnish a visualization about the top national markets worldwide. The US market is still the largest one, with 45.9% of revenues generated in whole world's quota; the huge gap with the following markets is evident looking at the second largest market, China, that is 8% of the total that has an approximate value of in between 1.25-1.27 trillion of US dollars: therefore, US has alone 533.5 bln. This gap can find some explanations in the discrepancies in prescription medicine's price.

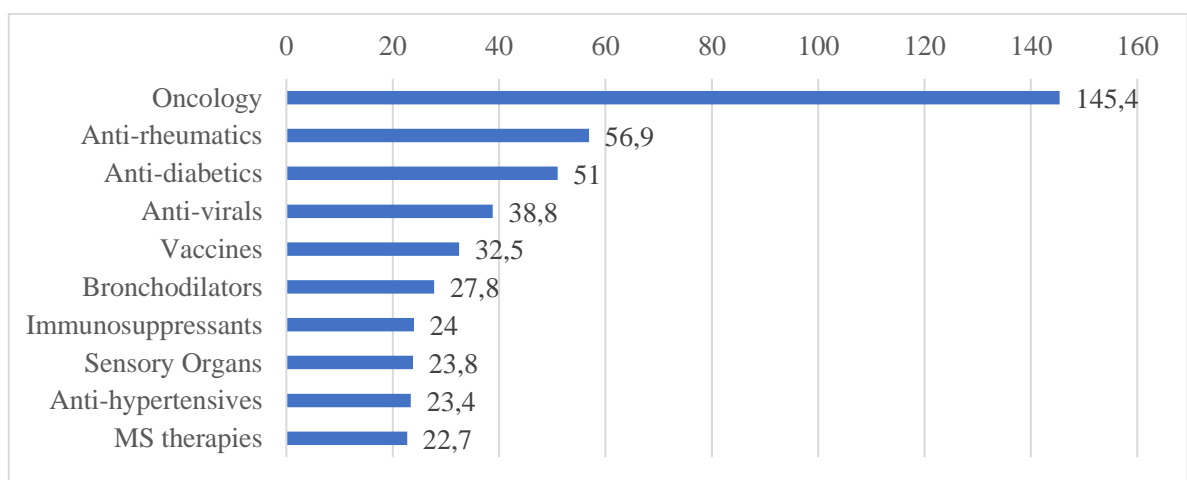


Figure 8 Leading 10 therapeutic areas worldwide by sales in 2019 (in billion U.S. dollars), Evaluate 2020

In the graph is visible which are the most attractive therapeutic areas worldwide when the measure is based on sales. It is highly remarkable, considering how the

oncology size is almost three times than the second area, the anti-rheumatics one (Evaluate, 2020).

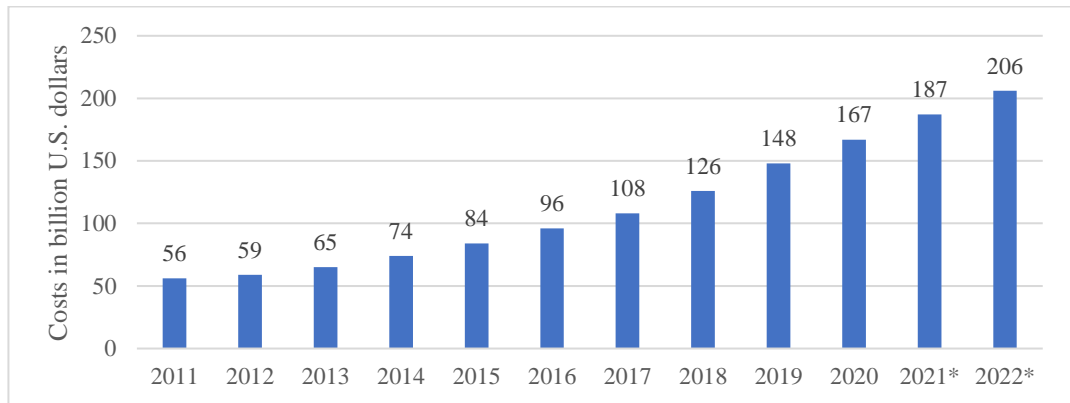


Figure 9 Global oncology spending from 2011 to 2022 (in billion U.S. dollars), Evaluate 2020

This is confirmed by the constant increase in expenditures for oncology treatments globally. From 2011, where the outflow was 56 bl of dollars, latest data forecast a global expenditure of 206 for the year 2022, with an increase of about 367% in a time span of ten years (Evaluate, 2020).

Every new product needs to go through a very complex and costly process before it could be launched. R&D is one of the main fields of competition for every pharmaceutical company and is one of the industries with the highest expenditure for it. Indeed, a new medicine usually takes an average of 12 years from the individuation of its API to be effectively sold. Among thousands of compounds that could have developed into labs, an average of 2 over 10.000 manage to become final product.

In million of euros		In million of euros	
Austria	311	Latvia	-
Belgium	3846	Lithuania	-
Bulgaria	91	Malta	-
Croatia	40	Netherlands	643
Cyprus	85	Norway	126
Czech Republic	62	Poland	339
Denmark	1543	Portugal	117
Estonia	-	Romania	75
Finland	182	Russia	727
France	4451	Slovakia	-
Germany	8466	Slovenia	180
Greece	51	Spain	1212
Hungary	242	Swededn	1104
Iceland	-	Switzerland	6383
Ireland	305	Turkey	137
Italy	1600	UK	5437
TOTAL			37754

Table 3 Pharmaceutical Industry R&D expenses in countries, adapted from EFPIA 2021

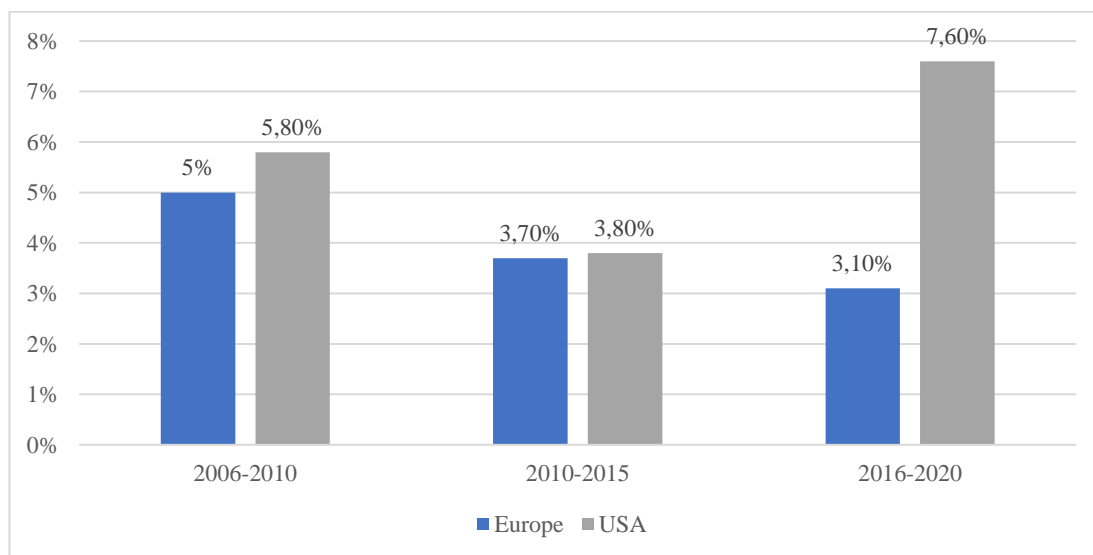


Figure 10 Annual growth rate (in %) of R&D expenses in Europe and United States, EFPIA 2021

The stress on R&D is supported by all the empirical evidence disposable in the literature and in the latest data. Indeed, among those industrial sectors considered high tech, the pharmaceutical industry is leading in term of R&D over net sales, with 15.4% (EFPIA, 2021). European Federation of Pharmaceutical Industries

and Associations (2021) reports that in the pharma industry, more than 37.700 mln of euro have been invested in Europe: nevertheless the trends seem to be in negative for this number because of, on side, the dominance of US market over the European one, and on the other side, the increasing focus on the developing countries: European markets seem to becoming less appealing compared to the emerging ones, translating in a minor amount for resources involved in its territory for R&D. As the leading industry of industrial high technology sector, the pharmaceuticals score also the “*highest added-value per person employed*”. This has an important implication when it comes to employment, HR management and value chain: this industry is employing a huge number of employees whose majority of them is employed indirectly rather than directly European Federation of Pharmaceutical Industries and Associations. (2021). The employment rate witnessed a constant increase constantly in the last decades, especially in the R&D function (EFPIA 2021).

2.1.2 Italy overview

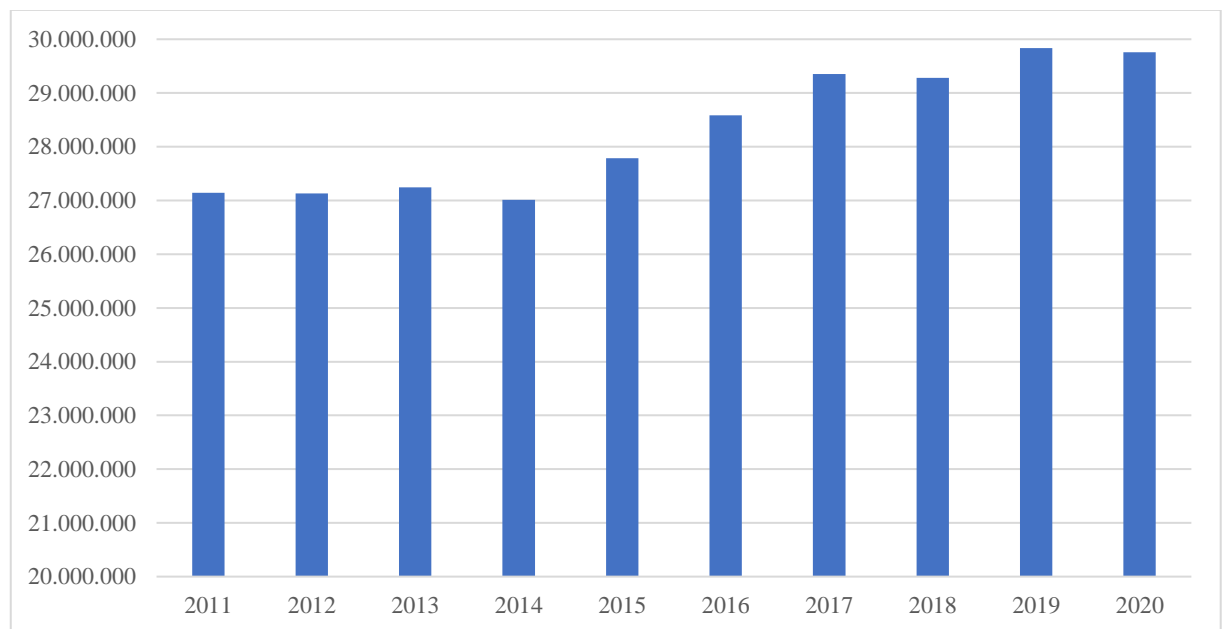


Figure 11 Net revenue of pharmaceutical and cosmetics industry in Italy from 2011 to 2020 (in 000 euros), Mediobanca 2021

The Italian market seem to follow the general worldwide path when it comes to revenues of the industry. The data collected by Mediobanca (2021) about the revenue stream of companies operating in this industry indeed, confirm this

positive trend considering since from the period that in between 2011 – 2020 the size of revenues has grown from 27.143 bln to 29.759 bln, an increase about of 9.6%.

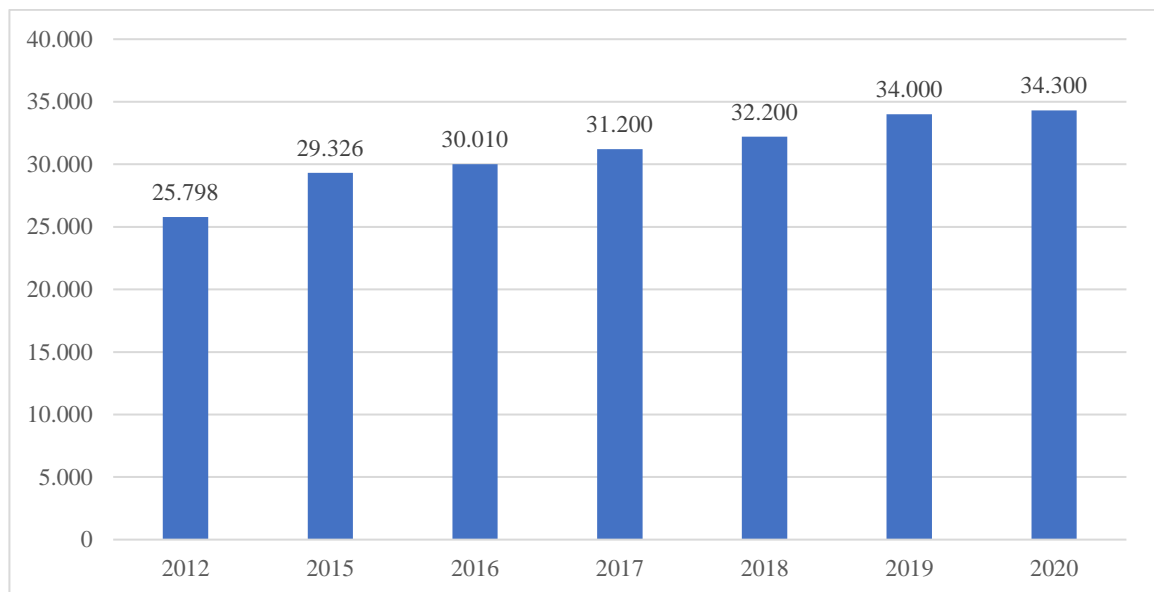


Figure 12 Production value of pharmaceutical industry in Italy in between 2012 - 2020 (in mln euros), Farindustria 2021

The previous information is consistent with the constant growth in term of production value of the industry: taking the time span from 2012 to 2020, the value went to 25.798 bln to 34.300 bln. Farindustria (2021) shows that, despite some negative years, in the last twenty years the value added by the pharma industry has a positive trend, bringing the value added to be almost 9.3 bln in 2020. In this scenario, is worth mentioning the contribution to this value given by companies sustained by Italian capital, which is 43%, and foreign capital firms, which count the 57%. Among this 57%, 35% is composed by firms whose capital are European or Japanese, while the other 22% stands on US capital (Farindustria, 2021). Foreign capital firms belonging to the pharmaceutical industry have a strong impact on the Italian economy, for several factors such as the added value we have mentioned, the exports, occupation but also for adding value through the indirect effect on other sector (Farindustria, 2021).

