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Is COVID-19 the business game changer?

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Firma dello studente

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ABSTRACT

How many things have changed in recent months due to COVID-19? How have companies responded to a world pandemic that has never been faced before? What will remain structural and what will the new trends be?

The sudden advent of COVID-19 destabilized entire companies and nations, taking everyone by surprise and completely reversing the trend or strategies that companies had begun to pursue. Our days have changed, the habits we had have changed, and even our way of approaching things could have changed, both positively and negatively.

In these months where each of us has been locked in its house we have certainly noticed how technology has become a fundamental and integral part of our life. Before the pandemic there was a slightly more pessimistic view regarding technology, it was considered more with contempt rather than appreciation of a tool that allows you to carry out multiple actions, either from an individual point of view, whether it is training or entertainment, and from a corporate point of view, allowing you to keep the business and its main functions alive.

We all had the opportunity to live this experience in the same way by staying indoors for a few months, allowing us to focus on some important values such as returning to spend time with our family. The reasons why I decided to focus on how companies have responded to COVID-19 are mainly the fact of being able to analyse the behaviours used by companies to understand what future trends could be and finally be able to take advantage of them for my professional future.

The goal of this paper is to understand how companies have reacted to COVID-19, which elements will be abandoned and which will remain in the future. Surely the reference to technology is essential in order to better analyse the problem and understand how companies have organized their work / process thanks to it, at the same time I decided to exploit a theory related to complex adaptive systems in reference to the integration between different systems, which are the social system and the technical system. The analysis turns out to be different from a mere economic analysis, as it aims to be an analysis focused on human resources using a theory that derives from the natural sciences. However, since there are several elements that match the social sciences, I decided to try to take it into the economic field and put it into practice.

In the first chapter I will provide an introduction to the COVID-19 problem, analysing various ideas and problems such as the difference between the pre- and post-COVID-19 trends, especially from a human resources point of view, the change in consumer attitudes and some of the methods implemented by companies, and what implications the pandemic has had at the company level.

In the second and third chapter two main theories will be analysed: complexity theory, with the explanation of complex adaptive systems, in order to take the concept of "system" and its main characteristics from the natural sciences to the social sciences; virtual teams, in order to explain and define the key characteristics of this type of team and what are the implications at the organizational level.

The fourth chapter refers to the empirical analysis, in this case a questionnaire carried out to three people working at Sinloc - Sistema Iniziative Locali SpA, a company in which I am currently doing an internship. There will be a questionnaire carried out to the human resources manager, in which the problems at strategic level will be analysed more closely, while a more operational questionnaire addressed to the other two people working as junior consultants. This will be followed by the chapter containing the conclusions of the thesis, trying to give an answer to the main question: Is COVID-19 the business game changer?

CHAPTER 1

GENERAL COVID-19 PERSPECTION

1.1   BEHAVIOURS DURING COVID-19

COVID-19 is revolutionizing the way we live day after day, starting with the lifestyle to the way we work or interface with others. Such a large global pandemic had never been dealt with until now: the most recent examples of crises date back to the SARS-CoV around the 2000s, which occurred mainly in the Chinese area, the fall of the Twin Towers and the post-war period. in relation to the Second World War. Each crisis has brought some changes globally, often bringing new positive elements to the society.

Figure 1 – Crises often lead to long-lasting changes

Source: BCG (2020)

As we can see from Figure 1, some of the biggest crises brought about major transformations. Following the order of events in terms of proximity, the spread of the SARS virus in China led to the growth and development of e-commerce, nowadays a fundamental element for all companies, which can no longer rely only on retail. The terrorist attack on the Twin Towers led to new aviation security measures, implementing greater controls that before the episode were not accepted by consumers, but which after the event were necessary and fundamental to restart and guarantee the use of air vehicles. Finally, the new ways of working after the war with the increase of women's presence in the workforce of the last century and which today is still a central problem in many countries.

If these were the most recent examples of crises where there were changes in individual / social behaviour, we can say that also COVID-19 will bring some changes in terms of customs and lifestyles. This is because the virus arrived suddenly, partly because the government forces did not initially analyse and put in place security measures to prevent the problem, partly because when they decided to implement these measures it was too late. Thus, overnight, the major world powers (and beyond) found themselves closing their borders and implementing a total lock-down policy to try to limit the spread of the virus. From this moment on, new behaviours on the part of individuals and new working methods on the part of organizations will arise, both in order to face the pandemic in the best possible way and to confirm more efficient tools in similar situations.

If it is true that on the one hand the technology and the means to tackle the pandemic were available to everyone, it is also true that on the other hand we had never been forced to use them in such a massive way. But the problem did not refer only to the use of technology, but also to a chaos on several fronts, firstly from the economic and health point of view, secondly from the point of view of social inequality and organizational resilience (Reeves et al., 2020).

The economic impact of this crisis will be a catastrophe and it is confirmed by the negative data related to the gross domestic product of all the countries. On the other hand, the closure of the borders first and the closure of the companies then could only bring about a total collapse of the economy.

A graph that allows us to understand and analyse the business breakdown generated by the pandemic is provided by the OECD, the Organization for Economic Cooperation and Development. The analysis carried out by the OECD (2020) first of all demonstrates the economic collapse from the third quarter of 2019 to the second quarter of 2020, then it analyses two possible scenarios for the end of 2020 and the beginning of 2021: the first scenario, more positive compared to the second one, consider the fact that the world economy is able to avoid a second wave of COVID-19; on the contrary, the second scenario considers a second wave of the virus by the end of 2020, leading to a further breakdown of the economy and slowing its recovery over time.

World GDP, index 2019-Q4=100

In both scenarios, we won't be back at 2019-Q4 level for at least 2 years

Single-hit scenario

November 2019 forecasts

Double-hit scenario
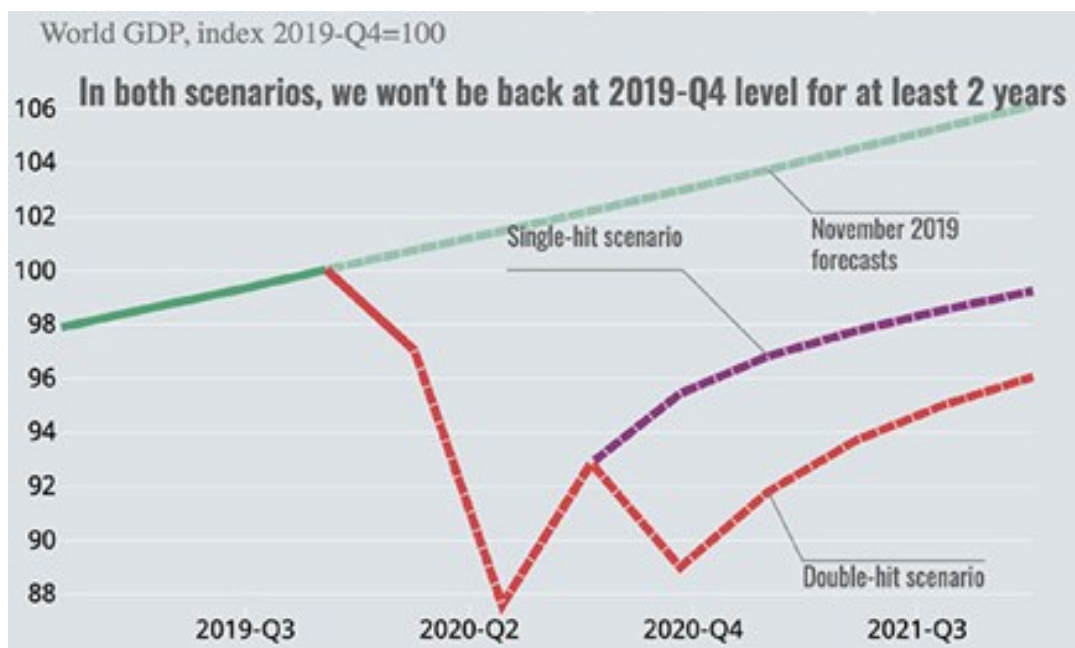
Source: OECD (2020)

Figure 2 demonstrates what was written in the previous lines and as reported by the OECD (2020) this pandemic has generated the largest recession in recent centuries, leading governments to invest in health care and to introduce measures to protect employment contracts, even if despite the implementation of these instruments young people are the ones who suffer a greater vulnerability, especially in the short term. In addition to the economic impact, a trend was analysed that demonstrates a change in the way consumers buy. This analysis was conducted by the Boston Consulting Group (2020) analysing credit card activity, and as we can see from Figure 3, groceries and pharmacies in the US have increased their sales by more than 50% compared to pre-virus sales, besides the online sales through the use of Amazon; on the contrary, as could be deduced given the closure of retail shops and entire nations, there is a sharp decline, also by 50%, in activities such as travel, entertainment outside home, clothes and accessories (Reeves et al., 2020).

Figure 3 – Purchasing patterns in the US are shifting as the outbreak intensifies
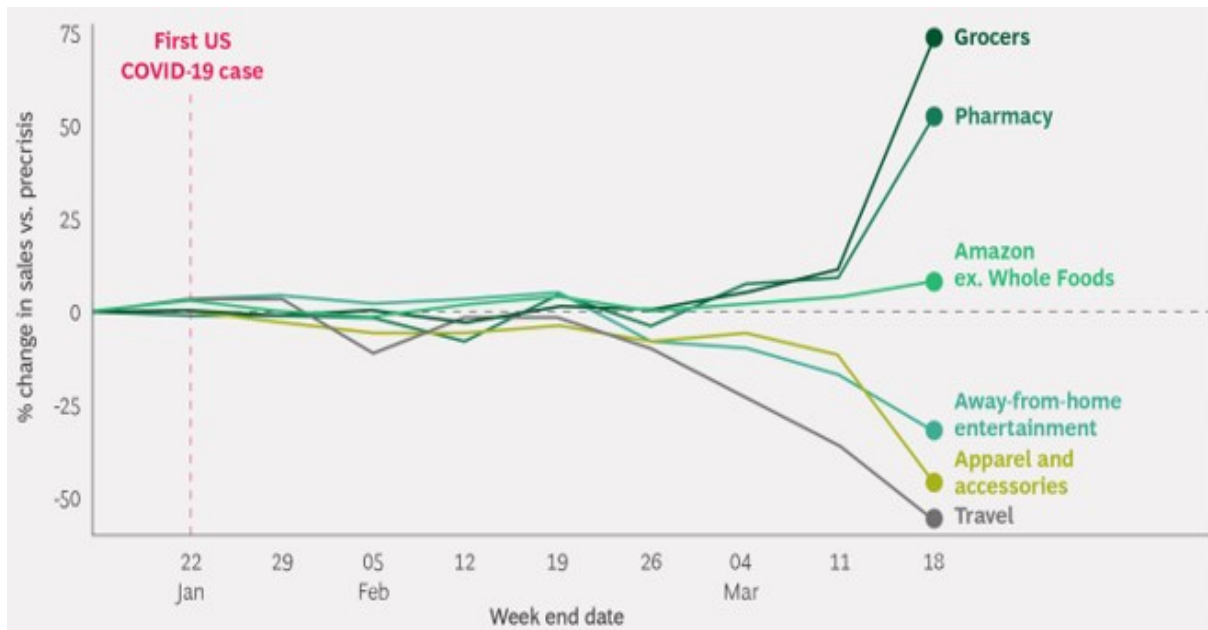
Source: BCG (2020)

Seeing this graph and noting the strong increase in the purchase of essential goods, we can predict that this increase will not be constant in the long run. If we take as example the fall of the Twin Towers in 2001, certainly in the months following the catastrophe the air transport experienced a decline in demand and an increase in consumer distrust, but in the long term and with the implementation of new forms of safety everything is back to normal. Similarly, after COVID-19, the elements analysed above will most likely return to the normality.

Another very interesting analysis provided by Reeves et al. (2020) and that we can see in Figure 4 refers to the potential implications related to spending more time at home, or to the possible changes in some habits both of consumers and producers.

Figure 4 – Potential implications of spending more time at home
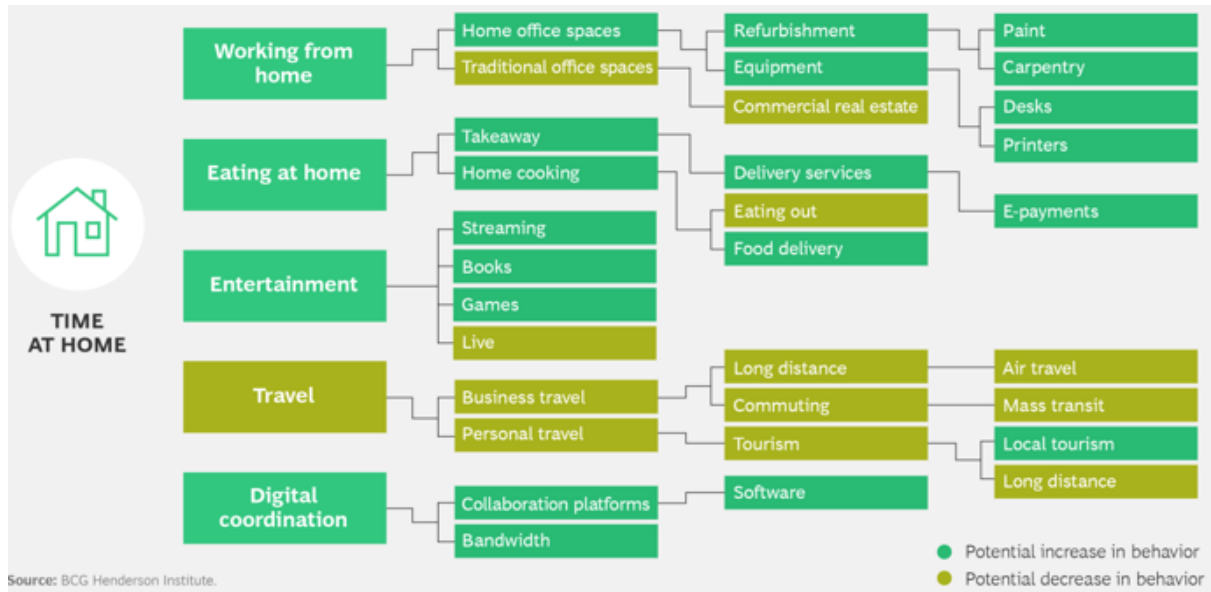
Source: BCG (2020)

Figure 4 allows us to have different ideas at the individual level but also at the global level, analysing some of the characteristics of complex adaptive systems that I will explain better in the next chapter. As we can see, at the individual level entertainment in the form of electronic means and eating at home have a potential increase in behaviour, a sign of how technology has greatly helped individuals to face the days spent at home, outlining new possible scenarios and opportunities for businesses after COVID-19. Food delivery was certainly already present in our lives but being forced to order through some delivery applications could have increased its use in the long run. Same reasoning with regards to streaming, already present in the virtual world but which until the pandemic it was seen in a "negative" way, especially by generations prior to generation Y.

For what interests us most in this thesis, that is the relationship between the individual and the company, as well as the development of some behaviours in the long term, several interesting ideas can be identified but of which we do not have an absolute certainty of their implementation in the long period. As we see from Figure 4, spending more time at home implies two important elements such as "working from home" and "digital coordination", both considered at the same time as problems and solutions during COVID-19.

Although from Figure 4 it can be seen how both have a potential increase in behaviour, we must consider how difficult it is to implement these elements at national / global level and how many implications they cause.

Taking working from home as the first element to be analysed, also often commonly called smart working, in these months of pandemic the advantages and disadvantages that this new working method causes have been identified. Not analysing all the pros and cons of this tool, but citing only a few, we can say that this instrument is absolutely to be taken into consideration from several points of view. As Reeves et al. (2020) say, being able to work from home guarantees more flexibility to people, ensuring greater management of their time. However, this does not imply a greater work-life balance, as smart working can often cause an inability of people to divide their private life from work, thus being always available. As shown in Figure 4, another advantage that it is important to not underestimate is a potential decrease in behaviour in traditional office spaces. This is because working from home implies electronic communication and this has two relevant aspects for the company: firstly, a greater number of people working from home implies fewer workstations needed at the workplace, thus determining a lower need for space and therefore lower costs; secondly, and today it is one of the main topic worldwide, allowing workers to stay at home would reduce the environmental impact.

Figure 5 – Telework Savings Calculator-Lite
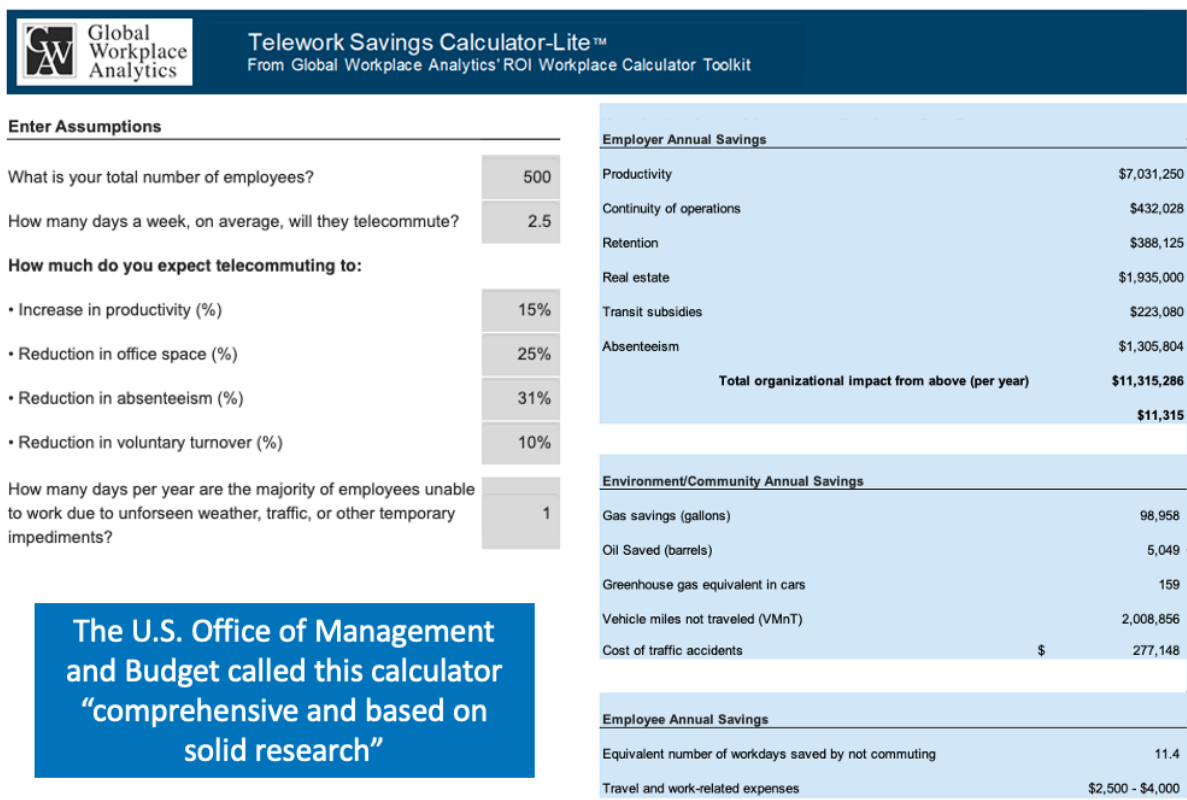
Source: Global Workplace Analytics (2020)

In order to understand how incisive smart working can be in terms of resources saved for the employer, employees and the environment, I was able to use a software capable of roughly calculating the savings of the three categories as demonstrated by Figure 5 above. The savings for all categories are considerable, both in terms of costs and productivity: if we take the case of workers, allowing them to stay at home two days a week allows them to earn eleven days of work, besides saving a substantial sum of money between $2500-$4000. Smart working must certainly be considered, but if those analysed up to now were some advantages generated by the use of this system, it is also necessary to analyse some disadvantages it causes, and which are difficult to deal with electronically. It is true that smart working allows greater flexibility to the worker, making them freer and more autonomous in managing their time, but it is also true that at the company level it is much more difficult to create the so-called organizational culture, an element that has become of fundamental importance and one of the primary objectives for those responsible for human resources. In addition to the difficulty of spreading the organizational culture due to a lower flow of information and less physical presence, another fundamental problem that arises is the one of introducing new staff within the company. Very often, especially at the beginning of their career, new entries need some instant feedback / help that cannot be obtained through smart working.

The use of technology and its implementation within the company is one of the elements most considered by companies in recent years, but it is still necessary to find the right compromise that allows you to make the most of its use. Larger and more structured companies can have a greater advantage in using smart working thanks to a greater standardization of the roles and tasks assigned to individual people, but other smaller companies, in which workers range between different projects and work with different people, they may face greater difficulty managing everything from home.

1.2 TREND PRE- AND POST-COVID-19

Given the reference to the increasingly important diffusion of organizational culture and smart working, both central topics of recent months, in order to better understand how much COVID-19 has affected the company it is interesting to analyse the differences between pre- and post-COVID-19 trends.

