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The influence of COVID-19 on digitalization strategy of European and Indian pharmaceutical companies

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Abstract

The COVID-19 pandemic changed the way economic actors interact. Measures taken by national governments to counter this pandemic forced the companies to rethink their processes and business models. In an economic world in full digital transition, this health upheaval has a significant impact on economic stakeholders, whether positive or negative. Indeed, to guarantee and efficient adaptation to digital world, a company must move from traditional processes to digital technologies in order to gain in economic efficiency and aspire to keep a dominant position within the economic world. Firms have to internalize change if they expect to comply with the digital revolution. This is a fascinating phenomenon as this allows to understand how companies such as pharmaceutical companies behave regarding the digital development. In fact, the pharmaceutical sector is an interesting point to analyze as it is a key industry in the fight against COVID-19 pandemic.

The coronavirus pandemic has propelled the pharmaceutical industry to the forefront of the world stage due to the imperative need to develop a vaccine and to protect the population. In the present work, I will compare two leading industries: the European and Indian pharmaceutical industries. Both industries are performing extremely well in different activities. The European pharmaceutical industry is a leader in marketing and R&D, while the Indian pharmaceutical industry is a leader in R&D and production. This an innovative and fast-growing sector. That is why it is relevant to look at the evolution of the digital development under this pandemic.

Does the COVID-19 pandemic impact these industries in a similar manner? Does it boost or slow down the digitalization strategy of these firms? To what extent? These are questions that I will try to answer within this paper while analyzing the behavior of pharmaceutical companies in order to find common features or point out differences that could potentially explain the differences in the impact of the COVID-19 pandemic.

Purpose of the work

Analyzing markets and topics related to this problematic is something very interesting indeed and inspiring. As a student in management, it is very much in line with what I studied at University. Markets are fascinating entities as they allow us to understand the interactions and

then to learn more about the functioning of the world. Each aspect of the society has a relationship, albeit varying in intensity, with economy whether it concerns social, political or environmental issues.

The functioning of the society is constantly evolving and changes in management is one of the most important keys on which we need to be focused. As a human being or as a company, internalizing changes in our decision-making process is a *sine qua non* condition to survival.

I have decided to address this matter as it allows me to associate and analyze three topics in which I have a particular interest: *Digital revolution*, *pharmaceutical industry* and the *effects of the COVID-19 pandemic.* Why choosing India? I could have chosen China or Japan, but this paper is not oriented about sales and market share but about production. We will discuss later the importance of Indian pharmaceutical industry in medicine production on a worldwide basis.

Digital revolution has a significant impact on economic interactions and influences economic actions to a considerable extent. This is a modern transition that we are now facing such as the rise of emerging countries (India, China, etc.). As to the industry, I could have chosen another one, but I have decided to choose the pharmaceutical industry for two main reasons. First, this is a very complex market influenced by governments, lobbies, local authorities, international organizations (World Health Organization, European Directorate for the Quality of Medicines, etc.) and with complex rules concerning origins, substances and patents. Second, in view of the present COVID-19 situation, it is appropriate, in my view, to reflect and discuss about health issues because this is a concern that is shared throughout the world. It has changes, and it will continue to change, the way companies behave. It is relevant to analyze the impact of the present pandemic in order to try to assess whether COVID-19 is a catalyst or a break concerning digitalization strategy.

Furthermore, after reading the existing literature, I can say that there is a lot of information on each of these three subjects separately but the literature which treats them together is either weak or not compete enough. I am aware of the fact that information concerning the Indian pharmaceutical market is rather fragmented and difficult to collect. Hence, my goal is to modestly try to investigate and bring something new to the existing literature.

1. Introduction

1.1. Practical problem statement

Digital revolution is a macro-event that has multiple impacts on most economic sectors. This revolution has changed our habits. We produce, we think, we consume, we live differently. Each day, we unconsciously produce 2.5 quintillion bytes of data. (*Dihuni, 2020*)

"2,500,000,000,000,000,000 bytes of data per day"

It is a major change in the economic history but also in the social, legal and technologic worlds. This is an essential improvement of economic mechanisms whose impact can be compared with Gutenberg's printing house, the discovery of electricity and the aviation pioneers.
Old business models are being replaced by new business models based on data analysis, shorter supply chain, digital interaction and cost-efficiency. We all know the GAFA (Google, Amazon, Facebook, Apple), but there are also other large and competitive firms such as Alibaba, Huawei, Samsung, …
Digital management is the key to develop enduring new business models. For instance: Uber is the largest "taxi" company and does not possess any taxi. Airbnb is one of the largest rooms renting company and it does not possess any hotel or any room. Their success is based on their ability to answer to a demand. Data are their way to meet this demand and adapt the activity to changing environment. (*Bleicher, 2018*)
Adaptability does not only mean being able to change from an environment to another. It is more complex because it means being able "*to do the right thing at the right time*" (*Forbes, 2016*).
The concept of digitalization will be discussed in greater details in the following sections of this paper. (*Cracknell, 2020*)

It is important to bear in mind that this sector is one of the most significant in that it concerns every individual human being. The pharmaceutical industry is a particular sector due to the fact that the economic interactions are not only based on the sell/buy process and there is also a necessity factor which makes these interactions more complex. For instance, pharmaceutical firms cannot decide the price of their products in the same way as clothing companies do. The

pharmaceutical industry is a regulated market where governments, international organizations, lobbies and leading pharmaceutical companies have a strong influence.

Concerning the COVID-19 pandemic, the economic world has changed. Change of habits, social distancing, telecommuting are the most visible consequences. However, the impacts within a company are multiple. Every side of a company can be modified by this "habits revolution". Human resources management, marketing strategy, supply chain management, research and development, implementation of strategies, decision-making could potentially be impacted by the COVID-19 pandemic. (*Chudik, 2020*)

This is the reason why it is interesting to see how a particular sector like the pharmaceutical industry evolves when it is confronted to a macro-event such as digital revolution and to see to what extent the current COVID-19 situation influences the digitalization strategy.
How does it change the company's behavior regarding its own internal environment and its stakeholders? How does it change the competition between leaders (United States and Europe) and a significant emerging actor like India?

We already know that European companies are mostly excelling in marketing and R&D, while India is a key actor in supply chain and R&D. *Research and Development* is a competitive advantage which is common to both industries. The relation between these industries is semi-competitive insofar as they are competitors but at the same time they also cooperate. (*Bhardaj, 2019*)
The objective of the empirical analysis is to understand the reaction of European and Indian pharmaceutical companies with respect to the COVID-19 pandemic and its effects on the digitalization strategy of several services. Does it boost or inhibit digital development? To what extent?
Through interviews, I will verify pre-established hypotheses and this will allow me to emphasize common features or specificities that could justify the differences between the European and Indian situations.

1.2. State of art in research

This section is dedicated to the results of prior researches. As we know, the COVID-19 pandemic is a recent phenomenon. That is why the literature available is not much diversified. However, there are some previous researches that provide interesting points of view concerning the problematic.

The pandemic had negative effects on worldwide economy and businesses. Even if this phenomenon forced companies to innovate and think differently, COVID-19 boosted processes of digital transformation. This improved the importance of marketing and digital channels. Digital consumption increased and now it is possible to work from anywhere. This new model enhances interactivity and cooperation. Furthermore, this creates a proximity with online communities, potential customers and collaborators. (*Almeida, Duarte Santos, 2020*)

The COVID-19 pandemic exposed the limit between the concepts of organization and technology as each of these concepts had to be rethought. Companies had to digitally adapt their activity and the overall organization had to be readapted in order to comply with this new economic world. (*Samer, 2021*)

The pharmaceutical industry has not been spared from the pandemic. This brough pharmaceutical and healthcare industries into spotlight. Pharmaceutical production companies faced shortages at the beginning of the pandemic because they needed a reaction time to adapt the processes. The pandemic increased the utilization and innovation related to digital marketing. Pharmaceutical companies are much more focus on branding and product development. (*Dr. Vidya A. Nakhate, Dr. Avadhoot D. Pol, Mithilesh Fredericks, 2021*)

The pandemic also boosted the digitalization of R&D regarding the creation of new drugs but also regarding the development of medical devices that could improve the follow up, the quality of healthcare or the prevention or diseases or virus. (*Manteghinejad, Amirreza & Javanmard, Shaghayegh, 2021*).

1.3. Research gap and question

If we decompose the problematic, there are three entities: the pharmaceutical industry in Europe and India, the digital development of companies and the COVID-19 pandemic. The pharmaceutical company is an old industry, there are already a lot of literature about that topic. The digital development of companies, on the other hand, is a revolution for companies. Indeed, digital technologies exists since a few decades and companies are more and more forced to adopt those digital technologies if they aspire to survive and keep a dominant position within markets. Consequently, those companies are in an unequalled digital transition phase because some of them are more digitalized than others due to their strategy, their management or to the market configuration.

The transition is evolving according to digital innovations and market expectations but since the end of 2019, the economic world faced a health upheaval. The COVID-19 slowed down the worldwide economic development. It remains a very unknown and unstable phenomenon so it is interesting to analyze how European and Indian pharmaceutical companies react to the pandemic and how their digital strategy and development has been impacted. It leads us to the following research question:

"*What is the influence of COVID-19 on digitalization strategy of European and Indian pharmaceutical companies?*"

1.4. Structure

To realize an accurate and relevant work, it is necessary to work in an organized way. That is why the thesis has been divided in 3 parts in order to decompose the problematic and then making the concepts interacting together.

First, there is the theorical part which helps to understand the ins and outs of the problematic. The literature review is an essential section of the theorical part as it allows to treat the literature related to the topic in its globality and understand the problematic deeply. As the topic can be divided in 3 concepts, the theorical part is mainly focus on making those concepts interacting together. It is important to understand the impact of the pandemic and the digital

revolution on the development of European and Indian pharmaceutical companies. It is also necessary to collect data concerning the digital development of companies during the COVID-19 pandemic as it will provide interesting information on pharmaceutical companies' behaviors. Making these concepts interacts will allow us to rise hypotheses that will discussed with professionals. The goal is to prepare those hypotheses to be tested quantitatively in a future research. When those statement have been discussed, we will provide a potential answer to the research question and conclude the work by summarizing the work the most efficient way possible.

2. Literature review

In order to find relevant data and literature, it is essential to look for information at the right place. I have therefore looked for data and literature by using several tools. Private websites (Deloitte, BCG) and public websites (EPFIA, European Commission, WHO, …) have been analyzed in order to understand current COVID-19 situation and the true functioning of the pharmaceutical industry. Furthermore, I have looked for information in online libraries (Cairn, Google Scholar, Publish or Perish, OAlster, DOAJ, …). There are many articles and essays dealing with the digitalization of pharmaceutical companies or addressing the impact of COVID-19 on pharmaceutical firms. The challenge is to make these articles interact. The cut-off point of this literature review is January 2021 as the current pandemic situation is evolving rapidly and so are the behaviors of individuals and companies which are related to it.

Digitalization is not only an opportunity. If a company aspires to sustain and survive, then it must internalize digital technologies, digital process, analytics and social media within its activities. Digital revolution is a combination between personal and corporate IT. The global economy becomes more and more data-oriented and we know the importance for a company to evolve within its environment. Moving to a digital business means *business transformation*. According to the *University of Cambridge*, the success of this concept is based on the 4R rule. Transforming a business is about reengineering (rethink the organization), restructuring (improve or change the structure), renewing (revitalize success process) and regenerating

(improve existing process) the model. At the end of the digital transformation, three crucial pillars of the company are digitalized: context, content and process. When the firm is working within a digital context, the content of its activity is digital and the process used are digital, then the organization is considered as a "digital company". There is a consensus in the literature on the fact that digital transformation enhances business models, customer's experience and the speed of business development. This speed depends on the digital strategy. A digital strategy is:

"*Set of process that accompanies the company within its digital transition*". (*Deloitte,2019*)

There are many kinds of strategies but the main ones adapted to the pharmaceutical industry are digital recruitment (hiring high potential talents and professionals), digital partnership & ecosystem (collaborating with stakeholders to develop the business widely), leader (being the first to develop the activity in order to benefit from the first mover advantage) and expert opinions (investing massively in R&D so that you are able to bring a more qualitative product on the market).

Coronavirus is a respiratory virus that has spread quickly across the world, so that people and companies were forced to modify their habits. COVID-19 represents a major challenge for companies and industries. Companies have to improve their management and the strategy related to their supply chain because this crisis disrupts supply chains. Furthermore, investors will be more reluctant to invest and, as a result, global investments will logically decrease.
An analysis of the existing literature shows that the European pharmaceutical industry is a leader in digital transformation. In 2017, European pharmaceutical companies reached a high level of digitalization as a result of their high developed automation systems and their efficient data management. Germany stands at the highest rank of digital index (EPFIA). The European Union is known for its free movement policies. These policies of free movement concern individuals, capital, goods and services, but also they concern data. It is an advantage for European companies of any sector because data movement restrictions could be a significant barrier to international development.

Digital transformation is a significant opportunity for *Big Pharma.* Instead of seeing the digitalization as an independent factor, pharmaceutical companies must integrate it within their activities. (*Fox & al. 2016*)

Pharmaceutical companies have set up partnerships with high-tech companies in order to speed up their digital adaptation and share their knowledge and expertise. This collaboration will allow them to better analyze and integrate the specificities of the market. (*Bréant & al, 2018*)

For instance, GSK works with Google since 2016 on the conception of new bioelectronic medicines in order to treat chronic diseases. (*GSK, Press release, 2016*)

Concerning the pharmaceutical industry, European companies are highly dependent on Indian and Chinese firms because those two industries produce between 60% and 80% of active substances which are necessary to medicines production. Europe lost its sovereignty in medical production since the deepening of production cost gap between EU and Asian companies. (*Euractiv Germany reports, 2019*)

In addition, the COVID-19 pandemic will increase this dependence. The lockdown in China and India reduced the level of production, so that drug prices increased under the law of supply and demand. This caused shortages in Asia and, consequently, also in Europe. Moreover, decision of the Indian government in relation to the pandemic has led to a slowdown of the Indian economy, so that now the first objective of Indian economy is to meet the domestic demand.