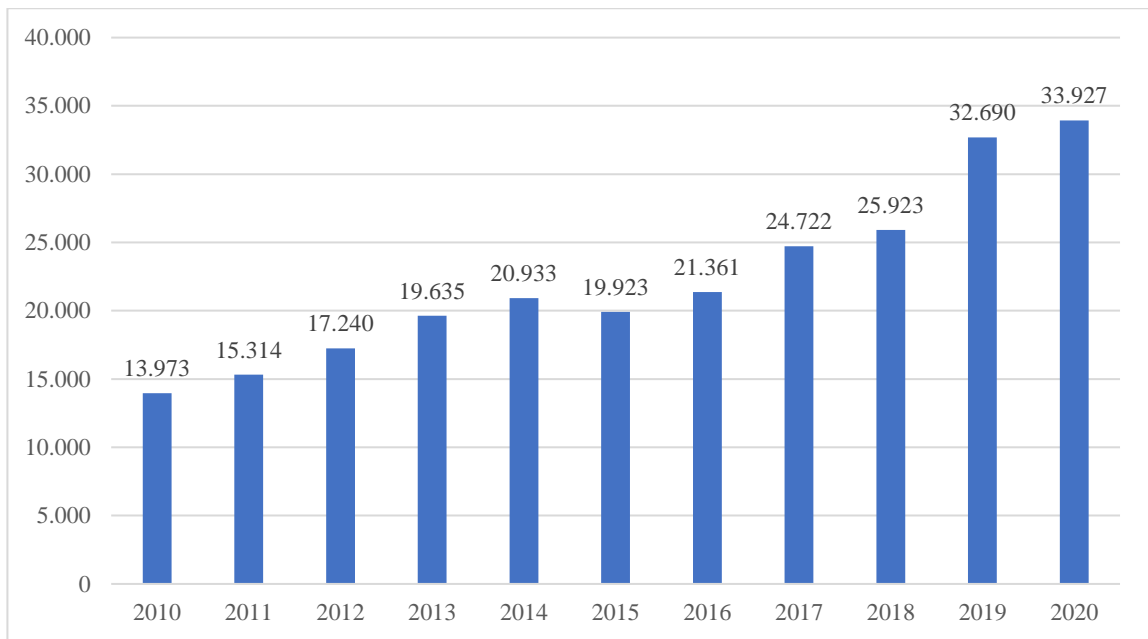


Figure 13 Export value of pharmaceutical products in Italy from 2010 to 2020 (in mln euros), Farindustria 2021

Focusing on the trade balance and the value of product exported, data shows a resulting remarkable growth in the past years that moves from 13.973 in 2010 to 33.927 in 2020. This last value is represented for more than the 70% by medicines, followed by raw materials and other product (25.3%) and vaccines as least exported product, with 4.5% (Farindustria, 2021). The increasing importance for the exports in the Italian pharmaceutical companies is confirmed by data, the shares of pharmaceutical exports deeply increased, starting from 34% in 1997, almost going double with 71% in 2016 and finally arriving at 96% reported in 2019 (Farindustria, 2021).

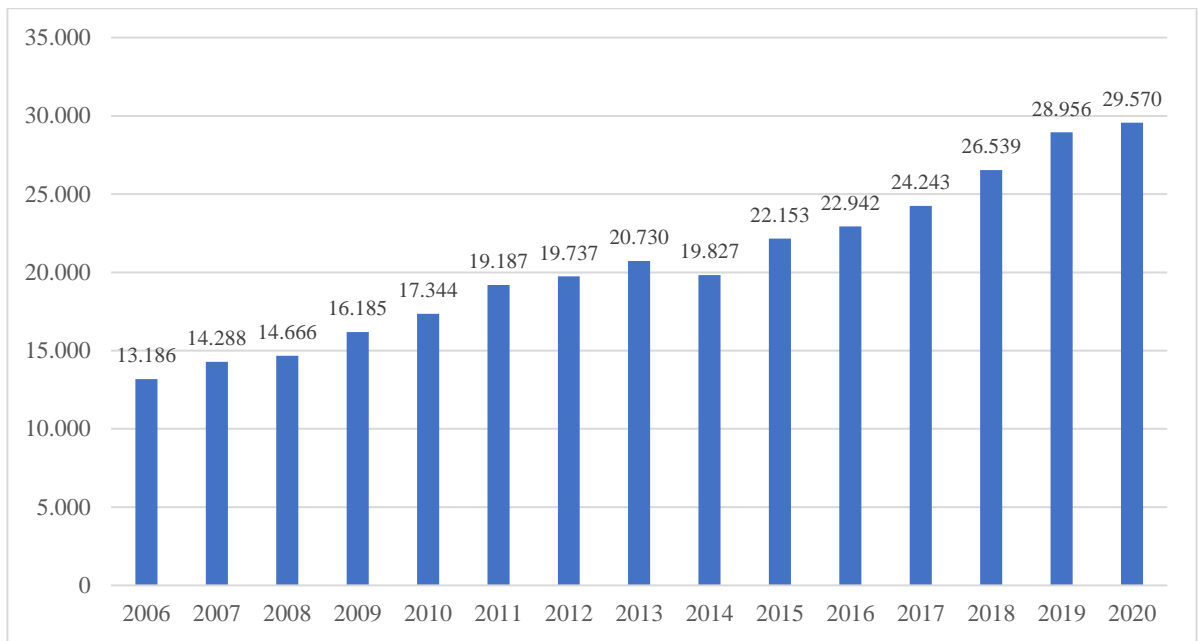


Figure 14 Import value of pharmaceutical products in Italy between 2006 – 2020 (in mln euros), Farmaindustria 2021

On the other side of the trade balance, the trend is positive as well. Indeed, from the report of Farmaindustria (2021), is highlighted the positive trends that see a stop just in 2014, until he reached the value of 29.570 bln in 2020. This is significant for the foreign companies who have foreign operations in Italy. The amount recorded in 2020 include medical mixtures in dosage as the primary imported product, almost the 54%, followed by human and animal blood 26.3%, Pharmaceutical preparations with medical mixtures not in dosage, gland and extracts and dressing packages for medical use the resting 19.4% (International Trade Centre,2021). To the extent of the research is also important to stress the major suppliers of imported pharma products; in data provided by (Prometeia., 2020). US is increasing its quote in importing products compared to Switzerland and Belgium plus Luxembourg, where major players have HQ. Indeed, United States record the most remarkably increase, from a value of 486 mln of imported products to 1017 mln in 2019, surpassing both the other countries.

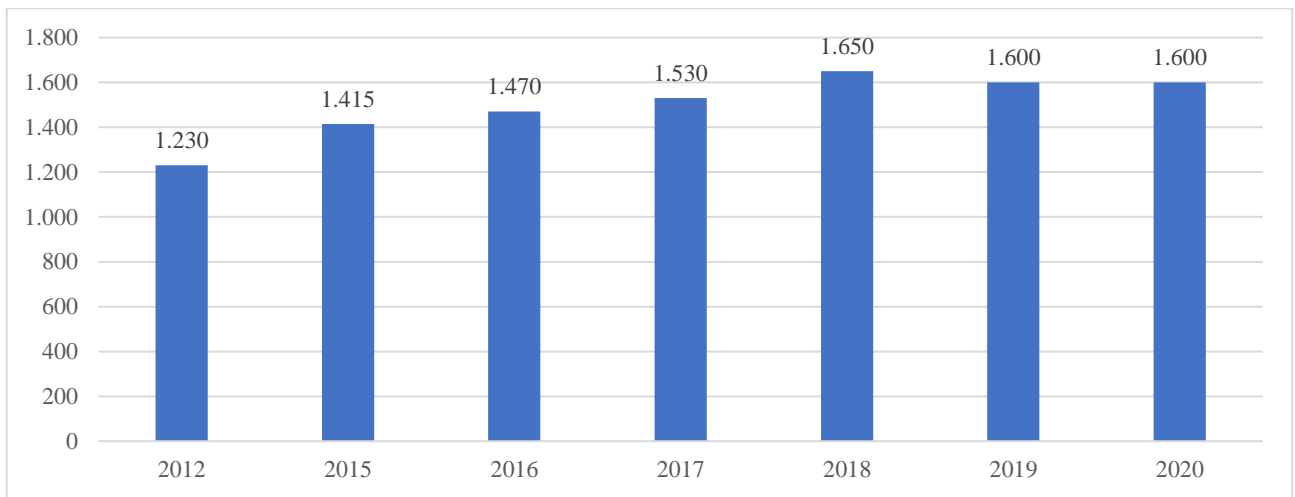


Figure 15 Share of pharmaceutical companies investing in R&D in biotechnologies in selected years between 2011 and 2019, Farindustria 2017

When it comes to the investments in R&D, Italy seems to be aligned with the global trend that characterizes the pharmaceutical industry. Nevertheless, in the last two years reported by Farindustria (2021), 2019 – 2020, in which the value that reached 1.650 mln in 2018 dropped a little bit to 1.600. These figures are confirmed also by the investment made by companies in R&D in biotechnologies among years. The share records a significant growth, jumping from 30% in 2011, to 78% in 2016 until the meaningful 97% in 2019 (Farindustria, 2017).

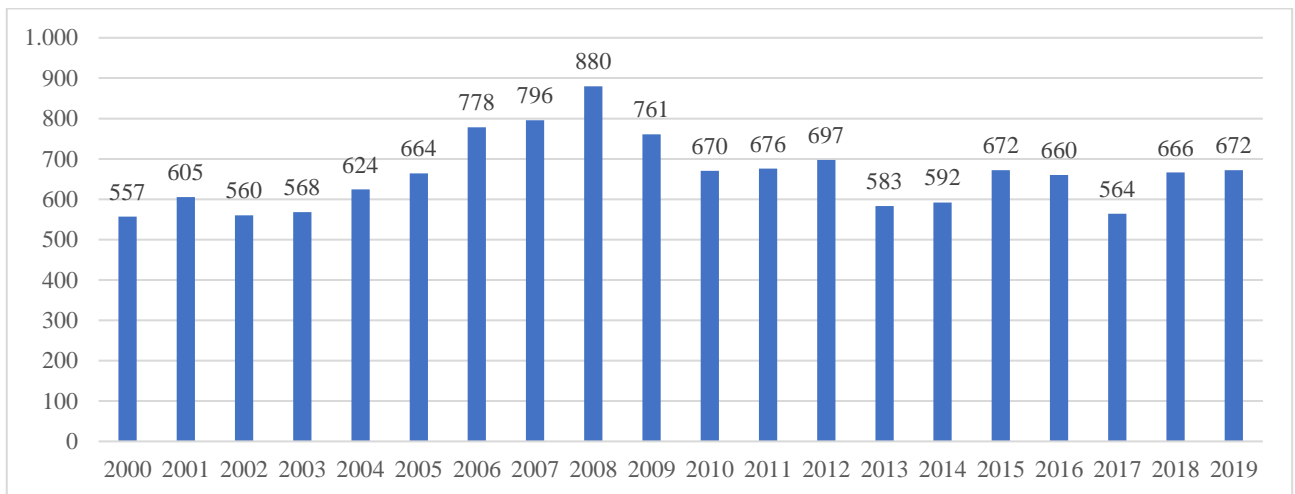


Figure 16 Number of clinical trials authorized by the competent authority in Italy from 2000 to 2019, AIFA 2020

The investment in R&D can then be compared with the number of clinical trials that the authority in charge have authorized in Italy in the last years. From 2020 till 2008, there has been a constant growth then decreased in 2009. Up to that year,

the number even with fluctuations seem to be stabilized between 660 and 700 units of trials. The two low peaks in 2013 – 2014 and 2017, standing on the explanation of AIFA, are justified by regulatory issues in the first case and a general trend that affected the European industry in the second one due to the diffusion of new ways to develop a drug (AIFA, 2020). Looking at the data is AIFA itself that assess positively the trend, sustaining that a new organization of the regulatory framework about clinical trials has improved the conditions for new drug's development.

2.1.3 UK Overview

UK is a developed market that shows revenues of 28.7 bln in 2020, which represent 2.5% of market share in the global markets (IQVIA ,2021). It does become more relevant considering the growth rate that put UK as second market with 6.7% in 2020 (IQVIA, 2021).

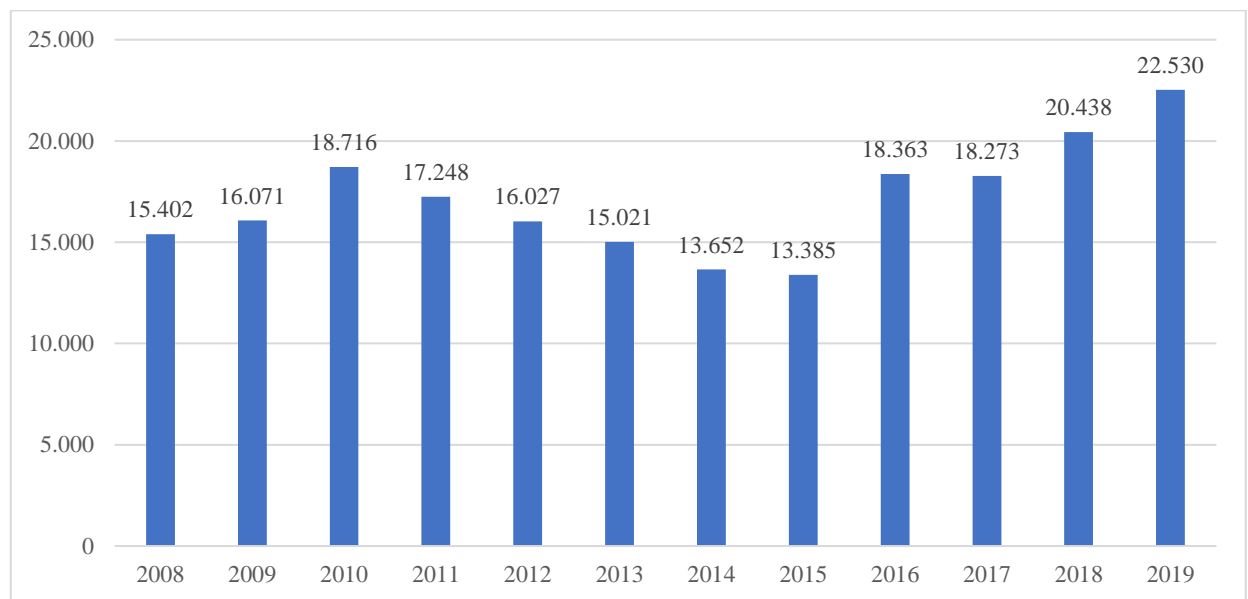


Figure 17 Turnover of pharmaceutical preparations and products manufacturing in the United Kingdom from 2008 to 2019, Office for National Statistics (UK), 2021

Statistics shows indeed a significant growth trend, even with some deflections registered from 2010 to 2015 and from 2016 – 2017: nevertheless, the turnover's value reached the highest results considered the time span in 2019 with 22.530 pounds (Office for National Statistics (UK), 2021).

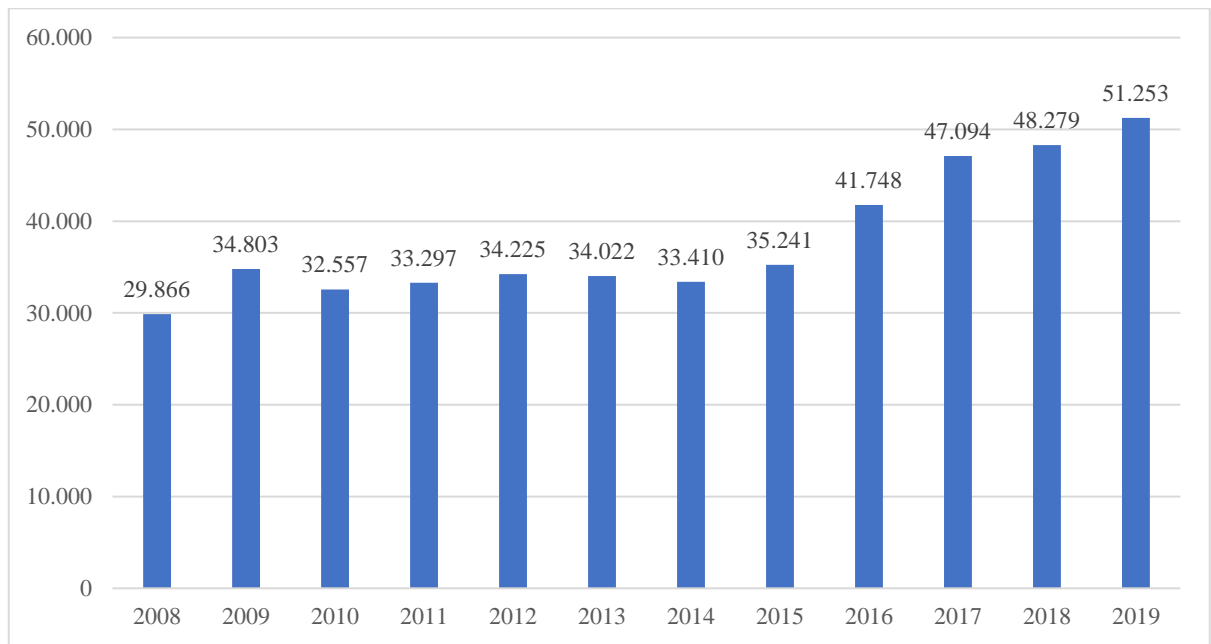


Figure 18 Annual turnover of pharmaceutical goods wholesalers in the United Kingdom from 2008 to 2019 (in mln GBP), Office for National Statistics (UK), 2021

In the statistics reported by Office for National Statistics (UK), (2021) then, the turnover of pharmaceutical good wholesalers instead seems to have been more stable than the previous measures. It has had a constant growth starting from 2014 until reaching a value of 51.253 in 2019: this growth has been followed by the increase of firms operating in this sector as well, going from being 2.1 thousand to 2.7 considering the same period (Office for National Statistics (UK), 2021). To the purpose of outlining the key features of this market, is relevant as well to mention the trend regarding the spending made by customer across UK. Among 2005 and 2020 there has been an outstanding growth that reached 12 bln in 2020, almost 10 times compared to 2005 given the significant investments in new technologies and R&D that widened the coverage of illnesses (Office for National Statistics (UK), 2021).