As Jeanne Meister (2020b) analyses in her article, the pre-COVID-19 trends mainly referred to the use of artificial intelligence and some technological systems such as virtual reality and bots. Here there are ten pre-COVID-19 HR trends:

1) Start with focusing on worker wellbeing: in recent decades there has been an increasing focus on the well-being of workers, more specifically a physical, mental, emotional and spiritual well-being. Also this year this element is placed among the first places in the rankings and it is increasingly essential in order to have a healthy internal environment and to be able to build a strong organizational culture, as well as organizational resilience.

2) Prepare for humans with bots as the new blended workforce: the ability to divide the work between the workforce and the bot was considered as the ability to create a competitive advantage. Some examples are the use of chatbots to reduce the screening time of candidates and be able to answer about 95% of the questions asked by candidates, thus allowing recruiters to focus more on soft skills.

3) Look for new use cases of AI for HR: sometimes employees are afraid to report some discriminatory behaviour for fear of retaliation, instead in this way it would be done anonymously and it would allow greater benefit at the company level.

4) Focus on building ethical AI: nowadays it is increasingly important to conduct interviews or tests in an ethical manner, not making distinctions of sex, race or age; at the same time, there is still the need to create a system that appropriately protects the personal data of employees / candidates.

5) Consider soft skills to be power skills in 2020: as mentioned in point two, the most routine actions will be carried out by artificial intelligence, thus allowing recruiters to focus more on the soft skills of candidates, which are becoming increasingly fundamental at the interview. The ability of an individual to relate to others or have the right attitude towards a particular job is very important in order to create a cohesive and efficient group.

6) Audit your workplace environment: companies often offer benefits such as the gym, nursery school, fringe benefits such as the company telephone or other. But what has been discovered by the research carried out by Jeanne Meister (2020b) and her collaborators is the fact that employees want more basic things like the right lighting in the office or the ability to customize their workstation.

7) Explore virtual reality for corporate training: the use of systems such as virtual reality allows for greater immersion and practice than traditional methods, allowing for a better development of one's skills through this new form of training.

8) Re-define blended learning: the fact of being able to carry out courses or teachings in a virtual way allows a greater number of people to participate and increase their efficiency and usefulness.

9) Recruit for skills rather than college pedigree: having attended important and expensive universities should not imply having priority access at the interview. Interviewers are increasingly relying on systems that are based on the verification of the candidate's skills rather than the university they come from.

10) Make your workplace experience a top priority: the employee must be seen as a consumer, and we must try to give him / her the best possible experience in order to keep him in the company and make him grow internally.

These were the pre-COVID-19 trends, where it is clear that companies were concentrating more and more on the implementation of a system increasingly composed of the combination of man and technology, where the former tries to apply his own creativity, innovation and adaptability, whilst the second seeks to bring to the company greater efficiency in terms of time and quality of routine work, as well as creating greater immersion and learning capacity in some areas such as virtual learning previously analysed.

However, if these were the main trends that companies were trying to pursue, COVID-19 has drastically stopped the chasing of these strategies / actions, but at the same time it is bringing about the greatest workplace transformations in contemporary history, as the way we work, learn, communicate and behave is changing. It is normal to think that during the pandemic the primary problem to be solved was an efficient management of remote work, clearly defining company objectives and trying to maintain one's own corporate identity, transforming everything that was physical into virtual. This operation was not easy and companies are still clashing with this reality, at the same time some companies such as Gartner, McKinsey and the Boston Consulting Group have made available some useful guidelines to try to tackle the pandemic.

Taking into consideration the article published by Mary Baker (2020) on the Gartner website, she has provided some recommendations on how HR leaders should behave, and we find them below:

- Provide direction, confidence and resilience: defining clear and precise indications helps your employees to understand the role they have and the tasks to perform, establishing greater confidence, less confusion and increasing organizational resilience;
- Keep staff updated on communications related to the coronavirus, by sending official information communicated by the most important authorities (therefore avoid sending possible fake news taken from social media);

- Encourage peer-to-peer interactions: Coronavirus has led workers to work from home, limiting the possibility of having physical contact with other people. Therefore, companies must set up constant meetings or communications through the use of platforms such as Zoom or Microsoft Team in order to encourage employees to share their experiences during the quarantine;

- Define rules at the team level: being at home implies that some people have to spend their time with their children or solve some issues related to the house, thus going against the canonical eight hours of work and increasing the risk to work at different times than the ordinary schedule. Establishing fixed team-level meetings is useful for keeping up to date on projects / work in progress and defining the workload for the following days / weeks;

- Last but not least is to give workers flexibility once they return to work. When the lock-down is concluded, team leaders should allow some flexibility to their team members in order to guarantee them the best solutions to manage their commitments.

An example of how these suggestions have been taken into consideration and put into practice by some companies is provided by Microsoft, one of the most important companies in the world, which has decided to create a guide on how to work from home, editable and usable also by its customers in their companies (Meister, 2020a). Below there is a small extract of the contents of this document.

Figure 6 – Tips for working remotely

For Remote Workers

Focus on Your Wellbeing
- Make time to exercise, set an alarm for frequent breaks, eat well, hydrate, and assign time slots to tasks! Set boundaries for when to be online, and consider all areas of your wellbeing each day.

Use video
- Always use video on calls. It creates emotional connection between you and your team members. Point the camera so your eyes are 2/3 up the screen and your face is visible.

Set Up Your Physical and Virtual Workspace
- Find a space where you can focus. This may be hard if your kids, partner, or spouse are also home. Look for a space with natural light, comfortable furniture, and strong WiFi!

Record Your Meetings
- Be sure to record key meetings so you can review the transcript, which often is automatically generated. With so many virtual meetings, it's important to have a way to recall all the details!

Be Inclusive in Conducting Remote Meetings
- Remember to pause frequently, ask for feedback, encourage chat, and answer questions as they occur. Avoid all multi-tasking so you are present in each online meeting.

For Managers of Remote Workers

Be Transparent about Workload & Project Status
- Make transparency part of your culture by inviting questions and feedback to build trust, belonging, and a shared purpose. Remote workers need to feel safe surfacing issues to their leadership team.

Over-communicate with your Remote Workers
- Communicate often each day. Consider daily check-ins over a virtual cup of coffee, quick video chats, and end of week recaps sharing the status on projects.

Offer Online Training to Remote Workers
- Training can range from online Employee Resource Groups, to eLearning courses on successful strategies for remote working or managing a remote workforce.

Create Virtual Water Cooler Opportunities
- Working remotely can be isolating, so look for ways to connect. Try frequent chat messages, plan Friday afternoon catch-ups, or even organize teams into hub cities so they can share local news with each other!

Invest in Tools, Technologies, and Equipment
- Start with what's free: for example, Microsoft Teams. Then explore tools you can invest in, like Zoom for Virtual Meetings, Slack for Communication, G Suite or Dropbox for Collaboration, and Notion for Documentation.

Source: Forbes (2020)

The left side of Figure 6 is dedicated to the worker and once again it allows us to note how the well-being of the worker is important, also highlighted by Jeanne Meister (2020a, p.1), who thinks that "the future of work is the future of worker wellbeing", in an age where we are constantly connected and receive thousands of news and requests a day.

The pandemic has therefore allowed us to focus even more on the importance of worker well-being and the use of technology, elements that are increasingly essential if we want to compete globally. In addition to having implemented new communication and development systems, the coronavirus has also brought new forms of re-skilling by companies. Organizations like Amazon, PwC, Walmart and many others have already announced that there will be teaching systems that will go far beyond the individual training programs used so far (Meister, 2020a).

During the pandemic, companies faced several difficulties that had never occurred before, putting organizations in a state of full uncertainty. Some of them have made it through their organizational resilience or their flexibility, others have had to close the business.

However, in addition to having accelerated the technological transformation on the part of companies and the ability of workers to be more autonomous, the virus has also led to different trends from those set before the pandemic. Below there are the new trends established by Mary Baker (2020) on the Gartner website, noting a clear distinction from those defined by Forbes in the previous paragraphs.

1. As mentioned in the previous paragraphs and being the greatest change generated by the pandemic, remote work will be considered increasingly important by companies, as the workers themselves ask more insistently for the use of this system.

2. Due to greater use of remote work, there will consequently be greater control by employers over employees, through the use of software that monitor and count the work made by their employees from home. This kind of control will be a decision that every single company will take differently, there will be companies that will have more massive control over the productivity, other companies that will control to a lesser extent and perhaps will be more interested in the well-being of the worker.

3. Greater use of contingent workers as a cost-saving measure to cope with the economic impact of COVID-19.

4. The role of the employer as a social safety net is increasingly important and well received by workers. The fact of being able to help workers from different points of view, for example financial or general well-being, has also become a key as a social image: think of all those large companies that have transformed part of their production in order to be able to produce masks in emergency situations, or think about how important it has become to listen and understand the personal urgencies of their workers.

5. It has become essential to consider the skills of the workers rather than the role, it has therefore become crucial to have people in the company capable of filling multiple roles and being flexible rather than people specialized in a single role.

6. The pandemic has generated two different types of companies: in one case, employers have become more human, understanding the needs and requirements of people who have children, thus allowing those workers to have a more flexible working hours; in other companies, people were seen more as workers than people, therefore greater productivity was required and a greater number of checks were carried out.

7. The transparency of a company is increasingly important in the eyes of a possible candidate. Knowing how a company handled the pandemic and how it treated its employees has become one of the main information asked by candidates, who will judge an organization based on this information as well. Companies must therefore be able to

demonstrate how they are helping their employees through welfare measures or financial aid, although there may still be staff cuts for cost-saving measures.

8. COVID-19 has shown which companies were resilient or not, able to cope with such a big change in their management in order to survive. Companies that have managed to stay alive, especially those with greater difficulties, must therefore ensure that they can increase their resilience to face the next possible crises, by increasing flexibility, roles, training and a different organizational structure.

9. The pandemic has generated an increase in organizational complexity, increasing the use of technology, increasing the flexibility needed to cope with smart working. Another important factor is the increase in mergers and acquisitions, which means an increase to the size of companies and consequently also their complexity, with a greater need for skills and support.

From these trends we see how the role of people within the company has become of considerable importance, perhaps more than technology as it was widely evaluated in the pre-COVID-19 trends. Most likely large companies such as Google, Microsoft and many others have nevertheless maintained technological trends thanks to their ability and their duty to innovate, but at the same time the importance of personnel has become a primary issue at a global level. Another fundamental point is the increase in organizational complexity, a theory that will be analysed in the next chapter through the use of complexity theory.

The above paragraphs have analysed how a pandemic such as the COVID-19 can generate significant changes in everyday life, from consumer consumption habits to the use of new working methods and new focus by organizations. In the next chapter will be analysed complex adaptive systems, a method to identify how different systems, in this case identifiable in individuals as a subsystem of organizations, the organizations themselves and technology as a technical part of each company, influence each other to respond to the problem and create new standards.

CHAPTER 2

COMPLEX ADAPTIVE SYSTEMS

In this chapter I will try to analyse how companies have acted in such a complex context and how the theory related to complex adaptive systems can provide new ideas at a strategic, organizational and operational level. This theory allows to analyse the response of companies to a problem such as the pandemic faced in recent months from different points of view, that is from a strategic point of view, from a possible change in the organizational and management structure of the teams, as well as from a technological point of view.

2.1   INTRODUCTION TO COMPLEXITY

If we want to try to give a brief definition to what the company represents, we can think of defining it as a system consisting of two main parts, that is a part represented by people, namely human capital, while the other part is represented by assets, in short from technology and other technical assets.

These two parts that make up the company have constantly linked each other, influencing each day and trying to develop the company's vision, mission and strategies. As previously mentioned, we can already see how the company, sometimes in this chapter we will call it "system", is made up of different sub-systems, which in turn will be further divided into further parts.

Trying to analyse the different sub-systems within the company, we can easily define different types of variables that make up the entire system:

- Organizational variables, related to the way the company is structured, how it divides the roles in order to achieve its objectives and how it defines its processes.
- Human and social variables, related to the peculiarities of people within the company and the way in which they interact with each other
- Technical variables, related to the technologies used by the company and how they evolve over time

Already internally, the company represents a real complex system, made up of continuous interactions between different people with different personalities. When the company wants to create its own identity and define its position globally, it must find the right cohesion between the people who are composing it. Practical examples related to this topic could be the division

of work, the division into groups, how people interact within them, the type of communication between the different hierarchical levels, the level of decentralization of decisions, and we could go on with many other examples to define business complexity.

Given a brief definition of company and trying to move towards a wider vision of complexity, these systems clearly interact with each other and also interact with the external environment. In doing so, the company is naturally part of a much larger and much more complex system than its own individual reality, and it is daily subject to changes and pressures carried out by a much larger system, that is the above-mentioned external environment.

Trying to give a general and concise definition, in economics when we talk about the environment, we define the context in which the company operates.

Trying to be brief but at the same time clear, we can take the variables that make up the PESTEL analysis in order to define the main variables that make up the environment:

- Political: the sum of different policies and rights undertaken at national level;
- Economic: all those economic factors that can influence business decisions, at the micro and macro level;
- Social: the cultural and social aspects of a specific country
- Technological: level of technological development
- Environmental: nowadays, the environmental impact is one of the most important variables taken into consideration by companies
- Law: some elements often coincide with political factors

It can be seen that the complexity generated by the interaction between a single entity / company and the environment is something difficult to define in quantitative terms, so in this chapter I will try to define this complexity in qualitative terms, taking into account different theories developed by several researchers in the last decades.

It is important to emphasize that the company is not a static system, rather due to constant changes at a global level it must always try to evolve in order to survive. As Eve Mitleton-Kelly (2003, p.1) says, "if organizations are seen as complex evolving systems, co-evolving within a social 'ecosystem', then our thinking about strategy and management changes." With the continuous change of the different variables that influence the company, it is now obvious that it must develop new methods of acting and new working methods, leading to the development of new organizational forms.

A typical example to convey the concept of change is the globalization and technological development that we have faced over the past two decades. Nowadays companies use systems, strategies, metrics, organizational forms that are very different from what was used in the previous century. Think about the effect of globalization, how it has led companies to compete on a global level and not only on a national level, or how companies nowadays must increasingly face the problem of multiculturalism within them.

2.2   COMPLEX ADAPTIVE SYSTEMS

2.2.1   HISTORY

When we talk about complex adaptive systems we also talk about complexity theory and we are not referring only to the social sphere and the application in it. This theory has previously been used in natural sciences, such as biology, chemistry, physics, computer simulation, cybernetics, mathematics, and so on and so forth.

Therefore, it born in the natural sciences and it has often been applied to that field, but in recent decades scientists and researchers have been increasingly trying to take this theory into the economic sphere, in order to figure out how companies respond to the change that is keep going around them, which affects its internal staff and structure. It is evident that there is an important difference between humans and molecules. The former is able to imagine and invent new correlations, in addition to being able to establish correlations between different elements inside and outside a system. This difference allows humans to be able to perceive and deal with certain events in a more effective and efficient way compared to natural sciences or the use of technology. Take the case of COVID-19 as an example: nowadays, if the workforce had been used more by employers, there would have been two sides of the coin: on one side we have the technology that could have reduced the large drop in production; on the other side, however, there would have been difficulties in responding to the pandemic, and given that a high-impact problem such as COVID-19 had never been faced, technology would probably have had difficulties in responding and making companies survive (without using the human intervention) (Terra & Passador, 2015).

As Serena Chan (2001) says, researches carried out in relation to complexity theory include the work undertaken over the past four decades by scientists associated with the Santa Fe Institute (SFI) in New Mexico, USA, and particularly that of Stuart Kauffman (Kauffman 1993, 1995, 2000) John Holland (Holland 1995, 1998), Chris Langton (Waldrop 1992), and Murray Gell-Mann (1994) on complex adaptive systems (CAS), as well as the work of scientists based in Europe such as Peter Allen (1997) and Brian Goodwin (Goodwin 1995, Webster & Goodwin

1996); Axelrod on cooperation (Axelrod 1990, 1997 Axelrod & Cohen 2000); Casti (1997), Bonabeau et al (1999), Epstein & Axtel (1996) and Ferber (1999) on modelling and computer simulation; work by Ilya Prigogine (Prigogine & Stengers 1985, Nicolis & Prigogine 1989, Prigogine 1990), Isabelle Stengers (Prigogine & Stengers 1985), Gregoire Nicolis (Nicolis & Prigogine 1989, Nicolis 1994) on dissipative structures; work by Humberto Maturana, Francisco Varela (Varela & Maturana 1992) and Niklaus Luhman (1990) on autopoiesis (Mingers 1995); as well as the work on chaos theory (Gleick 1987) and that on economics and increasing returns by Brian Arthur (1990, 1995, 2002).

These are the main authors who developed this theory, which I will analyse in the following paragraphs with different theses applied. The main reason for the discussion of this theory is to try to transfer it from the natural to the social sphere, specifically trying to understand how it can be applied to human organizations and how companies have considered it to face COVID-19.

2.2.2 DEFINITION

Generally, companies are seen as entities with a fixed structure and as a set of linear variables, as well as determined and predictable. To this can be attributed the name of the top-down system, that is where the strategies and directions are established from the top to the bottom. Nowadays, however, this mentality is no longer recognized as the best system to be able to respond to the external environment, as it leads to limits that do not allow to keep up with the ever increasing complexity and number of connections that the company has with the external environment (Gupta & Anish, 2014). Given the new reality that organizations face today, there are three elements that are a fundamental part of the characteristics that each company must have and take into account: complexity, dynamics and openness (Haselhoff, 1981).

If the definition of dynamics and openness can be quite clear and immediate, complexity theory, as the name itself says, is much more complex. It refers to the innovation and creativity that arise when systems operate at the so-called "edge of chaos", that point where systems must have the ability to adapt to a new and unusual situation or due to the change in the surrounding environment (Parker and Stacey 1995; Bak 1996). Through the definition of "edge of chaos" we define another very important concept for each company: when the organizational system is too stable, it means that nothing inside is changing and the system will collapse; on the contrary, if the system is too chaotic, it will be overloaded with change (Burnes, 2005).

In both situations, the organization will not be in its optimal point, commonly called the equilibrium point, and it will have to respond through new sets of order-generating rules

(MacIntosh and MacLean, 2001). Providing this point of view and referring to companies, we can figure out how there is a knowledge forms divided into several levels, starting from the knowledge of the individual up to the knowledge of the entire organization, increasing the complexity and the interdependences (McElroy, 2003).

The organizational change and the spread of a knowledge form can be faced in different ways, based on the context, the variables and what most influences the choices that the company will try to make, but there are two dominant categories: the Planned and Emergent approaches (Burnes 2004b; Cummings and Worley 2001; Dawson 1994; Kanter et al. 1992; Pettigrew 2000; Stace and Dunphy 2001; Weick 2000; Wilson 1992).

The Planned approach "is aimed at improving the operation and effectiveness of the human side of the organization through participative, group- and team-based programmes of change" (Brunes, 2005, p.75). The biggest problem lies in its rigidity: as the name of the theory announces, a planned approach leads organizations to have too much bureaucracy, to be inflexible and therefore to be slow and unwilling to change (Peters and Waterman 1982). This is a problem that many companies are still facing today and, especially with the advent of COVID-19, we were able to glimpse how the companies that used this system led themselves in great difficulty, unlike those who use a more open and flexible approach to change.

Moving towards a more appropriate approach to these days, the second theory that refers to organizational change is the Emergent approach. As mentioned by Weick (2000, p.237), "Emergent change consists of ongoing accommodations, adaptations, and alterations that produces fundamental change without a priori intentions to do so. Emergent change occurs when people accomplish routines and when they deal with contingencies, breakdowns, and opportunities in everyday work."

The organizational system is therefore preparing to respond to the change day-by-day, not planning a detailed plan a priori, in order to remain flexible and be able to deal with problems, restrictions or sudden changes generated by the external environment. Some facts, as COVID-19 can be, although they are a big problem as they may lead to the closure or survival of the company, cause important opportunities for some companies that until then had not considered some fundamental aspects. For example, a reflection should be dedicated to the use of technology and its impact on the company from different points of view, as the use of smart-working and the possibility of being able to impact positively on the environment by reducing emissions.

As mentioned before, there are several theories that describe complexity theory, but Stacey et al (2002) defined three fundamental components:

1) Chaos theory: this theory developed thanks to Lorenz's work on atmospheric changes, and he defines chaos theory as something that seems to change according to the case, but in reality, the change is the result of certain laws (Lorenz, 1993). Since climate change is a chaotic system, they are consequently non-linear systems, and small changes can lead to a new pattern of behaviour, which can be a higher-order structure, as well as dissipative structure (Stacey, 2003).

2) Dissipative structures: they are defined in this way as these structures can evolve into a better system by taking energy from the outside: by taking the concept from the natural sciences to the economic environment, in some cases companies can absorb a large amount of "Energy", therefore of information, influence, changes and threats; in other cases, they consume a minimal part of energy that could radically change the company (Styhre, 2002).

3) Complex adaptive systems: they consist of a large number of people interacting with each other, influencing each other and constantly changing their behaviour in relation to others, allowing organizations to adapt to the environment in order to survive (Stacey 2003; Stacey et al. 2002).