COVID-19 will have short/middle-term and long-term impacts on the pharmaceutical industry. In the middle term, there are shortages of ingredients and finished products. There are also more regulations and rules related to importations in order to protect national economies. Finally, medicines demand changed and had been characterized by a phenomenon of panic buying and a rise of medicine sales related to coronavirus. For example, the company Pfizer noticed an unexpected increase in sales of *Prevnar 13* which is a pneumonia vaccine.

In the long term, there will be more delays related to ingredients deliveries and pharmaceutical exchanges will be slower. India and China will be more focused on self-sufficiency, so that the European market will be less supplied and, at the end, the global pharmaceutical market will grow in a less intense way. (*DARU Journal of Pharmaceutical Science, 2020*)

The challenges for pharmaceutical companies will be to manage these issues, rethink and improve existing process such as digital supply chain, cybersecurity and crisis unit development.

Indeed, many articles deal with the importance for the company to implement a crisis strategy. Management has to internalize the issue and think about a strategy to minimize the negative effects. There are three principal strategies: keeping the initial strategy, adapting the activity according to the actual measures or radically change the activity. Managers have to think about short- and long-term objectives. They also have to discuss about which needs have to be done now and which ones can be done later. This represents a choice that companies will be forced to make. (*Abbas, 2021*)

Firstly, they have to create space and determine a strategy. Secondly, a command center must be implemented in order to create a crisis management structure. When this is done, resources must be secured and processes must be readapted. This is a general way to implement a crisis management department. (*PwC, 2021*).

3. Pharmaceutical industry and the COVID-19 pandemic

This section will provide a general overview of the worldwide, European and Indian pharmaceutical industries. Common features and differences will come up so that we will be able to identify potential explanations concerning the evolution of the digital strategy during the COVID-19 crisis. The principal objective of this section is depicting the pharmaceutical industry from tree angles: the worldwide view, the European view and the Indian view.

3.1. Worldwide situation

The pharmaceutical industry includes three economic steps: research, manufacturing and commercialization. It represents the 6th most significant economic market after oil, food and trafficking of drugs, weapons and human beings.

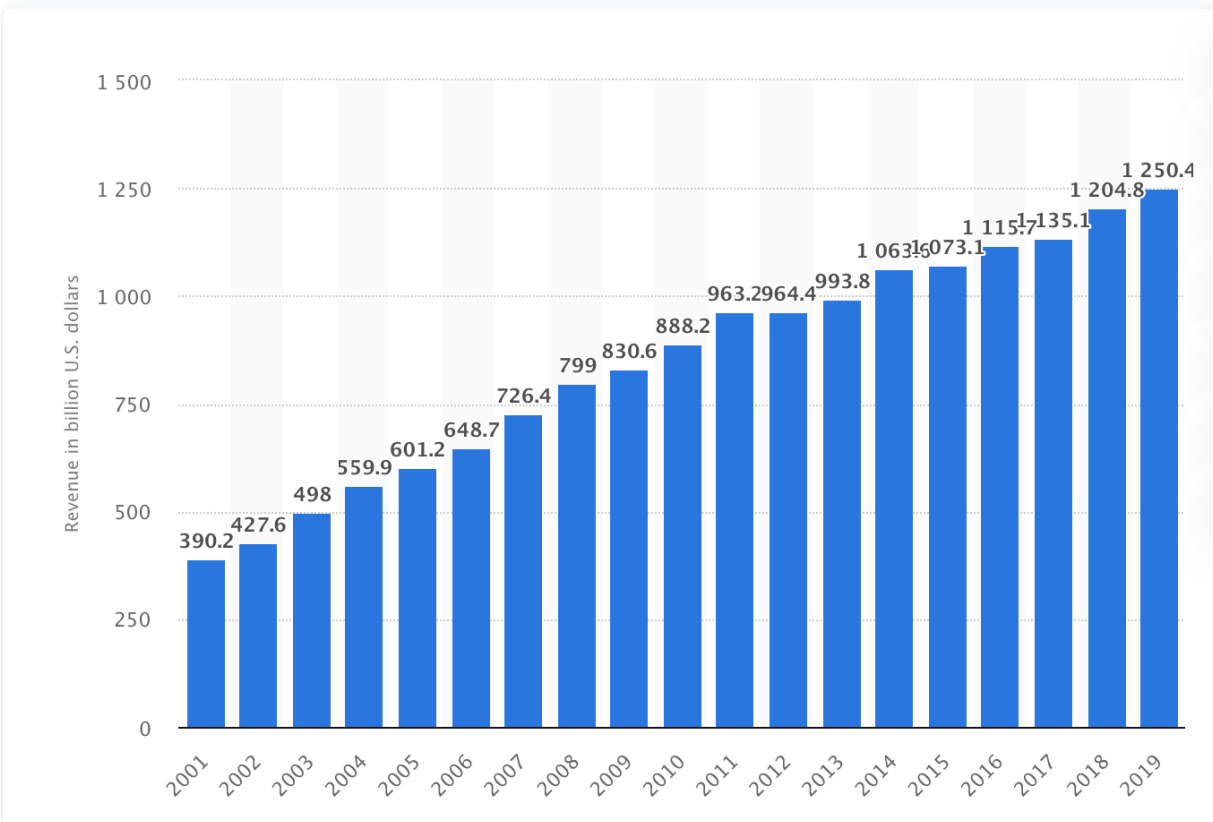
Between 1999 and 2017, the 11 leading companies have achieved a profit of around $1,019 billion. According to *EvaluatePharma,* the top 10 leading companies are comprised mostly American and Swiss companies. There are only one French company (Sanofi) and one Japanese company (Takeda) within the top 10 ranking (see feature 1). It is important to keep in mind that

the ranking differs according to time, perspective (sales, production or revenue) and the author of the study. The ranking changes but not the companies. (*EvaluatePharma©, 2020*)

Feature 1

Lobbies have a strong influence on the pharmaceutical economy as their role is to implement measures in order to influence political and sanitary decisions. The main goal of lobbies is to protect companies' interests, and sometimes to the detriment of ethic and collective interest. According to the *International Federation of Pharmaceutical manufacturers & Associations* (IFPMA), the pharmaceutical industry is a booming industry as it is less costly to invest in medication than in hospital costs. For example, investing 24$ in cardiovascular drug allows to save 89$ in hospital cost. This is one of the reasons for this growing market. Between 2001 and 2019, the revenue of the worldwide pharmaceutical market has almost quadrupled (see feature 2).

Feature 2 : Revenue of the Worldwide pharmaceutical market between 2001 & 2019



Source: Statista2020, Matej Mikulic, 25 May 2020

Even if this industry is one the fastest growing sectors, it is not exempted from future challenges.

First, the health sector is constantly evolving just like viruses and diseases. The COVID-19 is the most striking example. Companies must find new drugs and this follows from the improvement of research and development. As we all know, the main objectives with regard to this pandemic is to protect the population, preserve the economy and to avoid the overwhelming of medical care services. (*TheBMJ, 2020*)

Secondly, generic medicines represent a new form of competition with brand medicines. Companies have to choose between working with or against this new form of supply. Governments encourage or at least reassure the population vis-à-vis de generic medication claiming that it is only a difference of brand image and marketing (*Food & Drugs Administration, 2020*).

Third, health authorities must be vigilant concerning the traffic of counterfeited medicines. Pfizer explains on its website the global threat that this trafficking represents for health and the economy. Indeed, it can seriously decrease the health level of a community and weaken pharmaceutical industries. (*Pfizer UK, 2021*).

Finally, the rise of biotechnology has to be internalized by companies because this is the future of research and medication. Biotechnology is the key to personalization of medical care but overall it is the new way to modify and use biological entities in order to collect data and knowledge. Biotechnologies improve the quality and the efficiency of medication because a part of the drug is now composed of a living organism. (*HealthAffairs.org, 2020*)

3.2. European position

The European pharmaceutical market is a significant one in term of market size. However, if one takes a look at the ranking (see feature 3), there is only one truly European company within the Top 10. This is the French company Sanofi. There are also two Swiss companies (Roche and Novartis) which are a part of the European environment but cannot be called as European companies. It does not, however, mean that there is no significant company in Europe. Bayer or Servier Laboratories are important players on the market. Instead of being a business pool such as United States, Europe is a leading actor in the pharmaceutical research and development activity. Around €33.9 billion have been invested in pharmaceutical R&D in Europe (see feature 3) and 48.5% are allocated to clinical trials. R&D represents 15% of net sales which makes the pharmaceutical sector the highest one in term of R&D as percentage of net sales (*EPFIA, 2011-2015*).

Feature 3

PHARMACEUTICAL INDUSTRY RESEARCH AND DEVELOPMENT IN EUROPE

EFPIA 2016	€ million		€ million
Austria	294	Latvia	n.a
Belgium	2,889	Lithuania	n.a
Bulgaria	n.a	Malta	n.a
Croatia	40	Netherlands	642
Cyprus	85	Norway	126
Czech Republic	77	Poland	289
Denmark	1,497	Portugal	75
Estonia	n.a	Romania	109
Finland	198	Russia	412
France	4,451	Slovakia	n.a
Germany	6,227	Slovenia	180
Greece	42	Spain	1,085
Hungary	178	Sweden	1,104
Iceland	n.a	Switzerland	6,429
Ireland	305	Turkey	66
Italy	1,470	U.K.	5,679
TOTAL			33,949

Note:
The figures relate to the R&D carried out in each country.
Austria, France, Greece, Norway, Portugal, Sweden: 2015 data; Cyprus, Ireland: 2013 data; Czech Republic: 2012 data; Croatia, Netherlands: 2011 data
Belgium, Croatia, Denmark, France, Germany, Greece, Ireland, Italy, Netherlands, Norway (LMI members), Poland, Romania, Slovenia, Sweden (LIF members), Switzerland (Interpharma members), Turkey: estimate

Source: EFPIA member associations (official figures)

The European pharmaceutical sector is also doing well with respect to employment. Indeed, between 1990 and 2017, the employment in the pharmaceutical sector rose from 500,000 to 750,000 workers and, in 2017, 115,000 workers were allocated to R&D.

The European production is also significant and rose to €248,053 million in 2016. The largest producing countries are Switzerland (€46,280 million), Italy (€30,010 million) and Germany (€29,197 million).

According to EPFIA and concerning the trade balance, exports (€373,333 millions) are higher than imports (€278,462 millions), so that the trade balance is positive (€94,871 millions). The European pharmaceutical market is making profit from international exchanges.

3.3. Indian position

The Indian pharmaceutical industry is considered as the “laboratory of the world”. Indeed, India produces around 20% of worldwide non-patented medicines and 50% of vaccines. India counts around 3,000 pharmaceutical companies and 10,500 manufacturing units. India has the highest number of factories approved by the *U.S. Food and Drug Administration* (USFDA, 2019).

The Indian industry is a major actor in generic drugs production. There are many generic producers such as Cipla, Lupin, Zydus Cadila, Sun pharmaceuticals, etc.

As stated above, India is the laboratory of the world which means that is a major actor concerning manufacturing and transformation of pharmaceutical products. However, this industry depends on China since Chinese companies supply 70% of the global Indian demand for raw materials. China has an important role when it concerns active chemical ingredient. India is able to produce it but at a lower level. This component is necessary to the production of licensed and generic medicines.

Narendra Modi (Indian Prime Minister) stated that « *Indian pharmaceutical industry is an asset for India and for the world.*”

In fact, exports from India rose by 8% and represent $16.2 billion whereas imports into India only amount to $2.3 billion. Indian exports make up 20% of global generic medicines exports. Pharmaceuticals are the 6th most exported products after minerals, refined petroleum, automobiles, machinery appliance and organic chemicals. (Exports Data Bank, 2019)

United States is the most lucrative marketing for Indian medicines. The US market represents $3.21 billion, followed by the United Kingdom ($591million) and Russia ($448 million). Germany stands at the 5th position with $417 million, whilst the Netherlands and Italy are at the 8th an 9th position with respectively $193 million and $156 million. (*Statista 2020*)

India is a crucial point of interactions between Western countries and China but also concerning the worldwide pharmaceutical supply chain.

In India, costs related to R&D and production are more affordable. This is why Indian companies are efficient and attractive. This industry is known for its innovative workforce and its high quality research system. Furthermore, the growth of this sector is due to qualitative and

numerous infrastructures, high volume of medicine production, innovation and medical tourism.

3.4. Similarities and differences

European and Indian pharmaceutical industries are two key actors within the pharmaceutical environment. Both have a valuable and qualitative research and development system. Their objectives are oriented towards future and improvement of existing technologies. Europe and India do not only compete against each other but they also collaborate. India is a producer of generics and components. This is why Europe and India entered into a *Cooperation Agreement on Partnership and development* in 1994. Indeed, these two market players need to collaborate because Europe needs Indian production to provide medicines to the European market and India needs Europe's approval to sell its production and penetrate the European market. (*Official EU website, 2020*)

Europe has a positive trade balance which means that it exports more than it imports. According to the OECD, European countries such as Germany, Switzerland, Ireland, UK, France or Belgium are leaders when it concerns pharmaceutical exports. India is in the same situation but at a much different level. Despite the significant volume of Chinese imports, India keeps a positive trade balance due to the high volume of exportations to United States, Europe and the rest of the world.

Analyzing exports graphs and analytics may be misleading because it shows that Western countries are leaders. It is true with respect to finished products. The error would be to think that Europe and India are doing the same type of activities. Europe is more focused on commercialization whereas India works on manufacturing. They do not work at the same level of the value added chain. This being said, both are top exporters in their own respective category. (*Exports Data Bank, 2020*)

Concerning infrastructures, Indian infrastructures are better adapted and more numerous. As we said previously, Europe produce and sell licensed medicines while India does the same for generics.

It is also important to recall that the general rise of cost in Western countries forced a number of companies to relocate their activities to countries where costs are more affordable. This

explains why Western countries are so dependent on nations such as India. They are dependent for their outsourcing and to maintain a competitive edge.