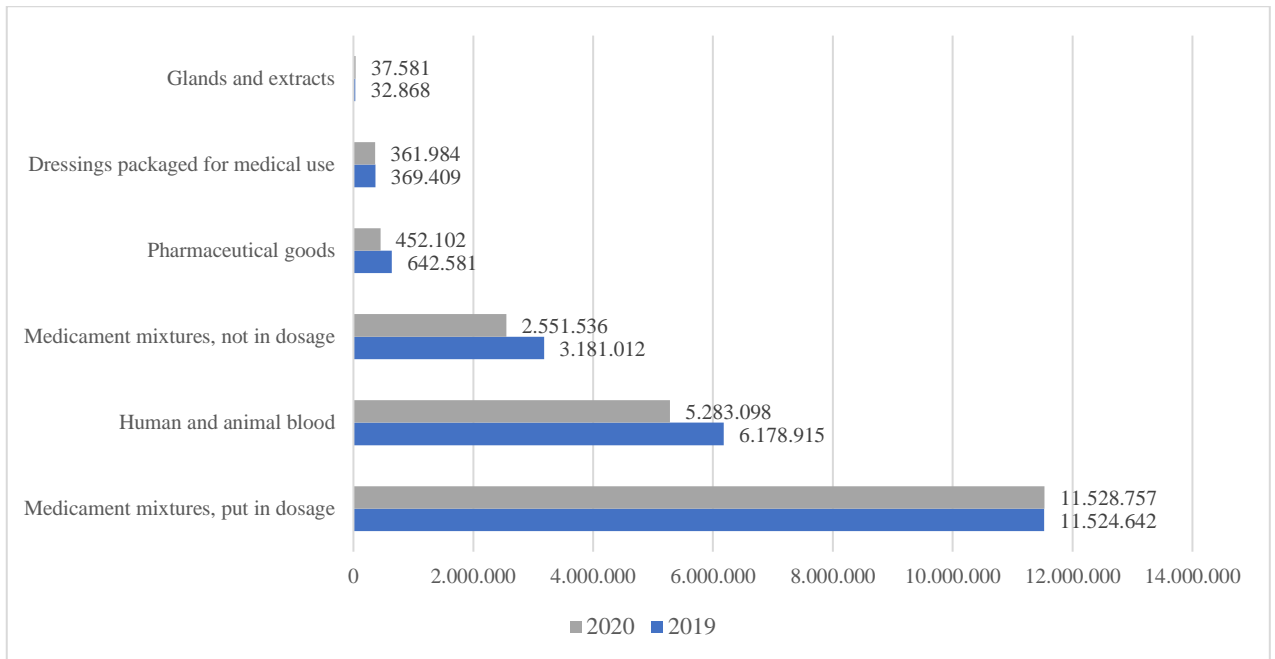


Figure 19 Value of pharmaceutical products imported to the UK in 2019 and 2020 (in 1.000 GBP), International Trade Center 2021

When it come sot the trade balance, the data coming from International Trade Centre. (February 26, 2021) shows that medicament mixtures are the greatest imported product with no significant variation between 2019 and 2020, the other products instead confirm a negative trend in term of imports. A similar pattern is followed by the exports value of product looking at the type of them (International Trade Centre, February 26, 2021).

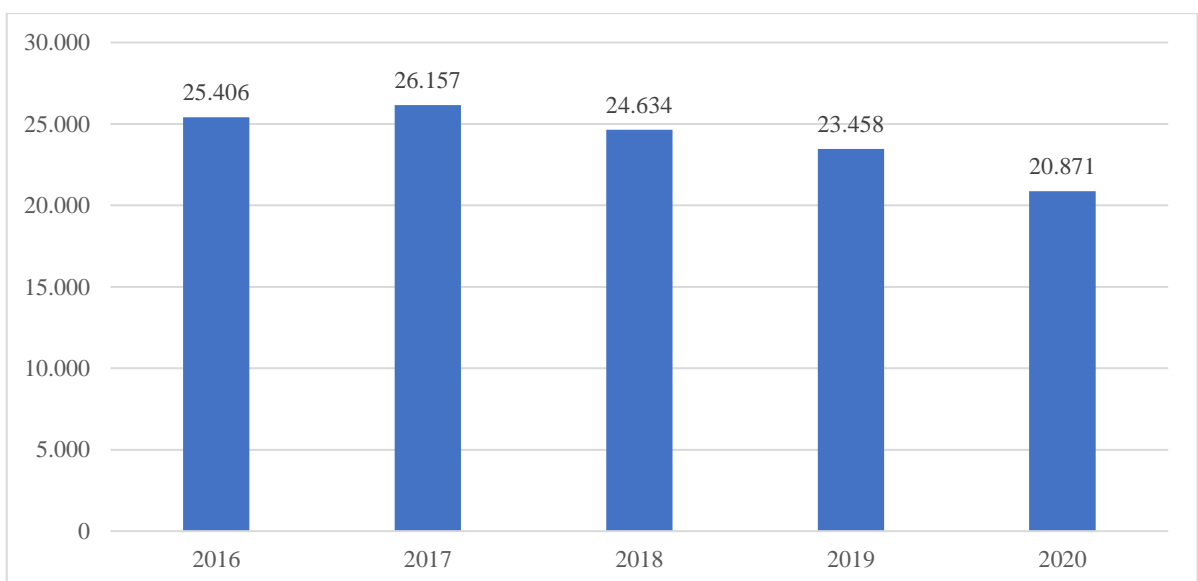


Figure 20 Value of pharmaceutical products imported into the UK from the EU-27 from 2016 to 2020 (in mln \$), OECD 2021

Overall, the trade balance seems to be in a negative trend comparing the previous year's data; indeed, from 2016 to 2020 there has been a significant decrease from 25.406 to 20.871 of import's value form the European countries. A significant decrease has been recorded also in the exported value of pharma products, since from the 15.594 bln in 2018 it dropped to 11.228 bln in 2019 (OECD. (August 14, 2021).). The overall negative trend in term of international trade, especially with the EU countries, could find its explanation with the Brexit and the regulatory issues that have slowed down the commercial relationships, bringing to some extent and advantage to those companies coming from the US.

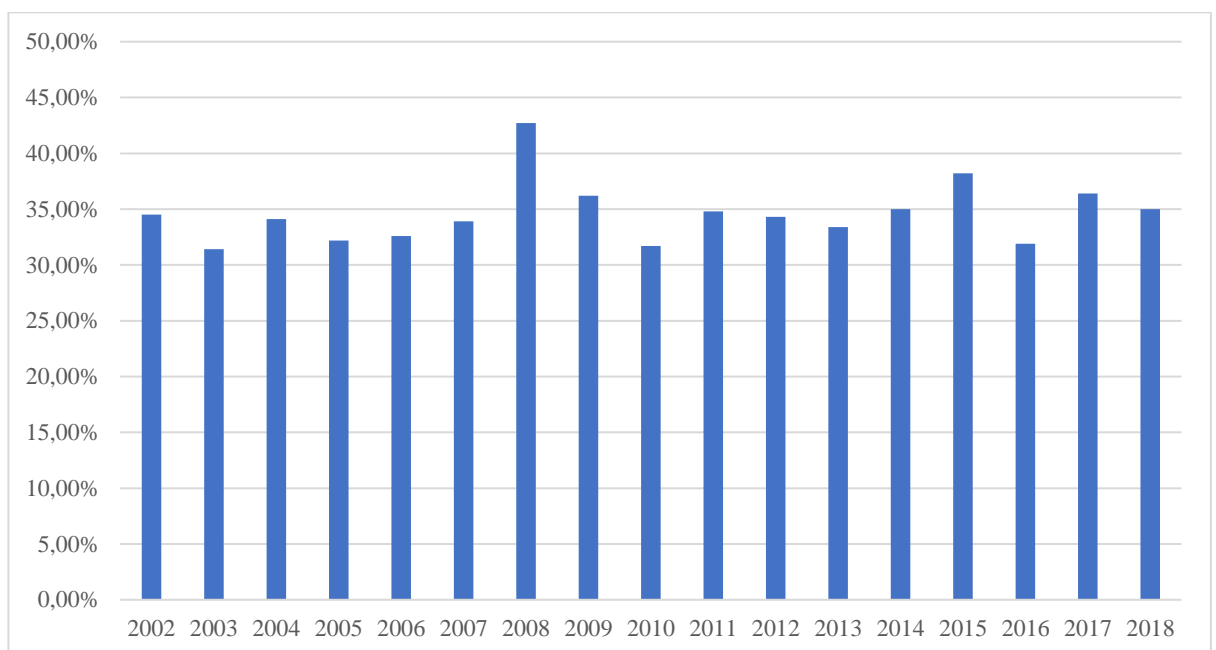


Figure 21 R&D as a % of sales in pharmaceuticals manufacturing in the UK, 2002 - 2018,
Office for National Statistics (UK), 2021

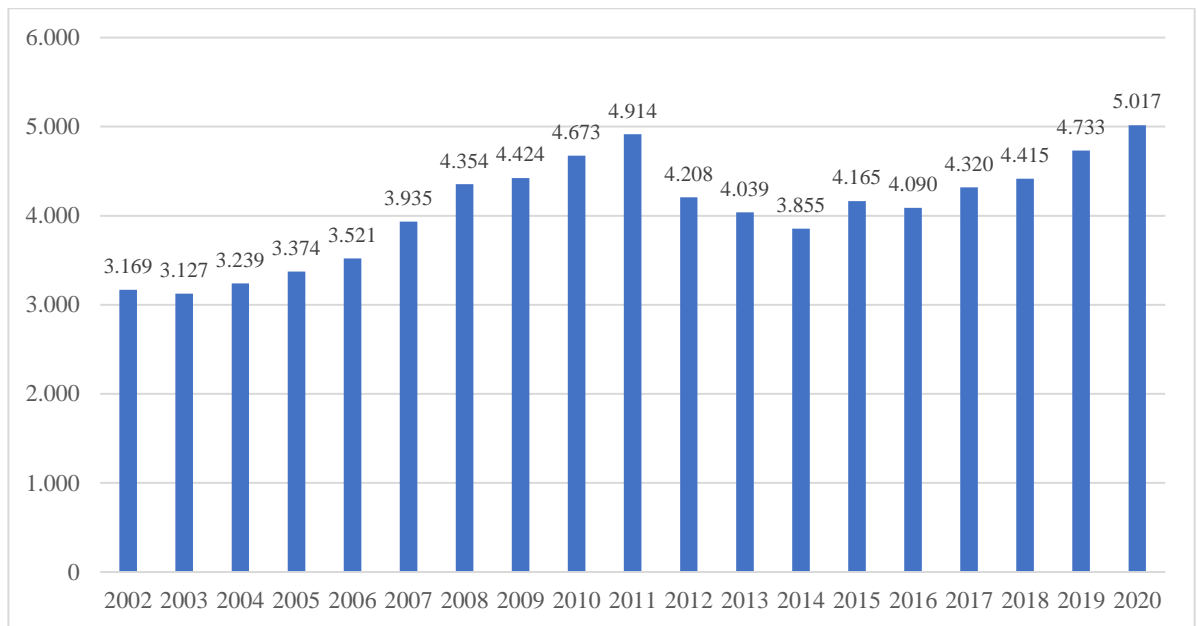


Figure 22 R&D expenditure of pharmaceutical businesses in the UK 2002-2020 (in mln GBP),
Office for National Statistics, 2021

The R&D expenditures are consistent with what happens in the rest of the world; despite some low value, from 2016 they have increase constantly reaching 5.017 mln of pounds (Office for National Statistics (UK). (November 20, 2020). Office for National Statistics (UK). (November 21, 2019) offers a good outlook on what concerns the R&D intensity in UK, showing the R&D spendings as a percentage of the sales coming from the pharma manufacturing process taking into account the years 2002 to 2018. The percentage is quite variable between year and year with a peak in 2008 with the 42,7%, but overall average value that is set on the 35% on sales Office for National Statistics (UK). (November 21, 2019). This is directly related to the fact that, in general, the R&D are sustained by the enterprise themselves: in 2019 the 73,6% of funding for R&D came from the business' income Office for National Statistics (UK). (November 21, 2019). That is directly correlated to what has been discussed already, about the importance of patents and the possibility to leverage on the price for pharma companies.

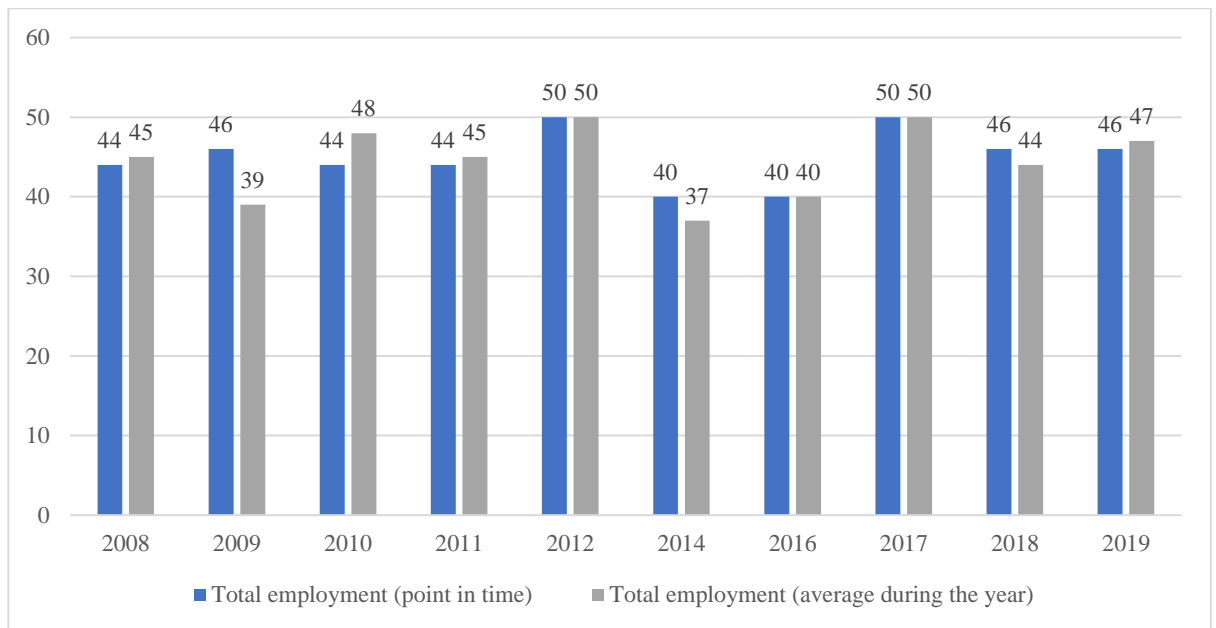


Figure 23 Employment in pharmaceutical products and preparations manufacturing in the United Kingdom from 2008 to 2019 (.000), Office for National Statistics (UK) (2021)

Is worth mentioning that the pharma industry also in UK represent one of the main sectors when it comes to employment and, especially, the employment of people with technical skills. Office for National Statistics (UK). (June 24, 2021) shows how the, on average, the number of employees is around 45 thousand.