On the basis of the elements examined so far, it is noted that complex adaptive systems are an integral part of the complexity theory, going to emphasize and resume the concepts analysed so far as the complexity generated by a large number of people interacting with each other, the evolution through external sources and the response to change by applying a "Planned" or "Emergent" approach. Moving towards complex adaptive system, there are some definitions provided by different authors:

"A Complex Adaptive System (CAS) is a system that exhibits certain behaviours like learning, self-organisation, emergence, co-evolution etc. which are common across a variety of systems like ant colonies, human settlements, organisations etc. Understanding some of these unifying themes of a CAS would help develop metaphors that relate directly to the case of an organization" (Gupta & Anish, 2014, p.1).

"Complex adaptive systems are defined as open systems with large variability and diversity of elements or agents, with dynamic interactions among them that create non-linear feedback systems" (Faucher et al., 2007, p.3181).

This last definition gives us the starting point to identify three important elements of complex adaptive systems, somehow already mentioned before:

1. They are open systems, therefore the interaction between the different parts does not necessarily have to be physical, but can also be virtual;
2. The interactions are non-linear, therefore it is more complex to define the number of systems within it and consider the system as a greater value than the sum of the individual parts;
3. Non-linearity leads to complexity (Byrne, 1998), and it leads to the fact that in certain conditions small changes can lead to large effects and vice versa, not necessarily knowing the result of the change a priori.

When we talk about complexity theory, complex adaptive systems and self-organizing organization, Visa is usually the best company to describe all these concepts. As Tetenbaum (1998, p.26) says, "you don't know where it's located, how it's operated, or who owns it. That's because Visa is decentralized, non-hierarchical, evolving, self-organizing and self-regulating. … It is a chaordic system conceived as an organization solely on the basis of purpose and principle. Its structure evolved from them."

This is very important because it returns to emphasize the concept of the absence of hierarchy and decentralization, essential dogmas of the last century, but which today can be more of an obstacle than a theory to follow. I think it is interesting to highlight several thoughts about it, developed by several researchers in the past decades:

- "Morgan (1997) maintains that complexity will require managers to rethink the nature of hierarchy and control, learn the art of managing and changing contexts, promote self-organizing processes, and learn how to use small changes to create large effects" (Brunes, 2005, p.82).
- "For Tetenbaum (1998), the move to self-organization will require managers to destabilise their organizations and develop the skill of managing order and disorder at the same time" (Brunes, 2005, p.82).
- "Managers will need to encourage experimentation, divergent views, even allow rule-breaking, and recognize that people need the freedom to own their own power, think innovatively, and operate in new patterns" (Brunes, 2005, p.82).
- "For Jenner (1998, 402), the key to achieving this is structure: '[t]he dissipative enterprise must be organized into flexible basic units that permit new organizational structures to be identified and to emerge, and which promote" (Brunes, 2005, p.82).

These definitions allow us to understand how traditional systems are no longer well performing, as nowadays the staff within the company system (but also outside the company, whether they are competitors or cooperation cases) is much more important and relevant than decisions made only by the highest hierarchical levels. A more open and flexible perspective allows to face the change, and to explain these statements it is important to make an operational distinction through Figure 7 below.

Figure 7 – Degrees of freedom
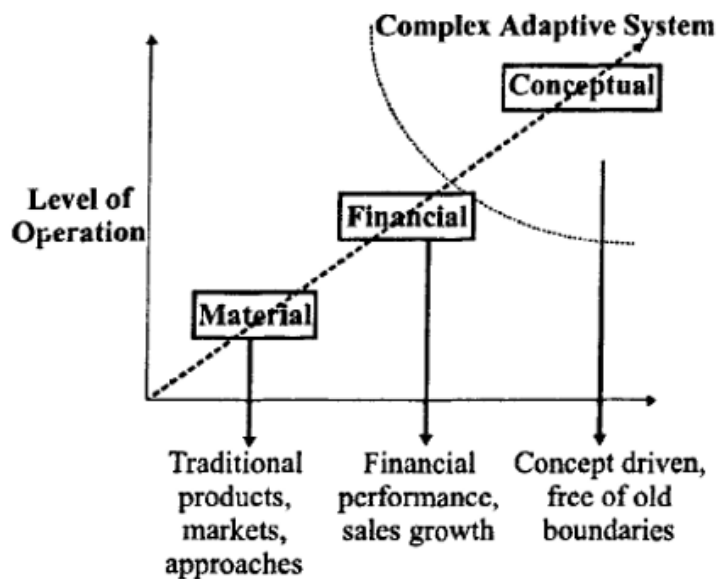
Source: Pravir Malik (2003), Business transformation through the
creation of a complex adaptive systems

As we can see from the graph and as analysed by Pravir Malik (2003), there are three levels of operation:

1. Material: at this stage the organization is linked to something that has been successful in the past. It continues to develop its products and strategy according to customers, products, markets and processes already known by the company. It is easy to understand how it is therefore stuck in old concepts, how it is in its point of balance and stability, a non-positive element in order to survive;

2. Financial: if at the "material" level the company is within its own boundaries / limits, at this stage it has some more degrees of freedom and it is not stuck in something that has made it a successful company. On the contrary, it is trying to change and grow in such a way that it can reach financial elements that it has set itself, such as ROI, sales revenues, sales growth, and so on and so forth. The risk of this stage consists in the fact that the company risks focusing exclusively on the pre-established financial results, focusing more on the short term rather than the long term;

3. Conceptual: the last stage, that is the one with the most degrees of freedom, is what all companies should achieve or want to implement. If a company lies in this stage, unlike the previous ones, it means that it is not tied to the past, it is not focused on financial results, but it has reached a point where it aims to be able to adapt to changes in the environment, such as the constant change of consumers, products, markets, and it is therefore able to cope with the complexity that surrounds it.

This last stage allows us to define an organization as complex adaptive systems and it is important to highlight and explain what its main features are.

Figure 8 – Characteristics of complex adaptive systems
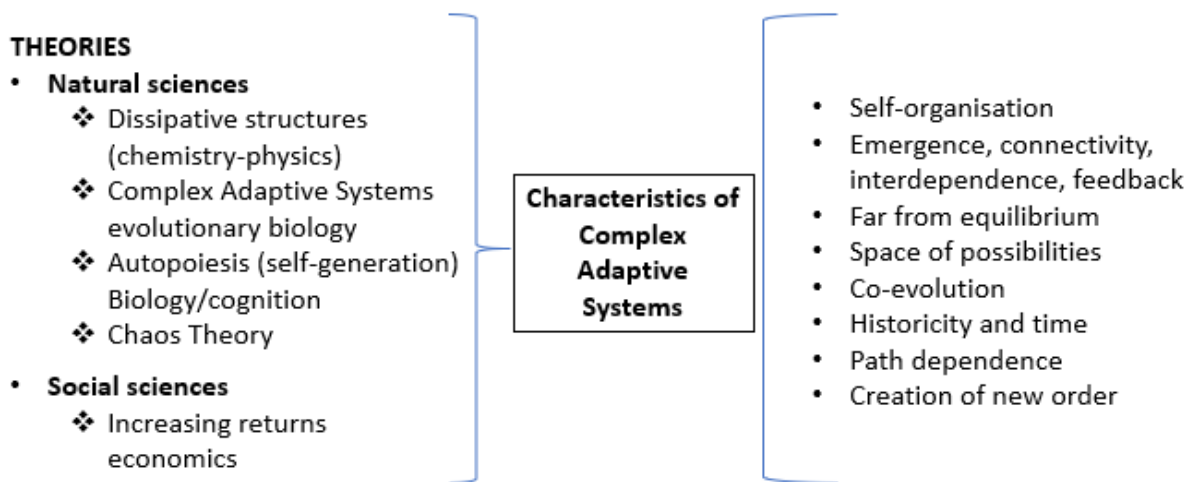
The most important part of the figure above is the part on the right, where the main features of the Complex Adaptive Systems are listed. These characteristics are fundamental for those who will have to build or develop a strategy in a complex system, as these principles are considered generic to facilitate the creation of organizational forms that will be sustainable in a constantly changing environment and they are common in all natural complex systems (Mitleton-Kelly, 2003).

2.3 CHARACTERISTICS OF COMPLEX ADAPTIVE SYSTEMS

2.3.1 CONNECTIVITY & INTERDEPENDENCE

As Mitleton-Kelly (2003, p.4) says, "Complex behaviour arises from the inter-relationship, interaction, and inter connectivity of elements within a system and between a system and its environment." Taking into account human behaviour and taking up the components mentioned by Mitleton-Kelly, connectivity and interdependence imply the fact that a decision made by an

individual, group or company can influence the decisions of other systems. However, this influence will not have the same effect on all individuals, as it will depend on the degree of relationship between them, taking into account their history and personality, which in turn include the organization and the corporate structure. Connectivity applied to inter-relatedness between individuals within a system, as well as to the human social system which includes for example information technology (IT) (Mitleton-Kelly, 2003).

However, the complexity theory does not dispute the fact of an increasing degree of interconnectivity, as high connectivity implies high interdependence. This implies the fact that with increasing interdependence between different systems linked together, the probability of disturbances or changes generated by one of them increases. A high degree of interdependence between different systems, however, does not only generate positive or beneficial aspects for all connected systems. A system or organization that tries to increase its position in the market, trying to improve its efficiency or its brand image, could cause a worsening for the other companies connected to it. This means that any improvement by a company could impose costs on the companies connected to it (Mitleton-Kelly, 2003).

Connectivity and interdependence are a very important feature of complex adaptive systems and how complex behaviour arises between individuals. In this first feature of the CAS, it is important to consider the multidimensionality of the complex systems, therefore the consequent mutual influence that is generated between different dimensions of the same system. These dimensions are made up of humans, and in a human context social, cultural, technical and economic variable are the basis of a relationship and influence each other.

2.3.2   DEGREES OF CONNECTIVITY

If we take the organizational structure of a company as an example, we easily come to the fact that there are many and different degrees of connection between the different members. Think of a centralized structure, where there are various levels starting from the CEO, staff positions, line managers, intermediate managers, team members and so on. Let's take the example of a divisional organizational structure, where therefore each division is divided by product or market. The members within this division will have a strong degree of connection between them, as they all aim and want to achieve the same goal, respecting the indications provided by their division head. Instead, if we consider the degree of connectivity between the members of division A and the members of division B, where the members of division B have totally different objectives and markets, it is easy to think how they have a very low degree of connectivity, despite they are part of the same company and they try to meet the objectives set

by the top management and transmitted through multiple hierarchical levels and to the whole organisation.

In addition to the degree of connection between members within the company, considering the theory of complexity and the interaction of different systems, such as the company with the external system, there are therefore also connections between elements within the company with elements out of the company, and here we move on to the second feature of complex adaptive systems mentioned in figure 1, also called co-evolution.

2.3.3 CO-EVOLUTION

As said by Mitleton-Kelly (2003, p.7), "connectivity applies not only to elements within a system but also to related systems within an ecosystem." An ecosystem in biology means, "each kind of organism has, as parts of its environment, other organisms of the same and of different kinds ... adaptation landscape by one kind of organism alters both the fitness and the fitness of the other organisms" (Kauffman, 1993, p.242).

The influence generated between systems within a company, which in turn generate an influence in the ecosystem to which they belong, is part of the co-evolution process which Kauffman describes as "a process of coupled, deforming landscapes where the adaptive moves of each entity alter the landscapes of its neighbours" (Kauffman & Macready, 1995, as cited in Mitleton-Kelly, 2003, p.7).

Taking as a starting point the quotes provided by Kauffman & Macready, although they refer to the natural sciences and not to the social sciences, I can try to use these definitions into the economic world. As mentioned above, a company is a complex system that is located within an even more complex system, or the environment, which is composed of countless independent systems that influence each other. Given that this thesis focuses mainly on the behaviour of companies in response to the pandemic generated by COVID-19, we note how different systems have influenced each other to be able to co-evolve and at the same time survive.

The pandemic that has arisen in recent months has highlighted how there has been a sudden and exponential evolution by companies from different points of view, and how these in turn have influenced and will influence the working methods undertaken by the companies. Think of how the virus has led companies globally to implement technological / IT systems in order to allow the employees to be able to work from home. This was the first response from companies to face the problem of non-mobility taken by their employees; at the same time, it is not obvious and it is important to underline how individuals were not used to working every day from home without the slightest physical presence of other colleagues, in addition to the fact that not all

employees were and are able to interact with technology provided by companies. From this point of view, it is easy to see how companies had to implement, and therefore further evolve, learning systems and guides for all those people who had no skill in using IT.

What was mentioned in the previous paragraph is only a small example of co-evolution, where many and different company sub-systems have influenced each other and have had a co-evolution thanks to the virus, which therefore has not only brought negative results, but also helped to grow and implement systems that pre-virus had been taken into account in a lesser form.

Another important point highlighted by Kauffman refers to the fact that co-evolution cannot happen as an event in itself, but it takes shape within an ecosystem. A social ecosystem considers social, cultural, technical and economic variables, and co-evolution can influence both the structures of organizations and the relationship that exists between different systems such as individuals, groups, organizations, etc. (Mitleton-Kelly, 2003).

Previously, a brief definition and a brief example of what can be called co-evolution have been provided. At the same time, it is important to distinguish between co-evolution with and adaptation to a changing environment (Mitleton-Kelly, 2003).

The concept of "system" and "environment" are often distinguished, especially in the economic sphere, but it is important to emphasize that there are no big boundaries between these two elements as in Figure 9, where a system is separate from its environment and constantly adapts to its changes. Instead, what needs to be analysed is a system strongly connected to all the other systems within the ecosystem (Figure 10), therefore the change must not be seen as an adaptation to a different environment, but must be seen as a co-evolution with all systems connected within the surrounding environment.

Figure 9 – Adaptation to a separate and distinct environment
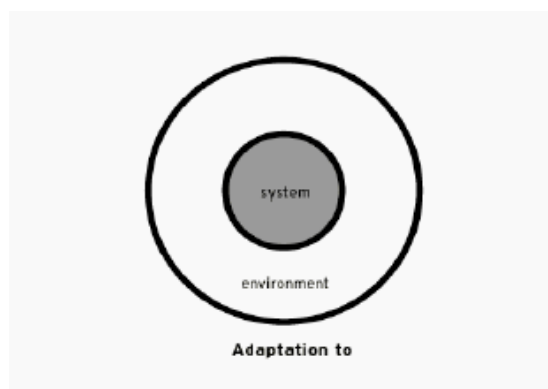
Source: Eve Mitleton-Kelly (2003), Complex systems and evolutionary perspectives on organisations: the application of complexity theory to organisations

Figure 10 – Co-evolution within an ecosystem
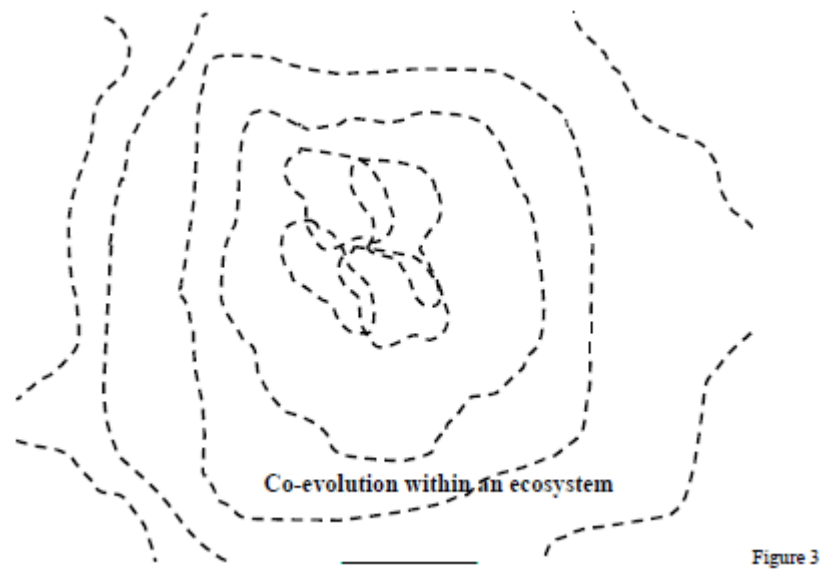
Co-evolution within an ecosystem

Figure 3

Source: Eve Mitleton-Kelly (2003), Complex systems and evolutionary perspectives on
organisations: the application of complexity theory to organisations

As mentioned by Mitleton-Kelly (2003) and briefly cited in the previous paragraphs, within an ecosystem every company can influence and be influenced by the systems connected to it, which can be individuals, consumers, organizations, institutions, etc. Looking at this brief definition and trying to figure out what it means in terms of strategy, it means that the strategies implemented are not just a response to a changing environment, but they are considered adaptive moves, which means that they affect both the initiator of the action and all the others firms influenced by it.

If we try to understand the co-evolution concept from a different perspective, we can say that it takes place when all the organizations are changing at the same time. And here we can have a slight but important distinction between adaptation and co-evolution: when we talk about adaptation, we talk about a change related to the short-term, while when we talk about co-evolution, we refer to the long-term of the ecosystem (Mitleton-Kelly, 2003).

The short distinction between the two terms is really subtle, at the same time it is very important to be able to define this fundamental characteristic of complex adaptive systems. Nowadays, the global factor is fundamental for every type of company, from the smallest to the largest, as this factor can bring constant new knowledge and information. Think of how the phenomenon of globalization makes all companies in the world participate, for example when a large company makes an important change, this influence all other companies to adopt a new strategy

or new assets, and how they can improve the same system used by the others and therefore further influence other operators in the sector.

As Mitleton-Kelly (2003) says, co-evolution can happen at different levels and in different forms, and we can distinguish it in endogenous co-evolution when it is applied to individuals and groups within the organization, while it can be defined as exogenous co-evolution when the company is evolving and interacting with the broader ecosystem.

2.3.4 DISSIPATIVE STRUCTURES, FAR-FROM-EQUILIBRIUM & HISTORY

Trying to go ahead with the characteristics of complex adaptive systems, as a third characteristic we come across dissipative structures, a theory defined by Nicolis and Prigogine, two researchers in Chemical physics, in which they declare as the flow of energy or information, and therefore moving away from the equilibrium point, creates new corporate structures.

In order to better understand what is meant by moving away from the equilibrium point, we cite the laboratory example carried out by the two researchers:

"The Bénard cell is an example of a physic-chemical dissipative structure. It is made up of two parallel plates and a horizontal liquid layer, such as water. The dimensions of the plates are much larger than the width of the layer of water. When the temperature of the liquid is the same as that of the environment, the cell is at equilibrium and the fluid will tend to a homogeneous state in which all its parts are identical (Nicolis & Prigogine 1989, Prigogine & Stengers 1985). If heat is applied to the bottom plate, and the temperature of the water is greater at the bottom than at the upper surface, at a threshold temperature the fluid becomes unstable. "By applying an external constraint, we do not permit the system to remain at equilibrium" (Nicolis & Prigogine 1989, p10). If we remove the system farther and farther from equilibrium by increasing the temperature differential, suddenly at a critical temperature the liquid performs a bulk movement which is far from random: the fluid is structured in a series of small convection 'cells' known as Bénard cells" (Mitleton-Kelly, 2003, p.10).

This example is very important because it defines several fundamental characteristics of complex systems, moreover in the next chapter it will allow us to shift it to how the virus has impacted companies from the different points of view that I will analyse below:

a) Self-organisation: the water molecules arranged themselves in the most correct way;
b) Order and structure: after generating the chaos and the molecules have responded to the problem, a higher-level system than the previous one has been created;
c) External constraint or perturbation: the system has been removed from its equilibrium;

d) Unpredictable and uncontrollable: the rotation of the molecules is unpredictable, every time you try to figure out the rotation, it is not possible to predict whether they will go left or right;

e) Several solutions for the same parameter values: there are several possibilities to adapt to the environment;

f) Historical dimension: the fact that only one solution happens among all is the fact that there is still an influence due to past events that will influence the future;

g) Symmetry was broken due to the chaos generated and a new pattern is coming;

h) Emergent behaviour: this behaviour starts initially for each individual / molecule, and then becomes consistent with all individuals at a macro-level.

Given the eight points listed above, I would say that today they are fundamental in being able to analyse the problem generated, and partially solved, by COVID-19. Another important element, and not at all obvious, is to note that from an example and research purely related to natural sciences, specifically to chemistry, it can be moved into social sciences, in this case the economic science.

The complexity generated by the pandemic has been very high, probably one of the highest after the economic crisis of the last decade and the great economic depression of the last century. It is important to note how the example of molecules fully defines the behaviour of companies in a complex situation such as that of COVID-19. Taking some of these points as an example, the companies responded autonomously and found solutions suitable for their system, some with more advanced systems, others with more mediocre systems but still suitable for their structure. A new order has been generated, just think of how technology has now become part of our lives in different aspects such as working, entertaining, studying, and how this can also revolutionize the labour market, through greater flexibility and greater independence taken by people within the company. In the next chapter, I will analyse point by point what has changed and what the responses of the companies within the ecosystem have been.

Coming back to the third characteristic of complex adaptive systems, the following graph defines how there are different alternatives to the same problem in dissipative structures, and it is up to the company to decide which path to take on the basis of its structure and history.