3.5. The impact of COVID-19 pandemic on pharmaceutical industry

Both industries are leaders in more or less digitalized sector. Research and development is a common activity that requires digital technologies. Almost every activity require digitalized tools. We saw in the previous sections (3.1. to 3.4.) that pharmaceutical industry is growing significantly and the part of investments allocated to high level of digitalized activities is considerable too. This means that to keep this development pace, pharma companies must meet markets needs and this goes through the development of digital technologies.

The COVID-19 pandemic changes the functioning of the global pharmaceutical market. Indeed, peoples are locked at home, people are afraid of this "unknown virus". Social media is a major key in the spread of fake news and "grandmother's remedies". (*Asselin, 2021*)

In case of health issue, individuals prefer staying at home than going to the doctor or going to the hospital. These new behaviors changed the global functioning of the healthcare system. Patients order their medications via *click&collect* platforms and meet health professionals through *teleconsultation*. (*Gielens, 2021*)

These new needs and expectations forced pharmaceutical companies and the global health sector to readapt existing methods. The relation between the patient and the professional is more distant than ever. This forced firms to invest in digital technologies to meet this new demand and keep the working pace while applying sanitary measures.

4. Digital Revolution in the pharmaceutical industry

4.1 Concept

The digital revolution is a societal upheaval that can be compared to the "third industrial revolution", characterized by the rise in numerical technologies such as Internet and telecommunication systems. The worldwide society is facing the emergence of social medias for several years already. This new way to communicate known by everyone represents a major change in human interactions. Whether widely known (Facebook, YouTube, Instagram, Twitter,

…) or less known (WeChat, TikTok, Pinterest, Line, …), social medias meet a growing numerical demand.

This revolution is also represented by the appearance of artificial intelligence and data management. It has a significant impact on people's behavior and firms' decision-making process. Let's retrace the history of the digital revolution in order to better understand this phenomenon.

4.2 Context

i. Leibniz & Hobbes

The digital revolution began around the 17th century with Leibniz and Hobbes who thought that it might be possible to turn thinking process into mathematical language. According to Hobbes, "Reason is nothing but reckoning" and Leibniz compared argumentation to computation. This the transition to the mathematical world. This first phase of digital revolution came up from the necessity to meet a mathematical need. (*Chadelat, 2014*)

ii. Industrial revolution

It is important to explain the importance of industrial revolution. These technological improvements have changed the economic mindset because industrials had to innovate in order to remain profitable. The concepts of cost-efficiency, productivity and profit became central in managerial decisions and ideas as illustrated by *Base and Superstructure* (Karl Marx). These marxist concepts will lead the economy to be based on productivism and technologic determinism. This is the beginning of capitalistic production. (*Ouellet, 2009*)

iii. The 1950's

The digital revolution starts booming in the 1950's with the computer age which started earlier but the main improvements were made at that time.

The year of 1958 is marked by the development of the *integrated circuit* which has been created by Jack Kilby (Texas Instrument). The integrated circuit is a component of most electronic devices. (*Official website of Texas Instrument, 2019*)

Another essential improvement was made by the company Bell who created the *modem*. It is a tool able to convert binary data into analogic language. It is a very important creation in the digitalization process.

At the end of the 1950's, there is rise of *internet* and its consequences on the mentalities and behaviors.
The progress did not stop there, there are also a lot of other improvements such as creation of the microprocessor, mobile phone, screens, smartphones, etc.

iv. Big Data

This is a part of the digital revolution. One cannot deny that the actual world is becoming more and more digital. This transition requires to turn information into data. As everything becomes more digital, technologies must be able to stock this new flow of information. This is the *Big Data* concept.
The concept of Big Data rose around 1997 due to the necessity to improve data storage systems and data "mining" systems. Managing the Big Data is rethinking and find new ways to get, stock, treat and share information. In short, Big Data is a three-dimension concept based on the notion of 3 V's: Volume, Variety and Velocity. Treating Big Data is analyzing a high volume of information (Volume), the types of information treated are multiple (Variety) and the data analysis process is realized quickly in order to follow the high speed of data flows (Velocity). (*Dumoulin, 2019*)

4.3 Digitization digitalization and digital transformation

First, it is important to avoid confusing three similar concepts. Digitalization, digitization and digital transformation seem to represent the same process but, in fact, they are three different but closely associated transformations within the digital revolution. These concepts are often used incorrectly. It is therefore important to define them and to use these concepts appropriately.

i. Digitization

Digitization represents the basis of the digital revolution. It is the first step because it is a concept necessary to digitalization and digital transformation. Digitization is moving from a non-digital format to a digital format. It is converting everything from the daily life into data. Writing on a laptop, sending a message, scanning a document, recording a voice or a video, taking pictures are examples of digitization. Digitization is also moving from a manual process to an automated process because collecting information is important, but the process used must also be taken in account. (*Forbes 2018*)

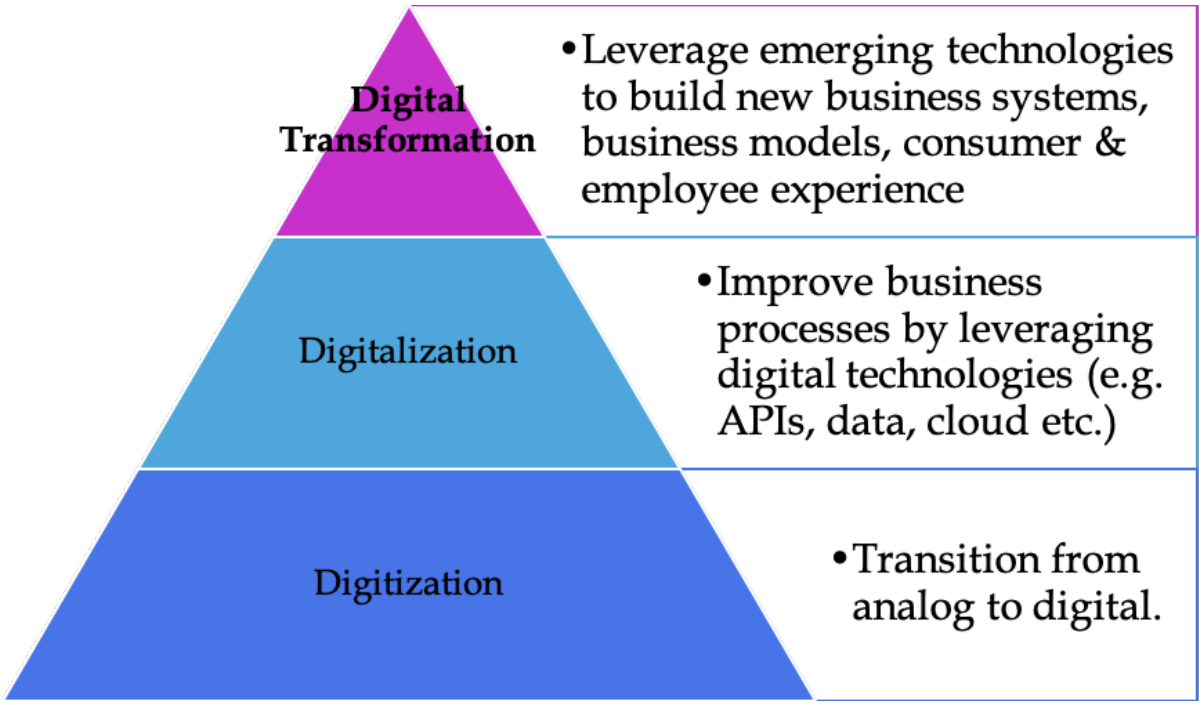
ii. Digitalization

Digitalization is the second step and it can be defined as the conversion of "manual" tasks and human interactions into digital functions. The transition from a traditional process to a digitalized process can make a task fully autonomous or semi-autonomous. It consists of improving and rethinking business actions and business interactions in order to create revenues and be profitable . Road tolls are the perfect example of digitalization. Previously, people worked there but now it is all automated. Agriculture is an example of semi-autonomous digitalization because a lot of tasks are automated, but the sector still needs human workforce. "Digitalizing a business leads to digital business". (*I-scoop.eu*)
It means that digitalizing business interactions one by one will convert the actual business into a digital business because every aspect of a business will finally be digitalized (Marketing, finance, supply chain, human resources, …). (*AOE.com*)

iii. Digital transformation

The difference between digital transformation and digitalization is subtle. Digitalization is taking advantage from digital technologies in order to create revenues. However, digital transformation is different as it represents the way to move to a digital business. Digital transformation is about strategy. Its main goal is rethinking the actual business model in order to match it with the modern digital era.

Feature 4



Source: Digital Transformation, Digitization and Digitalization, Rohit Prabhakar, 31 May 2020

4.4 Impacts on firms (Microeconomic perspective)

In order to understand how a company digitalizes its behavior vis-à-vis the digital revolution, we must consider and pay attention to the digitalization of the most important pillars of a company's structure. This section has been created in order to address the impacts of digitalization on the internal structure of a company. This will help to create hypotheses for the following study.

i. Human Resources ('HR')

Human resources management is a necessary department within a company. It is based on rules and methods predefined and must be respected. Human resources concern every aspect of human interaction within a company such as communication, recruitment, salaries, formations, careers management.

The digital revolution converted human resources into digital human resources by rethinking and digitalizing HR methods. To internalize change, a company must digitalize its structure and its internal procedures. (*Polish Journal of Management Studies, 2018*)

The digitalization of HR has a numerous positive impacts on a firm. The main one is that human capital is managed more efficiently. For instance, algorithms and HR programs have a better knowledge concerning the actual human capital and the type of task that needs to be realized, so that it is easier to assign the right worker to the right task. It enhances the attractivity vis-à-vis workers and young talents. Furthermore, it improves the performance and efficacity at work because tasks are easier, done faster and done more efficiently due to technological assistance. Documents and data are centralized in servers which help the workers to optimize their worktime. (*Bejtkovský, 2018*)

Digitalizing human resources improves the brand image as external people will think that the company invest in human capital and do not only see its personnel as a workforce. (*AIHR Analytics, 2019*)

Digital HR also enhances the communication within the company. The two main improvements are internal social media and chatbots. The former is an internal "Facebook" specific to the firm which allows workers to discuss and have a larger access to information. The latter is an artificial intelligence that chats with the employees in order to answer their questions. These two methods alleviate the work of the human resources department. (*Deloitte's 2017 Human Capital trends report*)

However, entering the digital world means complying to rules and laws concerning digital actions. The company has to work in accordance with those rules. It also implies to rethink working procedures with reference to recruitment, formation, salaries, communication and working time. (*Del Pozo, 2019*)

If these challenges are well managed, the company will have improved its procedure and will save time, funds and energy. For example, the e-recruitment makes the recruitment faster and more targeted. Moreover, a digital knowledge of human capital improves the specification of formations available because the firm will have a more efficient knowledge of its employees' skills. (*AnalyticsinHR, 2018*)

Rethinking the way of working will lead to new ways to work. For instance, teleworking, coworking, teamworking are concepts raised by the idea of rethinking the work. As to Adecco, in 2030, 60% of existing jobs will be replaced by new ones which would be much more digitalized. The survey took the example of a community manager. This a new job totally created by the digital revolution. It globally consists of managing fans and potential customers on social medias. (*Adecco, 2019*)

To conclude the HR section, it is necessary to say that moving towards data-driven HR management reduces costs due to automation and analytics which make programs more efficient.

ii. Marketing

Marketing represents an important part of a firm's strategy as it concerns the relation with other stakeholders such as customers, suppliers and many others. In this activity, the key actor is the human being because every strategy targets stakeholders. The principal stakeholder involved is the "customer" because the main goal is to sell even if there are many other objectives related to marketing. (*Morris, 2009*)

Marketing is the entry point of digital revolution into the company. Implementing digital marketing strategies should not be compared to a "mix" between web and strategy. This discipline needs to be constantly digitalized in order to stay competitive, understand and use new technologies efficiently. Furthermore, customer's economic behavior changes over trends which imposes to "modernize" activities. This modernization may take some time. As a result, a change in the management can lead to a potential competitive advantage. (*Digital Marketing Excellence: Planning, Optimizing and Integrating Online marketing, Chaffey & Smith, 2017*)

Digitalization of marketing means digitalization of communication and selling skills. Communication modes have changed, whether it concerns the message or the channel. Messages are more personalized because it is easier to segment and target the market. Concerning the communication channels, the digital revolution created new ones such as social medias, series, mailing and apps. (*Digital Marketing, Chaffey & Ellis-Chadwick, 2019*)

Digitalization requires two main improvements, namely *innovation* and *new technologies*. Companies must invest in these improvements in order to continue to keep their position on their markets. The digitalization revolutionized the marketing discipline with the rise of *data management* and *artificial intelligence*. (*Couldry & Turow, 2019*)

a. Data

Collecting data is a step towards a more digital marketing discipline. It improves the customer knowledge that a firm can possess. The digital revolution makes it easier to find and analyze customer's preferences in order to offer personalized goods and services and implement strong marketing strategies while saving time and human capital. (*Benalla, 2018*)
Carrefour is good example because the company distributed 14 millions of loyalty cards and the large amount of information that was created by these loyalty cards is treated by 54 employees and by data management systems. This illustrates the benefits of digitalization within the marketing department. (*Lijko, 2019*)

b. Artificial intelligence ('AI')

Artificial intelligence is a form of digital intelligence which helps workers to achieve tasks. These tasks can be achieved partially or totally by the artificial intelligence. The AI is a major improvement from digital revolution as it allows firms to save money and time. In 2016, the CEO of Google stated that "We will move from mobile first to an AI first world". This statement shows the importance of artificial intelligence. Concerning marketing, the AI created the *predictive marketing* characterized by a more qualitative customer service. Services are more specialized and personalized than previously. Moreover, the AI helps customers to make their best choice through several mechanisms such as cookies, personalized ads, algorithms, video's, entertaining webpages, … (*Salesforce.com, 2017)*

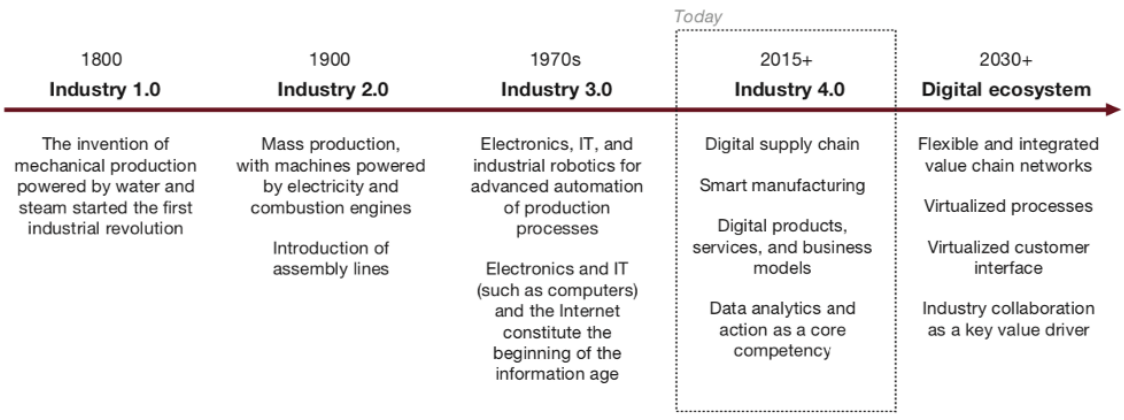
However, the AI and the marketing tools are nothing without data. Hence, one cannot see data and AI as two different improvements since they are related to each other.
Digital marketing has developed new communication and selling skills so that customers retention rate has been improved. Furthermore, data and AI allowed to implement strong and effective predictive models which strengthen the *Business to customers* (B2C) model.