2.1.4 China overview

The developing markets are rising attention for the rapid expansion they have experienced in the last times: China, for dimension and other factors, is one of the most relevant markets worldwide. It is indeed the second market considering revenues generated in 2020, with 93bln dollars, the second market share of 8% after the US. In term of growth rate, it seems that the pandemic situation heavily affected a positive trend that witnessed significant increases: indeed, the growth rate of 4% stable in the years 2017 to 2019, turned to be -2.4% in 2020.

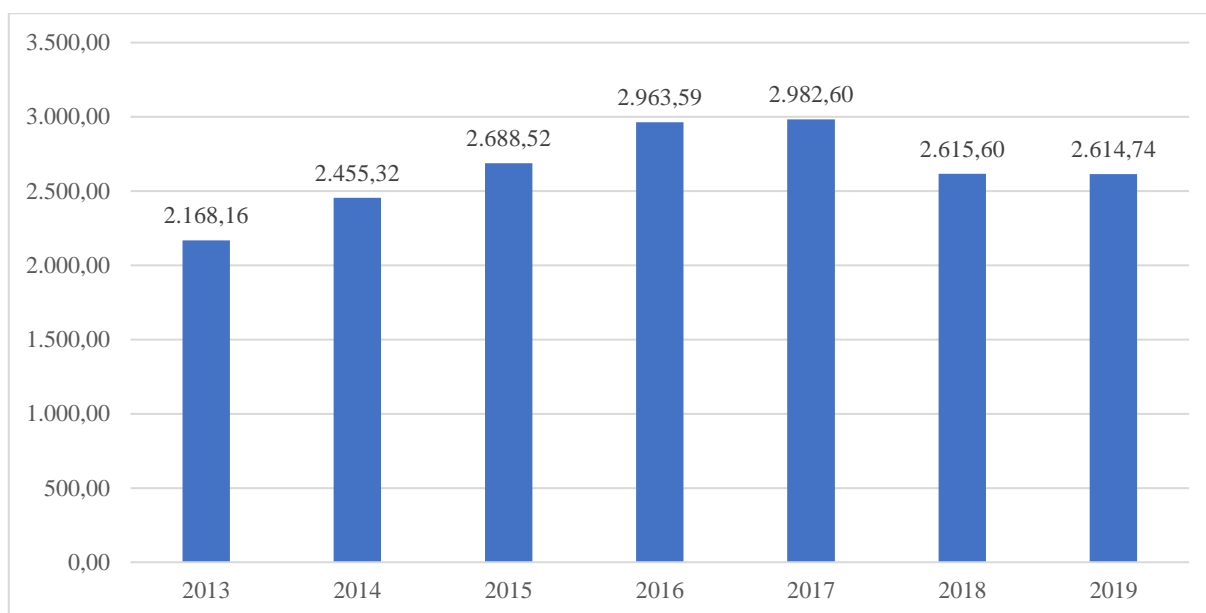


Figure 24 Prime operating revenue of the pharmaceutical industry in China from 2013 to 2019 (in bln yuan), National Bureau of Statistics of China 2020

Looking more in depth these figures, National Bureau of Statistics of China, & China Pharmaceutical Enterprises Association. (June 1, 2020) shows the past trend of prime operating revenues in China in the period in between 2013- 2019; the peaks have been recorded in 2017, with 2982.6 bln of Yuan, while the decrease after till the 2614.74 bln in 2019. The annual growth instead follows a different pattern, with the latest 8% on a 2019 on 2019 change in prima operating revenues (National Bureau of Statistics of China, & China Pharmaceutical Enterprises Association, June 1, 2020).

Segment	2014	2019
Pharmaceutical preparations manufacturing	630,37	857,61
Chinese patent drug manufacturing	580,65	458,70
Active pharmaceutical ingredient (API) manufacturing	424,04	380,37
Medical devices and equipment manufacturing	213,61	281,48
Biological medicine manufacturing	274,98	247,92
Chinese herbal decoction piece processing	149,56	193,25
Sanitary and medical product manufacturing	166,23	178,14
Pharmaceutical machinery manufacturing	15,89	17,23

Figure 25 Breakdown of operating revenue in the pharmaceutical industry of China in 2014 and 2019 (in bln yuan), National Bureau of Statistics of China, 2020

It is then useful to see the breakdown reported by China Pharmaceutical Enterprises Association, & National Bureau of Statistics of China. (June 1, 2020)

of the operating revenue by segment: pharmaceutical preparation manufacturing is by far the segment leading the pharmaceutical industry in China that had also a significant increase in respect to 2014.

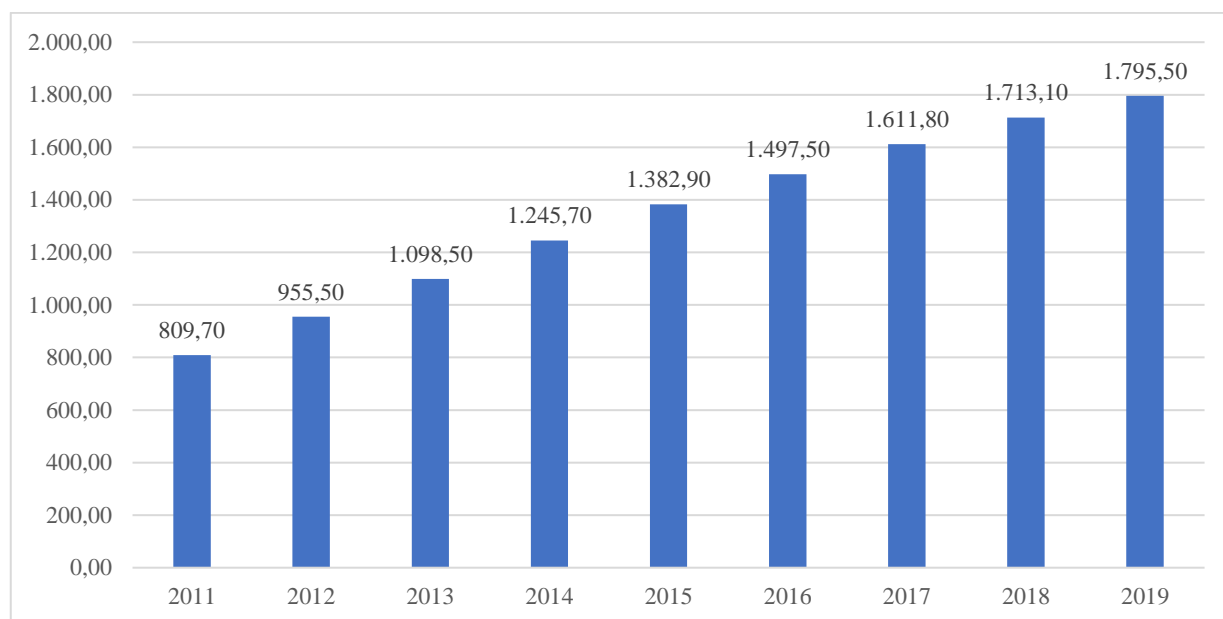


Figure 26 End market sales volume of pharmaceutical industry in China 2011 - 2019 (in bln yuan), Forward Intelligence (Qianzhan), April 16, 2020

The market sales volume is also consistent with the previous trend of a market that is going through a transformation. This statistic has a constant growth from 2011 to 2019, that ends up with a value of 1795.5 bln of Yuan.

The Chinese market is experiencing an evolution in term of quality and speed, increasing becoming a “*value added economy*” (Forward Intelligence (Qianzhan), April 16, 2020). The fact that the Chinese population is aging, is the increasing the possibilities to the pharmaceutical industry to prosper encountering new diffused needs, while the market is already at the second place for revenues generated. The market has been characterised by high fragmentation due to the presence of many SME companies and by the great diffusion of generic drugs. Nevertheless, recent regulatory changes occurred in between 2017 and 2019 are opening the market, making it more prone to welcoming international companies and investments. There Chinese market is likely to encounter a period of consolidation, probably through a wave of mergers and acquisition and an

increasing expenditure in R&D to shift into a quality field of competition (that will result increased as well). The number of foreign drug application is confirming this trend (Forward Intelligence Qianzhan, April 16, 2020)., thanks to the integration of Chinese regulatory framework and processes for drug's development with the standards of the international community.

2.2 PFIZER ANALYSIS

“Pfizer Inc. is a research-based, global biopharmaceutical company. We apply science and our global resources to bring therapies to people that extend and significantly improve their lives through the discovery, development and manufacture of medicines and vaccines.” (Pfizer, 2022).

Strategy

Pfizer has its operations in different business segments along the value chain of the healthcare industry, with a wide range of biopharmaceutical products delivered globally. The declared mission of Pfizer is *“Breakthrough that change patients’ lives”*: the centrality of the patient is at the core and the scientific research the main competitive priority for the company’s business model (Pfizer, 2022). The company summarizes its growth strategy into 5 *“Bold Moves”*, the key drivers through which Pfizer is meant to deliver and capture back value.

Lead the conversation

- Lead the conversation means to assume a central role in the communication with authorities and stakeholders to push for pro innovation policies and so make possible for everyone to receive the result of this innovation and consequent therapies. At the same time the commitment is towards people, granting them transparency and information and convey the idea that the core value of the company stands on the science that produce every medical product (Pfizer, n.d.).

Win the digital race in pharma

- The company is pursuing a deep digital transformation, coherently with a trend characterising all the industry. Digital solutions, and so the employment of AI in the daily processes or the use of big data to improve operations, represent a means through which is possible to improve the consumer experience as well having results on the population of patients (Pfizer, n.d.). Smart technology is a way to add value on the medical product. Indeed, the use of it can effectively help to tackle with diseases obtaining significant results. An example is “*patient with chronic myelogenous leukaemia*” are supported in being constant with therapy with smart technology (Pfizer, n.d.).

Transform our go to market model

- Pfizer is pursuing new form of collaborations to increase the affordability of healthcare, developing for example new flexible payment methods. This commitment translates in an attempting to bring cancer treatments in developing economies, as well as increase the manufacture capacity for Covid 19 vaccines (Pfizer, n.d.).

Deliver first in class science

- Pfizer is addressing the value of its scientific research as one of the main sources for competitive advantage. They pursue ambidexterity in this sense, working on the best performing products as quick as possible maintaining the highest quality (Pfizer, n.d.). Results have been:
 - “*The development of the first FDA-authorized oral treatment for COVID-19*” (Pfizer, n.d.)
 - “*Progressed 52 programs in our research and development pipeline (Phase 1 to registration), with a focus on oncology, inflammation & immunology, vaccines, rare disease, and internal medicine*” (Pfizer, n.d.)

- “Secured FDA approvals or achieved clinical milestones in oncology, women’s health, rare diseases, immunology, and more” (Pfizer, n.d.)

Unleash the power of people:

- Pfizer is trying to leverage its human capital to increase performance. In a knowledge intensive industry such as the pharma one, a well-designed remuneration system and bonus scheme combined with a goal oriented and inclusive culture can lead to the ambidexterity (Pfizer, n.d.).

Design and Planning

On the edge of this framework, Pfizer managed to restructure its operating segments and be recognized as the company they mean to be in the statements, focused on the production process of innovative biopharmaceuticals product (Pfizer, 2022). At the end of 2021, the commercial operation of Pfizer shows two operating segments, each managed by one top manager. One is Biopharma, the segment in charge of the development of innovative science based pharmaceutical business and Pfizer CentreOne, the CDMO branch of the company leading in the supply of API. The first segment covers the following therapeutic areas that define the company’s portfolio:

Therapeutic Areas	Description
Vaccines	Innovative vaccines for all the ages in pneumococcal disease, meningococcal disease, tick-borne encephalitis and Covid 19, with a pipeline focus on infectious disease with significant unmet need
Oncology	Innovative oncology brands of biologics covering several forms of cancers
Internal Medicines	Innovative brands in cardiovascular metabolic and women’s health, as well as regional brands.
Hospital	Global portfolio of sterile injectable and anti-infective medicines, as well as an oral COVID-19 treatment
Inflammation and Immunology	Includes innovative brands and biosimilars for chronic immune and inflammatory diseases.

Rare Disease	Includes innovative brands for a number of therapeutic areas with rare diseases
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Table 4 Therapeutic areas served by Pfizer, adapted from Pfizer Annual Report (2022)

Pfizer Global Supply is the company’s branch that fulfil manufacturing and supply needs. Those comes from a global network that intertwine more than 30 companies, 42 manufacturing sites, 134 logistics centres, over 200 supplier and 38.000 colleagues. The capacity is proportioned to a production that counts over 850 products for more than 24.000 SKUs (Kane & Jhonson, 2017).

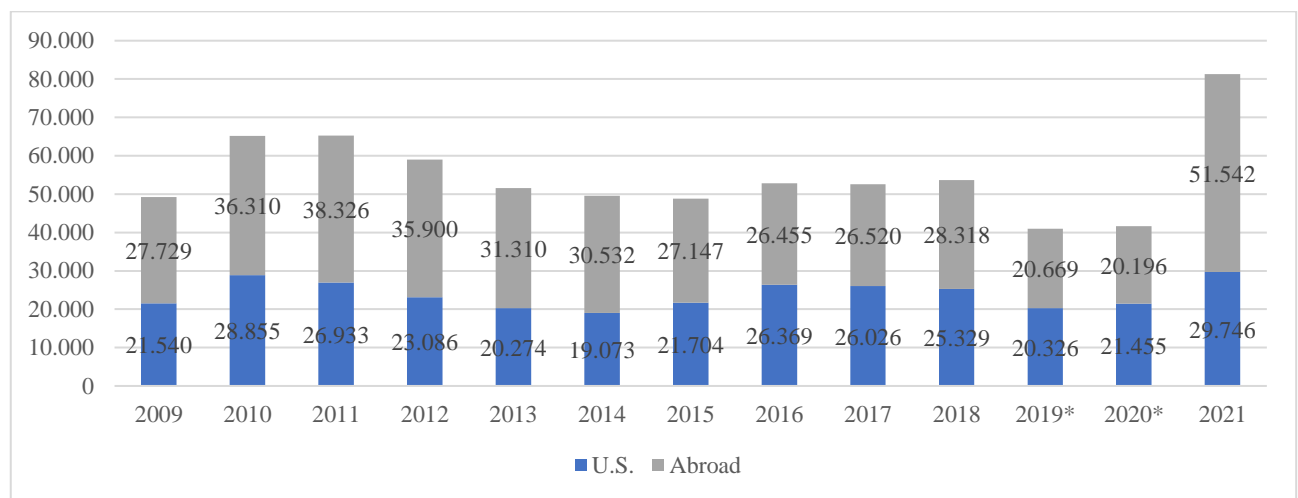


Figure 27 Pfizer's revenues in the U.S. and abroad from 2009 to 2021 (in million U.S. dollars), Pfizer 2022

Global operation has always meant major part of Pfizer’s revenues: despite the US market is the largest one in the world, Pfizer has global operations represent the major source of revenues. In 2021, 51.5 bln out of almost 81 bln \$ have been realized abroad (Pfizer, 2022). Global means being in 125 countries served: in the operations, emerging markets such as China is becoming increasingly important for Pfizer due to the progressive closeness they are witnessing with developed markets (Pfizer, 2022). In the manufacturing process takes a leading role the R&D function, which could be considered as integrating part of the core processes in the pharmaceutical business compared to other sector or industries. R&D in Pfizer have always been a substantial part of the operational improvement. The function is focused thereby focused strengthen the pipeline, both under efficiency and effectiveness dimensions, while achieving high sustainable standards and make possible a value delivered in the medium - long term (Pfizer, 2022). The revenues

of Pfizer reached the outstanding results of \$ 81 bln in 2021, thanks to the distribution of the Comirnaty vaccine, developing jointly with BioNTech. Pfizer detained the leading in the industry for R&D spendings and prescription drug sales for years. The main segment to which Pfizer relies on is Innovative Health, which aim to develop medicine in fields such as the one of rare disease or vaccines. These segments are characterised by a high profitability but requires indeed an extremely high investment in scientific research. Over the covid 19 vaccine, also the portfolio related to Prevnar has characterised Pfizer 2021 sales. Among the top products we also find Lipitor, for treat cholesterol peaks even tough is recording a sales' decline in the last years. Near to this there is also Viagra who caused a decrease in term of revenues as well since, even if it still one of Pfizer's blockbusters, its U.S. patent expired during 2017 (Pfizer, 2022).