Figure 11 – Bifurcation diagram

X

(b₁)

Stable

(a)   Stable   (a')   Unstable

Thermodynamic   □ₑ   □
branch

Unique   Stable
Solution   (b₂)

Multiple
Solutions
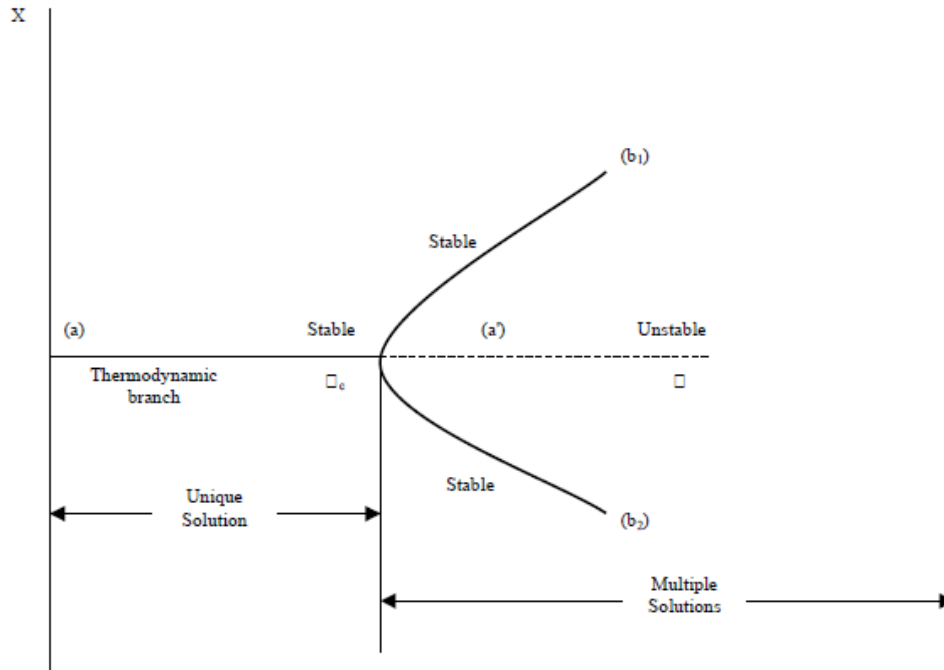
Source: Nicolis & Prigogine, 1989, p72, in Eve Mitleton-Kelly (2003), Complex systems and
evolutionary perspectives on organisations: the application of complexity theory to organisations

As can be seen from the graph, at a certain point a division into two parts is created, and it is
the moment where the company must decide which solution to undertake. The outcome of this
choice is not predefined, it is not certain that it will lead to the optimal result, but as Gregoire
Nicolis and Ilya Prigogine (1989, p.14) say, "only chance will decide, through the dynamics of
fluctuations. The system will in effect scan the territory and will make a few attempts, perhaps
unsuccessful at first, to stabilize. Then a particular fluctuation will take over. By stabilizing it
the system becomes a historical object in the sense that its subsequent evolution depends on
this critical choice."

In economics, but in general in the social sciences, every decision becomes important in order
to define the strategy and the path of a company. Each situation will generate multiple solutions,
but at each step the company will make a choice and defines a "historical path" from which it
cannot escape, knowing the positive or negative outcome of certain choices. In the same way,
the choices of an individual are not taken only through a random system, but they are based on
previous events that occurred in the his / her life and that have influenced his personality or his
way of evaluating different alternatives. When an entity, that can be an individual, a group or
an organization, is faced with a problem it had not yet faced before, at that point it finds itself

having to make decisions that can lead to a new way of operating, new ways of relating to others or new organizational forms (Mitleton-Kelly, 2003).

2.3.5   EXPLORATION OF THE SPACE OF POSSIBILITIES

A constantly evolving environment and an ever-widening network to face lead companies to have to explore and take new paths, new strategies, new possibilities. The fact that the world is increasingly complex causes positive and negative implications for organizations: we can interpret the positive implications as a way for companies to be present globally, both physically and online; on the other hand, we can combine the negative aspects in a greater competition and a greater need to know different markets and different cultures in order to satisfy the needs of consumers. However, trying to glimpse a common point of these possibilities, what links the positive and negative sides of the matter is the need for companies to explore new possibilities, therefore continue to innovate, cooperate, introduce new technological systems, enter new markets, and so on. So, if on the one hand globalization and innovation allow the company to survive and keep up with the times, as well as compete with its rivals, on the other hand the lack of innovation could lead to the closure of the company.

In the new millennium, the basic concepts for each type of company consist of innovation and flexibility, therefore not only by trying to introduce new systems unknown to the company, but also by trying to model what they already have within them. As Eve Mitleton-Kelly (2003, p.14) says, "Flexible adaptation also requires new connections or new ways of seeing things. Seeing a novel function for a part of an existing entity is called 'exaptation". To try to make the concept clearer, think how in some libraries there are desks with a drink holder. Very often in those cases the drink holder could be used not for its real function, that is to keep a drink to avoid dropping it or making it more comfortable for the user, but to pass the computer power cable through that hole to avoid to have disturbances on the table.

2.3.6   FEEDBACK

Nowadays, feedback has become something fundamental for each of us, individuals, groups, companies. The word "feedback" is mainly associated with a system that allows you to evaluate positively or negatively an experience with a specific individual, group, company, process, service and so on. However, in this paragraph I will not analyse the term as the "final grade" of a certain fact, but I will analyse it according to the implementation of a certain strategy in response to the change.

As Ilya Prigogine and Isabelle Stengers (1985: xvi) say, "In far-from-equilibrium conditions, non-linear relationships prevail, and a system becomes" inordinately sensitive to external

influences. Small inputs yield huge, startling effects that cause a whole system to reorganize itself.

This definition is usually used in engineering, therefore I will try to shift it to the human sphere as previously done with the other characteristics of the complex adaptive systems. Trying to analyse the far-from-equilibrium conditions in a company, and therefore what can happen when there is an important instability, think about the case of a merger or corporate restructuring.

If we try to take the case of a business merger, two or more companies must take into consideration many variables (economic, technical, physical, cultural, etc.) that bring both companies to a point far from their equilibrium. This process and this merger, however, despite all the considerations made by the two companies, does not inevitably lead to success. The operation, in fact, can lead to two results: the first result could be a failure, and therefore there is a degrade into disorder (loss of morale, loss of productivity, etc); the second result could be a success, therefore a higher order would be created and the organization would implement new processes and new work methodologies that would lead to a new coherence (Mitleton-Kelly, 2003).

There could be several reasons that lead an organization to move from its equilibrium point: a certain process is no longer efficient, the company wants to enter a new market, the company wants to expand and achieve economies of scale, the company does not have the means to respond to new technologies, and so on.

As above mentioned, moving to a new point of stability is not necessarily a success, because "in human interactions feedback is rarely a straightforward input-process-output procedure with perfectly predictable and determined outputs. Actions and behaviours may vary according to the degree of connectivity between different individuals, as well as with time and context" (Mitleton-Kelly, 2003, p.16).

2.3.7   PATH DEPENDENCE AND INCREASING RETURNS

As anticipated in the previous paragraph, feedback can be of two types, that are positive or negative. Brian Arthur argues that negative feedback loops in the economy leads to diminishing returns, and this in turn leads to an almost redefinable balance. Negative feedback has a stabilizing effect, and implies a single equilibrium point, as "any major changes are offset by the very reactions they generate" (Arthur, 1990, p.92). On the contrary, when we talk about positive feedback, Brian Arthur himself (1990) mentions how they generate increasing returns and amusing equilibrium points, while taking into consideration the negative feedback that can still operate in the system.

As there can be positive and negative feedback, it is also important to take into account the history and the path taken by the company up to that time. Recalling what was represented in Figure 11, namely the possibility for the company to choose different alternatives and the possibility of having different solutions for the same problem, we must always remember how the actions taken today are the result of decisions taken in the past. At this point it is difficult to be able to effectively and efficiently set the strategy that the company will try to define, as it depends on a series of factors that are difficult to contextualize and to predict.

An example to define these characteristics, that are path dependence and increasing returns, refers to the market of recorder videotapes presented by Brian Arthur (1990, 1995):

"The VCR market started out with two competing formats selling at about the same price: VHS and Beta. Each format could realise increasing returns as its market share increased: large numbers of VHS recorders would encourage video outlets to stock more pre-recorded tapes in VHS format, thereby enhancing the value of owning a VHS recorder and leading more people to buy one. (The same would, of course, be true for Beta-format players.) In this way, a small gain in market share would improve the competitive position of one system and help it further increase its lead. ... Increasing returns on early gains eventually tilted the competition toward VHS: it accumulated enough of an advantage to take virtually the entire VCR market" (Arthur, 1990, as cited in Mitleton-Kelly, 2003, p.18).

2.3.8 SELF-ORGANISATION, EMERGENCE AND THE CREATION OF NEW ORDER

The characteristics analysed so far are all very important for defining complex adaptive systems and starting to understand their foundations, at the same time when we talk about self-organization, emergence and the creation of new order we refer to the fundamental features of complex and essential systems to be able to deal with the topic related to COVID-19.

Let's start from some definitions of emergence properties provided by different authors:

- "Emergent properties, qualities, patterns, or structures arise from the interaction of individual elements; they are greater than the sum of the parts and may be difficult to predict by studying the individual elements. Emergence is the process that creates new order together with self-organisation" (Mitleton-Kelly, 2003, p.19).
- "As a whole entity, which derives from its component activities and their structure, but cannot be reduced to them" (Checkland, 1981, p.314).
- "As the transition from local rules or principles of interaction between individual components or agents, to global principles or states encompassing the entire collection

of agents" (Varela & Maturana 1992, Varela 1995, as cited in Mitleton-Kelly, 2003, p-20-21).

Among these definitions, the first thing we notice is a linearity in reference to the fact of not considering activities, individuals, or companies as single elements, but of considering them all together as a single entity, which has a greater value than the sum of the individual elements.

The definition provided by Varela is the one that also allows to move from a more local context to a more global context, thus allowing to be able to bring together some elements that have been explained in the previous paragraphs. The emergence of mental states for example, such as pattern recognition, feelings and thoughts may be explained by the evolution of (macroscopic) (Varela's global principles or states) "order parameters of cerebral assemblies which are caused by non-linear (microscopic)" (Varela's local rules or principles) "interactions of neural cells in learning strategies far from thermal equilibrium" (Mainzer, 1996, p.7).

A company works in the same way: the evolution it has and achieves at the macroscopic level is generated by a set of non-linear events at the microscopic level, therefore allowing it to remain operating in the market. However, these elements must not be taken individually, as both influence each other and are not one the consequence of the other, but it is a vicious circle that continues indefinitely, thus citing again the second characteristic of complex systems, it is called co-evolution.

When we move from the emergence properties to the self-organisation characteristic, we can split it into two different categories: conservative and dissipative. As Mitleton-Kelly (2003) says, conservative self-organization is the category in which the structure is considered reversible, therefore it can go back to the initial state despite the changes that have occurred; on the other hand, dissipative self-organization refers to those systems that have an irreversible structure, therefore a new system with some critical value emerges, generated by the interaction between the organization and its environment (Mainzer, 1996).

To this Nicolis (1994) adds "non-linear dynamics and the presence of constraints maintaining the system far from equilibrium" are "the basic mechanisms involved in the emergence of ... (self-organising) phenomena" (Mitleton-Kelly, 2003, p.20).

If we want to try to apply the self-organizing feature to companies during the COVID-19 period, we can think of what they have implemented in order to try to keep up with the times and the environment. COVID-19 has been a pandemic that no one has ever faced before, individuals, companies, governments and international policies. There was no strategy used for previous pandemics, and during the current crisis, every strategy was something new for everyone. Each

company has tried to implement different systems to be able to face the problem, but without someone telling them how and what to do in order to resolve the situation. Each organization has implemented different systems, obviously based on its sector, thus implementing greater use of technology, greater IT systems, greater flexibility, a wider subgroup division, and so on. We are currently still in a phase where we do not have a clear and certain answer regarding what will remain, at the same time I would say that in this case we will most likely have more irreversible self-organization than reversible, as it is a system that could generates greater overall efficiency. Let's think about how the lock-down has caused a net reduction in air pollution, a problem that nowadays is one of the main international debates; another example can refer to the greater flexibility that is guaranteed to workers, which therefore allows a greater work-life balance and also allows to avoid the hours lost in public transport to reach the workplace.

An important link between the sense of emergency and the organization is the fact that the former generates ideas and new forms of work / thought, thus influencing and becoming part of a path and development of individuals and companies, hence influencing the evolution of both (Mitleton-Kelly, 2003). "When learning leads to new behaviours, then the organization can be said to have adapted and evolved" (Mitleton-Kelly, 2003, p.21). This makes it clear how much important it is for individuals and companies to learn, but collectively and not as an individual. An example that could make it easier to understand this point could be the concept of corporate culture: if only one individual knows the vision or mission, the other members of the group will not be aware of it and therefore it will be difficult to achieve a common goal or try to build a corporate culture. In the same way, it is important for everyone to learn and share their experiences and ideas, so that they can evolve and reach a high-order level. And here we return to the connection between some of the most important features of complex adaptive systems, as we take up the concepts of emergence, self-organization and connectivity.

2.3.9   CHAOS AND COMPLEXITY

When we talk about chaos and complexity, we don't refer to the same thing. A definition of chaos theory is provided by Eve Mitleton-Kelly (2003, p.22), that is "Chaos theory describes non-linear dynamics based on the iteration either of a mathematical algorithm or a set of simple rules of interaction, both of which can give rise to extraordinarily intricate behaviour such as the intricate beauty of fractals or the turbulence of a river." Brian Goodwin (1997) describes such emergent patterns as the "emergent order (which) arises through cycles of iteration in which a pattern of activity, defined by rules or regularities, is repeated over and over again, giving rise to coherent order" (Mitleton-Kelly, 2003, p.22). And herein lies the difference, in

that in chaos theory the formula remains constant, while the complex systems are able to adapt and evolve (Mitleton-Kelly, 2003).

2.4   SHIFTING AN ORGANIZATION

Having analysed the fundamental and main characteristics of complex adaptive systems, given the objective of the thesis, it is important to try to transfer them from natural sciences to social sciences. As anticipated by Figure 7, where the different level of operations of the companies were analysed, when we talk about an organization located at the material level, we refer to a company that needs to be shaken abruptly in order to be able to keep up with the times, as it is rooted in old concepts, strategies and behaviours; on the other side, a company that is in the conceptual level is already considered a complex adaptive system, and it is therefore dynamic and able to deal with external pressures. This difference in "positioning" by companies leads to different techniques for dealing with change, briefly described by Figure 12 and then analysed in detail by Table 1.

Figure 12 – Mobilizing techniques
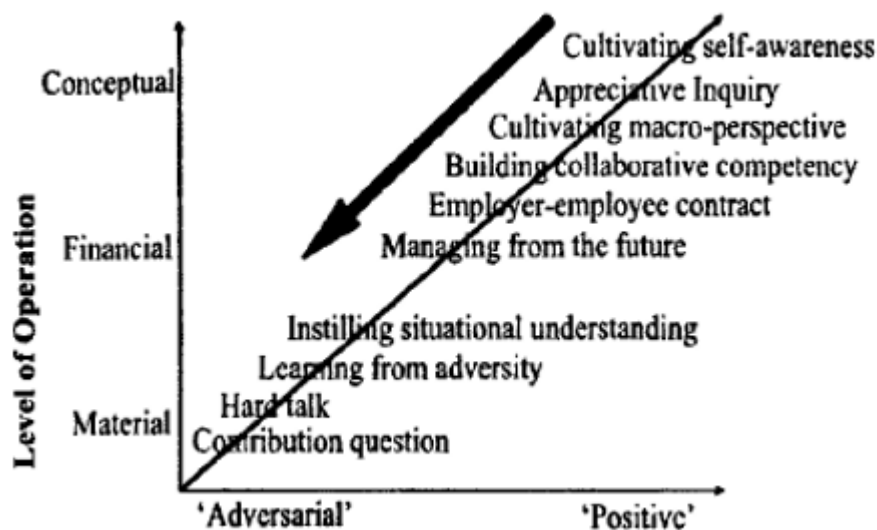
Source: Pravir Malik (2003), Business transformation through the creation of a
complex adaptive systems

The arrow inside the Cartesian ace, which indicates the different techniques available and starts from the top-down, indicates the fact that the techniques used by companies that are at the conceptual level, therefore the maximum level , are techniques that have greater impact on these companies but can also be applied to companies that are at a lower level. On the contrary, the techniques used by companies that are at the material level or financial level, cannot be used by companies that are at the conceptual level

In the following Table 1 there is a description of the techniques that can be used by organizations:

Table 1 – Description of techniques

Technique	Brief Description
Contribution question	Contribution question is about creating an underlying sense of questioning to do with individual level of contribution to the company. While 'contribution question' is an aspiration for peak performance, it is based on a foundation of self-questioning insufficiency. In this respect it always pushes the subject(s) toward self-exceeding.
Hard talk	Hard talk requires a shift in the mutual understanding of the nature of 'conflict'. Conflict needs to be viewed as a means to surface difference of opinions, and to work through them to create a more robust business foundation.
Learning from adversity	Learning from adversity is about learning from adverse situations to create a more robust system.
Instilling situational understanding	This is about creating a widespread understanding of those variables that really drive the business.
Managing from the future	Managing from the future requires participants to stand in the future and to remove any obstacles that remain in the way of being there.
Creating a holistic employee-employer contract	The employer and employee have to enter into a holistic contract that nurtures the employee and provides the employee with a stimulating and rewarding work environment.
Building collaborative competency	Technique for being able to collaborate with others through focusing on what is unique and best about them.
Cultivating macro-perspective	Participants need to 'see' differently, so that the corporation, the entire business environment, along with all stakeholders, is seen as one unified complex adaptive system.
Appreciative inquiry	Appreciative inquiry is about mobilizing and leveraging the positive patterns and energy that exist in all people, organizations and situations.
Cultivating self-awareness	A series of introspective techniques to create greater self-awareness, leading to increased levels of calm, concentration and creativity.

Source: Pravir Malik (2003), Business transformation through the creation of a complex adaptive systems

What is important to underline and highlight from the ideas offered by Pravir Malik (2003) in Table 1 is the fact that there are many systems, means, strategies and techniques that can help a company become a complex adaptive system (in the case of companies at the material or financial level), while it may become a sustainable complex adaptive system in the case of companies at the conceptual level. If we focus for a moment on Figure 12, we notice how in the x axis the indicated items are "adversarial" and "positive". As Pravir Malik (2003) mentions, it is important that organizations are able to have and apply different perspectives to the emergence of a possible problem. Taking as an example the "hard talk" technique, the company, thus the components within it, must be able to pass from conflict to dialogue, therefore to pass from something negative (such as a conflict) to something positive and constructive as dialogue. We have already analysed how, nowadays, managers and the highest levels of the hierarchy must be able to create a dialogue and share knowledge and culture with all the members of the

organization, or how people should feel part of a common project, without the fear of intervening. This is what makes a company capable of being a complex adaptive system capable of responding to the environment.

2.5   THE BANK CASE STUDY

The example provided by Eve Mitleton-Kelly and Papaefthimiou (2000, 2001) allows to better apply and understand complexity theory in management.

The operational part of a major international bank in Europe needed an update to manage the European currency. At the beginning, the main problem of the project were the restrictions and requests imposed by law, which are considered exogenous variables and were in any case necessary to achieve success. In addition to them, however, the fundamental part of the project was to internally create an infrastructure that was socially and technically valid for the project.

The project introduced new technologies, and being a high-difficult project, an international team of experts was also implemented. What led to the success of this project, especially from a technical point of view, was the project manager's approach, as he created a strong relationship and connection between business and information systems' experts, while up to that time none of them were talking. The meetings were monthly and in those occasions managers exchanged their opinions, therefore began to be born new forms of communication and the characteristic related to "self-organization" began to exist, given the fact that this new way of working was not controlled by top management. This was a totally different approach from the bank's precedents.

Some of the enabling conditions were:

- Networking, trust and common language
- Autonomy
- The top management who did not interfere with the project
- Stability
- An interpreter who allowed to combine the two sides, business and technician's

The challenge to pass were:

- Adaptability to the change
- Management unable to complete projects
- Lack of experience during the projects
- The system was still seen as old but good, so the reason for the change was not seen

The fact that the project manager introduced constant and face-to-face meetings between different members of different sections was of fundamental importance for the success of the project. As Mitleton-Kelly and Papaefthimiou (2000, 2001) cites, the continuous interaction between the vice president who owned the product, the project manager and the technology project manager can be seen as a positive feedback or reinforcing process. The trust generated between individuals generates better communication, which in turn creates a better development of the project with fewer misunderstandings, which in turn facilitates a better evolution of the company both technically and socially.

This is only a case where the development process and the interaction between individuals led to a positive result of the project. It is important to underline, however, that this arrangement and predisposition of facts and variables is not absolutely correct, as each situation depends on the personalities of the individuals, on the structure of the project / company and on the technologies available to communicate. In this case the meetings could be faced face-to-face, but what would have been the result of the same project using only virtual meetings? Some could confirm the result obtained, others could be more hesitant because of the lack of physical contact between people, an element that has always been fundamental for everyone.