However, some of these tools might be too intrusive and this is why marketing strategies must comply with laws and ethical rules regarding data protection and privacy. Customers and web users are protected by laws, but they are also able to protect their data through programs and websites. (*Hall, 2019*)

iii. Supply chain

The digitalization of the supply chain might have the most significant impact on the firm's activities. The supply chain is a very complex system that varies depending on time, technologies available and companies' strategies. The digitalization of the supply chain implies the rethinking of the whole process from the manufacturing stage to the distribution stage. It also implies changing industries by changing logistics. The supply chain system of a company depends on trends (ecology, digital revolution, COVID-19, and many more). (*Bhardwaj, 2019*)
Consequently, the supply chain could be a relevant point concerning the underlying question of this work as the COVID-19 pandemic could modify the supply chain of pharmaceutical companies. Globalization catalyzed the emergence of a digital supply chain. (*SupplyChainDigital.com*)
According to PwC, companies are actually working within the *supply chain 4.0* era. Technologies used in the supply chain sector are becoming digitalized so as products, services, business models and other components of firms' structure. The efficiency of the supply chain management depends on analytics and data.

Feature 5



Source: PwC, Industry 4.0, *How digitization makes the supply chain more efficient, agile, and customer-focused, pp.8*

Digitalizing the supply chain is based on the integration of digital technologies within the manufacturing process. When this integration is well organized and implemented, then it might increase the long-term visibility, the reactivity and the accuracy of procedures. (*Grimshaw, 2020*)

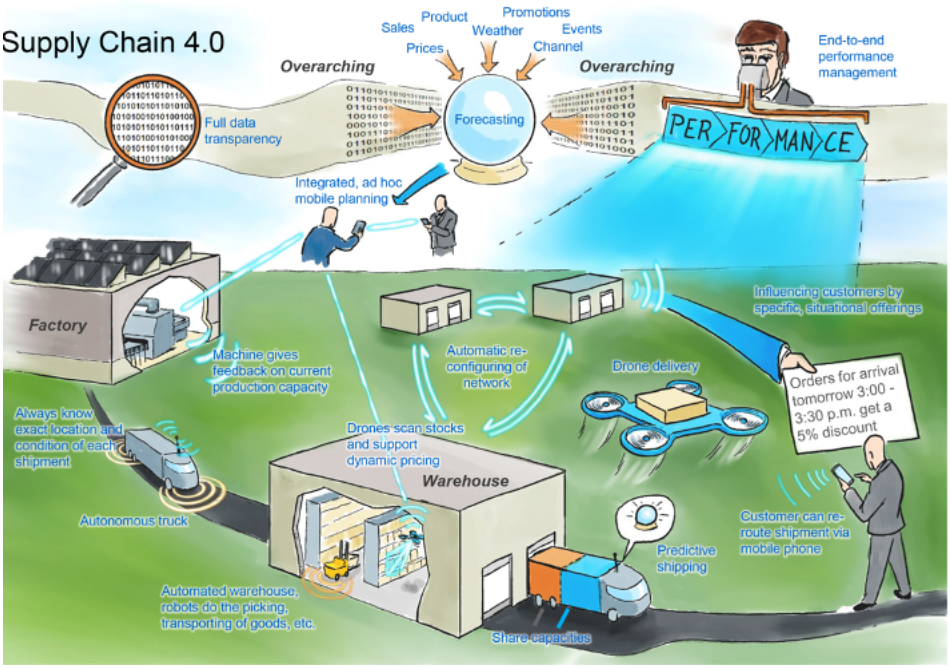
Digital revolution of supply chain leads to efficiency and planification concerning logistics. At the end, it boosts the speed of manufacturing and reduces the costs due to the economy of scale. (*Euchner, 2017*)

Identifying how to improve internal workflows in order to work more efficiently is a major challenge of the digital supply chain. (*PwC, 2016*)

Collecting data is also a key point as it requires to work and collaborate efficiently with suppliers and partners. Digital technologies enhance the of information transmission which allows to realize tasks faster and in a more efficient way. This saves money, time and create value as processes are realized faster than traditional processes. (*Jacobsen, 2019*)

Indeed, according to Accenture, 80% of the required data are outside the organization. Data are driving supply chain activities such as inventories, manufacturing systems, production, traffic, deliveries, track-and-trace, relations with stakeholders, …

As mentioned above, digital supply chain increases the speed of procedures, but it also helps to make faster and better decision concerning the supply chain strategy. The original supply chain model moved from the linear one to networks systems. (*Accenture, 2017*)



Source: McKinsey & Company, Supply Chain 4.0 – the next-generation digital supply chain, 27 October 2016

As we can see on the diagram above, the actual supply chain 4.0 is no longer based on the production to distribution model but rather it is based on interactions and feedbacks between supply chain components. Human workforce is gradually replaced by digital workforce as it is cheaper and sometimes more efficient. It is important not to forget that digital supply chain is based on *performance*. (*McKinsey, 2016*)

Moving to digital supply chain is not only a matter of business development but it is also a requirement to the company's survival. Customers have a larger access to information so that their preferences are much more personalized than they used to be. It is harder to convince them and the customers diversification is so large that businesses must adapt their strategies in order to meet this personalized demand. This phenomenon leads to micro-segmentation and that brings us back to the importance of data collection because micro-segmentation is impossible to realize without data. It increases the value proposition due to the rise of efficiency.

iv. Finance

Digitalizing the finance function represents a challenge for the company. It costs time and money but it can be a smart investment insofar as digital finance can lead to more agility and efficiency in the finance function. One of the most digitalized activity within the financial department is accounting. It is based on computing automation and valorization of data. Data flows are getting larger and the financial function must be able to stock this higher volume of data for a longer period of time and, thus, it requires digital systems. Furthermore, digital transformation increases to speed of electric process and structure data within predictive models. (*Kumar, 2018*)

According to PwC, an efficient financial department spends around 75% of the time analyzing data.

According to the *Journal of accounting, finance & marketing technology*, if one compares digital finance to sport, then finance plays four roles: first, the *sprinter* because digital finance must keep the pace with the digital world as it evolves very quickly; second, the *marathon runner* because the function has to follow this constant evolution over the long term; third, financial managers must be *coaches* concerning the importance of guiding workers and business units; and the fourth role is the *referee* because the financial department has to provide answers and make decisions, but it must also be able to confirm and secure those decisions. (*Journal of accounting, finance & marketing technology*)

The transition from the original finance function to digital finance is characterized by a revolution of procedures and digital programs such as financial softwares, the integration of artificial intelligence within activities, blockchain (backup system based on one register), cloud systems, RPA (robotic process automation). All these digital tools facilitate the finance function and help providing analytical solutions to problems. (*Evin-Leclerc, 2017*)

v. R&D

Digital research and development allow to discover what people want and what they need. Digitalization of R&D is rethinking development process and constantly improving existing technologies. Digital R&D allows the decision-making process to become more efficient and predictive models are reinforced. (*Navigating the Digitalization of R&D, Jim Euchner, 2017*)

Furthermore, cross-function activities are more frequently used which make the global firm's activity more homogeneous. This concept is based on three pillars:

a. Virtual experimentation

Virtual experimentation is based on a simulation. It leads to more sophisticated procedures and guidelines. This kind of experience is more and more important to get and keep a competitive advantage. Simulations reduce the probability of having unexpected results and make the procedures more efficient. Virtual experimentation also improves the design process of products and services which enhances the personalization of products and services while reducing production time in that those improvements upgrade the creation chain of those products and services.

b. Digital collaborations

This pillar is characterized by sharing and capturing knowledge. Improving the R&D by improving digital collaborations means collaborating on a faster and broader way.

c. Big Data

The importance of Big Data within the digital R&D is significant as it is necessary to learn and build better products but also to enhance customers' experience and work. This means that if data are well collected and analyzed then it is possible to improve employees' experience in order to have more efficient workforce within the organization. (*Accenture, 2017*)

vi. Strategy

Digital strategy refers to managing and creating interactions between departments such as human resources, finance, IT, marketing, sales, customers services and many others. It is based on the utilization of analytics in order to implement efficient and cost-effective strategies. Analytics allow to see the real position of the company concerning the analyzed sectors since it reveals the real advantages and the real weaknesses of the activity. Digital strategy must be seen as a tool and not as a goal. This is a common mistake that managers often do. Digitalizing

the conception of strategy must include every aspect of the economic activity. For example, people, products, customers, process, distribution channels and experience are key aspects. (*AOE.com*)

According to *Boston Consulting Group (2019)*, a robust and efficient digital strategy must comply to five rules:

a. Assess the strategic impact of digital

In order to implement an efficient digital strategy, the organization must have a good knowledge of the environment. Digital revolution can lead to new technologies that can radically modify the functioning of the market. It can change the opportunities but it depends on the sector and the function. Digital technologies do not change the product itself but it may consolidate the competitive advantage if it is correctly internalized. The objective is to enlarge the possibilities in order to discover emerging opportunities.

b. Set your digital ambition high

Regardless as to whether it concerns existing or potential advantage, companies must think widely. Best digital strategies are based on value creation. Concerning the digital revolution, the winner is the organization that takes advantage from network effects. The lack of ambition is one of the reasons of strategy failure because it prevents the company from evolving in accordance with the environment so that the organization misses opportunities of financing and organizational concentration since the firm was too focused on traditional activities. (*Farrington, 2017*)

c. Place big bets

Organizing priorities as a portfolio is important. Managing short-term objectives while keeping in mind long-term objectives is a criterion for an effective digital strategy. The accomplishment of short-term priorities releases funds that can be allocated to more important long-term objectives.

The company must be able to question itself: “With the panel of issues the customer face, for which one am I well ranked in order to create value?”

d. Build new strategies muscles

When we talk about ambition, we talk about rethinking process. Ambitious digital strategy means changing the culture within the organization in order to create new *muscles* to improve strengths and reduce weaknesses. Combining new talents with existing talents in order to associates new competences and less recent ones is a great step to digital efficiency. This is why the digital culture is crucial to a successful strategy because attracting and retaining talents is essential to bring autonomy and creativity within the company. This kind of management could improve the speed and the quality of results. (*Boston Consulting Group, 2019 & Sommer, 2017*)

e. Manage transformation actively

Companies have to develop their strategy and their process regarding the available technologies. The main point is to be able to strengthen its core activities because this is what remains after a transformation or a transition. It is therefore important for an organization to know how to adapt to changes in order to keep its core activities unbroken.

Feature 7

Source: Boston Consulting Group, The Five Rules of Digital Strategy, Dan Wald & Romain De Laubier, 29 May 2019

4.5 Impact on markets (Macroeconomic perspective)

i. Impact on local markets

According to a study from PwC, in 2011, the digital transition generated about $38 billion in Europe and $55 billion in Asia. Digital transition improves growth as it fluidifies economic interactions. Trade barriers weakened because information move further, faster and in greater volumes. Moving to a digital world means rethinking activities. Indeed, it creates new tasks, new jobs, so it increased the level of employment.

Digitalization forced the companies to reshape their business models because there are new products, characterized with new design, new digital functionalities, new ways to communicate about the products and many other novelties. Customers have also changed their behavior. Indeed, their preferences changed (they prefer to order from their comfort zone instead of moving to shops) and they have a greater access to information.

The *European Economic and Social Committee* (EESC) highlighted the fact that digital revolution did not only change companies but it also changed their environment. For example, the legal framework has changed. The rules related to physical trade are not similar to those related to digital trade. Moreover, this wide access to information must be protected by rules in order to avoid abuses (data protection). Laws about trade restrictions, intellectual property or taxation also needed to be reshaped since it is important for these rules to be applicable to the real situation of the digital world.