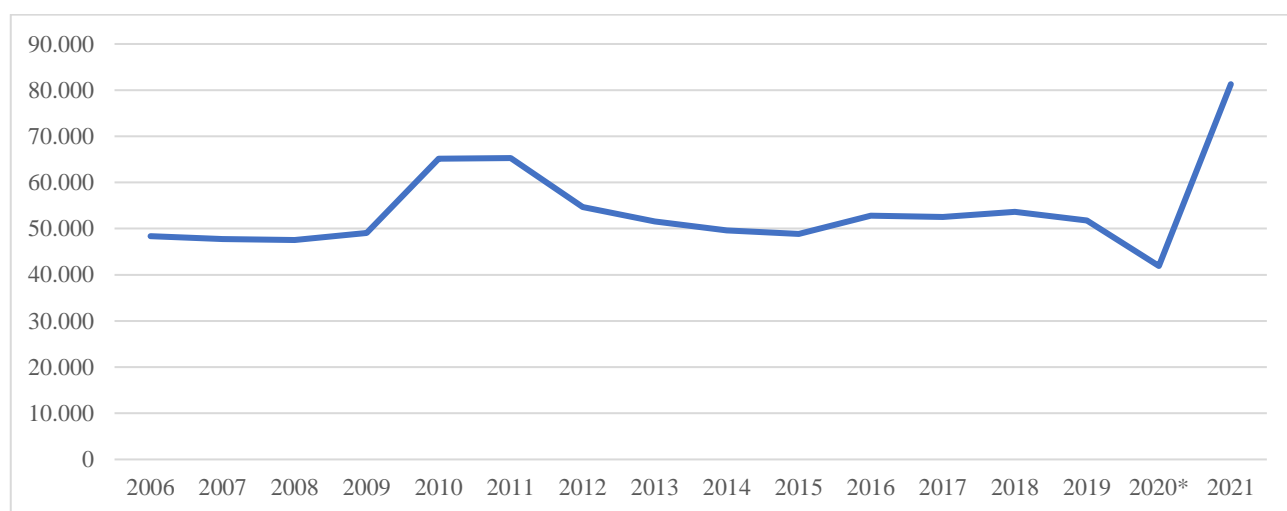


Figure 28 Pfizer's total revenue from 2006 to 2021 (in million U.S. dollars), Pfizer 2022.

Compared to revenues, net income has much more closeness in term of numbers. In 2021 it reached \$ 22 bln, more than double compared to 2020. The drop of 2020 is justified by the important investments made in R&D plus restructuring costs. It should also be clarified that the peak in 2017 is due to a significant tax benefit worth \$ 9 bln. With the prominent level of net income of 2021, there has been a consistent peak in basic EPS of 3.92 \$, the highest in the period considered. The general path of EPS is coherent with the dynamics of net income changes

whereas it is happened during 2020 negative peaks are usually backed up by large investments in R%D (Pfizer, 2022).

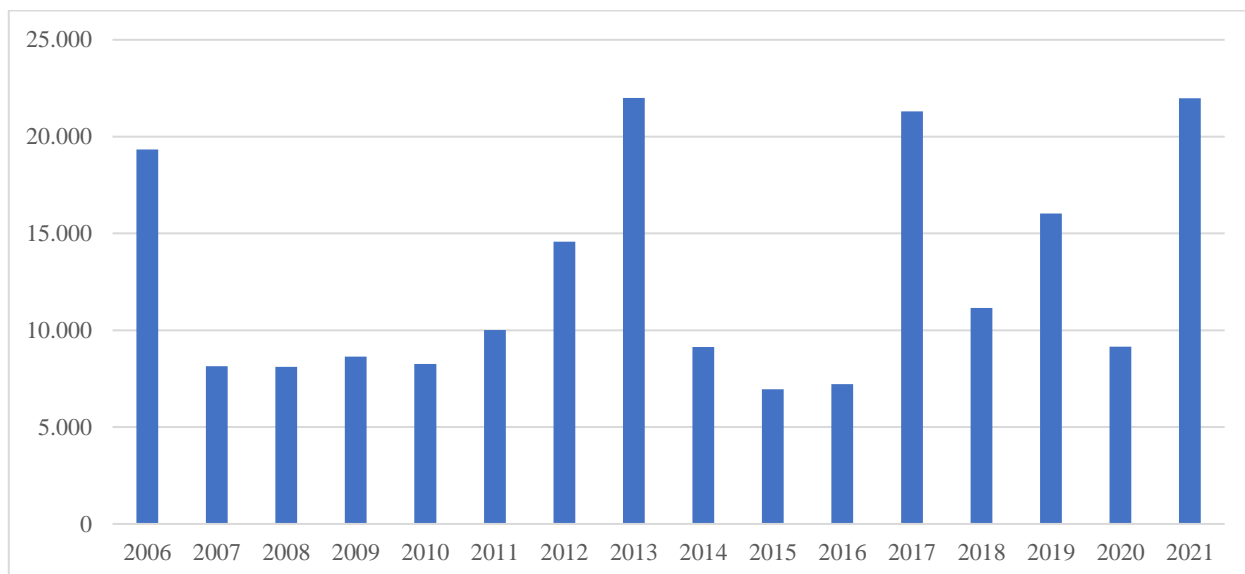


Figure 29 Pfizer's net income from 2006 to 2021 (in million U.S. dollars), Pfizer 2022

Coming to the investment in drug's development, the last R&D spending recorded has been \$ 13.829 bln, 47,2% more than 2020 (\$ 9.393 bln). This investment, which gave the Covid 19 vaccine, has been significantly higher than the average which is \$ 8.515 bln and the peaks of 2010 of \$ 9.483 bln. Rather than be just number, these data represent the commitment of Pfizer to enhance the science value of the manufacturing process. R&D is indeed a feature of the industry, and Pfizer has embraced the challenge combining strong efforts with therapeutic area in which these could be translated in an increased value both for customers and company itself.

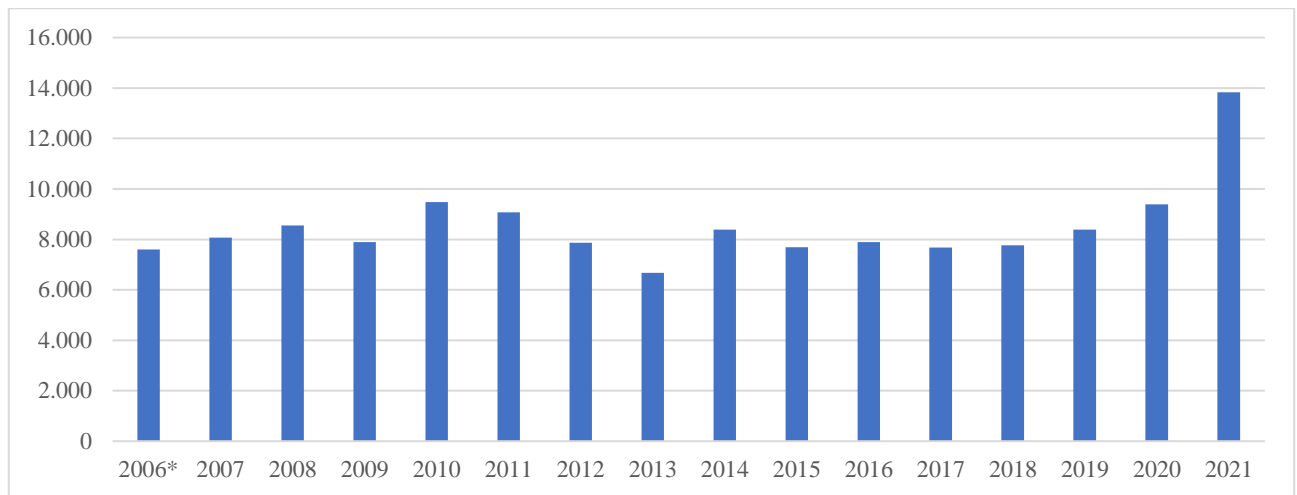


Figure 30 Pfizer's expenditure on research and development from 2006 to 2021 (in million U.S. dollars), Pfizer 2022

Improvement

Knowledge management has been found to be a key tool to improve operations. Effectively manage knowledge represents a mean by which is possible to improve flexibility, fast decision making and learning process over tackling with the change in workforce that is happening (Kane & Jhonson, 2017). Literature validates the role of knowledge management practices as a tool to meet customer centric strategies, exploiting the connections that could be implemented by digital means along the supply chain (De Giovanni, 2021). KM is functional to a Pharmaceutical Quality System and PGS has been working to integrate the best implementation of it (Kane & Jhonson, 2017).

- Retaining critical knowledge
- Connecting people to people
- Connecting people to content
- Connecting and transforming data

The efforts to improve operations finds several validations, given that Pfizer has started to adopt sustainable solutions for its operational processes since the end of 90s. Solutions that have been implemented for example are “*geothermal heating and cooling o buildings, photovoltaics, biomass for energy generation*” or technologies such as “*adiabatic cooling of laboratory areas and a pilot plant for*

drying process air using solar energy” (Schmidt et al., 2019). The core idea of innovative and sustainable solution has been to foster digitalization or process and shifting to sustainable source of energy flows. Pfizer try to foster innovation also through a foreign operation architecture that enhance competition among locations. Set the global requirements, each site can meet them and then work on its production competitively achieving bonus and using market’s opportunities. This is ensured by the integration of modern technologies coherent with an industry 4.0 view and lean manufacturing approach to systems (Schmidt et al., 2019). Pfizer has been working on the implementation of continuous manufacturing since several years, started with a joint research effort of Pfizer by its Research Center of Groton (USA), the company GEA and the University of Ghent. The aim was and still is to have an automated process that can substitute the less efficient batch manufacturing process (Schmidt et al., 2019). Continuous production represents a way to lower costs by the increased efficiency of each manufacturing step, monitored and controlled digitally, with positive effects on the sustainability of the whole production (Schmidt et al., 2019).

2.2.1 Pfizer in Italy

Pfizer has been in Italy since 1955 and has always represented a leading company not only at the pharmaceutical level, but also for the overall industrial relevance (Pfizer in Italia - Pfizer Italia, n.d.). In 2020, the turnover was almost 800 mln euros and it counts more than 2.000 employees in different facilities. In particular, Pfizer has facilities in Rome where the administration body is, “Farmacovigilanza” and Regulatory strategy divisions are set in Milan where is also working an international research group in the oncology area (Pfizer in Italia - Pfizer Italia, n.d.). Two manufacturing sites are also placed in Italy: Catania and Ascoli.

The first plant in Catania has a long story and the plant oversees manufacturing products for the therapeutic areas Anti-infective and oncology (Pfizer Italia, 2020). The core production it has is made of parenteral antibiotics mainly used in

hospitals. The amount produced is around 23.6 bln units manufactured in 2019 and gave the company's products that are exported in over 110 countries (Pfizer Italia, 2020). Ascoli Instead represent one of the Pfizer's sites most considered in the field of operational excellence worldwide. More than 100 markets are served by its outputs which is composed by high technological oral solids: the capacity of the plant is remarkable, with 130 mln of packages that means over 4 bln of tablets produced in a year (Pfizer Italia, 2020). In the plant in Ascoli will be also produced the recently developed anti-covid drug branded Pfizer, Paxlovid (Ansacom & Pfizer, 2022). This represents a new treatment to deal with Coronavirus and so a new mean to avoid a pandemic comeback. Pfizer has focused its efforts to develop these medicines, in line with its mission to reduce the impact of disease such as the Covid 19 is on a global scale that brought the production plant in Ascoli in the first line for it (Ansacom & Pfizer, 2022). In Milan instead is set one of the strategic research center of Pfizer specialized in the clinical research of tumours. Among its task, the is possible to see the delivery of studies on innovative molecules that can deal with oncological disease that do not have an actual treatment, has a role in setting the procedures for the R&D, set up clinical reports for the regulatory authorities of EU, USA and ASIA and is part of an excellence research network in this field (Pfizer Italia, n.d.). In Italy have been implemented co-innovation initiatives with the aim to improve processes by the introduction of new technologies, with benefits in the process' improvement (Ombrosi et al., 2019).

2.2.2 Pfizer in China

Pfizer is present in China since the 80s and consistently with the corporate guidelines focus its efforts to be leader in innovation and improving the health care condition of Chinese people, bringing the company to the leader among foreign biopharmaceuticals companies operating in China (Pfizer China, n.d.). The trends characterizing the Chinese market and the expansion it has been witnessing in the last years are turning to be the perfect condition where to run

operations in lines with Pfizer's values and core missions. The importance of the Chinese market is confirmed by the number resources and assets the company has and have invested into it.

The efforts in innovation have brought Pfizer's to effectively launch around 60 innovative drugs, and so having contributed into the building of a well-diversified portfolio of products that covers a wide area of disease. Nevertheless, the areas in which Pfizer has a top market position are cardiovascular and antibiotic. In China there is a strategic R%D center in Zhangjiang High Tech Park in Shanghai, which has a key role in both the management of R&D operations in the Asia-Pacific region and at a global level (Pfizer China, n.d.). The centre coordinates several teams committed in the pharmaceutical scientific research and the collaboration with several entities operating in the development of biomolecule and chemical pharmaceutical (Pfizer China, n.d.). Among the collaborations, is worth to mention the strategic choices to involve a high qualified network of universities to bring further the research in innovative drugs (Pfizer China, n.d.). In the R&D settlement for Pfizer in China does also represent an important pillar the Wuhan Biolake industrial base (Pfizer China, n.d.). At the side of that, Pfizer owns four different manufacturing facilities in China. The first one was set in Dalian, which have been the first good manufacturing practices plant operating in China; then there is the Suzhou Pharmaceutical plant which has been taking a leading role in the manufacture of OTC medicines; in 1995 has been set the plant in Wuxi which is focused on the production of anti-cancer drugs; the last one, leading in innovation ,in the Pfizer Global Biotechnology Center in Hangzhou which is the third center in this world and produced biosimilar medicines both for the Chinese market and global needs with high quality standards ((Patnaik, 2016; Pfizer China, n.d.,). China has a crucial factor that need to be considered, which is the regulatory constraints: the main product of Pfizer in the last year, which caused in incredible growth in term of revenues, is not authorized in China yet (Pfizer, 2022). The regulatory approval requires to fulfil different steps, in a process that is extremely

costing and time consuming and next to this, there is the competition raised by generics drugs that especially in China represent relevant a risk factor; the main authority to deal with is the National Medical Product Administration (Pfizer, 2022).

2.2.3 Pfizer in UK

Pfizer has been operating in UK since 1952, making this country one of the longest subsidiary open in the European continents. UK represent peculiar characteristics for such a big company as Pfizer is, since in there are some peculiarities to which it has to deal with. We are referring to a deep involvement of the National Health Service, as well as other healthcare organizations, in the company's operations because the key role played by them in the English pharma industry.