Complexity theory therefore suggests how the characteristics of complex systems influence each other, how individuals interacting with each other create new ideas and new forms of work, in some cases transforming an entire organizational structure. In turn, this structure is part of an even larger and more complex system, but it still has the power and connections to be able to influence other entities, which can receive information, evolve, and in turn allow other elements of the system to improve.

Connectivity, co-evolution, space of possibilities, feedback, are all characteristics that influence each other. Individuals must experiment and understand what the best method can be to be able to go ahead and fight the challenge introduced by the larger system, namely the environment and, in our case, the COVID-19.

A table that can help us to have some ideas related to the organizational context in the explanation of complexity theory is the one provided by Gupta & Anish (2014) and which I report below. If we want to see it in a more general perspective, the company, and therefore in our case the Complex Adaptive Systems, does not refer only to the characteristics listed above. If we think about the situation generated during this pandemic period and look at Figure 13, it can certainly be established that there has not only been an organizational change, but in the future months there could certainly be implications for organization design as well how it will

be structured at the space-time level. I will try to develop this theory in the next chapter, where I will try to bring more practical elements related to the change generated by the virus.

Figure 13 - Overview of applicability of complexity theory in the context of organizations

Source: Indian Institute of Management, Bangalor (2014)

Continuing to take into consideration the table above mentioned, another important element that fills the complexity theory, and therefore the organizational context, refers to the strategy adopted.

From a complexity theory point of view, in fact, Stacey (1995) analyses how a strategic problem, in response to multiple systems that interact with each other, is seen and considers two main problems: the first problem refers to a strategic choice, which is that the company decides to implement and transform in a rational way, so as to be able to respond to environmental changes; the second problem, however, refers to ecology, or a process of evolution by the whole population to adapt to change, with the problem of some restrictions established by institutions and scarce resources.

The increase in complexity often implies an expansion by the company (Ashby, 1957; Espejo et al., 1996), and this in turn leads to a greater ability by the organization to respond to change and survive. It is self-evident that the two are related to each other: a company in an increasingly complex environment must try to expand in such a way as to have more human capital available, in turn, however, having more human capital increases the complexity inside the company, and so on. At the same time, as Bertalanffy (1972) says, the more an organization grows and therefore there is more human capital, as well as hierarchies and roles, the more the way of communicating with each other will be longer and will be a limit for the company. A company

with a low staff and few hierarchy levels will certainly be leaner than an international company, regardless of whether it is a functional, divisional or matrix company.

As we have seen so far, the problem of integrating a strategy considering both internal and external elements of the company and the relationships between them is part of the strategic problem. As Gibson et al. (2012, p.4) say, organizations are "entities that enable society to pursue accomplishments that can't be achieved by individuals acting alone". Another definition is defined by Shipilov et al. (2014, p.449), where they write "[o]rganisations, as complex adaptive systems, are embedded in heterogeneous networks consisting of many different kinds of nodes (people, projects, machines, buildings)", and this definition allows to emphasize for once again the concept of different subsystems within the company.

The latter definition allows to extrapolate another important piece of the theories used and developed in recent decades: the relationship between man and technology. As Emery and Trist (1960) have studied in the past decades, they proposed a sociotechnical approach, in which organizations can be seen as open socio-technical systems, where "[...] the technical and social sub-systems are interrelated, interdependent and mutually influence each other"(Caravantes et al., 2005, p. 153, editors' translation) (Figure 14). The name of this approach allows us to easily understand which are the parts that make it up: the social component and the technical component. According to Trist and Bamforth (1951) and Emery and Trist (1960), the social component includes all the human aspects and the relationships between them, inevitably going to consider their behaviours, their reactions and their ways of relating to other individuals so they can preserve the organization. The technical component, on the other hand, considers all those elements that are part of the technical area, therefore machinery, equipment, technology, and so on, and therefore do not adapt their behaviour in relation to others, but are used and set by the human being. The main difference consists in the fact that the human being is able to adapt and innovate constantly, responding to external stimuli and changes, while machines and everything related to the technical part needs human intervention.

Figure 14 – The Tavistock Institute's socio-technical approach

As Terra & Passador (2015) say, considering the dynamism of the two subsystems that make up an organization, that are the social system and the technical system, a person could define such an approach as a technical aim system, namely a system that aims to use and exploit the resources of the technical system. However, it is associated with a social system made up of groups of individuals who guarantee the integrity of the organization. These two parts allow to exchange disturbances between them and, being an open system, they are also connected to the outside world (Figure 15).

Figure 15 – Conversion of the first essence of an organization
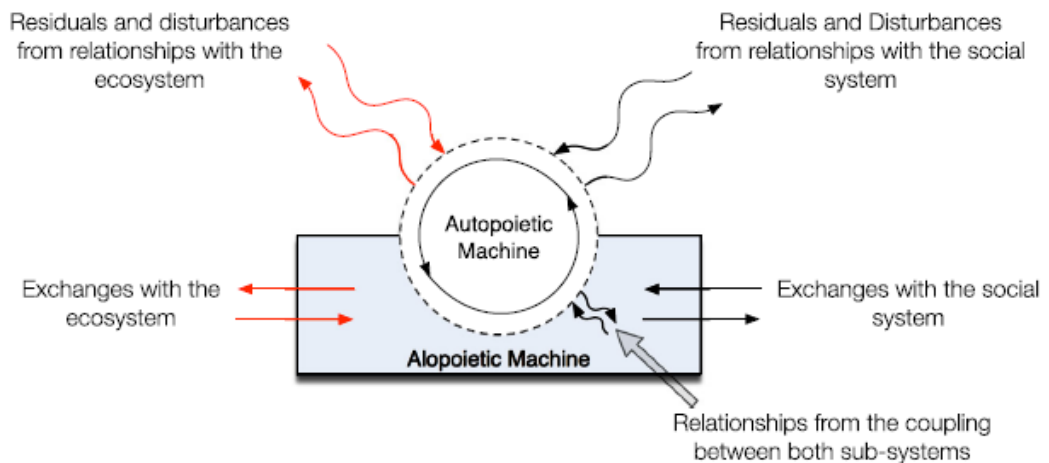
Therefore, organizations are led by the social part, which has characteristics such as autonomy, identity, consciousness and intentionality (Terra & Passador, 2015). It is the fundamental part for an organization, capable of interacting both with the technology within the company and with the stimuli generated by the external environment. As described in the characteristics of complex adaptive systems, the social part is able to establish new behaviours, it is able to evolve higher-order patterns, it is capable of evolving through connections, interrelationships and a continuous feedback system. Organizations must therefore find a balance between cooperation and competition, so that they can discover new resources and obtain new information through the external environment and achieve higher-order systems (Terra & Passador, 2015).

As Terra & Passador (2015, p.245) say, "the characteristics of the 12 strategic problem variables listed next are particularly important for the survival of organizations and require careful mapping by the strategist:

1. System components, considered individually;
2. Internal couplings of the organization's social system;
3. Internal couplings of the organization's technical system
4. Internal couplings of the socio-economic system;
5. Internal couplings of the ecosystem;
6. Coupling between the organization's social and technical systems
7. Coupling between the organization's social systems and the socio-economic system;
8. Coupling between the organization's technical system and the socio-economic system;
9. Coupling between the organization's social systems and the ecosystem;
10. Coupling between the organization's technical systems and the ecosystem;
11. Coupling between the ecosystem and the socio-economic system;
12. Coupling between the ecosystem and the rest of the universe."

The general framework provided by this theory allows us to understand how external events can generate opportunities and difficulties for organizations, which generally aim to reach a point of equilibrium but at the same time must continuously innovate and adapt to what happens in the external environment, regardless of sudden causes such as the virus or elements introduced by other organizations and replicable internally. From the characteristics of complex adaptive systems it can be seen that, although the theory is generally applied to the natural sciences, its peculiarities can be replicated and transferred to the economic environment.

The connection between individuals and organizations is fundamental in terms of growth, as it stimulates an evolution that can be internal or even considered a co-evolution, generating greater efficiency throughout the ecosystem. The worldwide spread of a virus has shifted the balance point of companies towards a more digital world, consequently implementing new working methods and highlighting new needs, such as greater flexibility and greater attention to the welfare of workers. All this is surrounded by a feedback system, more and more important nowadays, where we are all constantly looking for feedback, whether it is positive or negative, to try to improve in what we compete. All features that therefore have a feedback in the economic sciences.

Given the reference to the new working methods above mentioned, the next chapter will deal with the analysis of the virtual team, an element that characterized many companies during the lockdown period. Being able to better analyse the digital features related to an organization carried out completely remotely will allow us to better understand what were the major difficulties and benefits generated by such a system.

CHAPTER 3

VIRTUAL TEAM

3.1   INTRODUCTION

"Wake up, roll out of bed. No need to change from your pajamas. Make an extra strong coffee. Change the kids and get breakfast ready. Take the trash out. Check your calendar to make sure you can first skim the news. While checking LinkedIn, another status update from a colleague that has been furloughed. Change your Zoom background to something fun since your first meeting is just a check-in with your small team. Mute your microphone because your dog starts barking. Unmute to provide some insight to show you are still connected. Stop your video, so you can answer your kid's math question. Finally, start going down your long list of emails, in order, to avoid answering unnecessary emails. You have gotten the most pressing emails out of the way and the video conference ended. Oh! Your next meeting is not for another 30 minutes. Maybe it's time to shower. Wow! It's only 10:15am. Another long day ahead." (Feitosa and Salas, 2020, p.1).

This is a perfect tale of a typical day of a virtual team member during the pandemic, therefore it is important to analyse another fundamental theory that gave way to respond to the emergency generated by COVID-19, which refers to the virtual team concept.

So far the central part of the analysis has been the relationship between different systems and subsystems, with a main focus in the relationship between the company and the external environment. In recent months, however, being able to communicate virtually has been fundamental for companies, therefore through the description and the deepening of the virtual team theory I will try to expose the concept and the annexed practice applied by companies.

One of the main obstacles generated by the pandemic has certainly been the development and the ability to have and obtain the technological means to be able to cope with such a large problem, which has never been faced by companies before. If we try to think about the previous crises, surely they had an economic impact on companies, but never happened a total lockdown of entire countries / nations that forced companies to work entirely from home. Obviously not all companies have been able to take advantage of the technology to continue their production (i.e. companies with greater labour / handcraft activities), but in this thesis I will try to analyse those companies that have been able to transfer their activities from the work office to the living room of their employees' homes.

In the last two decades, technology has developed a lot and it is clear to everyone that it has become an integral and fundamental part of our lives, but in certain countries, such as Italy, there had not yet been a clear technological development and a clear increase in infrastructure to be ready for any crisis. To give a practical example, think of how, according to the analyses carried out at European level, Italy has always positioned itself in the bottom positions of the ranking regarding the concession and availability of broadband / high-speed connectivity. Another starting point that I want to analyse, as well as merely personal thinking developed through the reading of articles related to smart-working, refers to the lack of confidence on the part of the upper hierarchy levels towards its employees. Clearly it is a thought that should not be seen from an absolute viewpoint and applicable to all companies, but I believe that in Italy there has always been a certain hesitation in applying smart working, firstly due to the lack of infrastructure and technological means, but secondly because there is a general thought of lower productivity in the work done from home, as well as difficulties for managers or people in charge of a team to control the work of their colleagues.

However, the pandemic forced Italy to respond by using technology and smart working in order to not bring the entire country to a total collapse. Fortunately, in recent years companies have noticed the importance of implementing a certain flexibility at the internal level, some guaranteeing a few days of smart-working per week to their employees in order to reconcile a greater work-life balance, therefore some were already partially prepared to face the problem.

Anyway, the most complex part generated by the virus was not the use of technology by an individual, but the use of technology by the entire company and therefore the management and coordination of the various teams towards corporate objectives. Because if it is true that on the one hand some people are more predisposed and more prepared in being able to work from home, it is also true that the other side of the coin is made up of people who have some difficulty in using technology from home, or even they don't have the means to do it. Another problem to consider is the loneliness of each individual, where each respond differently and has an impact primarily on his productivity, but consequently this also has an impact on the company. In the following paragraphs I will analyse some of these problems and what are the theories developed in the last decades relating to virtual teams, analysing their benefits and risks in their implementation.

3.2 DEFINITION

Before giving a definition of virtual team, it is important to make a brief distinction between the words group and team. A group is a set of two or more people who interact with each other, but "the group's purpose is the same as the broader organizational mission" (Katzenbach & Smith, 1993). In this definition we note that there are two fundamental parts: the first one, where reference is made to the interaction between two or more people, implies the fact that they influence each other, thus returning to the connectivity paragraph defined in the complex adaptive systems; the second one, or the achievement of certain objectives, refers to the fact that everyone has a common goal, at the same time not all members' needs are identical. On the other side, the definition of team says, "is a group of people who are interdependent with respect to information, resources, and skills and who seek to combine their efforts to achieve a common goal" (Thompson, 2018, p.4). From this statement we can figure out how the team is a subset of the group, and within the team all the components have the same needs and objectives.

Defined the concept of team, we can now analyse the general concept of virtual team defined by different researchers. "We define virtual teams as groups of geographically, organizationally and / or time dispersed workers brought together by information and telecommunication technologies to accomplish one or more organizational tasks" (Alavi & Yoo, 1997; DeSanctis & Poole, 1997; Jarvenpaa & Leidner, 1999; as cited in Powell et al., 2004, p.7).

From this definition we can draw several fundamental components of the virtual team, which have always established the difference between virtual and physical team, but at the same time, it is a different concept from what has been used during the COVID-19 pandemic. As we can see from the definition, there is a geographical, organizational and time distance from the members of the group. As we previously defined, nowadays companies increasingly need to implement flexibility internally, both in terms of the individual and in terms of the group. In fact, the virtual team was created to satisfy certain specific needs of certain customers, thus sometimes companies decide to unite people located in different places to deal with the problem. Trying to make a practical and quick example, we think of a team of six people, where they are divided into two Americans, two Europeans and two Asians. It is easy to understand how highly complex it is to be able to develop such a project, and the fundamental means for the success of this project are the availability of adequate IT resources, flexibility and organization by the six team members.

Before delving into the main characteristics of virtual teams and trying to apply these concepts to the pandemic faced by companies in recent months, it is important to emphasize how the members of the virtual teams are essential for the team to be effective and efficient. On the one hand, members must be independent, autonomous and have an innate ability on how to organize their work; on the other hand, these members must work interdependently, trust others and be able to resolve any conflicts virtually (Suchan et Hayzak, 2001). Nowadays it is important to understand well and exploit a system like virtual teams, because besides the fact of having benefits such as increasing flexibility, it can reserve big problems such as lack of trust, means of communication or organizational problems that can cause serious damage to the company.

Figure 16 – Simple systems model
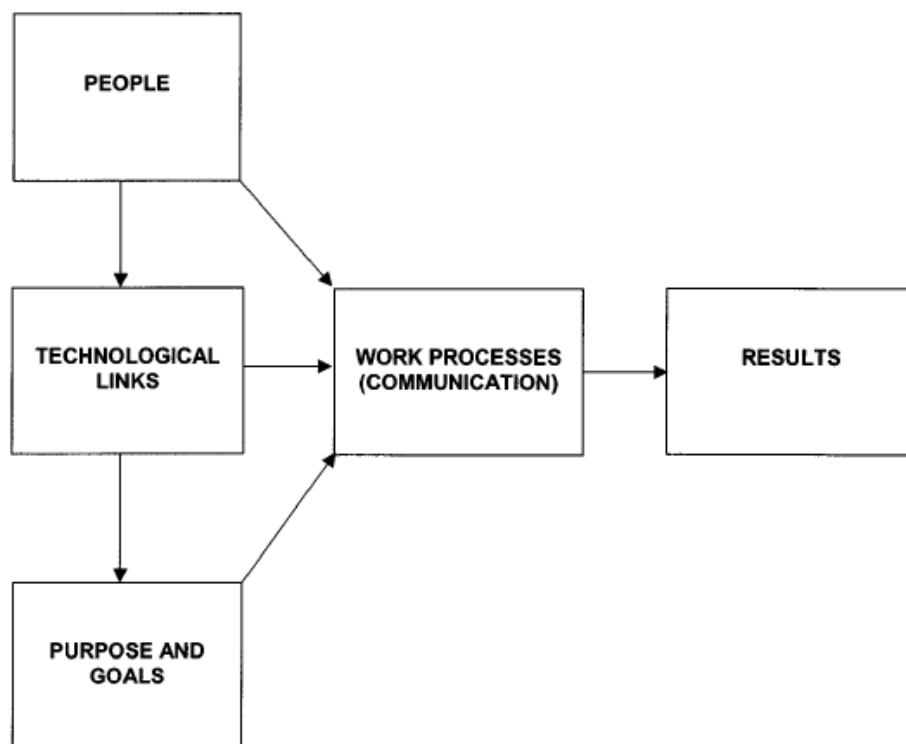
Source: Jim Suchan et Greg Hayzak (2001, p.176), The communication characteristics of
virtual teams: a case study

The above Figure 16 is able to define how a virtual team works and what are its fundamental elements. People form the team, in order to interact they need technological means and objectives, they communicate with each other to be able to reach the goals and finally they get the final result. Furthermore, it must be added the possibility for top management to introduce reward systems for the results to be achieved, but it is important to define a reward at the group level rather than the individual level, otherwise there is the risk of compromising cooperation within the group (Suchan et Hayzak, 2001).

As Suchan et Hayzak (2001) say, in order to make the most of virtual teams, project leaders usually look for people who:

- are able to work without constant supervision
- are able to work independently and able to concentrate on ongoing projects
- are capable of communicating, both oral and written way
- have an entrepreneurial spirit and are capable of facing new technological challenges

It is certainly not easy to find people with all the required skills, but the greatest risk of virtual teams lies in the sharing of information or in the isolation by some people, elements that are not admissible if you communicate only in a virtual way.

3.3   MAIN CHARACTERISTICS OF VIRTUAL TEAMS

Going ahead and trying to focus on the characteristics of a virtual team, in accordance with the life cycle model generated by Saunders (2000) and as we can see from Figure 17, virtual teams are composed of four categories: inputs, socio-emotional processes, task processes and outputs.

Figure 17 – Focus of early virtual team research
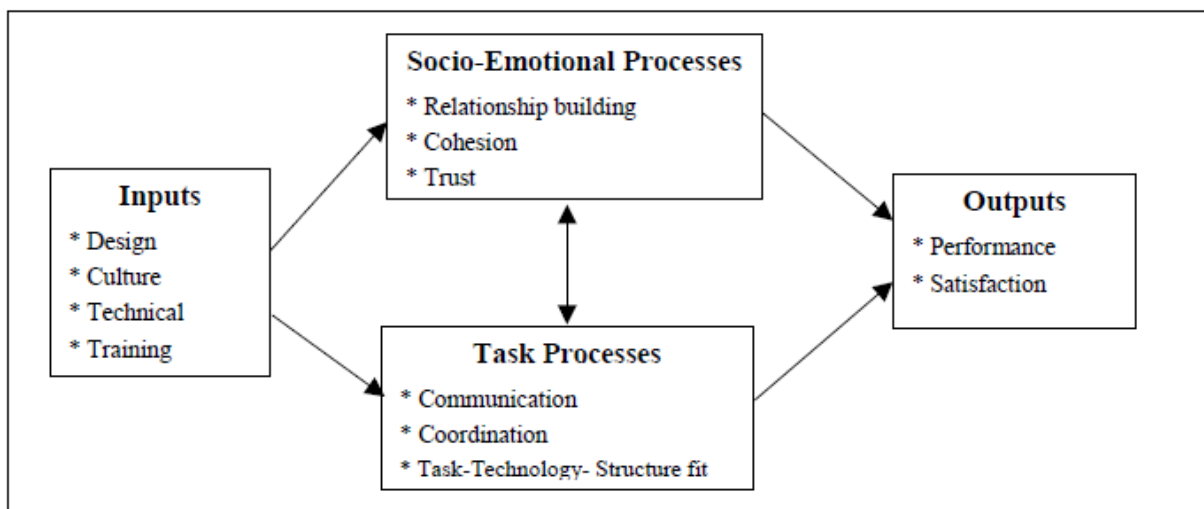
Source: Powell et al. (2004, p.8), Virtual teams: a review of current literature and directions for future research

3.3.1   INPUTS

As Powell et al. (2004, p.8) says, "Inputs represent the design and composition characteristics of the virtual team and the endowment of resources, skills, and abilities with which the team begins its work."

As we can see from Figure 17, inputs are composed of design, culture, technical expertise and training. This category, as of course also the others, is fundamental for every virtual team, as the team's development born from it and here we begin to define the first traits of virtual teams.

Design

In this category, the first concept refers to design: this component, together with the way the team decides to interact, is particularly important in the early stages of the team, since from the beginning we try to develop a common language within the team, so that all members can understand and share the same language with each other (Powell et al., 2004). There are various types of designs, such as the number of face-to-face interactions, the planning of activities, the tools to be used to communicate, how to communicate between team members, the definition of objectives, standards, values and much more. Each team can use a different type of design, always modified according to the needs of the company and the personalities of the team members.