Digital revolution is a significant tool for local companies. The *United Nations Conference on Trade and Development* (UNCTAD) put forward the importance of digital revolution for local markets in the creation of new digital opportunities. In addition, the quality and efficiency of services can also be improved when human workforce is supported by machines and artificial intelligence. With digital process, it is easier to understand customer's preferences and therefore offer more diversified and customized products on markets. Industrial production and efficiency of the AI lead to economy of scale and then cause a general decrease in prices and transaction costs.

ii. Impact on international market

The most significant point is the removal of most trade barriers. Data move quickly and at a higher volume which increase the efficiency of activities. It is easier to communicate and interact with other stakeholders which enhances the amount of partnership and investment opportunities. It is easier for companies to learn and develop worldwide networks. International knowledge is easier to convey and digital revolution improves the ability of companies to match local market expectations with strategy goals. (*European Commission, 2019*)

4.6 Digitalization of pharmaceutical industry

The pharmaceutical sector has been impacted like any other sector. However, many aspects have changed in the functioning of this industry. For example, the communication between health professionals and laboratories has evolved positively. Efficiency of treatments, transparency and diversification of access to information are positive results from the digital revolution. Patients are followed digitally through digital tools and apps. The follow-up is much more efficient because the patient is monitored at any time. (*Seux, 2017*)

McKinsey indicated that data are necessary to the medication development and to the growth of the pharmaceutical industry for several reason such as the fact that processes are more efficient and stocks are managed in a more effecient way. The development of new technologies such as FitBit or Apple Watch enhances the patient's involvement. It is easier to demonstrate the quality of a product by relying on data since the results and analytics are much more reliable. Furthermore, the competition concerning data management is also transmitted to the pharmaceutical world, so that companies such as Apple, IBM, Qualcomm Technologies are also entering healthcare market. (*McKinsey, 2019*)

Pharma selling methods has significantly evolved during the past years (see feature 8). Indeed, the traditional sales model is mainly based on physical promotion, field salesforce, planning and territory design. Digital model enhanced the marketing and the R&D as heavy and difficult tasks can now be carried out digitally. Companies have been able to create new drugs and develop a brand image. The digital model accelerated the decision-making process and reduced delays. The overall pharmaceutical market is now more sensitive and more focused on patients

and medical professionals. This transition represents a potential competitive advantage for those who are able to efficiently manage information platforms, analytics, e-consultation or online medicines. (*Upadhyaya Sanjay, 2019*)

Feature 8

Traditional Model of Pharma Selling	Digital Model of Pharma Selling
Advantages: • Tried and true • Personalized services • Locally oriented • Convenience • Built on face-to-face interactions to understand potential customers • Engagement	**Advantages:** • No geographical limits • Very scalable • More Transparency • Short business development cycles • Easy to measure project result • Trustworthy • Lower cost • Easy to deal • Relevant
Disadvantages: • Less geographic regions coverage • Very limited access to distant markets • More man-power • Long business development cycles • Hard to scale and measure project results • New digital players threats • Busy physicians • More knowledgeable patients	**Disadvantages:** • Diverse groups to deal • Specialized treatments • Global reach is to global competition • More and latest technologies to be used • No local orientation • No face-to-face contact with the prospect • More time to invest to succeed

Source: Distinction between Traditional and Digital selling Methods, www.Mckinsey.com, 2018

i. Europe

In Europe, data have mostly improved the marketing, finance and research and development functions. For instance, we know that artificial intelligence and virtual reality are the principal development axes related to digital transformation.

Sanofi uses artificial intelligence to optimize the production of its factories and many other activities. The company plans to invest $60 million in digital infrastructures. (*Sanofi.com*)

GlaxoSmithKline, on the other hand, bets on virtual reality to enhance the IT function and reduce the use of paper. (*Diligent.com, 2018*)

ii. India

In India, the principal functions impacted by the digital revolution are research and development, supply chain management and marketing. Digital revolution brought a positive impact on the Indian pharmaceutical sector. Indeed, the return on investment ('ROI') of

pharmaceutical activities has increased as companies became more able to capture value from the value chain. Indian companies have now a real time access to information. According to Kedar Upadhye (CFO of Cipla), data and networking have allowed the supply chain and other necessary services such as quality control, audit and finance to improve considerably. (*HealthCareRadius.in, 2019*)

5. Covid-19 and digitalization strategy

5.1 Context

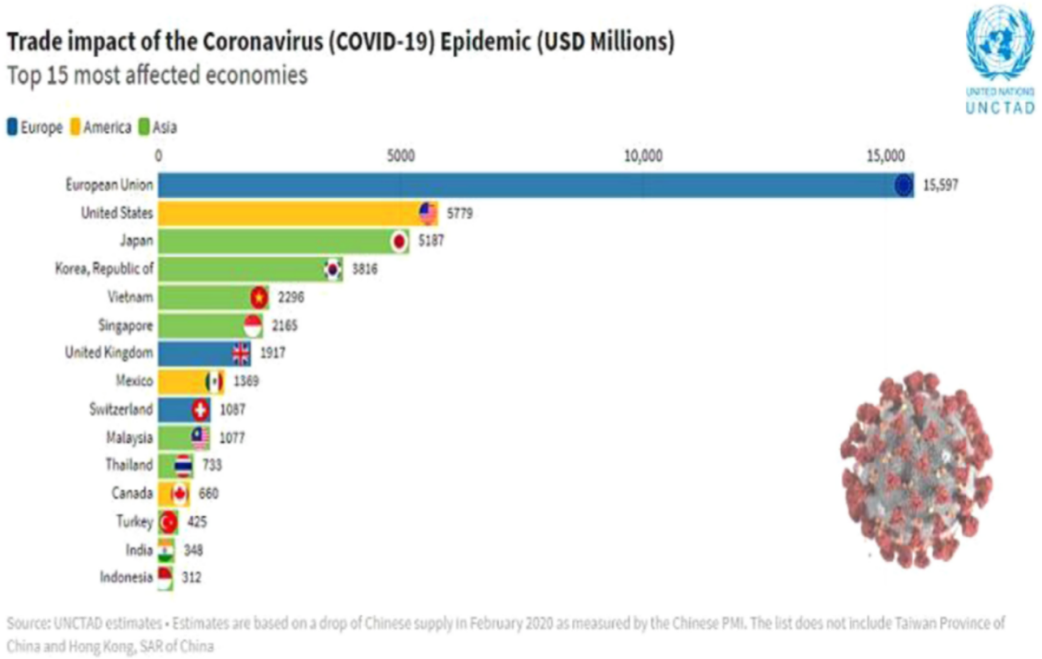
COVID-19, also called SARS-CoV2, is a respiratory virus detected in December 2019 in Wuhan, China. (*World Health Organization, 2020*)
Several symptoms such as fever, loss of taste and smell or sore throat characterize this virus. COVID-19 has spread very quickly throughout the world, so that most governments have decided to put the population under lockdown, curfew or other restrictive measures. The economic and social consequences of these restrictions are significant.

i. Impact on markets

Governments forced the population to stay at home in order to reduce the contagion rate and thus to protect the weakest persons. Companies and self-employed were forced to find solutions and adopt new ways to work. The principal solution is teleworking. The consequences of COVID-19 on markets are multiple. The restrictions related to travel (travel certificates, requirement of a negative PCR test, curfew, ….) are measures that impede on human travel. As a result, exchanges between economies are reduced. Indeed, people are less allowed to spend and invest funds within local and foreign economies. (*UNDP,2020*)
In 2021, a vaccination passport is being studied as a potential option to travel and as a condition for other contact activities to reopen. This could be a solution but it will take time to reach the initial level of consumption. (*SchenghenVisaInfo, 2021*)
Restrictions and uncertainty related to this period of pandemic led to reduced investments. All those measures created a contraction of international trade (see feature 9). As we can see, the impact of the coronavirus crisis was more severe in the European Union as compared to the

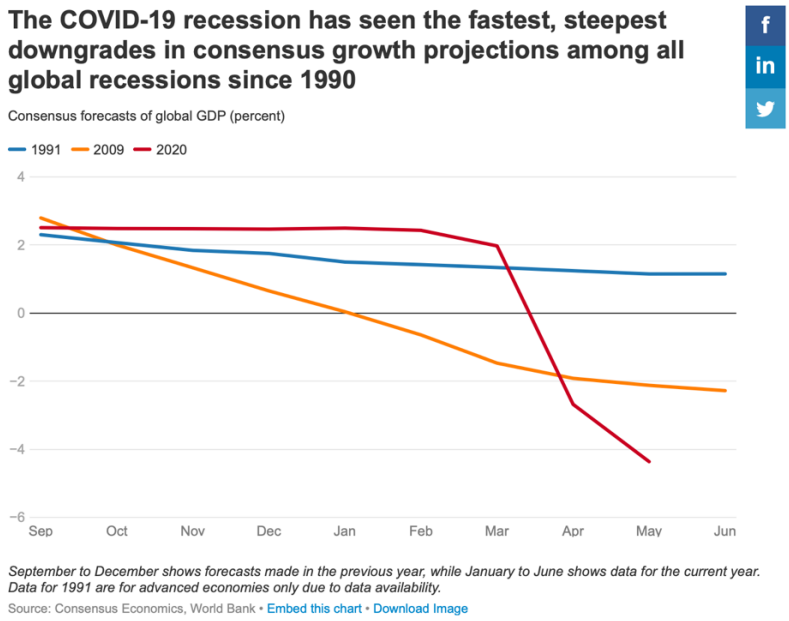
other main economies of the world. The Indian economy also felt the consequences of the COVID-19 pandemic. As shown in the chart below, the trade loss in the EU and in India amount respectively to $15,597 million and $348 million. (*UNCTAD, 2020*)

Feature 9



Companies are suffering from this situation so that it will increase the level of unemployment by 9.4% by 2021 (*E.C. Europa, 2020*).

People and funds flows are slowed down so that it reduces the growth of economies. Many countries will enter in recession (see feature 10).



European and Asian growth will decrease by 4.7% (*World Bank,2020*).

If economies are slowing down, the income per capita decreases and this leads to a drop in consumption at the same time. The economy then enters into a vicious circle.

It is also important to remind that the SARS-CoV2 is a deadly virus. On the 8th of February 2021, 2,314,602 people died from COVID-19. (*JHU CSSE COVID-19 Data*)

Even if most of the victims are elderly people and retired workers, the COVID-19 pandemic created a fear related to human interactions which is a fundamental of economy. (*Baldwin & Di Mauro, 2020*)

ii. Impact on companies

Economic process changed during the COVID-19 crisis. Indeed, companies reshaped their business model. They had to find other solutions to deliver values. Restaurants and bars have re-oriented their activities towards delivery and take-away. Most of other companies had to propose a digital service because the B2C system has changed. Customers cannot come to the company, so the company has to come to the customers. The B2B system has also changed as firms have more troubles reaching suppliers, partners and other stakeholders. Companies were

forced to improve and adapt their principal economic functions. Strategy has to be much more digital-oriented to reach the customer directly in his comfort zone. (*McKinsey, 2020*)

Supply chain has to be reorganized in order to reduce delays and uncertainty related to governmental restrictions. Marketing should be more digitalized because the only contact between customers and the outside world is the internet. Undoubtedly, paper marketing as well as word of mouth perform less well during the COVID-19 crisis.

However, human resources management has become an increasingly important function. Workers were socially supported within a company but, during this pandemic, they might have had the feeling to be left alone, unequipped and this can have a significant negative impact on their motivation and performance. Hence, HR managers have to pay attention to workers' well-being as this can lead to serious performance issues which is, especially during that period, something to avoid absolutely. (*FEB, 2020*)

iii. Impact on pharmaceutical industry

The COVID-19 pandemic has created a sentiment of fear in the society and the pharmaceutical industry has registered positive results for the first trimester of the pandemic. As to individual protection, this crisis has created new logistic challenges (supply chain, HR, marketing, etc.). These challenges cannot be solved without using data.

Hydroalcoholic gel, masks and plexiglass are new products whose demand suddenly increased. Inventory and order management are functions that needed to be adapted due to the increase of delays related to suppliers, deliveries, production process, etc. As a result, most of pharmaceutical companies have decided to multiply the number of their suppliers in order to mitigate the impact of delays on their activities. (*PharmaConsult, 2020*)

The COVID-19 crisis led to a reduced economic activity within the pharmaceutical sector. The challenge is thus to keep the pace in the production volume while maintaining the level of quality.

Export restrictions and the fact that China and India based their production on self-sufficiency, forced pharmaceutical companies to develop their production process in order to become less dependent on Asian production. (*Deloitte, 2020*)

Finally, the COVID-19 crisis has created a new competition within the sector. Indeed, the race to vaccine production increased the investments in R&D as every pharmaceutical firm wants to

be the first to develop the vaccine. Vaccine production gives access to investments, fame, reputation and to a leading position on the coronavirus vaccine market.

5.2 COVID-19 and digitalization strategy

Telecommuting and lockdown restrictions are COVID-19 effects that forced companies to move on and invest in digital technologies. Improving intranets, IT systems, data collection and protection, customer experience, processes and others are activities that had to be digitalized as a result of the fact that digital interactions are replacing human interactions.

Digitalizing internal processes of a company is necessary but developing digital instruments and infrastructures is also important in order to improve and provide efficient pharmaceutical products and services. As to digital tools, COVID-19 boosted the development of digital technologies such as the tracking strategy to slow down the pandemic or the necessity for workers and companies to adapt their services and their working methods. (*ScienceDirect, 2020*)

As shown in the diagram below (see feature 11), digital responses to COVID-19 pandemic are multiple. Even if this does not directly concern the pharmaceutical industry, it modifies the functioning of the health system. Apps, analytics, wearable and sensors, machine learning and digital diagnostics are improvements that will impact indirectly the pharmaceutical industry. Indeed, all those digital technologies will make medical diagnostic quicker and more reliable, so that it will be easier to assess the potential disease and treat it efficiently. (*Deloitte, 2020*)

Feature 11

Source: Deloitte, *The interconnected digital technologies used in the public-health response to COVID-19.*

Furthermore, Mckinsey discussed in a paper the five facts concerning the influence of COVID-19 on the digital strategy of pharmaceutical companies. First, patients' behavior will change as they interact less, they are more careful and fearful than previously and this is why companies have to invest and count on the digital to improve process within the functioning of the company and to interact with the rest of the economic world. Only improving the customer journey is only one part of the solution. Firms have to digitalize their internal process because now the B2C distance has increased considerably. As an illustration, Gamamabs, a French pharmaceutical start-up, invested in the implementation of management software in order to digitalize its production. This led to an improved production process and improved traceability through Big Data, AI and machine learning.