UK has represented a big destination of investment for Pfizer: £267 mln have been dedicated in R&D considering just 2021 (Pfizer UK, 2022). The R&D operations are conducted in a super cooperative environment in UK, being the company related to different actors that span from the academic world till the professionals' workers that bring together knowledge and skills to develop new innovative medical solution (Osborn, 2019). This is a feature that enhance the fragmentation we talked about previously, since different activities could be carried out even in symbiosis with competitors. The efforts translated in 27 clinical trials ongoing in 2021, in 71 sites involving 234 patients form the start (Pfizer UK, 2022). The NHS polarize the demand given its role in the delivery of drug's, especially prescription ones, and Pfizer is one of the main suppliers with several medical treatment (drug's, medical devices and vaccines) that goes over 150 (Pfizer UK, 2022). Pfizer in UK counts 2.273 colleagues which are dislocated in different sites. The one in Sandwich is at the core of Pfizer UK's operations, being a "*fully automated Pilot Plant*" (Pfizer UK, 2022) that achieve to complete all the process of drug's development (Pfizer UK, 2022). At the same is time in Sandwich the company has the Worldwide Safety & Regulatory operations. In Cambridge is

based the Devices Centro of Excellence, one of the top leading center in the research and development of medical devices, which is set as well in a cooperative network of research partners to develop innovative solutions for medicine's delivery when the treatment cannot be assumed orally (Pfizer UK, 2021b). The manufacturing process happens when all the steps before, from the molecule development and the clinical trials are managed successfully: in Sandwich there is the Material Characterisation Team who is in charge for quality and safety control of manufacturing (Pfizer UK, 2021a). The importance of this team is to “ensure exacting standard world-wide” (Pfizer UK, 2021a). Pfizer has created with a strong pipeline and flexible supply chain a strong product portfolio intertwining the capabilities with Wyeth, becoming leader in the Specialty Care.

2.3 PFIZER Profitability Ratios and competition

The profitability analysis is an effective financial tool to measure the ability of the company to generate profit and so, measure its performance in term monetary value creation. Several are used and each of it could be analysed to furnish a view on how of the company is managed, looking both at the result of the pure operational activities or considering the effect of the financial activities undertaken by the company. To the extent of the research, the profitability ratios that deal with the operations management are displayed.

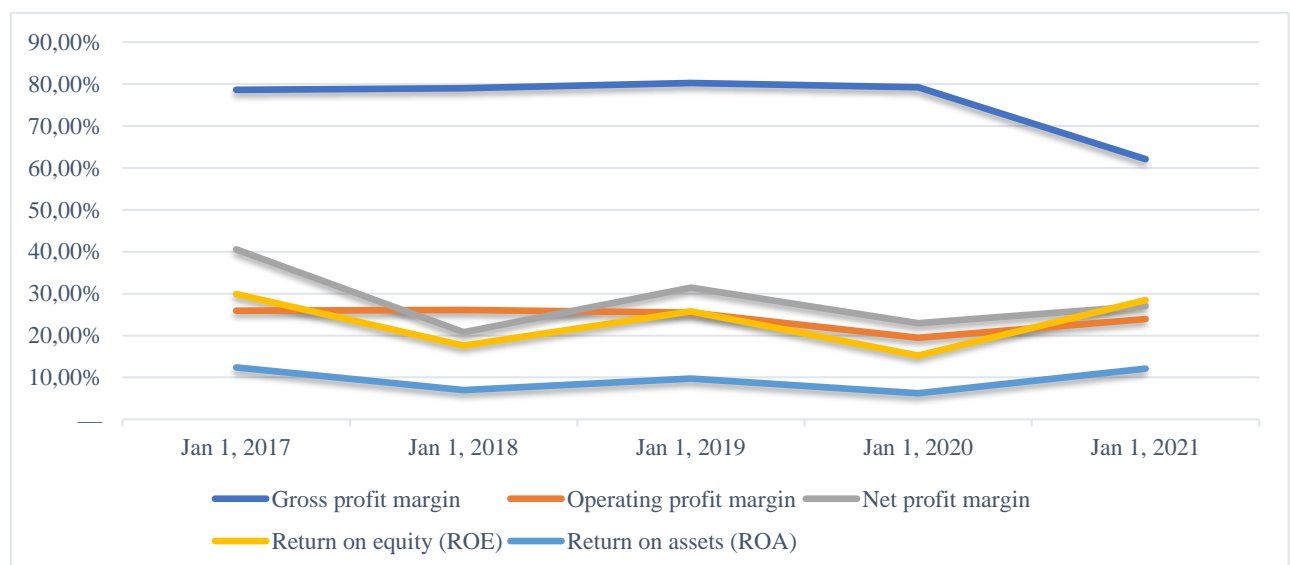


Figure 31 Pfizer Profitability Ratios, elaboration from Pfizer (2022)

In the graph, is possible to look at the trend of different ratios referring to different measures of the profitability:

Gross Profit Margin	Gross Profit / Revenues
Operating profit Margin	Operating Income / Revenues
Net Profit Margin	Net Income / Revenues
ROE	Net income / Total Shareholder's Equity
ROA	Net Income / Total Assets

Table 5 Profitability Ratios

Considering the previous information about Pfizer, is possible to see how the company has some fluctuation performance in the last years. Pfizer has a business model and value proposition that is devoted to innovation and huge R&D investments: high quality standards, differentiation and innovative medical treatments are the core business. This paradigm finds significant achievement in 2021, where to the decrease in the gross profit margin, all the other ratios recorded an increase meaning that the exploitation of the supply chain and the operations to develop the Covid 19 vaccines have translated in a positive result.

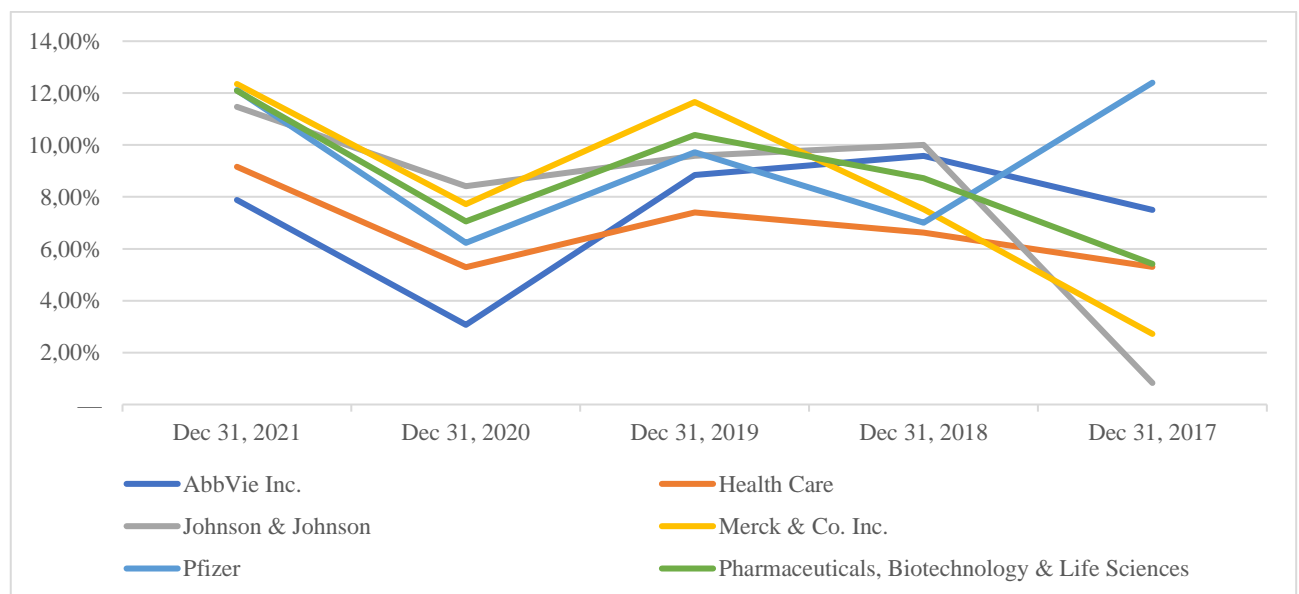


Figure 32 ROA comparison from Dybek, M. (2022).

The ratios have meanings when they are compared to the ones of the competitors. In the graph is displayed the ROA's trend of 3 main competitors of Pfizer with the ones of the industry (Health Care) and sector (Pharmaceutical, Biotechnology

& Life Sciences). The overall performances of Pfizer assume a particular relevance and confirm that Covid-19 is a very well opportunity exploited by the company that, overall, recorded a general underperformance from the characteristic management of the assets. Is worth to mention that major part of this difficulty come from the regulatory clashes and litigation outbreaking with generic companies or issues coming from the patent expiration of top brands.

The chapter opened with the industry global overview, followed by its status in the countries interested by the research. After the context has been defined, Pfizer has been analysed using the model as described in Ch. 1, going through the how its operations are implemented globally and illustrating the peculiarities in Italy, China, and UK. The last subchapter reports the result of the profitability analysis of Pfizer that shows the result of the operational management: the ROA is then compared with the ones of the sector, industry and main competitors to provide a comprehensive view of the company.

3. CONCLUSIONS

3.1 FINDINGS

The analysis conducted on Pfizer throughout its operations and the functions that support them, lead the research to a conclusion. Those one allows to confirm some of the trends that are shaping the industry, related on how pharmaceutical company are changing, adapting, and innovating their operations and respond to needs and challenges constantly posed by an increasingly complex environment. This could be outlined from the similarities and differences found in the way in which Pfizer carries on its business in an international landscape.

Similarities

The features that are recurring in each country in which Pfizer has a subsidiary are the followings:

- There is an increasing tendency to boost co-operation with subjects that both are participating or not in the pharmaceutical industry, with no significant differences among developed and developing subsidiaries. This is true for different steps of the drug's development process. Nevertheless, this tendency is much stronger in the initial phases of the process where the R&D activities are more intense and cooperation among several stakeholders guarantees a better outcome.
- Digitalization is one of the top priorities at every managerial level: especially in the pharmaceutical value chain, the possibility to digitalize part or the entire process of drug's manufacturing has become crucial to reach ambidexterity. In Sandwich there is already the first fully automated pilot plant; nevertheless, automatization of processes and the pattern toward a continuous manufacturing is something that Pfizer is looking for its global operations strategy.
- There is the pathway toward sustainability and the effort to leverage knowledge as competitive priorities to which carry on the differentiation strategy pursued by the company. Sustainability is a raising concern

regardless the location site to which anyone is looking at: every subsidiary analysed is making efforts to reduce the carbon print of the production and related activities. At the same time this is backed up by several investments in social responsibilities' practices which are functional to the company's mission to improve the general health of each country served. At the same time, operations are implemented by the constant process of knowledge sharing and coordinate efforts among subsidiaries and their functions. Manage and effectively leverage knowledge does translate in increased performances: those practices are deeply related to the technological development, since digital means have offered companies ways to make it efficient.

Differences

When it comes to the differences it needs to be highlighted that those ones spotted are mainly related to exogenous factors, that therefore are out of the control of managers. Indeed, the differences are influenced by each regulatory framework and authority ruling a country: if there is a substantial homogeneity between developed countries, especially among EU countries where the communitarian authority is EMA and UK, there are some relevant divergences in China. Comirnaty vaccine is still not distributed over the Chinese market, while in EU territory it has been the blockbuster among vaccines for Covid-19. This has important implication in the which in managing the product portfolio and so the pipeline that ensure its constitution. In China the fight against generic brands and patent expiration are a constant challenge to which deal with. Location responsiveness is the other factor that determines differences among operation in foreign subsidiaries. Indeed, the therapeutic areas in which each subsidiary stands out differs, exception made for vaccines and rare disease, are generally different.

Managerial implications

The local responsiveness combined with a transnational strategy that pursues differentiation and innovation translates in a very high-cost structure to be

sustained. But it does also translate in a relative low flexibility at the managerial level, where the decision-making process is compressed in the hierarchical layers and centralization is the way to reduce costs. Nevertheless, to enhance a better response to challenges coming from the different market, as well as improve the overall performances of the company, adopt a more horizontal way of operating could enhance the development of more focused business. Decentralization in the decisions making process, manufacturing and clinical trials represent effective choices to implement it. Next to this, the progressive shifting toward a stakeholder capitalism and new competitive priorities to build corporate strength, is suggesting to managers a holistic approach to manufacturing strategy, that take into consideration every site in relation with the other facilities spread in several countries. The approach is a must have for every international company because in this way is possible to successfully manage knowledge sharing practices among sites. It also allows to structure a comprehensive operations strategy which considers the specificities of each location. This finds consistency with the adoption of a data driven approach to arrange operations, supply chain relationships and manufacturing choices. Data need to lead and follow up the implementation of operational strategy, because it ensures a systematic representation of what is happening inside processes, if there are any pitfalls and so is possible to segment the value chain process and boost it in its smaller steps. This needs the appropriate human resources and digital assets to be sustained, as the practices prove. At the same time data and technologies offer those digital means that could ensure the formation of a network in which knowledge and know-how could be shared. Indeed, the leverage of knowledge is something that could make the difference when it comes to manage global operations: it enhances the resilience and flexibility of the supply chain and makes possible adaptation of tangible and intangible assets faster when it is needed to face new challenges from the environment. The complexity of the environment indeed is calling players in the industry to new form of co-operation: collaboration among companies or stakeholder, can they be companies operating in the sectors, patients, healthcare

organization, is translating in an increased delivered value for people and firms such as Pfizer who aims to improve the overall health condition where they have facilities. Among benefits, the improvement in process' efficiency through shared technologies and the reduction in operational costs are the more relevant.

3.1 Conclusive notes

Limitations

The research presents some limitations that are worth to be mentioned. Despite a comprehensive financial description of the company is available, this does not stand for each subsidiary which financial data are not available. The availability to this information requires payments or access to data source which are not open to everyone. On the side of this, the analysis performed for each market does not use the same metrics to compare the three dimensions observed (size, R&D intensity, and trade balance) because of a great variety of reports who have made different decisions in term of studies. It should be added that each country has a specific regulatory framework which implications affect how the company operates in each of them. Laws and directives that rule the pharmaceutical field requires specific knowledge to measure the extent by which its constraints managerial decisions: this does not translate in the impossibility to effectively analyse the operations of companies in this sector but limits sometimes the deepness of the analysis. Last elements that need to be considerate is that the increasing uncertainty of the global context makes less reliable projections and predictions about the future, over posing some constraints to the field of actions of each company. The pandemic period is a vivid example of how each prior forecast has been completely twisted by the happening of unpredictable events.

Furter research in the field

Healthcare has always been a pillar in the worldwide economy; the pharmaceutical segment has become even more extremely interesting to literature especially during covid era. Nevertheless, the changes that succeeding themselves in the international landscape, are constantly offering new sparks for researchers.

Further research could be conducted in the relationship between sustainability, CSR and performances since the financial aspect often miss it. There is poor evidence, most of the time qualitative rather than be quantified, in how the financial performance and value delivered are intertwined with these dimensions. The pharmaceutical operations furthermore could be explored more when it comes to sustainability with a systemic review of practice characterising the industry, since there is a categorization of practices for each part of the value chain could represent a significant source of ideas for managers. Moreover, how this research is built suggest that it could be improved adopting a systemic review of other companies to shift the point of view on how challenges from the environment are undertaken by each of them leading to a more comprehensive general framework.