In relation to the design of the virtual teams, some researches carried out by DeMeyer (1991), Galegher and Kraut (1994) have highlighted how traditional teams manage to perform better than their virtual "competitor" in relation to the exchange of information and greater organizational efficiency. Especially a few years ago, think about how it was actually more difficult to communicate virtually rather than physically, partly because of technological limits, partly due to the nature of the human being, partly also out of habit, but I will analyse this better in the following paragraphs.

Given the result obtained by the economists mentioned above, other researchers have tried to solve the problem through interventions in order to bring virtual teams to "compete" with traditional teams. Some means such as team building exercises (Kaiser et al., 2000), the definition of shared norms (Sarker et al., 2001; Suchan & Hayzak, 2001), and the definition of a well-defined structure (Kaiser et al., 2000), would lead to the success of virtual teams. If it is possible, especially in the initial phases of the project, or in the planning phase, we should try to carry out periodic face-to-face meetings and use electronic communications to coordinate simpler tasks such as the schedule, results, documentation etc. (DeMeyer, 1991).

As mentioned by Bordia (1997), virtual communication compared to traditional means can be longer and more confusing, thus leading to misunderstandings among group members. A fundamental part of this problem can be attributed to the lack of physicality as well as verbal response through expressions of the body that the human being is used to doing during conversations. A discussion or dialogue carried out virtually have the only result of facial

expression, making it more difficult for both parties to figure out in the proper way the situation they are in, whether a consensus situation or a dissent situation. At the beginning of the project, the face-to-face meetings also allow to increase the project definition (Ramesh & Dennis, 2002), to foster socialization, trust, and respect among team members (Maznevski & Chudoba, 2001; Robey et al., 2000; Suchan & Hayzak, 2001), and to enhance the effectiveness of subsequent electronic communication (Krumpel, 2000; Majchrzak et al., 2000a). It is therefore important to try to define a design that makes communication between the members of the group easier, defining a common language shared by all, so as to reduce possible misunderstandings that would lead to less efficiency and a possible project failure.

Cultural differences

Connecting to the definition of virtual team, and therefore referring mainly to geographical distance, very often there is a close correlation between virtual team and cultural differences. As previously mentioned, virtual teams born with the idea of satisfying a specific need from consumers, therefore it is easy for experts from different geographical areas and cultures to be part of the team. If on the one hand cultural differences can bring innovation and new ideas, on the other it can also bring difficulties related to communication and understanding. In addition, often even within the same country there can be totally different behaviours and habits, just think of the countless subcultures that we can find in Italy. In order to limit the problem related to different cultures, one option is to try to understand and accept the differences, trying to take into account the positive sides of the differences and put aside the negative sides in order to carry on and conclude the project (Robey et al., 2000; Sarker & Sahay, 2002).

Technical expertise

The use and knowledge of new technologies by team members is a significant part of their satisfaction and performance. In fact, when some people have technical gaps or fail to solve some problems related to the technology used, they tend to have a negative impact on their performance and overall experience with the team (Kayworth & Leidner, 2000; van Ryssen & Godar, 2000). In a situation such as that which has arisen in recent months due to COVID-19, this was perhaps the biggest problem faced by companies. From one day to the next, all the employees found themselves at home, some with their own computer, others with the company computer, but in fact without the constant presence of other people with whom they could quickly solve the problem. Everything was more difficult for some people who were closed at home, causing lower performance and lower productivity.

Training

Last but not least, training is essential to bring all team members to the same level. As the results obtained by Kaiser et al. (2000) and van Ryssen & Godar (2000) say, if consistent training is performed for all team members, this will lead to an increase in team performance, while if members of the team have a different experience and different levels of knowledge of some software you will be more likely to experience conflicts or problems at the team level. It is important not to underestimate training, as it promotes cohesiveness, trust, teamwork and satisfaction (Tan et al., 2000; Warkentin & Beranek, 1999).

3.3.2   SOCIO-EMOTIONAL PROCESSES

As we can see from Figure 17 and how it is taken up by several authors, the key points of the socio-emotional process are relationship building, cohesion and trust, which foster the achievement of a certain team effectiveness, but at the same time in the case of virtual teams they are more difficult to reach compared to traditional teams (Alexander, 2000; Kezsbom, 2000; Lipnack & Stamps, 2000; Solomon, 2001; in Powell et al., 2004).

The fact of having to interact and manage several members within the team in a virtual way causes many problems for efficiency and the result to be achieved. Taking a football team as an example, although it is not an example of a virtual team, when there is not the right relationship between the players and the coach, the team usually tends not to perform well, even if it is made up of eleven champions. This conflict from the team members causes a poor relationship between them, a poor cohesion and little trust in their teammates. On the other hand, when the team, therefore players and coaches, follow the same principles and speak the same language, even if it is not made up of eleven champions, they can often achieve results that go well beyond expectations.

Trying to shift this concept to a team in the company, the difficulty that arises in wanting to achieve a goal without the presence of cohesion and trust, becomes almost impossible, especially in the case of virtual teams, as communicating in a virtual way causes from the beginning a certain emotional detachment compared to the traditional experience of face-to-face meetings.

Relationship building

Virtual teams tend to have a much more task-focus approach than social-focus, mostly because of the distance between people. Despite this, in the long term, virtual teams still tend to decrease their dedication to the task focus (Chidambaram & Bostrom, 1993; Walther, 1995; Walther &

Burgoon, 1992; in Powell et al., 2004). Having to communicate only through electronic means and not being able to meet physically is an important barrier for people, who tend to focus more on their jobs and goals rather than building their own social network. Consequently, when you create a virtual team and you want to try to encourage the trust building between team members, at the beginning of the project face-to-face meetings are the best solution to try to form interpersonal relationship, promoting better performance in the long period (Maznevski & Chudoba, 2001; Robey et al., 2000; Robey et al., 2000; Kaiser et al., 2000; in Powell et al., 2004). The ability to relationship building and socialize also depends on the culture of the members. Taking an experiment given by van Ryssen & Godar (2000), they noticed how Belgian students wanted to try to socialize and start building relationships with their classmates right away, while American students preferred to wait for the end of the project.

In the case of the pandemic faced by the companies, they had not the possibility of conducting face-to-face meetings, and this was initially a big problem for all, as no one had never faced such a big problem. In this case, trying to see the glass half full, the luck of the companies was the creation of virtual teams with people that already knew each other and had the opportunity to physically relate face-to-face inside the company. This was a big advantage in the management of the team and the tasks, even if the part related to keep all the members up to date with the work, sharing the work done, and giving greater autonomy to the staff was something new for the business managers. In some companies, more restrictive policies have been adopted, such as one-two meetings per day to keep up to date on the work done; other companies have introduced "coffee breaks" where the staff connected virtually to be able to share emotions and moments lived during the quarantine. Such a complex moment is difficult to manage, but what is important is to try to share emotions and experiences in order to feel involved in the team, thus stimulating relationship building. A detail arose from the research carried out by Savicki, Kelley and Lingenfeller (1996), as according to their research the virtual teams made up of women only share much more social information between them than the virtual teams made up of men only or mixed gender.

Cohesion

Cohesion is a very important element for the development and success of a team. As mentioned above and taking up the concept, a football team composed of eleven players (not champions), if they have a high cohesion they can achieve important results, even if no one would have ever bet on it. "Cohesion is an important aspect of the virtual team. It has been associated with better performance and greater satisfaction" (Powell et al., 2004, p.10). Various studies on cohesion have been carried out, both in traditional and virtual teams, and some of them have discovered

how initially virtual teams have less cohesion than traditional teams, but in the long period virtual teams share enough information to be able to increase and strengthen one's cohesion (Chidambaram, 1996; Chidambaram & Bostrom, 1993; Chidambaram et al., 1990-1991; Walther, 1995; in Powell et al., 2004).

Trust

Trust is a fundamental element when working in traditional teams, and its importance increases even more when we talk about virtual teams. In the case of the workplace, when a person (trustor) trusts another person (trustee) it means that he will be less afraid that the latter did a job lower than the trustor's expectations, in some cases implying less control of the work done by different members. Trusting your teammates is important because a healthy climate is generated within the team, where everyone feels an integral part and everyone feels they can say their thoughts to others, in any situation that can be a discussion, a reflection, an analysis etc.

When a person feels he / she has the teammates' trust, they tend to perform better and be a little more confident in their abilities. At the same time, trusting other people, especially in the case of virtual teams, is complicated because it is difficult for the human being to trust in a person who he / she has never physically met in his life (McDonough et al., 2001). In this case, the scholars developed the research considering people who, as the definition of virtual team says, are geographically or temporally located in different positions of the globe. In the case of coronavirus, however, fortunately in most cases people already knew each other and had already established a relationship of trust between them.

Trying to link this short-term situation to the research carried out, when the teams have a short duration, they are often able to immediately establish high trust, by exploiting the application of the swift trust model rather than the traditional model (Jarvenpaa et al., 1998; Jarvenpaa & Leidner, 1999). When virtual teams are short-term, this causes high confidence from the early stages of the project, "as well as predictable communication patterns, substantial feedback, positive leadership, enthusiasm, and the ability to cope with technical uncertainty" (Jarvenpaa & Leidner, 1999; as cited in Powell et al., 2004, p.10). From this we can understand how the trust between teammates is fundamental and can lead to excellent results, at the same time it must not be a process generated only by team members, but it must also be favoured by some actions established by the project manager.

3.3.3   TASK PROCESSES

"Task processes are the processes that occur as team members work together to accomplish a task or goal" (Powell et al., 2004, p.11). The main categories that make up the third area of Figure 17 are communication, coordination and task-technology-structure fit.

Communication

When we talk about teams, whether traditional or virtual, we mention communication and how it is fundamental to coordinate, manage and achieve objectives. A team made up of excellent people at the academic level but with moderate or low interpersonal skills may have difficulties in achieving what has been set as a goal. Many researchers and many articles refer to how important communication is, also underlining the importance of creating a team of excellent communicators, using the right technology to promote the right communication and trying to understand what the difficulties generated by the environment may be virtual (Johansson et al., 1999; Lurey & Raisinghani, 2001). Quoting Hulnick to better understand the importance of communication: "if technology is the foundation of the virtual business relationship, communication is the cement" (2000, p. 33).

Clearly when we talk about communication it is easy to think how, in the comparison between face-to-face meetings and virtual meetings, in the first case it is much easier to develop communication, despite cultural, personal, etc. differences. If, on the other hand, we try to understand some of the problems related to communication within virtual teams, the difficulty generated by the use of technological communication means generates problems such as the delay in sending an answer, the lack of a common general framework by all team members, possible problems of interpretation of written messages, and problems of participation in meetings remotely (Crampton, 20001; Mark, 2001). If we add to this the lack of non-verbal communication, we understand how this is a central problem for virtual teams and their success (Sproull & Kiesler, 1991).

Some successful companies have found that communication is the basis of success, therefore the company has decided to create and encourage communication through reward systems in order to foster a common culture in sharing information (Suchan & Hayzak, 2001). Instead, other companies have noted that not only communication between team members is important, but there must be something more, such as the discussion of what is shared by all team members, as well as the predictability of communication. This allows the team to get feedback from members, and this feedback generates more confidence and improves team performance (Jarvenpaa et al., 1998; Jarvenpaa & Leidner, 1999; Kayworth & Leidner, 2000; Maznevski &

Chudoba, 2001). On the contrary, as the studies of Johansson et al. (1999) say, when there is the presence of unpredictable communication, the team achieves less efficiency. The fact that someone does not answer questions for a certain period of time or that they forget to communicate their absence to other members generates a lesser chance of success (Crampton, 2001; Sarker & Sahay, 2002; van Ryssen & Godar, 2000).

As argued in the relationship building paragraph, also in terms of communication it has been found that a team composed only of women communicates more than a team composed only of men or mixed gender (Savicki et al., 1996).

Coordination

Let's start with the definition provided by Jim Cheng (1983), who defines: "Coordination represents the degree of functional articulation and unity of effort between different organizational parts and the extent to which the work activities of team members are logically consistent and coherent" (Powell et al., 2004, p.12).

This definition allows us to analyse the coordination from two main points of view: the first point refers to the coordination of the different units within the organization; the second point refers to the organization of different members within a team. The organization of different units, which could be divisions, functions, or projects, is often defined by the Board of Directors together with first-line managers, so as to all pursue the same objective, defining strategy, positioning and what can refer to the strategic part of the company.

Comparing the virtual team to the traditional team, it is by itself not only referring to the communication between the team members, but an important element at the basis of its functioning consists in its coordination. Let's take the example carried out previously, where the team is made up of two Americans, two Europeans and two Asians: they will have totally different time zones, in addition to the other problems mentioned above. The time zone problem generates a coordination problem, since when an American starts working and needs information from European members, the latter will be sleeping because of the time zone. It is therefore important to establish collaboration rules and regulations to encourage team development in a consistent and coherent way, so as to allow all members to be able to make their contribution at the maximum of their abilities (Sarker et al., 2001).

Also in this case, the possibility of carrying out face-to-face meetings periodically helps to coordinate the team's activities more efficiently (Maznevski & Chudoba, 2001). When, on the other hand, there is no possibility of traditional meetings, the researchers recommend

developing a coordination protocol to encourage and increase coordination and collaboration between the members (Malhotra et al., 2001; Tan et al., 2000; Warkentin & Beranek, 1999).

Task-Technology-Structure Fit

So far the main concepts have been in relation to people and their personalities, as well as their ability to organize and adapt to other team members. It is important, however, to introduce another concept, that is the technical part of the firm, because if it is true that a team is made up of the social part, namely people, it is also true that, as we have previously defined, a team is also composed of the technical part, in this case the technology used to allow members to relate and share information.

Through the previous paragraphs we understood the importance of face-to-face meetings to help teams organize themselves better, but also choosing the right technology for the team is an important step. Some research confirms that the choice of the technology to be used depends on the preferences of individuals, on the preferences of individuals in relation to some software rather than others, on the simplicity of use and on how much information is needed to be able to use a new technology (Hollingshead et al., 1993; Robey et al., 2000).

For example, it has been discovered that face-to-face meetings are much more useful and used to solve ambiguous, complex issues or to solve coordination problems. On the contrary, virtual communications are mainly used for routine actions such as resource control, monitoring of some results, and so on and so forth (Majchrzak et al., 2000a). A positive factor for the most efficient virtual teams is their ability to adapt to new technologies and try to find the right one that allows them to complete the required task (Maznevski & Chudoba, 2001). To this we can add the fact that members of a virtual team must not only adapt to technology, and therefore be able to use it, but they must be able to adapt also to the organizational environment and team structure (Majchrzak et al ., 2000b; Qureshi & Vogel, 2001).

3.3.4   OUTPUTS

The outputs category is the fourth and last, and it refers to the final result or performance to which the team aims to achieve (Powell et al., 2004). In this case, two main components were analysed: performance, which includes decision quality, the number of ideas generated, time spent, etc; satisfaction, that refers to the happiness of the members both in the relationship with other people and in achieving the goal (Powell et al., 2004).

As regards performance, several studies have compared the difference in performance between virtual teams and traditional teams, some highlighting a greater effectiveness for virtual teams

(Sharda et al., 1988), but the majority has shown that there is no substantial difference between the two types of teams (Burke & Aytes, 1998; Burke & Chidambaram, 1996; Galegher & Kraut, 1994; Lind, 1999).

What many studies have found is the fact that to ensure success for virtual teams the main important factors have been training (Kaiser et al., 2000; Tan et al., 2000), strategy / goal setting (Kaiser et al., 2000; Malhotra et al., 2001); developing shared language (Majchrzak et al., 2000a), team building (Kaiser et al., 2000), team cohesiveness (Maznevski & Chudoba, 2001), communication (Kayworth & Leidner, 2000; Maznevski & Chudoba, 2001; Suchan & Hayzak ,2001), coordination and commitment of the team (Maznevski & Chudoba, 2001), the appropriate task-technology fit (Malhotra et al., 2001; Maznevski & Chudoba, 2001), and competitive and collaborative conflict behaviours (Montoya-Weiss et al., 1999).

Satisfaction is the second point analysed by the research, and even here there were no differences between the two types of teams (Archer, 1990), while other researchers have found greater satisfaction from members of traditional teams (Warkentin et al., 1997). Regardless of working according to traditional or virtual methods, satisfaction is a fundamental element for the worker. A worker satisfied with his job and his group will have a better performance, thus increasing his help towards others, and he or she will have a less desire to leave his job, thus remaining an important resource within the company.

The deepening of virtual teams allows us to understand how we must not only think about taking a tool and make it available to people, but we must think about everything that represents inputs, so the resources, skills and abilities available to the company, understand its potential and weaknesses and try to introduce a system suitable for the organization, so that everyone can make the most of their skills, for the benefit of all. Communication and trust within the virtual team are two fundamental components to achieve a level of satisfaction and performance that is adequate and comparable to the results obtained at the workplace. A lack in building a socio-emotional relationship or a lack from an organizational point of view, such as the difficulty in communicating or coordinating activities, would imply a very low effectiveness of the tool.

In the next chapter we will try to understand how a consulting firm faced the virtual team problem during the pandemic through a questionnaire, considering also the theory of complex adaptive systems previously analysed.

CHAPTER 4

EMPIRICAL ANALYSIS

4.1   INTRODUCTION

In the previous chapters we first defined the problems and consequences generated by a pandemic like COVID-19, through an analysis of both consumer and business behaviour during the lockdown, as well as an overview of pre- and post-COVID-19 trends. Secondly, through an in-depth analysis of complex adaptive systems and the virtual team, we tried to extract some features in order to put them into practice in a problem never faced before.

The literature review on complex adaptive systems has shown us how it is possible to move from natural sciences to economic sciences while maintaining the same characteristics, adapting them to the context. The theories related to the virtual team have shown which are the most critical aspects and which, if considered, allow to have very similar results regardless of the work done in the office or through the use of technological means. In recent months the virus has certainly had a negative impact on the everyday life of people and companies, but on the other hand the features seen in complex adaptive systems have made it clear that the pandemic should not only be seen as a source of disruption for companies, but it can also be seen as a source of opportunity and change. Think of the "co-evolution", a feature triggered by the virus and through which companies have influenced each other in using more and more new technological systems, as could be the use of the cloud, which allow you to always have the documents on which you want to work. At the same time, the fact of being forced to stay at home for a certain number of months has triggered a certain understanding of the technological means we have at our disposal, allowing us to make the most of them, but we will see this better later through the questionnaire carried out.

The main objective of this chapter will be to try to obtain the information necessary to confirm or contradict the statements provided by the theories set out in the previous chapters.

As far as the theory of complex adaptive systems is concerned, being a theory mainly studied and shifted to the economic world only in the last decades, the objective is to try to understand if the majority of the characteristics previously analysed actually have an economic feedback. In the case studied so far, it consists therefore in being able to demonstrate how it is possible to use this theory also with regard to the strategy and organization of a society, and therefore not only to cases related to the natural sciences.

Regarding the virtual team theory, it will be my interest to understand if there was actually any positive or negative feedback through the use of tools or applications during the lockdown period, which means trying to compare the theory analysed with the responses obtained. The organization of work in virtual team changes drastically some fundamental elements of the human being, such as body language and interaction with other people, elements that are taken for granted when you are all present at the workplace, but that start to decrease when you work from home.

In the following paragraph I will give a brief description of the company in which I am currently doing an internship, that is Sinloc - Sistema Iniziative Locali SpA (from now on it will be abbreviated to "Sinloc" for simplicity), in order to give the reader a better understanding of the area in which I decided to apply the theories previously described.

4.2   SINLOC – SISTEMA INIZIATIVE LOCALI SPA

Sinloc is a consulting and investment company that operates throughout Italy and is active in Europe on EU projects. It promotes local development with consultancy and feasibility studies, with direct investments in Public Private Partnership projects and promoting the access and effective use of European funds, paying great attention to economic-financial, social and environmental sustainability (SINLOC, 2020).

Sinloc has been operating since the late '90s, only since 2006 it has started an intense path of development and corporate and business focus, achieving significant growth in many areas such as the number and quality of projects carried out, the geographical areas of intervention, risk management and management systems and procedures, as well as commercial and operational relations and reputation created (SINLOC, 2020). Below are some of the results obtained:

Table 2 – Sinloc Relevant Data

	2006	2019
Members Foundations	3	10
Equity	47	44,3
Project developed	Over 500	
Core investments	1	17
Technical advisor of investment vehicles	0	7
Revenues	1,6	5,6
People	7	39

Source: Sinloc.com

4.3   METHODS

As the thesis focuses on a current and still ongoing topic, in which there are many suggestions on how to operate by large companies such as Boston Consulting Group, McKinsey and many others, there is still no precise data on the methods used, besides the fact that there is not yet a best practice applicable to all companies.

This phenomenon could be analysed from different points of view, as the pandemic has affected different sectors in different ways. If we consider the manufacturing sector, clearly during the lockdown there was a total collapse of the sector due to lack of production by companies. At the same time, if we consider a consulting firm, as Sinloc can be, smart working was the ideal system to be able to continue the activities and achieve significant results during the pandemic. This is a great privilege for a company, but we must not forget how difficult it could have been to transform habits based on face-to-face interactions to the complete absence of everything related to body language and interaction.