Second, government policies change very quickly so as the restrictions and the rules. Companies must work on risk assessment and try to protect themselves from those changes. They need to think about alternatives and implement their strategies in accordance with the

precautionary principle more than ever. Third, data is the key to economic survival. This allows to increase the efficiency concerning management of any kind.
Fourth, healthcare is constantly evolving, diseases are muting so as COVID-19. Hence, the need to develop new technologies to counter the new and existing viruses.
Finally, this pandemic has created a fierce competition between pharmaceutical companies. This pandemic has put the pharmaceutical industry and laboratories on the forefront of the world stage. This is the perfect occasion for pharmaceutical companies to act and differentiate themselves from the others.

In 2021, COVID-19 vaccine market is divided between several pharmaceutical companies such as Pfizer/BioNTech (USA/Germany), Astrazeneca (Sweden/UK), Moderna (USA), Sinopharm (China) and several others. These vaccines are different by their type (RNA messenger, viral particle, level of replication, …), efficiency rate and their conservation requirements. These aspects are new aspects that pharmaceutical companies are working on in order to acquire some market share. (*Bloomberg, 2021*)

6. Methodology

6.1. Sample and data collection

In order to realize a qualitative and structured work, it is important to follow a certain way to analyze and apprehend the issue at stake.
This work has been divided into three parts. First, the theorical part helps to understand the ins and outs of the issue. The literature review is an essential section of the theorical part as it allows to treat the literature related to the topic in its globality and to understand the problematic to a greater extent. In order to treat the topic from many perspectives, several types of documents have been used to collect the most relevant information possible. Scientific articles, peer reviews, official website (European Commission, UNCTAD, WTO, WHO, OECD, World Bank, FDA and many more) represent a strong basis in the completion of an efficient and relevant theorical part. Furthermore, articles from independent groups such as PwC, Deloitte, Accenture, McKinsey and Company or Forbes have been analyzed in order to gather information of all types. Websites of significant pharmaceutical groups (Sanofi, GSK, Novartis,

Roche, Bayer, …) have also been examined to understand their position on the matter subject to the present paper.

When the knowledge related to the problematic has been read and treated, then there are potential hypotheses that come up and could hypothetically explain the problematic.
Once those hypotheses are stated, it is fundamental to develop them the right way. In this work, there are 6 hypotheses that rose from the analysis of the theory. The most efficient way to treat them is to contact and interview professionals in order to have their reality and their opinion about the problematic. The characteristic of qualitative research is that data may come from many supports such as observations, notes, interviews, chats, artifacts or written documents. (*Wertz, Charmaz, McMullen, 2011*)
After the analytical section, the objective is understanding the answers and prepare the hypotheses to be quantitatively analyzed. After that it is important to conclude the work by a recapitulation of the overall situation related to the questioning as well as the related answers.

Concerning the sample and the method of data collection, interviews were written or oral depending on the availability or the wish of the contributors. Ten professionals have been interviewed. All of them are currently working in the pharmaceutical sector in India or in Europe. They work in different activities such as supply chain, development implementation, analytical research department, viral vaccine production and product supervision. Initially, the proportion of interviewed professionals working in India and Europe respectively was expected to equal but, due to several reasons (developed in section 8 below “Limits of the study”), the actual repartition is respectively 30% and 70%, which still enabled me to carry out an efficient analysis. The gender equality was a particular point that had to be respected and that is why the sample comprises an equal share of men and women.
Interviewed persons have been contacted through three different ways. First, LinkedIn was the social media used to contact and interact with professionals. Indeed, it is complicated to find and discuss with specialists, mostly in India, and LinkedIn was a convenient way to find contributors.
Second, official websites were an efficient way to contact pharmaceutical specialists even if official websites are mostly dedicated to clients or suppliers. Third, personal and familial contacts allowed me to contact workers in person.

The interviews were “semi-directive” which means that there were 12 large questions divided in three sections: *preliminary questions*, *key questions* and *more questions.*

“Preliminary questions” are asked to introduce and set the basis of the interview. These are general questions for which the objective is to go in greater details into the analysis of concepts. The “key questions” are the central part of the interview as it directly addressed the topic of the paper. Finally, the “more questions” section is still important as it provides additional information to the discussion and helps the interviewer to have a better view and overview of the problematic.

The aim was to carry out a discussion around these questions without following strict guidelines. This diversified the interviews and allowed a discussion on unexpected topics. It also provided an undeniable quality gain. The interview grid is available in the appendix section.

6.2. Data analysis

The analysis method used in this work is the “qualitative analysis”. This method is based on the collection of qualitative data instead of quantitative data. The accurate qualification of this method is called “hypothetical-deductive” because general information is collected to rise hypotheses and then interviewed professionals provide additional explanations to these statements. Indeed, this method is based on 4 phases: we observe, then we suggest hypotheses, we experiment those hypotheses and at the end we reformulate those statements. (*Mesly, 2015*)

In a second time, the qualitative analysis will serve to test these hypotheses through a quantitative approach. The objective here is not the verify them but to develop them for a future quantitative research. The main objective of this kind of analysis is to develop concepts and facts that could potentially improve the understanding of notions and ideas. (*Mays et Pope, 1995, p. 43*)

However, this method could lead to mistakes or wrong conclusions if the data provided are imprecise. This way to analyze is more subject to subjectivity because qualitative data could be less reliable than quantitative information. (*Gubrium, J. F. and Holstein, J. A; 2009*)

That is why these interviews have been managed with rigor and professionalism in order to reduce the potential risk of misleading analysis. The questions, the people interviewed and the

modus operandi, have been thought deeply to provide a reliable and professional empirical analysis.

7. Findings and development of propositions

For this section, pharmaceutical professionals from Europe and India have been interviewed on the impacts of COVID-19 and of digital technologies on the evolution of their job.

7.1. Proposition of hypotheses

As discussed in the previous section, the objective is to define and highlight the similarities and differences between European and Indian pharmaceutical companies. After that, the goal is to extract potential hypotheses that could explain the impact of COVID-19 on digital development of pharmaceutical companies. Finally, I will examine whether European and Indian companies are facing the same issues and whether the solutions implemented are similar or different. Regarding the data collected, it leads us to the following hypotheses:

1. The COVID-19 pandemic slowed down the digital development of the pharmaceutical companies.

The aim of this hypothesis is to figure out to what extent did the pandemic reduce the digital growth of the pharmaceutical businesses in Europe and in India.

2. The COVID-19 pandemic enhanced the digital development of pharmaceutical companies.

After the theorical analysis, the concept of “pandemic boost” came up as companies had to and were “forced” to invest in digital development. Indeed, the change in customers’ habits forced those businesses to rethink and readapt their business model.

3. The impact of Covid-19 on European and Indian companies differs depending on the tasks.

This hypothesis has emerged as it is relevant to understand whether the difference of COVID-19 effects on businesses is due to the tasks or to another factor.

4. The impact of Covid-19 on European and Indian companies differs depending on the crisis management.

The importance of this hypothesis comes from the fact that, if the difference of COVID-19 impact on companies is not due to the tasks themselves, then it is relevant to understand if these effects might come from the crisis management

5. The impact of Covid-19 on European and Indian companies differs depending on market position.

This hypothesis relates to the importance of assessing whether European and Indian pharmaceutical companies are managing differently the COVID-19 situation due to their respective position within the global pharmaceutical industry.

6. The impact of Covid-19 on European and Indian companies differs depending governmental measures.

This last hypothesis must be tested on in order to understand whether governmental measures play a role in the COVID-19 effects on European and Indian companies. Did the lockdown and the telecommuting enhance or weaken the digitalization of companies?

7.5 Findings

This section has been divided according to the guiding principle of the interview in order to have a relevant and interesting confrontation of each interviewee's answer. It will allow us to highlight common and diverging information. Thereafter, it will facilitate the discussion of the stated hypotheses.

i. Preliminary questions

1. What is your current position? What are you responsible for?

This is the first question asked during the interview as it is fundamental to know more about the interviewee's background and functions. 70% of them are working for European companies whereas 30% of them are working for Indian companies. There is an experience gap between

the interviewees. The range of experience varies from 4 years to 27 years and this provides a wider spread of feedback regarding the problematic.
Their functions are also different as some are working in the supply chain while other are working in research and development, IT or trade. This large range of functions will provide information on the impact of the COVID-19 pandemic on the digitalization of each department. Also, some of them are working for the same company. For instance, Mr. Raja Kannivel (viral vaccines) and Mr. Varma (analytical research) are working in separate departments of Aurobindo Pharma ltd. which is an important Indian pharmaceutical company. It is a positive point at it shows whether the problematic is treated differently according to departments.

2. What do you think about digitalization strategy? Is your position digitally evolving?

This question is very important as it shows whether the position of the interviewee is digitally evolving. This is fundamental to assess the position of the interviewee.
As to the answers provided, 100% of the interviewees stated that their position, regardless as to whether it concerns the production process or the value delivery process, is digitally evolving and, in fact, is highly digitally evolving.

For Nina Charlène Dodo Tapé, product and project quality officer for *les laboratoires Expanscience* (France), digitalization is:

"*Making services, products and activity more digitally available through apps or internet platforms. It offers an added value to the company as it is an efficient way to differentiate in this very competitive and regulated pharmaceutical world"*. (Nina Charlène Dodo Tapé)

She explains that her position used to evolve digitally but not anymore because it is now fully digital.
A professional who requested to remain anonymous and who is working as a project manager in the supply chain of SUN Pharma (India) sees the digitalization as the way to improve work efficiency and explains that is the main reason that SUN Pharma invest in digitalization strategy.

"*At the end, we are all interested by profitability and efficiency, so if digitalization increases those 2 factors, then we have to invest in digital technologies*." (Anonymous working at SUN pharma)

The conclusion is that all types of activity are digitally evolving, only the intensity and the chronology change as some functions have already been digitalized while others are in the process of digitalization.

3. In what extend is your position impacted by the COVID-19 pandemic?

The answers to this question are very interesting as the result concerns the direct impact of the COVID-19 pandemic on everyone's position. This is a preliminary question in order to prepare the rest of the interview.

30% of the interviewees admitted that their positions have not been or have slightly been impacted by the pandemic. The jobs that have not been impacted are those that were fully digitalized such as research & development supervisor in the research of biological medicines (anonymous), product and quality officer (Nina Charlène Dodo Tapé) and quality manager (Thibault Mandicourt).

"*Except that I had to work from home, the pandemic did not really change my activity. But I agree that this small change is only due to the fact that my work is highly digitalized*." (Anonymous)

The other interviewees confessed that their position has been impacted by the COVID-19 pandemic, be it in the function itself or the work organization (working from home, IT installation, relations with stakeholders).

"COVID-19 pandemic has shaken our organization on almost every level. We had to reorganize, adapt or totally change some processes." (Bertrand De Castelneau)

Bertrand De Castelnau (Product supervisor at Theradiag) explains in his interview that the COVID-19 pandemic forced him and his team to readapt their activity entirely: from human

resources, production management and delivery process, almost everything had to be readapted to respect governmental measures and protect human capital. Most people have been sent home to work from there and many fixed-term contracts have not been extended. Furthermore, the lockdown forced the company to find new suppliers because of the general activity slowdown. He confessed that one of the most difficult part except firing employees is that some medicines medication components were not provided because the delivery delays exceeded the shelf time (cold chain, conservations rules not respected) so that it obstructs the supply chain in general.

ii. Key questions

4. What part of your activity is concerned by digital technologies?

This is the first question asked in the "key questions" section. This question is necessary as it allows to test the impact of digitalization on the functions themselves. For instance, if someone certifies that his/her activity is not impacted by the digital revolution whereas his activity does require digital technology. Then this represents the fact that digitalization is well imprinted in mentalities.

According to the answers provided by the interviewees, everyone's activity has been impacted to a certain extent by the digital revolution. If even if some of the interviewees have similar jobs, every answer is different. This shows the large impact of digital revolution as it affects the same functions differently. For instance, Mr. Varma and another anonymous professional are both working within the research and development department. One is working in India and the other one is working in France. Their answers concerning the above-mentioned question is radically different. Mr. Varma explains that digitalization mainly concerns processes and operations while the other professional states that digitalization mainly refers to the organization of the work such as meetings and information transmission.

"*Digital technologies are used to realise heavy tasks, stock and manage data and speed up processes.*" (Praveen Varma)

Interviewees are more familiar with the concept of "digitalization" than with that of "digital revolution". A very interesting remark came up from this question. Some interviewees stated

that their activity is not impacted by the digital revolution and then realized that this statement was not correct and that digital revolution had indeed an impact on their activity. The foregoing shows that the digital revolution strongly impregnated the mentalities to the extent that even professionals forget that they are confronted with digital technologies on a daily basis by using management programs, programming machines, treating data and many other tasks that are digitalized.

5. In what extend is your position impacted by digital revolution now and over years?

This question has been asked as an extension of the question 4. It helps to measure the impact of the digitalization over years. It is very important to measure this impact over years in order to give credit to the answers provided.
To illustrate that with a concrete example, we have, on one hand, Mrs. Dodo Tapé who explains in her interview that her function is no longer digitally evolving (because her function is fully digitalized) and, on the other hand, we have Mrs. Safaa Houimel (IT officer) who explains that her position has considerably changed over the years.

"Since March 2020, my job became overwhelming because governmental measures forced the IT department to digitalize almost every other department. We have to take care about everything related to technologies." (Safaa Houimel)

This question gives us a relevant outline of the chronology. Only paying attention to the outs or to the actual time does not improve the quality of the answers.
Eight out of ten interviewed professionals consider the digital evolution of their position as "significant" or "total", while the remaining two see=s the digital evolution as "weak" or "insignificant" because either their function is totally digitalized or highly digitalized so that they do not notice changes and improvements. (Nina Dodo Tapé and a professional of SUN pharma)

6. Prior and during the COVID-19 pandemic, how evolved the relation between your position and the digitalization process?