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MASTER THESIS SUMMARY

Similarities and differences in operations management of pharmaceuticals companies in foreign developed and developing countries exemplified by the case of Pfizer in Italy, UK and China

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Introduction

This research paper has been inspired by the tasks that the candidate has fulfilled during his internship at Angelini Pharma Russia. This opportunity has been significant not only for having watched how an international company operates in a subsidiary of a developing country, but also has offered the possibility to get a deeper understanding of an industry that became increasingly relevant. The pharmaceutical is one of the top industries for R&D and knowledge intensity, very deeply connected with the changes, often related to macro-trends, that characterize the external environment in which every corporation is set in. Moreover, around the pharmaceutical value chain, flourish several satellites activities: this translates in a significant impact on the welfare and socio-economic condition of a society. Furthermore, the relevance of the industry is also intensified by that fact that, dealing with the health of people, a company's achievement can represent an upgrade in the life's quality of people who need specific product, medical device, or treatment. A wide crowd of stakeholders can be positively influenced by an improvement in performances, operations and strategies of companies who operate in the pharma sector. The pandemic period has showed the world how much it is significant; the spread of Coronavirus has represented a challenge for every sector of the economy but the means to tackle with it have been delivered by the efforts of healthcare companies. The literature in this field has much more to say. Indeed, the continuous shifting trends characterizing the economic landscape as well as the increasingly complex environment offer several opportunities to research how companies are overcoming them. Literature shows poor evidence when it comes to exhibit practices that companies in the pharmaceutical segment have implemented or are meant to implement in order to succeed unpredictable events but also those one that have been accelerated by the Coronavirus. Sustainability, digitalization, new technologies, social impact initiatives are all need that companies are undertaking and trying to solve, but this could find a stronger validation in the literature. Based on this, the present research has as an object the operations management: this represents one of three core functions in any organizations (Operations, Marketing, Finance) and probably the most internal. For the role they have, operations are the place where both radical or incremental transformation happens and the value adding process takes place, in every process that brings input to become

output that will then be delivered on the marketplace. Similarities and differences of them in the pharmaceutical industry across developed and developing countries aim to give a deep understanding of the effect that the context has on them and how operational solutions are created to face the challenges coming from the outside. What is said, leads to the key question:

“Which are the similarities and differences in operations management of pharmaceutical companies operating in foreign developed and developing countries?”

From the question descend the goals of comparing the different elements that are related to the operations management and its configuration, of a firm with international operations. The analysis aims to outline operational related implications that integrate the challenging context around pharma operations, and how they are going through this period of changes to infer some more absolute managerial guidance. To achieve this purpose, a case analysis will be conducted on a company leading in quality and betting on its science to overcome the competition: Pfizer. The company has been chosen also in relation to the development of the Comirnaty vaccine, in collaboration with BioNTech, that resulted to be the main tool in the battle against the Covid-19. Its global operations make Pfizer the proper case company. The operations management related is assessed looking at the whole company's performance and settings, using the available literature, updates and financial data and then comparing infrastructural elements of three different countries: Italy, China and UK. The research tries to figure out the different solutions that are being adopted by the pharma companies given the existing research, always taking up to the front the latest trends and challenges that need to be addressed by players in the industry to increase the value delivered not only under a financial perspective, but also in terms of general health conditions. There is a substantial gap when it comes to their adaptation to the new strategic priorities arising from the environment. Indeed, the focus on how operations in this sector could make a change, has been enhanced by the pandemic: even though there is a progressive building of the theoretical knowledge in pharmaceutical operations, is still missing a practical point of view in the implementation of those practices that integrate sustainability, flexibility, and digitalization inside the operational processes. In other words, enhance the understanding, always through a practical point of view, of how the management is dealing and should tackle with the emerging issues from the environment, especially considering the differences in developing areas where the literature is not consistent as it is for developed ones.

Theoretical Framework: Chapter 1

In chapter 1, operations management will be defined, based on different scholars' definitions and representation. Operations management is described mainly under a process-based view

perspective based on studies of Krajewski, L. M. M., Malhotra, N., & Ritzman, L. (2021). The operations are then classified based on the volume – variety dimensions thanks to the adaptation made by Nenni, M. E., Caroli, M., & Fontana, F. (2017) of the Hayers and Wheelwright matrix. To build up the context for a model, operations are described as one of the main functions of an organization, disclosing the peculiarities of this function, related in a circular loop with the marketing and finance ones. Following to this, the thesis points out the literature that goes through the steps that are composing the operations management building on the Pycraft model (2000) adapted by Nenni et. al. (2017). Here the operations management is described as the result of a consequential and linked steps: strategy, configuration or design, planning and control, improvement. This model is enriched by the contribution of other prominent scholars. The first chapter then shifts towards international operations. Indeed, borders are blurred compared to the past: the incredible development of capital markets have allowed companies to raise capital more easily and all kind of investors to do that almost from everywhere; people and goods can travel in different locations thanks to new means of transport, enhancing the world trade and expanding supply chain among countries. The technological improvement has made the business' world much more linked. The result is a wider environment to be managed and to which structure an organization, develop strategy, and realize operations (Haniff & Caldwell, 2019; Heizer et al., 2020). Different scholars have been addressed to go through the hot topic of foreign market operations to identify models and framework that could describe it. The importance on how to conduct foreign operations has been widely explored by many researchers, especially relating to the field of internationalisation strategy and strategic management (Haniff & Caldwell, 2019; G. R. G. Benito et al., 2011; Morschett et al., 2015). The importance is even more stressed by the fact that foreign operations could not be changed easily and usually are a long-term decision (Morschett et al., 2015). On this time span many companies, working on their flexibility, could gain competitive advantages, becoming leader of their sectors of markets. Literature judge positively when foreign operations modes changes over time, in a continuous process of adapting to the new challenges coming out form the environment, both internal and external (G. R. Benito et al., 2009; Morschett et al., 2015). G. R. Benito et al. (2009) accents the importance of combination of different modes, highlighting the importance of incremental improvement rather than radical changes when it comes to international activities.

The paper put an effort to identify the main trends characterising this field of management. Several sources are related to the work of De Giovanni and other researchers who disclosed several topics related how new challenges are being faced under an operational point of view.

the environment in which the organizations are called upon to move is becoming every day more turbulent, dynamic, and unpredictable. Operations Management is deeply committed in implementing its core activities while pursuing ambidexterity, the highest efficiency combined to the best effectiveness (Burton et al., 2020). Heizer et al., (2020) identify three main drivers when it comes to the design and so the main value that operations management processes seek: “*design for efficiency*”, where the focus is to maximise the outcome from the available resources; “*design for resilience*” where the way in which activities are carried out is thought in order to manage every possible risk in the best possible way; then the increasingly important “*design for sustainability*” in which the main objective is to avoid impact on natural environment. The processes improvement from an internal perspective rather external than have been showed by De Giovanni (2012) as significantly more meaningful to target results embedding a triple bottom line approach, and this necessarily pass-through changes or improvements of the operational processes. The consideration is that nowadays every firm should try to work on all of them to be competitive. Indeed, the disruption occurred in all the fields related to management by several factors related to the effects of globalization and digitalization have significantly enlarged the scope of operations, including over the traditional costs, time and quality targets to resilience and sustainability as well. After this review, the object of the analysis is declined inside the pharma industry which “[...] *aims to find those molecules that can be further converted into medicines able to deal with certain types of disease or improve the life’s quality of patients*” (Come Nasce Un Farmaco, n.d.). researchers have investigated the strategic priorities of biopharma leaders, given the trends affecting environment and industry. These results came up with 3 main drivers: improve their R&D activities, a road towards digital transformations and boost the presence around the globe of the company. The analysis brought to:

- *Covid 19 effect*: Covid 19 has accelerated a process that was already happening, meaning specifically the race towards new drug’s development and the growing in investments in doing so more efficiently through the digitalization of processes.
- *Challenges*: three challenges to deal with in the upcoming future: “*changing consumer behaviour, cyberthreats and accelerated technology advances*”
- *Next frontier*: from the results collected by Blair, A., Ford, J., & Naaz, B. (2020), “*customized treatments, non-pharmacological intervention and prevention and early detection*” represent the future of the industry and most of their respondents admit work on the last one.

The pandemic period affected the pharmaceutical production process entirely, from the suspension of the drug's supply chain did not relate the virus, to stopping the traditional work of representatives through in person visits. This has caused the explosion of macro trends that were already taking place such changes in regulations increased volatility and trade uncertainty. On the other hand, companies boosted the number of collaborations, especially in term of research to develop the vaccine. New contingencies have brought companies to explore the opportunities offered by the co-operation in a competitive context, opening to new possible business models and drug's development process. One of the main outcomes pointed out by the research of Blair, A., Ford, J., & Naaz, B. (2020), is the changing in consumer behaviour and the impact this is having in the operations of pharma companies. "*Patient centric strategies*" have become a priority: companies should not only embrace a patient-centric approach but be prepared to participate in an emerging ecosystem of several stakeholders. Nevertheless, it should be mentioned that De Giovanni (2019) explores the trade-off related to the customization and servitization of the product delivered and its attractiveness toward the final user against the economic impact a shift in the operational structure could have, and it should be considered when dealing with the underlying topic. Moreover, there is a need when it comes to an adequate return in innovation. R&D have been always a huge expense for pharma companies and how much of these investments come back in term of revenues has been addressed as an issue. To close the chapter a distinction between developed and developing countries is extracted by different sources, and it could be summarized in the referral to a developed country when its level of industrial or economic development is tendentially high: this usually translate in favourable conditions under a political, social, economic and environmental perspective. This is functional to the definition of a theoretical outcome pharmaceutical companies who operate in foreign countries distinguished between developed and developing and which converging or diverging points can be detected. According to the latest research the similarities across the industry are converging on some touchpoints. Operations needs to be holistic (Dukart et al., 2022). In a context where challenges are increasing, properly leverage the manufacturing assets needs a comprehensive view of the operations and how there are linked across different sites (Dukart et al., 2022). At the same time, the complexity is increasing in the internal environment as well. Different value chains are managed in the same site as the product's portfolio become bigger: the companies need to create a specific manufacturing strategy for each of them to result more effective, while trying to keep the costs low (Dukart et al., 2022, Schrader, 2021). The strategy definition is shifting from being based on a total landed cost approach to consider several additional dimensions such as sustainability. Performance could not more be related just to the financial result. Consistently to that, manufacturing as inner process of operations

assume importance to implement those requests (Schrader, 2021). We can refer to digital manufacturing as all the improvements brought using digital means in this process, from high level technologies to analysis of big amount of data with advanced software (Jeffs, 2021, Schrader, 2021). The combination of them lead to the connection of different part of the processes, enhancing automation and flexibility: 94% of pharma manufacturing practitioners have been able to handle the pandemic period thanks to these applications (Jeffs, 2021). On his side flexibility dimensions apply to several part of an organizations and enhance it to manage unexpected needs or contingencies. In manufacturing it translates in adopting rapidly solutions that could translate in an advantage (such as the optimization of the asset utilization or adapting the production capacity to new needs). In this field, the traditional batch manufacturing is being replaced by continuous process. This practice has gradually become widely diffused in pharma operations because of its ability of improving the productivity. Compared to the traditional batch manufacture, the continuity ensures a “*production cycle with no hold times*” (Jeffs, 2021), lowering costs and error, embracing a lean perspective. Overall, produce a new drug is complex due to the strict regulations, segmentation of patients and harsh scientific research underlying the process: about the 10% of drugs manage to go through all the phases (Jeffs, 2021). In the industry there has been an increasing attention to the use of artificial intelligence to increase the efficiency of all process (Jeffs, 2021, Schrader, 2021). Data processing, that involves several activities such as collecting, manipulating, or organizing should stand next to every process of the value chain. The data analysis is offering to companies also a perfect instrument to improve the decision-making process: data allow to perform simulation and explore scenarios that could give to the management indications on which actions should be undertaken (Dukart et al., 2022). Moreover, new digital solutions could represent the solutions for the shortcomings they could cause by being employed: for example, blockchain technology has been appointed in the literature as a possible way to overcome the problem related to the quality control on the data integrity about new medical treatments related information (Volpentesta, T., Miozza, M., & Satwekar, A., 2022). On the other side, between developing and developed countries, differences exist and have an impact in how companies organize themselves to achieve such targets. Developing countries have a substantial problem in tackling counterfeit products and guarantee big companies from the generics' threat. This is usually due to the unstable socio-economical condition or poor regulatory framework, so results in different risk management approach to mitigate operational risks and different choices in term of product portfolio since for instance is it more difficult to protect top innovative brands (Enyinda, C. I., Mbah, C. H. N., & Ogbuehi, A., 2010). The pitfalls in the patent protection makes developing countries highly dependent form the imports of high value drugs. The operations of a pharmaceutical company

are so configured to consider this factors that could affect its output (Smith, R. D., Correa, C., & Oh, C., 2009). The conditions of developing countries have enhanced in the past the entrance by acquiring generic producers: this practice has been more diffused to build R&D capabilities, lowering the cost burden of the investments by focusing on bring together several resources (Smith et al., 2009). Another difference that came up from the work of Usman Awan, M., Raouf, A., Ahmad, N., & Sparks, L. (2009) is that among other several critical factors, "*top management commitment*" is the most determinant to implement total quality management practices and developing countries lack this commitment in the major part. This, with lack of technologies, governments efforts and economic condition jeopardize the development of tools and capabilities that can sustain this manufacturing approach. At the end, we have pointed out some tendencies leading the practices into the industry, while on the other side divergences persists due to socio-economic factors and structural implication. Recovering the research gap, the second chapter will go through the analysis of Pfizer to see how the previous arguments are effectively translated in practice and if which match could be found in the company's operational choices.

Chapter 2. Case analysis: Pfizer and its foreign settlement in Italy, Uk and China

In chapter 2 an overview of the industry is furnished. The pharmaceutical industry is deeply characterized by some trends, recently accelerated by the pressures of the environment and massive changes occurred after the pandemic period. The EFPIA (2021) reports furnish a first useful outlook to the industry:

- Emerging countries are witnessing a rapid expansion in term of market size and research environment, referring more precisely to Brazil, China, and India.
- The US market is still the main one. Two empirical evidences about that: 49.0% of global sales of this industry were in US during 2020 and as well as 63.7% of new medicines launched from 2015 to 2020.
- In Europe there is a significant fragmentation of the market which translated in a remarkable parallel trade harming the industry revenues and therefore, eroding resources for R&D expenses.

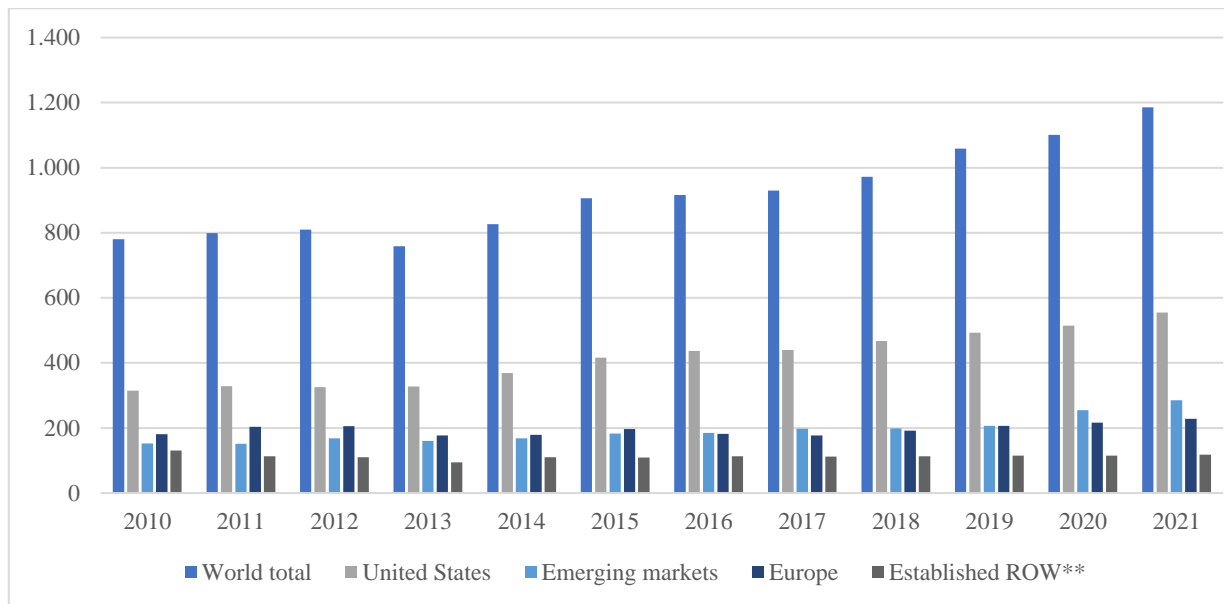


Figure 6. Global pharmaceutical sales from 2017 to 2021, by region* (in billion U.S. dollars), AstraZeneca 2022

After that an analysis on the markets of the three countries considered in the topic has been performed to detect some useful trends shaping the industry in each of them:

	Italy	China	UK
Size	Constant growth in production value: 2012 to 2020, from \$27.603 bln to \$36.701 bln	Market sales volume has a constant positive growth from 2011 to 2019, that ending \$11.940 bln	Turnover's value \$12.321 to \$18.02 bln (2008 – 2019) Positive Trends
Trade Balance	Exports \$14.951 to \$36.301 bln (2010 – 2020) Imports: \$14.109 to €31.639 (2006 – 2020)	In 2020 China has increase its exports, especially for API and generics brands. Positive trade balance	2016 to 2020 \$20.324 to \$16.696 bln import's value from EU countries Exported from the \$12.475 bln 2018 it dropped to \$8.982 bln in 2019
R&D	Aligned with the positive global trend, value of \$1.712 bln in 2020	Regulatory changes in between 2017 and 2019 are opening the market to welcoming international companies and investments	Consistent with global trend: from 2016 they have increase constant reaching \$4.013 mln

Established the context in which the company is operating, it is analysed applying the model and coming up with the literature findings disclosed in the first chapter.