There are two main reasons why Sinloc was chosen as a study analysis:

1. The company, as shown in Table 2, is made up of 39 people, so it represents a small company located in the Padua area. I believe that in part this has very different aspects and perhaps more interesting than the possible analysis of large companies such as Ernst & Young, Deloitte, PwC and KPMG, as these companies operate internationally and have integrated technological systems since before the pandemic.
2. As mentioned above, doing the internship within this company makes me a privileged actor and allows me a privileged access to information, firstly by being able to live day after day the development of some issues in first person, secondly by having direct contact with the people who have lived the experience and have the opportunity to witness the benefits and the critical issues had in recent months.

It is also important to mention the methodological approach used in this thesis and therefore what is suggested by Yin (2003), as he defines the case study as "*an empirical inquiry that*

- *investigates a contemporary phenomenon in depth and within its real-life context, especially when*
- *the boundaries between phenomenon and context are not clearly evident."* (Yin, 2003, p.13)

He suggests using the case study because it allows to better understand a phenomenon that is happening during our days and this thought falls perfectly with what is happening today, i.e. to analyse a current phenomenon (companies' reaction) to the pandemic generated by COVID-19.

As mentioned by Yin (2003), there are 5 fundamental parts to define a case study:

1. Case study's questions: very important are the questions carried out through "how", "why" and "what", and this is what has been done in order to understand the reaction made by the company;
2. Case study's propositions: the questions make you understand how they relate to the theories examined in the previous chapters and allow you to understand what you are really interested in, directing research on certain actions or processes;
3. Case study's unit of analysis: usually the unit of analysis is an individual, but it can also be a company. Once it was understood that individuals could be the best unit of analysis, the questionnaire was therefore addressed to three different individuals within the company, identifying different needs and reactions to COVID-19, both in strategic and operational terms, taking into account the main features of complex adaptive systems and virtual teams;
4. The link between data and propositions;
5. How the data is interpreted: it is important to interpret the data obtained, starting to justify and form future studies.

In order to be able to argue and obtain the right information in this case study, it was very important to immediately identify what could be the most appropriate elements to analyse Sinloc's reaction to the pandemic in a better way, categorizing them as follows:

- Actions of the company internally, regarding the social system
- Actions of the company internally, regarding the technical system
- Coupling between the social and technical system
- Coupling between the company and the eco-system
- Feedback from people within the company, to analyse the main difficulties faced and to figure out if their actions was in line with theories analysed in the previous chapters

The information was then collected through direct interviews to some people in the company, specifically to the human resources manager to obtain data related to a more general picture of the organization of the company during the pandemic, as well as some more specific questions related to the operations submitted to two junior profiles who represent interesting cases to be analysed as they were hired during the pandemic, without having ever interacted with other

colleagues within the company. All the questions are summarized in Appendix 1 and the people interviewed in table 3.3.

Table 3 - Collected data and use in analysis

Data types (dates)	Amount and Sources	Use in the Analysis	List of the Interviewees and their company's role
Dedicated interviews (05 Oct. – 10 Oct. 2020)	3 Interviews for a total amount of 8 hours	To gather information about how the company faced the pandemic	1 HR Manager 1 Junior Consultant working within the Public Administration Team 1 Junior Consultant working within the Investments Team
Informal conversation (01 Sep – 10 Oct. 2020)	Conversation with colleagues during breaks	To gather some information related to their feelings about working remotely	Colleagues within Sinloc
Direct observation (28 July – 04 Nov. 2020)	Possibility to work within the company every day	Personally involved during the post pandemic phase	
Internal documents (August – Oct. 2020)	2 documents	To gather information about the internal COVID-19 policy	

Source: own elaboration

4.4 QUESTIONNAIRE – HUMAN RESOURCES MANAGER

As mentioned in the abstract, how many things have changed in these months because of COVID? How have companies responded to this? Through the questionnaire I will try to give an answer to these questions, as well as try to confirm or refute the theses analysed so far. Before each question I will try to make a brief introduction to what will be asked, taking up the concept discussed in the theoretical chapter, and then draw final conclusions in the next chapter.

Going in order and respecting the sequence of the characteristics examined in the chapter on complex adaptive systems, the first characteristic referred to the "connectivity & interdependence", to which you can relate the subgroup "degrees of connectivity". In this case the principle of these characteristics mentioned how members within the same team have a high degree of connection, while members of different teams generally have a lower degree, but there could be cross-team projects where certain people work together despite the alleged "distance" between them.

Q1: How was the work organized within the company? More precisely, how was work organized within the same team, between different teams and with external clients? Was the interaction between all components within the company somehow stimulated?

Figure 18 – Teams in Sinloc
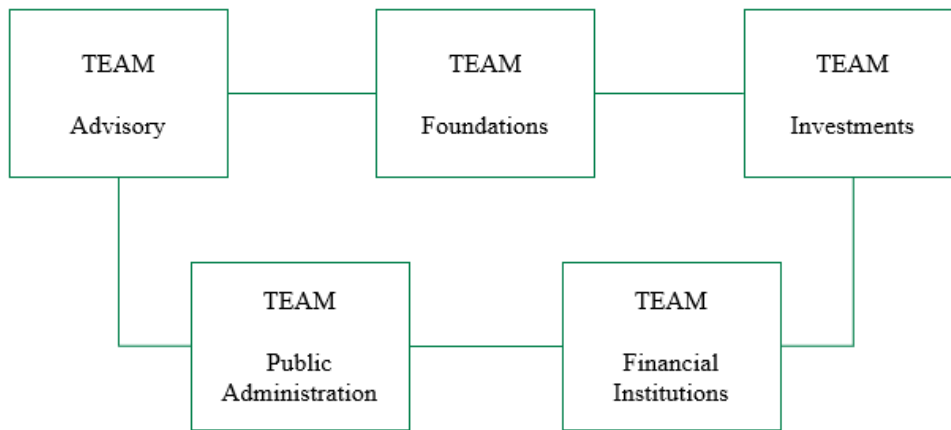
Prior to the COVID-19 related health emergency the company already had significant and focused smart working experiences, in fact the tool was used on specific people with limited amount of time.

Like all other companies, Sinloc suddenly found itself having to manage all activities remotely. From the regulatory point of view, in a very short time they covered all the resources of the company with a smart working agreement, with some understandable implications given the sudden external event. In an initial phase, in fact, several people continued to prefer to work at the headquarters despite the possibility of staying at home, but then the legislation obliged to switch to the new way of working.

Despite the sudden blockade by the authorities, the company was facilitated by the fact that everyone already had the laptop for company policy, consistently linked to the type of activity that provides business travel and activities at the customer premises for many people: in addition, laptops allow you to be more dynamic and flexible in the work at the headquarters. In addition to this, a good part of the staff owns a company cell phone, so in terms of technological tools the company already had the means to face the pandemic, but without ever exploiting its true potential.

After this brief introduction to better understand the company context, the answer to the questions is that the company had decided to open the company network remotely only to the roles held by team or area managers, i.e. mainly those people at the head of the respective team, so that they could act as a bridge with the staff.

One question arises spontaneously: why hasn't the network been opened to the entire staff? The answer is that there are security profiles that must be taken into account, and open the network to all the staff could expose the company to a higher risk, in terms of privacy and cyber-attacks, in addition to the limited capacity of the current physical server. Currently, however, after the total lockdown, the option of allowing access to all personnel with operational needs is being considered, so as to facilitate the work and the sharing of documents in real time, without the need of intermediation with your supervisor to be able to access the files.

From an organizational point of view, the company tried to keep contact between people as frequently as possible through special staff meetings, i.e. moments in which all the company staff connected by videoconference to discuss a specific topic, with questions and considerations from everyone, and through project presentations, i.e. moments in which generally one or two people present a project completed in previous months. Both means were used to maintain contact between all internal resources and to increase everyone's knowledge and competence.

At the team level, people intensified their contacts through the use of software such as Skype, the famous messaging software that allows you to keep in touch with colleagues but, above all, allows you to share the screen with your interlocutor, making it exponentially easier to solve a problem, and GoToMeeting, a service that allows online video conferencing and is often used to get in touch with the environment outside the company.

At cross-team activity levels, the same provisions that were used at the headquarter have been maintained, therefore a direct interaction between the different components of the project through the above-mentioned platforms.

The interaction between all members was therefore limited to staff meetings or presentations of projects carried out, but occasions such as a "virtual coffee break" was never adopted by the company, an idea certainly taken into consideration but it had not seemed very effective from a comparison with other companies that have activated it. Although the latter was an idea read several times on the websites of companies such as Gartner or Boston Consulting Group, it was not implemented in Sinloc, at the same time they continued with ad hoc occasions called "ADChat", moments of free sharing for those who participated but always with a specific theme of reference, such as "Analysis of a phenomenon through indexes".

As far as the contact with external customers is concerned, it can be said that the relationship with clients has changed, as habits have changed. Of course during the lockdown the relationship was based only on remote interaction, but since it has been reintroduced the

possibility to move around the main idea to make the meetings mainly via telematics has remained. Therefore, the approach to deal with some problems has changed, both internally and externally, because before the COVID-19 a meeting was held at the client's premises without thinking if it could have been done remotely, now people think if the same meeting can be done remotely, making the need for travel less frequent..

At the level of features related to the virtual team, the "design" is taken into account because the interaction modes have been predefined using the tools mentioned above. Both software are very easy to use and no one in the company has had any difficulty in using them, thus being able to maintain constant communication and increase performance thanks to a task-technology-structure fit.

In addition to these features, it is very important to highlight how a certain relationship building is maintained through the organization of ad hoc events such as staff meetings or ADChat, a way to maintain interaction between all members and share, as well as spread, the corporate culture even remotely.

Always linked to the first feature of complex adaptive systems, another question was asked to better understand the interaction between members, but this is also linked to a recurring theme in the theories related to virtual teams, namely the fact that the corporate culture is more difficult to spread, in addition to the fact that virtual teams are considered more task-focus and not social-focus, thus showing a greater attention to their work than building relationships with others.

Q2: Was there interaction with all members of the company or did you interact mainly with members of your team? Also, virtual teams are considered more task-focus than social-focus. Was this problem encountered?

Interactions were certainly more frequent with the project-specific team, but it did not always coincide with a particular person's team, since project teams are defined based on the skills needed for the specific project. Furthermore, during the lockdown, the research and development activity to evaluate new service proposals by Sinloc was greatly increased; for these activities ad hoc operational figures, belonging to different teams, were selected. Thus, the maintenance of the company culture and the sharing of experiences and skills among the staff has been encouraged, even if "hierarchically" from different divisions. It was also highlighted that with the "closest" colleagues, sharing and communication remained intense, because they were those colleagues who contacted each other even just to exchange ideas, to discuss some critical issues, therefore not only in relation to work, but also with regard to personal life aspects.

This shows how at Sinloc the connection between different team members was still high despite the "different hat", thanks to an incentive from the company to cooperate between different teams, thus debunking the typical hierarchical organization and also debunking the fact that virtual teams are more task-focus than social-focus.

Concluded the second question and moving towards the next feature of complex adaptive systems we come across the so-called "co-evolution", that is the influence mutually generated between different systems within the company, where by systems we mean individuals or groups, or the influence generated between the company and the external environment. A clear example of co-evolution is that one previously cited relative to the smart working, in how much the companies have influenced each other in using videoconferences instead of meetings in presence, establishing a mentality more and more oriented towards the use of virtual sharing systems.

As it has been examined in previous chapters, the smart working system can be influence and reason of a different organizational design, risking to impact strongly in the lesser need for space by companies and a greater flexibility and autonomy by people, as well as a more important and consistent technological structure to allow everyone to work from home.

The first question asked in relation to co-evolution was therefore the following:

Q3: How will you deal with smart working and the possible effect on organizational design? Will there be changes or will everything remain the same?

During the staff meetings, the majority of the staff feedback on the use of smart working was positive and they were interested in its implementation. A good part of the people considered it as an effective and productive mode, so the company plans to continue to keep it available and it is evaluating the most appropriate and effective ways to use smart working even after COVID-19.

Although the company has not yet defined the operating mode for post COVID-19 smart working, it will not need new space in the near future, nor will it need to reduce space as a result of the implementation of smart work. Although the company has not yet defined the operating mode for the post COVID-19, it will not need new space in the near future, nor will it need to reduce space as a result of the implementation of smart work. The issue of the reduced need for physical space on site, in relation to a future increase in resources, in relation to the carrying out of some activities in smart work and the resulting savings in structural costs are possible aspects that the company will address in the future.

Currently Sinloc tries to define a predefined day of smart work per organizational unit, a day mainly planned between Tuesday-Wednesday-Thursday, but the choice to work from home is directly up to the team/resource based on the professional effectiveness of the chosen mode and their commitments. The company policy defines a predefined day, but even in this case it is the person who decides whether or not to stay at home on that specific day, as there may be cases where, due to work commitments, it might be more useful to stay at home on a different day (for example, several calls to external clients).

The third main feature to be analysed refers to the "far-from-equilibrium", i.e. the shift by a company from its point of equilibrium due to external events. This feature takes into account multiple aspects such as self-organization, i.e. the ability of the company to respond to the problem in the best way, order and structure, i.e. the creation of a higher-level system compared to the previous one, or the possibility of having multiple solutions in order to adapt to the change generated by the external environment, in this case by the pandemic worldwide.

Together with this feature I decided to connect also the following ones, that is the exploration of new possibilities, the feedback, and the emergency and the creation of a new order. In fact, a company no longer located in its equilibrium point, must find a new one in order to survive and operate in its sector, both testing new strategies and new working tools, besides the feedback obtained by the people working inside.

Q4: What was the biggest emergency during the pandemic and how was the problem solved?

During the lockdown the biggest and most feared operational concern of the company consisted in the critical issues related to the hardware, because it would have been very complex, in some cases impossible, to solve the problems especially with respect to some geographical locations of residence of colleagues outside the province or region. Many people within the company live in Padua or at a limited distance from the city. For these people there was the possibility to go to the office so that the computer technician could check the computer in case the problem was related to the hardware component, instead if the problem affected the software the technician could solve it at a distance. For those living outside the region or province the logistical situation was more complex, so the computer breakage was a major concern, as it would have meant total non-productivity by the afflicted person.

At the organizational level, the company was well organized, also given the already present technological tools by all the staff. One of the most important aspects was the coordination of resources at a distance, an aspect that the Team/Business Unit/Area Managers dealt with the

most. In the case of the financial institutions team, the team in which I'm doing the internship, this problem was managed by setting two team video calls per week: one on Monday morning, for the start of activities and a brief alignment on the activities that would be carried out by each one during the week, and one on Thursday afternoon, to plan the activities of the following week.

Q5: Through the lockdown the company has been moved from its point of equilibrium, having to find a new system to keep the business going. Also based on the information gathered through the first question, what has the company learned and what are the new behaviours?

The key element learned by the company during this long period of pandemic is that smart working is a tool you can work with, while maintaining a good level of communication and productivity. Probably before the spread of the virus the company was not fully aware of the possibility of maintaining high productivity by all, partly because of lack of habit, partly because until a few years ago this tool could be seen in a more negative way. Of course, the instrument is more suitable for some people than others, in fact, within the company many of them have declared to have had an excellent productivity (as well as the presence in the office), others instead have declared to have had a negative experience compared to the typical human contact or a productivity comparable to the on-site one but with a higher effort.

Another element learned from the company, in this case related to a bad practice, refers to the best organization and efficiency of work calendars. During the pandemic it was found that being forced to work remotely by booking a GoToMeeting space, which has fixed start and end times, greatly improved the punctuality of people, never presenting a delay or a declination of an appointment previously undertaken, a problem that occurs occasionally when they work at the office. Probably the idea of keeping a colleague waiting created a great discomfort to the person in question, as if the digital interface forced the individual to be more structured and organized

These considerations can be discussed from the point of view of both theories examined in the previous chapters: from the point of view of complex adaptive systems, we can glimpse the creation of a new order, a very important element following an important crisis like the COVID-19, through a greater efficiency and respect of the commitments undertaken; from the virtual team's point of view, we can see how the use of technological systems within Sinloc has led to greater confidence and satisfaction in terms of compliance with commitments.

Q6: Resuming the question 2 and connecting also to the theory of virtual team, through the virtual interactions have been faced more problems of incomprehension, besides longer and confused communications? If so, how were they solved? Since communication is fundamental

to the success of the team, were problems such as delays in response, lack of a common structure to respect, low participation during meetings?

Longer and more confusing communication problems, as well as delays in responses or other issues due to the use of technological means, were not found. As mentioned earlier, the communication tools that were used (Skype for communication between colleagues and GoToMeeting for interactions with outsiders) were effective, and often the ability of these screen-sharing tools made communication more efficient and focused on the problem to be solved.

The only criticality that was found in reference to the virtual team is the slowness of communication: not being physically in the same space, the possibility to ask a quick question in an impromptu way was missing, and all those questions that in the office would be solved in a few seconds to a more structured communication. In other words, it is difficult to call a colleague to ask a question for a few seconds and you postpone it to a later moment, causing a slight slowdown in operations.

Moving from the characteristic relative to the point of equilibrium and going towards the characteristics relative to the exploration of new possibilities and feedback, the following questions have been asked, which being partly correlated will have a unique answer:

Q7: Not considering the lockdown period (a period in which one was forced to work in smart work) but moving to the next phase in which the return to the office was granted, was there ever any hesitation on the part of the company to implement such a system due to lack of confidence or fear of a reduction in productivity? During lockdown, were there any checks on people's hours worked?

Q8: Given the time of crisis, is there interest in investing in new markets and technologies, what might the cloud be like?

As far as the implementation of smart working is concerned, there has never been any hesitation on the part of the company due to a lack of trust, as the company has the utmost trust in its people. During lockdown all personnel communicated when they had specific needs, indicating the time they would have been " offline" and therefore not working, in addition to what was already provided for in the smart work agreements. Team managers never made reports due to uncooperative behaviour of their team members, showing how people are happy to work and try to meet the deadlines of the projects they are following.

In view of the confidence in its resources, the Company has not activated any type of control regarding the connection and the activities carried out in smart work and has maintained the planning and monitoring tools for the activities already active. The Company is investing in the development of new areas and projects, it has no plans to introduce new resources in the very short term, which will however be necessary if the activities are further developed.

The investment in the cloud server is in the interest of the company, which is evaluating it in terms of costs, but especially in terms of risks. The transition to the cloud has the advantage of digitizing the company even more and creating a certain organizational resilience, while at the same time it implies an increase in IT security to avoid any kind of IT problem, from hacker attack to data loss.

The last questions to the human resources manager refer mainly to the exploration of new possibilities, but also to the emergency that "is the process that creates new order together with self-organization" (Mitleton-Kelly, 2003, p.19).

Q9: Has the company considered hiring staff during lockdown? If there were new entries, what was it like to manage them compared to the presence in the office?

Q10: What are the soft skills required to work as a virtual team?

The company continued to hire what had already been planned before the lockdown, in fact, a junior consultant was inserted just at the beginning of the pandemic and another person to replace maternity the following month. From an operational point of view, the company has tried to provide the person with the available tools, such as the laptop, relying on the people available on the territory, while from an organizational point of view it has always been managed remotely.

A difficulty found certainly refers to the fact of not knowing the personality of the new hired and having to work remotely is more difficult to pass the body language through a webcam. Despite this, however, the people hired have been enthusiastic and willing to play the new role, so they have entered the company with difficulties not so different from those faced in the office.

The result was therefore positive and was mainly due to the desire and passion shown by the individual person, as these characteristics allow you to overcome certain obstacles such as integration within the team.

By linking desire and passion to soft skills, the ability and willingness of the individual to align with other team members quickly becomes increasingly important. As mentioned earlier,

through the virtual team there is a slight slowdown in terms of operations, so it is necessary to be more proactive in being able to solve some issues in an autonomous way, but also determined to have discussions with others if the problem is something beyond one's skills. These soft skills were present even before the lockdown, but now that you are forced to do so you increasingly see the need to possess them by an individual.

Another skill that will be more and more important and considered by companies is the technical attitude, that is the ability of the individual to use the technological tools available, as it helps a lot in terms of operation and sharing.

The combination of resourcefulness, technical aptitude and the transition to an organization by objectives will make the company move towards a mode increasingly linked to what the legislation provides as smart working.

The last question is related only to one of the categories of the virtual team, namely output. The latter includes performance and satisfaction, and according to studies carried out so far "the majority has shown that there is no substantial difference between the two types of teams" (Burke & Aytes, 1998; Burke & Chidambaram, 1996; Galegher & Kraut, 1994; Lind, 1999). It was therefore of interest to me to understand if there were any differences from the office experience.

Q11: In terms of performance and satisfaction, how do you rate smart work compared to working in the office?

In the majority of cases, smart work has been found to be more productive and easier to achieve goals on time, results obtained by the presence of fewer "distractions" compared to the office (e.g. colleagues asking for support, interruptions). However, the incentive and motivation to produce new ideas certainly benefit a lot from the possibility to have face-to-face interaction.