Analysing the presence of digital evolution before and after the COVID-19 pandemic is essential in order to correctly assess the impact of the pandemic on the digitalization strategy of

companies. This question is crucial as it marks the transition to the analysis of the COVID-19 phenomenon. Discussing about the situation before and after this health upheaval will help to test the hypotheses described in section 7.1 above.

The answers to this question are diverse. They vary from "identical" to "radically different". Contributors who answered "identical" are the persons whose function is fully digitalized. This shows the importance of assessing the level of digitalization through the previous questions.

The interviewed professionals who answered that the impact is different before and after the COVID-19 pandemic rely on approximatively the same elements. The main one is telecommuting, that is workers had to work from home which requires new installations and infrastructures since it is necessary to bring the same work comfort as that provided in an office. There are many other elements such as new programs, new software, new way to protect and transfer data.

"*It is simple, many of us have to work from home, so if the company don't invest in digital infrastructures, then almost nobody could be able to provide an efficient work.*" (Anonymous)

Mrs. Safaa Houimel, IT officer at *Labatac Pharma*, expressed the importance for the company to invest in new tools to insure data protection and transmission of information (performing and reliable devices). Without these tools, the company is exposed to data leak which can cause competitive disadvantage, weakening of the brand image, trials, etc.

"*Data protection is one of the most important sectors to improve and to invest in. the survival of the company depends on it*" (Safaa Houimel)

7. In what way did the COVID-19 boost or slow down the digitalization of your activity?

This part of the interview is central because this is the question used directly to test hypotheses 1 and 2. Indeed, a boost or a slowdown of the activity may result from many different factors such as crisis management, risk assessment, reactivity and the activity itself.

Through this question, I will try to figure out whether the digitalization strategy has been enhanced or reduced by the pandemic as well as the related factors. At first glance, one could say that the pandemic has slowed down the digitalization strategy because the global activity decreased. However, this is not the case. 70% of the interviewees contend that the pandemic

boosted digital development. 10% of them admit that it did not change anything and only 20% of them categorized the COVID-19 pandemic has an obstacle to the digitalization strategy.

"We are lazy to change until our survival depends on it" (Mathieu Frin)

Mr. Mathieu Frin, trade development manager for *les Laboratoires Expansciense,* acknowledges that his function changed radically in particular at the beginning of the pandemic. Trade relations and processes have been modified by companies themselves and also by governments. It was a challenge to adapt to each measure imposed by each government. Furthermore, some trade agreements were suspended which forced the company to rethink the value chain and the production chain. He qualifies this need of adaptation as "an opportunity" for the company to move towards new digital technologies.

"*Digitalization is contagious because when a service is completely digital, then digital technologies are the only way to interact with this service*." (Nina Charlène Dodo Tapé)

Mrs. Dodo Tapé, whose function is already fully digitalized, said that the COVID-19 pandemic had an impact on the digitalization strategy for other departments within her company. Because her job is fully digitalized, working from home is the only difference. However, she points out that since the pandemic, several departments are more often interacting with her and her team, so this means that other services are more digitally developed.

"*Concerning the beginning of the pandemic, we were forced to stay at home and the digital adaptation came lately.*" (Linga Raja Kannivel)

Mr. Linga Raja Kannivel, viral vaccines manager for Aurobindo Pharma Limited, admits that the COVID-19 pandemic reduced the digitalization strategy insofar as, in India, the government imposed the closure of many pharmaceutical factories. Considering that he works in one of these factories, he was not allowed to work and the activity of his department was suspended. This is why he confessed that the digitalization strategy was reduced during this period of time. However, when the Indian government took new measures to keep factories open, the digital transition resumed in his department but the implementation is not visible yet.

8. Did your company or your department implement a crisis strategy to guarantee an efficient use of digital technologies?

To ask whether the company created a new department to manage activities in order to counter or reduce the impact of COVID-19 pandemic is a relevant question. Indeed, it allows to understand the companies' behaviour with regard to the pandemic.

As to the results of the interviews, 40% of the interviewees admit that their company implemented an official new crisis strategy totally assigned to the COVID-19 pandemic management. The objectives of this strategy are to adapt the activity of each department to the pandemic and the effects it has on the activity of the company. The purpose of this type of crisis strategy is also to guarantee efficient digital interactions between the departments and with other external stakeholders.

"If we don't take the time to sit down and think about the crisis how to manage it, then it might be chaotic. We have to think about our weaknesses and what tools could be used to counter the effects of the crisis." (Bertrand de Castelnau)

Mr. Bertrand De Castelnau explains in his interview that a well-organized crisis management requires a daily collaboration with the IT department as well as the risk management department in order to guarantee an efficient technical use of digital technologies and an efficient adaptation of processes.

"*Each department has its own specificities, we know the real needs of our department. I don't think a general crisis management is relevant for issues except for applying governmental rules.*" (Jean Bungert, production department executive)

The interviewed professionals who stated that their company did not implement a crisis strategy have explained that each department had to adapt by itself but there is no formal crisis strategy as such. Can this be considered as a form of crisis strategy? The answers of all interviewees are negative as they emphasize that this adaptation results from their own common sense to reach their objectives. If a problem arises, they can contact other departments to solve it but there is no formal crisis strategy.

It is very interesting to highlight the fact that every Indian interviewee stipulates that no company implemented a formal crisis strategy to guarantee the efficient use of digital technologies.

iii. More questions

9. What are the gaps and good points of this crisis management?

This question marks the transition into the "more questions" section. It is the part of the interview that allows to go deeper into the problematic. Through this question, interviewees provide relevant information as regards the potential element that could boost or slow down the digitalization strategy within the company.

The interviewees had some issue answering this question for several reasons. First, they did not think about that previously as they focus on their work and on following the guidelines. They did not have the time the make this introspection concerning the quality of the crisis management.

"*We feel supported during this special period but sometimes the decisions made are out of reality*." (Anonymous)

However, everyone agrees on the fact that telecommuting is the principal good point of the crisis management. In addition to preserving the human capital of the company, it did not complicate the work as expected. On the contrary, it increased the autonomy of workers and it forced the company to digitally adapt its processes.

According to Mrs. Nina Charlène Dodo Tapé: "*We have been able to maintain the activity while implementing the telecommuting. We have been able through the pandemic, to increase the speed of communication and processes*". (Nina Charlène Dodo Tapé)

The foregoing shows that digital technologies are an efficient alternative to previous processes. It allows to work differently without losing knowledge or expertise as long as digitalization strategy is efficient and well implemented. Mr. Mathieu Frin has the same opinion but he highlights the importance of human relations within the activity. In his view, moving towards

fully digital activity will not represent a loss of value on the short- and mid-term but it might be a potential threat on the long-term value creation.

"*Digital technologies are very nice, we save time and money but it will never replace benefits of human interactions.*" (Mathieu Frin)

Concerning the Indian interviewees, it is important to remind that there is no formal crisis strategy. They explain that the main good point is the autonomy. Indeed, they can adapt the department according to the effective needs of the departments. This approach allows to act more efficiently. However, this "too much" of autonomy can lead to appreciation mistake or misconceived actions. They feel not enough supported as they should be.

10. What do you think about the COVID-19 crisis management concerning digitalization process and the use of digital technologies?

Eight out of ten professionals are satisfied or totally satisfied with the crisis management. Some of them prefer working under flexible guidelines, while others prefer to work according to a strict crisis strategy. It depends on the worker's profile.
A relevant remark came up from most of interviews, namely interviewees seemed a bit uncomfortable with this question, especially Indian professionals. I did not stop them from answering but their answers remained very basic. Furthermore, as long as they are still able to work under acceptable working conditions and they are still able to reach their objectives, then they positively consider the crisis management.

According to an anonymous professional, working at SUN Pharma: "*This is not my job to assess the crisis strategy as long as this does not represent an obstacle for my objectives*". (Anonymous)

However, some of them are more involved in the crisis management. For instance, Mrs. Safaa Houimel (IT officer) said that her department was very solicited, especially during de past year. Indeed, her team had to face a strong and unavoidable digital adaptation. Digital infrastructures had to be quickly implemented and professionals had to be quickly trained too. It was a

gruelling work. Now she focuses on fixing IT issues and protecting internal systems from threats.

She said during the interview that: "*We underestimate the global impact of teleworking on the digitalization of procedures*". (Safaa Houimel)

11. What would you do to improve the crisis management concerning digitalization process and the use of digital technologies?

It is very important to ask this question as it allows to have their own opinion regarding the problematic. Sometimes, they are not allowed or they do not have the time to express their ideas. The purpose of this question is to see if there are common points or if every opinion is different. For ten interviewed professionals, there are five different answers. The first issue listed relate to IT problems. It is not a surprise because the IT department is responsible for the transition to the telecommuting. The IT department is the one that had to adapt the most quickly. The issues faced are more technical (defective devices, broken equipment, weak wireless connection, etc.).
Furthermore, some interviewees talked about issues directly or indirectly related to the IT department. They mentioned data management issues such as unavailability of data, data leak, unexpected data deletion or cyber-attacks.

"Governmental measures are constantly evolving, sometimes it is really hard to take them in consideration but we have to." (Jean Bungert)

Mr. Jean Bungert mentioned in his interview that the most difficult part of the transition is to digitally adapt the activity to comply with governmental measures while keeping or increasing the level of data security.

Mr. Thibaut Mandicourt admits that he would improve internal processes in general because the COVID-19 pandemic reduced the quality of interactions and procedures. He stated that existing procedures are obsolete as they do not comply with the health situation. For him, the management should adapt the procedures in order to increase the efficiency of interactions.

"The pandemic changed the way to do our job, now procedures are no longer up to date."

(Linga Raja Kannivel)

Mr. Linga Raja Kannivel's advice is to improve the external procedures.
In other words, for both Mr. Linga Raja Kannivel and Mr. Thibaut Mandicourt, the procedures are obsolete and should adapted. This would cause a decrease in quality of relations, in the volume of exchanges and finally in the sales volume. The main advice would thus be to digitalize the procedures in order to increase the speed and quality of actions.

12. Would you like to add any comment?

This is the last question asked during the interview in order to cover the topic and be sure that there is no aspect or information that was left aside. The interviewees did reply very quickly to this question because for them the topic has been covered and they had nothing else to say.

8. Discussion of hypotheses

8.1. Discussion

Hypothesis 1: The COVID-19 pandemic slowed down the digital development of the pharmaceutical companies.

This hypothesis could potentially be true or false. It depends on the chronology of the events. The first part of the COVID-19 pandemic definitely slowed down the digitalization strategy. Indeed, most pharmaceutical companies have not taken this kind of phenomenon into consideration. The reaction time that companies needed in order to adapt their activity in the most efficient possible way is specific to each company. This kind of pandemic represents something radically new for those companies. Even governments were at a loss as to the measures to adopt. During this period, companies were hesitant too mainly because they did not know how long this pandemic would last. This uncertainty delayed the digitalization process and the general development of companies. Indeed, choosing between keeping or changing the activity was a hard call and uncertain choice at that moment. However, when governments started to officially implemented restrictive measures, then companies were able to adapt their procedures and their strategies to comply with the current situation. The most important point

is that this situation “forced” the pharmaceutical companies to digitally develop each part of their activity (HR, processes, strategy, supply chain, IT, etc.).

We can conclude that the veracity of this hypothesis depends on which part of the pandemic is taken into consideration. According to the interviewees, the beginning of the pandemic slowed down the digital strategy. However, if the rest of the pandemic is taken into account, then the pandemic “helped” the pharmaceutical companies to move towards digitalized activities. This hypothesis still needs to be tested quantitatively.
To achieve this task, it was of interest to have a look at the assets and the budget allocated to digital technologies before the crisis, at the beginning of the crisis and during the main part of the pandemic. Indeed, this could give an interesting statement about the digital evolution of the company.

Hypothesis 2: The COVID-19 pandemic enhanced the digital development of pharmaceutical companies.

The results of the interviews support this hypothesis. Indeed, most of interviewees agree on the fact that this worldwide pandemic enhanced the digitalization strategy of pharmaceutical companies in India and in Europe but at different levels. Some of them gave accurate examples.

Mrs. Linda Raja Kannivel explained that some tasks were done manually and the pandemic forced the company to invest in management software and computing programs to meet the objectives of the supply chain. The management was discussing about the possibility to implement management software such as *Cin7*, *NetSuite* or *IM3* in order to reduce COVID-19 effects.
The fear of seeing a slow down of the activity due to COVID-19 pandemic indirectly boost the digitalization strategy of companies. Many interviewees such as Mathieu Frin or Bertrand De Castelnau explained that they digitalized their activity because the health situation forced the company to do so. Otherwise, they were used to work in a certain way and did not see the need to adapt.
This hypothesis could be tested the same way as hypothesis 1, by analyzing the financial statements related to the implementation of digital technologies.

Hypothesis 3: The impact of Covid-19 on European and Indian companies differs depending on the departments.

As discussed in the theorical part of this paper, Indian and European pharmaceutical companies are performing organizations. However, it has been highlighted that these companies are not directly and totally competing against each other. Even if there are market shares to acquire, these pharmaceutical firms are brought to work in the same value chain but at different places. Indian companies are excelling within several sectors such as R&D, supply chain, production chain, infrastructures and other sectors. European companies are excelling in R&D too but also in trade, marketing, HR, finance and other sectors. However, this does not mean that those companies are not working in other sectors but, according to the interviews, the activities are managed differently. Indeed, the management is based on different principles: European managers think more about brand image while Indian managers are more focused on efficiency. This does not stop both of them from being mainly focus on profit and efficiency but it shows a difference of mindset and strategy. This behavior leads to a difference in risk assessment and reaction behavior.

Mr. Bertrand De Castelnau's main interest was to preserve the human capital of the company while the professional working for SUN pharma was more focused on preserving the activity and the resulting profitability. The difference of risk appreciation leads to a difference in digitalization strategy. Indeed, some managers see the pandemic and the lockdown as an opportunity to digitalize activities, whereas some others see the pandemic has a treat and prefer to proceed with caution with regard to adaption and transition to digital technologies.