Pfizer has its operations in different business segments along the value chain of the healthcare industry, with a wide range of biopharmaceutical products delivered globally. The declared mission of Pfizer is “*Breakthrough that change patients’ lives*”: the centrality of the patient is

at the core and the scientific research the main competitive priority for the company's business model (Pfizer, 2022). The company summarizes its growth strategy into 5 "*Bold Moves*", the key drivers through which Pfizer is meant to deliver and capture back value.

- Lead the conversation → to assume a central role in the communication with authorities and stakeholders to push for pro innovation policies, commitment is towards people granting them transparency and information
- Win the digital race in pharma → Digital solutions, and so the employment of AI in the daily processes or the use of big data to improve operations, represent a means through which is possible to improve the consumer experience as well having results on the population of patients.
- Transform our go to market model → Pfizer is pursuing new form of collaborations to increase the affordability of healthcare, developing for example new flexible payment methods.
- Deliver first in class science → Pursue ambidexterity working on the best performing products as quick as possible maintaining the highest quality (Pfizer, n.d.).
- Unleash the power of people → Pfizer is trying to leverage its human capital to increase performance.

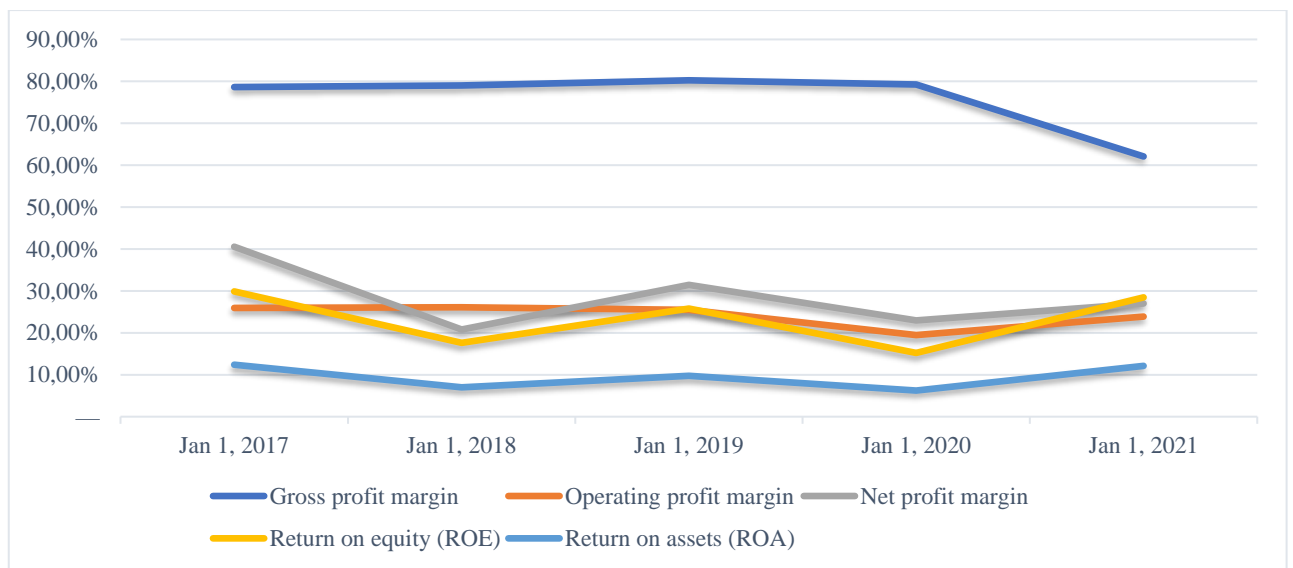
On the edge of this framework, Pfizer managed to restructure its operating segments and be recognized as the company they mean to be in the statements, focused on the production process of innovative biopharmaceuticals product (Pfizer, 2022). At the end of 2021, the commercial operation of Pfizer shows two operating segments, each managed by one top manager. One is Biopharma, the segment in charge of the development of innovative science based pharmaceutical business and Pfizer CentreOne, the CDMO branch of the company leading in the supply of API. Pfizer Global Supply is the company's branch that fulfil manufacturing and supply needs. Those comes from a global network that intertwine more than 30 companies, 42 manufacturing sites, 134 logistics centres, over 200 supplier and 38.000 colleagues. The capacity is proportioned to a production that counts over 850 products for more than 24.000 SKUs (Kane & Jhonson, 2017). In the manufacturing process takes a leading role the R&D function, which could be considered as integrating part of the core processes in the pharmaceutical business compared to other sector or industries. R&D in Pfizer have always been a substantial part of the operational improvement. The function is focused thereby focused strengthen the pipeline, both under efficiency and effectiveness dimensions, while achieving high sustainable standards and make possible a value delivered in the medium - long term (Pfizer, 2022). Figures and graphs are used along the thesis to give representation of the

dynamics in term of investments and revenues. Relevant topic is the case analysis is knowledge management as a key tool to improve operations. Effectively manage knowledge represents a mean by which is possible to improve flexibility, fast decision making and learning process over tackling with the change in workforce that is happening (De Giovanni P., 2021, Kane & Jhonson, 2017). KM is functional to a Pharmaceutical Quality System and PGS has been working to integrate the best implementation of it. The efforts to improve operations finds several validations, given that Pfizer has started to adopt sustainable solutions for its operational processes since the end of 90s. The core idea of innovative and sustainable solution has been to foster digitalization or process and shifting to sustainable source of energy flows. Pfizer try to foster innovation also through a foreign operation architecture that enhance competition among locations. Set the global requirements, each site can meet them and then work on its production competitively achieving bonus and using market's opportunities. Pfizer has been working on the implementation of continuous manufacturing since several years, started with a joint research effort of Pfizer by its Research Center of Groton (USA), the company GEA and the University of Ghent. The aim was and still is to have an automated process that can substitute the less efficient batch manufacturing process (Schmidt et al., 2019). Continuous production represents a way to lower costs by the increased efficiency of each manufacturing step, monitored and controlled digitally, with positive effects on the sustainability of the whole production (Schmidt et al., 2019). Proceeding on the analysis of the company, a view of how it is settled in the country considered for the research is performed to outline some results.

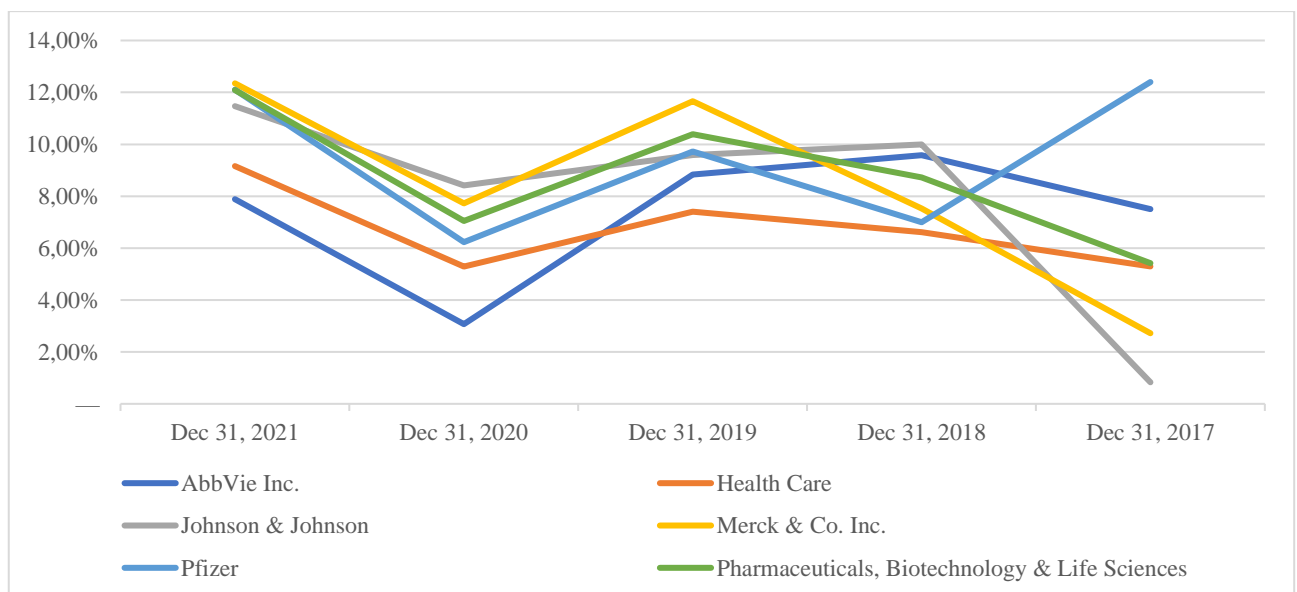
In Italy	In China	In UK
International group for oncology drug's development in Milan, 2 manufacturing plants	R&D centers 3 production plants and 1 Biotechnology Center, 3 innovative production plants , Invested about \$2 bln in China	71 trials sites, a fully automated plant and one of the main centre for the medicines delivery services
Catania: production of both generic and prescription sterile injectable Ascoli: excellence in innovative drugs with high pharmaceutical profile. Key areas: oncology and neurological disease; Comirnaty plant	Over 50 innovative drugs introduced into the market Market leader in China's cardiovascular and antibiotic market	Pilot plant in Sandwich: fully automated, manufacturing of medicines for clinical trials Devices Centre of Excellence in Cambridge specialized in the design and development of medicines delivery services

<p>Co-Innovation with SME that constitutes a big part of the socio-economic tissue</p>	<p>Intense collaboration with health service, academia and government</p>	<p>Deep collaborations with the academic world: National Apprenticeship Programme, undergraduate placement scheme and STEM activities</p>
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This analysis is followed by a profitability ratios analysis and a ROA comparison with the industry and competitors.



Pfizer Profitability Ratios, elaboration from Pfizer (2022)



ROA comparison from Dybek, M. (2022).

Chapter 3. Conclusions: findings, recommendations, limitations and further research

The analysis conducted on Pfizer throughout its operations and the functions that support them, lead the research to conclusions. Those one allows to confirm some of the trends that are shaping the industry, related on how pharmaceutical company are changing, adapting, and innovating their operations and respond to needs and challenges constantly posed by an increasingly complex environment. This could be outlined from the similarities and differences found in the way in which Pfizer carries on its business in an international landscape.

Similarities	Differences
<p>The theoretical outcomes finds several validations in the Pfizer's analysis.</p> <ul style="list-style-type: none"> • Tendency to boost co-operation with external subjects both involved or not in the industry • Digitalization on top of the priorities of every site and subsidiary • Knowledge management practices as means to improve operational efficiency through the network of facilities 	<ul style="list-style-type: none"> • Meaningful differences in the products portfolio manufactured in each country. • Sustainability concerns have a different weight in the production process between developed and developing areas (increases value in the first one) • Differences due to the composition of the market: more traditional, physician and price based on developing vs tenders market in developed ones

Managerial implications

The local responsiveness combined with a transnational strategy that pursues differentiation and innovation translates in a very high-cost structure to be sustained. But it does also translate in a relative low flexibility at the managerial level, where the decision-making process is compressed in the hierarchical layers and centralization is the way to reduce costs. Nevertheless, to enhance a better response to challenges coming from the different market, as well as improve the overall performances of the company, adopt a more horizontal way of operating could enhances the development of more focused business. Decentralization in in the decisions making process, manufacturing and clinical trials represent effective choices to implement it. Next to this, the progressive shifting toward a stakeholder capitalism and new competitive priorities to build corporate strength, is suggesting to managers a holistic approach to manufacturing strategy, that take into consideration every site in relation with the other facilities spread in several countries. The approach is a must have for every international

company because in this way is possible to successfully manage knowledge sharing practices among sites. It also allows to structure a comprehensive operations strategy which considers the specificities of each location. This finds consistency with the adoption of a data driven approach to arrange operations, supply chain relationships and manufacturing choices. Data need to lead and follow up the implementation of operational strategy, because it ensures a systematic representation of what is happening inside processes, if there are any pitfalls and so is possible to segment the value chain process and boost it in its smaller steps. This needs the appropriate human resources and digital assets to be sustained, as the practices prove. At the same time data and technologies offer those digital means that could ensure the formation of a network in which knowledge and know-how could be shared. Indeed, the leverage of knowledge is something that could make the difference when it comes to manage global operations: it enhances the resilience and flexibility of the supply chain and makes possible adaptation of tangible and intangible assets faster when it is needed to face new challenges from the environment. The complexity of the environment indeed is calling players in the industry to new form of co-operation: collaboration among companies or stakeholder, can they be companies operating in the sectors, patients, healthcare organization, is translating in an increased delivered value for people and firms such as Pfizer who aims to improve the overall heal condition where they have facilities. Among benefits, the improvement in process' efficiency through shared technologies and the reduction in operational costs are the more relevant. The research presents some limitations that are worth to be mentioned. Despite a comprehensive financial description of the company is available, this does not stand for each subsidiary which financial data are not available. The availability to this information requires payments or access to data source which are not open to everyone. On the side of this, the analysis performed for each market does not use the same metrics to compare the three dimensions observed (size, R&D intensity, and trade balance) because of a great variety of reports who have made different decisions in term of studies. It should be added that each country has a specific regulatory framework which implications affect how the company operates in each of them. Laws and directives that rule the pharmaceutical field requires specific knowledge to measure the extent by which its constraints managerial decisions: this does not translate in the impossibility to effectively analyse the operations of companies in this sector but limits sometimes the deepness of the analysis. Last elements that need to be considerate is that the increasing uncertainty of the global context makes less reliable projections and predictions about the future, over posing some constraints to the field of actions of each company. The pandemic period is a vivid example of how each prior forecast has been completely twisted by the happening of unpredictable events. Healthcare has always been a

pillar in the worldwide economy; the pharmaceutical segment has become even more extremely interesting to literature especially during covid era. Nevertheless, the changes that succeeding themselves in the international landscape, are constantly offering new sparks for researchers. Further research could be conducted in the relationship between sustainability, CSR and performances since the financial aspect often miss it. There is poor evidence, most of the time qualitative rather than be quantified, in how the financial performance and value delivered are intertwined with these dimensions. The pharmaceutical operations furthermore could be explored more when it comes to sustainability with a systemic review of practice characterising the industry, since there is a categorization of practices for each part of the value chain could represent a significant source of ideas for managers. Moreover, how this research is built suggest that it could be improved adopting a systemic review of other companies to shift the point of view on how challenges from the environment are undertaken by each of them leading to a more comprehensive general framework.