To conclude, it is important to recall that the pandemic is not the only factor of the difference of effects on digitalization strategy in India and Europe. Legal framework, culture, processes, internal rules are a few factors among many others that impact the digitalization of pharmaceutical companies.

To verify this hypothesis, it is necessary to analyze quantitatively the performance of each department before and after the crisis. Those social, legal and economic characteristics differ in Europe and in India but they are impacted by the same factor. Assessing the evolution of the digital performance (achievements of objectives, budget, costs, general situation, etc.)

provides interesting information on the digital evolution of the department and then allows us to verify whether the COVID-19 pandemic impacted differently the European and the Indian digitalization strategy.

Hypothesis 4: The impact of Covid-19 on European and Indian companies differs *depending on the crisis management.*

The general effects of the COVID-19 pandemic differ between Europe and India. Governmental measures, social habits, population concentration render the effects different in Europe and in India. This explains why the crisis has been apprehended differently in Europe and in India. It is the same case for the companies: European companies work differently as compared to Indian companies. They have a different structure, different activities, different rules, legal framework and habits, as well as many other differences. The interviewees discussed about the importance to have a "tailor-made" strategy in order to meet the real expectations and need of the organization.

Mr. Thibault Mandicourt states that a crisis strategy regarding the digitalization adaptation of a business must be implemented on a case-by-case basis. He compares a company to a family and explains that every family is different even if some of them might be similar. Managing issues is specific to each family if the objective is to solve the issue in the best possible way.
Contrary to the previous hypotheses, the most efficient way to test this hypothesis is to take the situation at the beginning and during the crisis. It could be interesting to quantitatively compare the economic and digital development of companies that implemented a crisis management department to companies that did not. This comparison could potentially highlight the impact of a crisis section in the COVID-19 management regarding the digital development of activities.

Hypothesis 5: The impact of Covid-19 on European and Indian companies differs *depending on market position.*

This hypothesis is developed in order to see whether the pandemic has a different impact on small or larger pharmaceutical companies. Perhaps the structure or the organization of large companies change the effects of the pandemic regarding the digitalization strategy.

In order to discuss this hypothesis, the answers of interviewees have been confronted. It is important that the panel of interviewees is diverse in that there are professionals working for small and for large pharmaceutical companies.

To have a comparison, we have on one hand, a professional working for a small pharmaceutical group in France, (he preferred to stay anonymous) revealing that his organization is very small (35 employees) and the main activity is not mainly about external trade but about R&D. the exchanges are principally made with neighboring regions.

On the other hand, we took the interview of Praveen Varma who works for Aurobindo Pharma, a large Indian company that employs around 23,000 persons and had a revenue of $3.3 billion in 2020. (*Official website of Aurobindo Pharma ltd*)

This is a closely connected approach as it allows to make an interesting and relevant comparison because those 2 companies are extremely different in term of size and both of interviewees are working in R&D.

According to the answers provided, we can confirm that this hypothesis will be difficultly validated. Indeed, both answers are similar and the difference of effects is more a matter of management structure, culture and other factors. It is not a matter of market position because even if the tasks are relatively different in terms of expectations and consequences, they remain identical in terms of objectives to achieve. They both globally explained that the main objective of the R&D department is to mobilize knowledge and competences to develop new entities. At no point did they mention the size of the company and the market position as influencing factors concerning the impact of the pandemic on the digitalization process. They globally faced the same issues and had the same related needs.

A quantitative analysis is necessary to officially validate or refute this hypothesis. An efficient approach would be to evaluate the relative performance of large and small pharmaceutical companies. It is obvious that the performance of a “Giant” will be higher than the performance of a SME but the key point is the assessment of the performance over the pandemic phase.

Hypothesis 6: The impact of Covid-19 on European and Indian companies differs *depending on governmental measures.*

Discussing with the interviewees allowed us to understand to impact of COVID-19 measures. Even if the principal measures are identical such as the lockdown, the curfew, social distancing, borders closures, telecommuting, and many others. The differences lie in the "lockdown-exit" strategy. In Europe, after the first wave, European governments relaxed some measures regarding the companies. For example, the Belgian Government allowed workers to come back in the office while wearing a mask, respecting social distance and other rules. On the other hand, Indian government only apply local lockdown, depending on population concentration, incidence rate of the virus and the local authorities.

According to this affirmation, we can support that this hypothesis as the governmental measures are implemented differently in Europe and in India and it consequently incur on the performance of departments. Indeed, comparing the duration of the lockdown, the time of curfew, the level of severity of measures, the amount of fines related to the disrespect of those measures are factors among many others that impacted the economic and digital development of companies. Consequently, it influences behaviors of consumers, companies and other stakeholders.

8.2. Answer to the research question

In addition to the existing literature, the interviews brought enough information to issue a relevant answer to the research question, namely:

"*How did the COVID-19 impact the digitalization strategy of European and Indian pharmaceutical companies?*"

Regarding the findings, we can confirm that the COVID-19 pandemic had a significant impact on European and Indian pharmaceutical companies. However, the impact and its intensity differ depending on many factors such as the company's strategy, the departments, crisis management or governmental measures. Through the interviews, we highlighted different answers from European and Indian interviewees.

As strategies of Indian and European companies are relatively different, the impact of COVID-19 pandemic is different too because the implementation of the activity is not identical. The organization and the objectives related to a department are different in India and in Europe. If a department's goal is based on efficiency, profitability or corporate governance, then departments and their related activity will be organized that way. For example, if the objective of the HR department is workforce efficiency or compliance to corporate governance, then the impact of COVID-19 pandemic will be different because the department will be managed on a different way.
If the objectives are different, then the crisis management is different too because the objective to preserve is different and the way to preserve it is therefore different.

It is important to note that the pandemic impacted negatively and positively the digitalization strategy of European and Indian pharmaceutical companies. Firstly, the surprise effect and the unfamiliar aspect of the pandemic negatively affected the digital transformation of those companies. Thereafter, it is up to each company to internalize this upheaval and turn it into an opportunity. To conclude, the pandemic impacted the general functioning of Indian and European pharmaceutical companies. It affected the way to work which has become much more digital, the internal and external processes and the relations with stakeholders.

9. Limitations and future research

We faced limits and difficulties for the completion of this work. Indeed, some factors intervened and had to be internalized in order to preserve the quality, the objectivity and the credibility of the research. Enunciating those limits is extremely important as it allows to take a step back from what has been said throughout the work.
The very first obstacle encountered is the recent aspect of the COVID-19 pandemic. Even if this event affects the world in its entirety, it remains very recent and blurry on several subjects such as vaccination or long-term economic effects. The assessment the veracity and objectivity of the existing literature required an additional work. Papers only concern short term analysis.
Another limit of this work was the difficulty to reach professionals for an interview. Whether they are European or Indian, it was not an easy task to reach them and organize meetings. Due

to the pandemic, face-face interviews were of course not allowed. Furthermore, the COVID-19 pandemic forced the professionals to rethink their activity and their procedures and, as a result, they were very busy and did not have much time to have a video interview or complete a survey.

Furthermore, contacting professionals working for large pharmaceutical was hampered by the fact that most of them are suspicious regarding information disclosure. Some of them are directly restricted by confidentiality clauses which makes the dialogue almost impossible.

This explains the fact that seven professionals working for European companies and three working for Indian companies have been interviewed instead of five in Europe and five in India, as originally expected.

The future challenges will be to adapt the activities on the long term regarding the pandemic duration, the markets expectations and future similar issues. Pharmaceutical companies learned that nothing is acquired and that it is clever to turn an issue, a problematic into a potential opportunity. Concerning a possible future research, when the pandemic will be over, it could be relevant to assess and analyze the behavioral change of pharmaceutical companies regarding digitalization. Did they keep the digital changes? Did they keep improving their digital activities? On the contrary, have they returned to their initial behavior?

10. Conclusions of the study

Throughout this work, I was able to define the principal concepts of the problematic which are the impact of the COVID-19 pandemic on companies, the digitalization of businesses and the pharmaceutical sector in Europe and in India.

We discussed about the digitalization phenomenon in order to understand its impact on companies and, in particular, on pharmaceutical companies. It appeared that digital adaptation is a necessary need for companies as the economic world become more and more digitalized. Investing in new digital technologies is certainly a cost but the resulting gain of efficiency and

productivity represents an essential factor for the survival and enduring activity of the company.

The worldwide pharmaceutical sector was analyzed to understand the specificities of each market. This is a very interesting part because, contrary to what one could imagine, European companies do not dominate the pharmaceutical sector. Even if European companies are excelling in many sectors and have a strong brand image, Asian companies are key stakeholders to their market position. Indeed, European companies are leaders in a lot of departments but above all in end-of-process activities. On the other hand, Indian and Chinese companies are doing well in many sectors but especially in activities positioned at the beginning of the value chain (R&D, production, supply chain).

The COVID-19 pandemic has also been discussed in detail so as to stress is effects and how it can potentially affect the digital development of pharmaceutical companies' activities. Then, this allowed us to understand the European and Indian position regarding this health issue. We noticed the effects on markets in general. In fact, all the restrictions imposed by governments locally and generally changed markets functioning. Furthermore, this kind of health issue has direct impacts on the worldwide pharmaceutical industry. Indeed, the slowdown of the general activity impacted the performance and the development of pharmaceutical activities in Europe and in India. Moreover, the panic and uncertainty effects led consumers to buy more pharmaceutical products because of what they have read in social media and forced many of them to read and learn more about the health sector. The pandemic pushed the worldwide pharmaceutical industry at the front of the stage because the populations were waiting for solutions and vaccines.

To conclude this work, we can affirm that the COVID-19 pandemic impacted significantly the digitalization strategy of European and Indian pharmaceutical companies. Indeed, the pandemic first slowed down the digitalization process since customers and workers had to stay at home. The first measures were highly restrictive and companies' management had to go through an adaptation stage. After that, many pharmaceutical companies took this situation as an opportunity to boost the digital development of the company. However, the effects are different in each sector due to several factors such as the size of the company, the

departments, governmental measures and the market position. However, the previous hypotheses have been discussed but a quantitative approach is necessary to officially validate or refute those statements. The empirical analysis allowed us to provide potential answers to the problematic.

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12. Appendix

Appendix 1: Register of interviewees

NAME	COMPANY	POSITION	YEARS OF EXPERIENCE	TYPE OF INTERVIEW
Jean BUNGERT	Laboratory Tilman *(Belgium)*	Production department executive	27 years	Oral
Anonymous	European pharmaceutical company (*France*)	Research & development supervisor in the creation of biological medicines	7 years	Oral
Nina Charlène DODO TAPE	Les Laboratoires Expanscience (*France*)	Product and Project Quality Officer	6 years	Written
Linga RAJA KANNIVEL	Aurobindo Pharma Ltd (*India*)	Manager - Viral vaccine	14 years	Oral
Bertrand DE CASTELNAU	Theradiag (*France*)	Product supervisor	9 years	Oral
Praveen VARMA	Aurobindo Pharma Ltd (*India*)	Head of the department formulations analytical research department	17 years	Written
Mathieu FRIN	Les Laboratoires Expanscience (*France*)	Trade development manager	4 years	Written
Safaa HOUIMEL	Labatec Pharma SA (*Switzerland*)	IT officer	6 years	Oral
Anonymous	SUN Pharma (*India*)	Project management, supply chain	11 years	Written
Thibault MANDICOURT	TODA Pharmaceuticals	Quality manager	4 years	Written

Table created by the author, 19/04/2021

Appendix 2: Interview grid

First Name Prénom	
Last Name Nom	
Name of the company Nom de l'entreprise	
Position in the company Poste au sein de l'entreprise	
Years of experience within the company Nombre d'années d'expérience au sein de l'entreprise	

Part1: Preliminary questions

1. What is your current position? What are you responsible for?
   Quel est votre poste au sein de l'entreprise ? De quoi vous occupez-vous ?

2. What do you think about digitalization strategy? Is your position digitally evolving?
   Pour vous, qu'est-ce qu'une stratégie de digitalisation ? Est-ce que votre job évolue digitalement ?

3. In what extend is your position impacted by the COVID-19 pandemic?
   Dans quelle mesure votre fonction a-t-elle été impactée par l'épidémie de COVID-19 ?

Part 2: Key questions

4. What part of your activity is concerned by digital technologies?
   En quoi votre activité est-elle concernée par les technologies digitales ?

5. In what extend is your position impacted by digital revolution now and over years?
   Dans quelle mesure votre fonction a-t-elle été impactée par la révolution digitale à travers le temps?

6. Prior and during the COVID-19 pandemic, how evolved the relation between your position and the digitalization process?
   Avant et durant l'épidémie de COVID-19, comment a évolué le lien entre votre métier et les technologies digitales ?

7. In what way did the COVID-19 boost or slow down the digitalization of your activity?
   De quelle manière l'épidémie COVID-19 a-t-elle amélioré ou ralenti la digitalisation de votre activité ?

8. Did your company or your department implement a crisis strategy to guarantee an efficient use of digital technologies?
   Est-ce que votre entreprise ou votre département a mis en place une stratégie de crise pour garantir une utilisation efficace de ces technologies digitales ?

Part 3: More questions

9. What are the gaps and good points of this crisis management?
   Quels sont les points positifs et négatifs liés à la gestion de la crise par votre entreprise ou votre département ?

10. What do you think about the COVID-19 crisis management concerning digitalization process and the use of digital technologies?
    Quel est votre opinion concernant la gestion de la crise du COVID-19 vis-à-vis de l'utilisation des technologies digitales au sein de votre activité ? En quoi l'épidémie a-t-elle restreint votre activité ?

11. What would you do to improve the crisis management concerning digitalization process and the use of digital technologies?
Comment amélioreriez-vous la gestion de cette épidémie vis-à-vis de l'utilisation des technologies digitales et de la digitalisation de votre activité ?

12. Would you like to add any comment?
Souhaitez-vous ajouter un commentaire ?

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