4.5   QUESTIONNAIRE – JUNIOR CONSULTANTS

As mentioned in the previous paragraphs, a more operational questionnaire was submitted to two people hired by the company during the pandemic. In the first case, the person in question carried out all the interviews in attendance, and then was hired in full lockdown; in the second case, instead, the hired person carried out the recruitment steps electronically, from selection to hiring. From this point of view it is certainly a new thing from Sinloc, but probably for most of the companies that hired during the pandemic, and it is therefore interesting to understand what were the feelings and problems experienced directly by the people themselves, source of news and future study analysis.

The questions asked to the two parties are the same so that the procedure can be standardized and possible differences between the experiences can be noted, as the two people work in different teams within the firm. Some questions also pick up on the same questions submitted to the human resources manager, as it may be useful to analyse the point of view of several people for the same problem/question. For simplicity and order, each question will be followed by "1" which is the answer of the first hired person and "2" which is the answer of the second hired person, in order to maintain a certain coherence and to understand more easily the general experience lived by both of them. Being an operational questionnaire, the questions will mainly refer to smart working and the experience lived within the virtual team, as it was not possible to take into account the characteristics of complex adaptive systems. The first question asked is the following:

Q12: How was the work within the team organized? What were the main problems addressed?

1: Within the team, at the operational level, there were no problems in coordinating operations, as the use of Skype made it easier to organize your work with colleagues, and in case of any doubts you could share the screen to solve the problem. From the work point of view the insertion is certainly longer and more difficult than in presence, but also from the point of view of building personal relationships I found more difficulties.

2: At team level, I have spent an intense period of time working alongside the person to be replaced, as well as participating in weekly meetings to get updates on the activities carried out by all members. This interaction was a very useful moment of confrontation, thanks to which I understood at 360° the scope of my team's intervention. Interacting with people I have never seen before is not easy, as it is more difficult to establish the level of trust that distinguishes interpersonal relationships between colleagues. A posteriori, I can say that it has been particularly difficult, often asked for things that require knowledge of certain business mechanisms that are acquired only with experience.

Q13: What are the soft skills required to work in a virtual team? In the absence of some skills, would you consider some training courses to be useful to increase them?

1: It is necessary to have more fellowship and sharing of initiatives and work in progress, allowing everyone to have an overview of the team and the objectives to be achieved, so that they can better perform their tasks. In order to be able to work totally in smart working, it is also necessary to have a good organization, autonomy and, above all, to be more proactive in investigating the issues individually. In the office this is undoubtedly easier, simply because

many things are perceived indirectly. I don't think you need specific courses, rather a greater involvement than what happens in the various teams, to make up for indirect information that does not reach you as can happen in the office.

2: I believe that the soft skills required to work as a virtual team are multiple and it is important to analyse them in an overall perspective. The effectiveness of communication is very important to be able to correctly transmit a message or a specific request related to a job to be done; availability and flexibility are very important to be able to keep up to date with colleagues at different times of the day, as calls or requests can arrive even at unplanned times as can happen in the office, but even more unexpectedly; proactivity is very important because in some circumstances it allows you to be more autonomous and able to solve the problem in an individual way. Seriousness and sense of duty are other characteristics that I consider fundamental to work as a virtual team, as the other members put trust in the work you are doing. If I had to implement a training course to increase some skills, I would recommend a course to try to achieve the greatest possible efficiency through virtual communication.

Q14: If you can compare work integration in presence and smart working, what were the main issues you faced? Have you ever had the feeling of a lack of teamwork or an uncommon corporate culture? In terms of technological equipment, did you feel you had the right tools?

1: Entering a company always involves a period in which to take measures and understand the different personalities and requests of people, as everyone has a different way of working and has a particular attention to certain contexts different from others, but being able to do all this remotely is more difficult. From the human point of view, and therefore understanding how to behave with a colleague, rather than with a client/supplier, takes much more time because a fundamental part such as body language is missing. If we take into consideration the meeting with a client, the initial part of the meetings in which you get to know each other often disappears and you go directly to what interests the parties most, in terms of objectives and resources. This fact can certainly help in the short term, but it loses effectiveness in the long term, when there may be difficulties and the synergy between the parties is fundamental. From the point of view of technological tools the company has provided me with the company computer to be able to work from home, in a more general context I believe however that in the company there is a more appropriate environment, which often at home you cannot have or you have to make at your own expense.

2: As far as the group feeling is concerned, I immediately perceived and appreciated the strong solidarity and spirit of collaboration that distinguishes the relationship between colleagues in

the company, while as regards the company culture, the company stands out for having a strong and widespread culture. When I started working, in fact, I had confirmation of the presence of those values that I had identified and shared during the selection phase, i.e. competence and passion, elements found in all the staff within Sinloc. Regarding the lack of adequate means, I can say that I suffered from the lack of access to the server containing the "data" of the company. In some situations, it would have been very useful to have it and would have increased the efficiency of the individual.

Q15: What are the benefits and problems you have experienced using smart working? In terms of productivity, communication, relationship with colleagues.

1: In general, what smart working lacks is the human component and the exchange of ideas in less official / formal moments, where creativity, collaboration and initiative can be expressed without hesitation, such as during coffee break, lunch break or some simple chat with colleagues from other teams. From the point of view of productivity there are activities that can undoubtedly be done more quickly and effectively from home, i.e. everything that may concern a routine or a data search. On a personal level I have not experienced smart working badly, but it doesn't change much compared to coming to the office if you can't change your working hours much. The real difference is not working from home with office hours (and often well beyond what you do in the office), but being able to manage your time and your work, knowing you have to achieve goals and being able to work even at inappropriate hours.

2: I believe that the ideal solution is to alternatively work remotely and in the company. Working exclusively from home is alienating, while working exclusively in the company is demanding and involves significant disadvantages for both the individual worker and the community (e.g. traffic, pollution, etc.). The ideal balance could be to work two or three days in the company and consequently three or two days at home, based on the tasks covered and your personal situation, such as the distance of the workplace from your home, having children, being away from home, etc.). At home there are fewer distractions and you can work more concentrated, but in the office you can have a direct confrontation with colleagues, which sometimes facilitates and speeds up the work a lot, as well as allowing you to establish a deeper relationship in less formal occasions.

Q16: Was the interaction between all members of the company or only between members of the same team stimulated? Were there "coffee breaks" organized by colleagues?

1: Interaction between colleagues is difficult, because in a video chat you can't create small groups as could happen in presence, but you talk, rightly, one at a time and this involves limited

conversations mainly to operational contexts. If there are many people during the videoconference, this phenomenon is even more accentuated because it becomes a para-didactic situation, where one person speaks and the others listen, limiting the interaction that could be formed between different people.

2: Yes, the company has created numerous moments of meeting (courses, staff meetings, project presentations). Clearly the interaction with the members of your team is stronger, considering that you have to work on common projects. However, the company represents a dynamic context in which the various teams often have to work in synergy with each other and as a result there were many moments of confrontation. I have never participated in "coffee breaks" organized by colleagues.

Q17: The virtual team theory says that through virtual interactions more problems of misunderstanding are faced as well as longer and more confused communications. Have you had this problem? If yes, how was it solved?

1: The misunderstandings are certainly more frequent, especially with regard to those feelings that are transmitted with non-verbal communication, which through remote communication is greatly attenuated. From this point of view, in fact, I had the opportunity to recalibrate many sensations only when I returned to the office. Instead with clients and suppliers I notice a greater detachment, but I would not say that the effectiveness of the meetings is reduced because of the transition from physical to virtual. To resolve this problem would be enough some face-to-face meetings during the initial phase and / or crucial phases, while for subsequent meetings video conferences are an excellent tool to update on the status of work.

2: It depends on the activities that must be carried out and the type of communications that must be made. I think it is necessary to communicate both in person and via email/mobile phone. Many doubts have come to me by doing things, and clearly it is easier to resolve them by having the contact person close to you. Very often I wrote down a list of things to ask at once. Now, with more experience behind me, I clearly wouldn't have the same problems I had in the beginning.

Q18: The theory says that virtual teams are more task-focus than social-focus. Have you noticed this difference between the studio experience and the virtual experience?

1: Absolutely yes.

2: It can be. However, if you have to work in a team, being social focus is an aspect not to be overlooked. I believe that at home you have fewer distractions and this can lead to more task-focus. However, I believe that this is an assessment to be made for each individual.

Q19: The theory says that communication is fundamental for the success of the team: were there problems such as delays in responses, lack of a common structure to respect, low participation during meetings?

1: No, at the organisational level there were no problems within the team, different on the human side.

2: More or less the communication via email was carried out in the same way at home and in the company. The only difference is that in the company you have the possibility to have a direct comparison with people for quick doubts. I found little participation during the meetings.

4.6   THE CASE STUDY ANALYSED AS COMPLEX ADAPTIVE SYSTEMS

As already mentioned in previous chapters, the pandemic is an external phenomenon that involves multiple processes and characteristics of a company, changing its structure especially from an operational point of view. Particularly in the lockdown period, in many cases the complexity has become high, for some companies easier to manage, for others impossible. The analysis of the characteristics of complex adaptive systems in chapter 2 and the answers obtained thanks to the questionnaire allow us to better understand how this theory can be used in the economic field, highlighting all the aspects that have been stimulated and generated in recent months. In this paragraph I will briefly go back to the theoretical concepts of each characteristic, with the relative answer obtained through the questionnaire, in order to understand the company's reaction to COVID-19.

For simplification, below the main features of complex adaptive systems that will be examined in the following paragraphs:

- Connectivity & Interdependence
- Degrees of Connectivity
- Co-evolution
- Dissipative Structures, Far-from-equilibrium & History
- Exploration of the space of possibilities
- Feedback
- Path dependence and increasing returns
- Self-organisation, emergence and the creation of new order

4.6.1 CONNECTIVITY AND INTERDEPENDENCE

As we have observed, this characteristic refers to the complex behaviour resulting from the relationships and connections that exist between different systems, which as mentioned several times refer to individuals, groups or organizations, taking into account the history and personality of each individual. In addition to this we can add how the decision taken by one person influences the decisions taken by other individuals. As we have seen in chapter 2, when we talk about complex adaptive systems and connectivity and interdependence it is important to consider the multidimensionality of the complex systems, therefore the consequent mutual influence that is generated between different dimensions of the same system. These dimensions are made up of humans, and in a human context social, cultural, technical and economic variable are the basis of a relationship and influence each other. To this we can aggregate the second characteristic of complex adaptive systems, that is the "degrees of connectivity", which consider different degrees of connection between different members. Taking the case of a divisional organizational structure, people within the same division will have a greater connection than the relationship that may exist between two members of two different divisions.

From the answers obtained through the questionnaire, both through the answers obtained at a more strategic level by the human resources manager and through the answers obtained at a more operational level, it was actually found that there is influence among the members of the organization, even if in a different way from what was theorized. From this point of view in fact Sinloc represents a company that works mainly on project, trying to stimulate relationships trying to make people from different teams interact, increasing personal relationships and working skills. At the same time it is important to highlight how high connectivity implies high interdependence, and this has been found especially in the management of work by people, who in case of doubt or perplexity did not interact instantly with colleagues, but kept a series of questions to be carried out all together at a later time, thus defining a slowdown in operations.

4.6.2 CO-EVOLUTION

Analysed the first two features of complex adaptive systems, the third feature refers to the co-evolution, which takes up the concept of connectivity but adds an extra phase, namely the fact that, as Mitleton-Kelly says (2003, p.7), "connectivity applies not only to elements within a system but also to related systems within an ecosystem". We are therefore moving from a feature applied only inside the company to one applied also to the external environment related to it, a stimulation for both systems to grow and adapt to something new. From this point of view, as has been pointed out several times, the pandemic has generated a period of total

lockdown for entire nations, thus causing a change in the management of people and activities by organizations. In fact, in these months many organizations have experienced the work remotely in a holistic way, without distinction from person to person. From the answers obtained through the questionnaire it was underlined how the relationship between an organization and its customers / suppliers has changed and evolved. What can be said to have changed in terms of ecosystem, so not only what concerns the individual organization but also everything that is connected to it, is the fact of a greater awareness by all in being able to use technology as a faster, but still effective way to deal with work sessions remotely rather than in presence. In fact, many meetings with external people continue to be held through technological tools instead of business meetings, thus gaining time, flexibility and increasing the environmental impact in a positive way. Most likely, therefore, the meetings held in person will be used only in the initial part of the relationship between the organization and external components, so as to get to know each other and establish a more consistent personal relationship, but for routine work or in the case of intermediate updates will be used more often video conferencing remotely, generating an evolution of the system.

4.6.3 DISSIPATIVE STRUCTURES, FAR-FROM-EQUILIBRIUM & HISTORY

The fourth feature is very important to understand the far-from-equilibrium concept and I think it is important to take the quote provided by Mitleton-Kelly to better analyse the problem.

"The Bénard cell is an example of a physic-chemical dissipative structure. It is made up of two parallel plates and a horizontal liquid layer, such as water. The dimensions of the plates are much larger than the width of the layer of water. When the temperature of the liquid is the same as that of the environment, the cell is at equilibrium and the fluid will tend to a homogeneous state in which all its parts are identical (Nicolis & Prigogine 1989, Prigogine & Stengers 1985). If heat is applied to the bottom plate, and the temperature of the water is greater at the bottom than at the upper surface, at a threshold temperature the fluid becomes unstable. "By applying an external constraint, we do not permit the system to remain at equilibrium" (Nicolis & Prigogine 1989, p10). If we remove the system farther and farther from equilibrium by increasing the temperature differential, suddenly at a critical temperature the liquid performs a bulk movement which is far from random: the fluid is structured in a series of small convection 'cells' known as Bénard cells"

This example allows us to replicate what has happened in recent months, i.e. how an external phenomenon such as the virus has shifted the equilibrium point of each organization. The main

characteristics generated by this natural phenomenon and transferred directly to an organization, in this case Sinloc, are the following:

- Self-organisation: in the case of water molecules, they are arranged in the best possible way to respond to the problem. In the case of Sinloc, the virus has shifted the balance of the company from a purely on-site work to a completely remote work. In order to be able to respond to the problem, the company was lucky to already have the necessary means to be able to work from home, at the same time it had to create a new way of interacting in order to keep all the staff working. So here the use of ad hoc software to be able to interact inside and outside the company, as well as a greater and systematic definition of update meetings within the work team.

- Order and structure: following the chaos generated by the virus, the company has responded to the problem by generating a higher-level system, something that until now had not yet been applied but that in conditions of necessity has led to the results obtained up to that moment, but through better efficiency in terms of operations and mobility by all the staff.

- External constraint or perturbation: as already mentioned in the previous rows, the virus has removed the company from its equilibrium point in a completely unexpected way.

- Unpredictable and uncontrollable: this phenomenon is found in the molecules because you are not able to understand if they will go to the right or to the left, while for the organization is a bit more difficult to apply because, in the case of the pandemic, the only way to respond to the problem was to make all the staff working remotely.

- Several solutions for the same parameter values: even if the only solution was to make the staff operative remotely, once overcome this problem there are many solutions to organize the work inside the company, based on the personality of the different people. To organize the work of a team, for example, multiple software can be used, from the most professional to the simple diaries generated by the calendar, from the use of a constant weekly comparison between all members to the monthly comparison. From this point of view Sinloc has implemented frequent moments of interaction through the presentation of projects, a way to increase the skills of all staff and a way to interact in a period of solitude and isolation.

- Historical dimension: the fact that only one solution is applied with respect to all possible solutions means that there is an influence generated by the past. As we have mentioned in the previous lines, Sinloc has surely been able to take advantage of an already consolidated pre-pandemic system, with all the technological means already

available. The solution fell therefore in a passage of the tasks management from the physical to the virtual one, defining a way to operate analogous to that one carried out at the headquarter.

- Emergent behaviour: it initially begins at the individual level, and then becomes common and consistent to all individuals at the macro-level. In this case, several emerging behaviours can be considered, such as the greater awareness by Sinloc of the efficiency of smart working, which has maintained high productivity despite it had never been used so massively; a greater awareness on the part of workers, who can take advantage of a few more days remotely being able to respond to personal needs, both in terms of flexibility and in terms of mobility; a greater awareness at the ecosystem level, that is the ability to stay up to date on projects without necessarily making business trips.

4.6.4 EXPLORATION OF THE SPACE OF POSSIBILITIES

An event like the pandemic inevitably generates the need for organizations to explore new possibilities. In an increasingly complex environment it is important for organizations to invest and explore new paths, strategies or tools to survive and continue to operate. In Sinloc we can see this expression in the fact that they hired new people during the pandemic, without blocking the selection process due to an external event. Other elements in the testing phase are certainly the expansion in terms of personnel despite the economic difficulty encountered in the industry, in addition to the consideration of a cloud server implementation instead of the physical server in order to increase work efficiency and continue a process of digitization of the company.

4.6.5 FEEDBACK AND PATH DEPENDENCE

As Ilya Prigogine and Isabelle Stengers (1985: xvi) say, "In far-from-equilibrium conditions, non-linear relationships prevail, and a system becomes" inordinately sensitive to external influences. The feedback system is very important to allow an organization to understand whether it is going in the right direction or not, helping it to take corrective action or confirm the measures taken. In the case of Sinloc, the feedback obtained from workers was very positive, as they showed a certain positivity in the constant implementation of smart working, due to high productivity, high efficiency, and high flexibility in time management. At the same time, however, some of them, in this case especially the two people hired during the pandemic, showed a certain difficulty in establishing personal relationships with colleagues or in fully understanding the deliveries to be made, as the interaction through a screen is considered more complex than the face-to-face working relationship. The company is taking into account the

opinions provided, at the same time in the period directly following the lockdown it has returned to pre-pandemic smart working levels, granting only one day of smart working per week. This behaviour is quite ambiguous on the part of the company, as it is generally manifested when negative feedback is obtained and therefore a "failure" of the measures taken, thus outlining a certain path dependence towards what has been consolidated in the past.

4.6.6 SELF-ORGANISATION, EMERGENCE AND THE CREATION OF NEW ORDER

The characteristics previously discussed are very important to better understand complex adaptive systems, at the same time self-organization, emergence and creation of new order are fundamental and have already been briefly examined in paragraph 4.6.3.

If we look for an element common to these three characteristics, one of the main elements is the consideration of individuals not as single elements, but the consideration of them as an entire system, therefore a value greater than the sum of the individual parts. An emergency born during the pandemic was certainly the possible reduction of communication between colleagues at work, as much as the loneliness perceived by workers. In Sinloc instead, a system has been adopted to make all people interact constantly, so that they can be constantly updated and facilitated in working feeling part of the group. Furthermore, "Emergence is the process that creates new order together with self-organization" (Mitleton-Kelly, 2003, p.19). This definition, together with the consideration of the components as a single entity instead of the sum of the single elements, causes an analysis of the organization placed on two different levels, at the same time related to each other: a macroscopic level and a microscopic level. Given the characteristics analysed so far, it is easy to understand how the macroscopic level, therefore the "single entity", is strongly influenced by everything that happens at the microscopic level, thus the interaction and complex behaviour generated by the single parts within the organization. In this, through the questionnaires carried out in Sinloc, it has been strongly outlined a certain trust between people, both from a hierarchical point of view (i.e. from people with the highest roles towards people at lower level), and between people at the same level, as well as a certain willingness to work on the part of everyone, leading society to reach a new order despite the difficulties generated by the pandemic. Through the questionnaires a certain mutual trust was perceived, as well as a certain dedication to work on the part of everyone, leading society to reach a new balance and a new order despite the difficulties generated by the pandemic. Moreover, one of the characteristics of self-organization refers to the existence of two categories: conservative and dissipative, where the first is the category in which society is considered reversible, while the second is considered irreversible. Sinloc can be catalogued as

reversible, since as mentioned in the previous paragraphs it has been noticed a certain tendency to want to recover some of the standards path consolidated in the past. To conclude what concerns self-organization and creation of a new order, a very important sentence is "When learning leads to new behaviours, then the organization can be said to have adapted and evolved" (Mitleton-Kelly, 2003, p.21). From this point of view, surely the company has understood the importance and efficiency of the new system of work, at the same time it is probably still learning it.

4.6.7 RESULTS

The analysis of the characteristics of complex adaptive systems applied to Sinloc allows us to understand how the company reacted to COVID-19. The pandemic is a phenomenon comparable to the crises faced in previous years, such as the fall of the Twin Towers and the consequent stricter aviation security or the spread of SARS with the consequent increase in e-commerce. We have seen how all the characteristics have been transferred to the economic environment, generating a greater awareness by the company using systems that already existed in the market, but were not exploited to their full potential. The connection between people has always been a fundamental element of any company, the important thing is to stimulate it as carried out by Sinloc at a time when the pandemic was trying to remove it completely. The shift of the equilibrium point and the exploration of the space of possibilities have been addressed with a new method of working remotely, while maintaining the main features already used previously. The emergence and creation of new order have been addressed through a shared trust and feedback system across all roles inside the company. It is still too early to define a new standard at global level, but if this crisis will be tackled in the same way as the previous ones, in a couple of years we will see the results of all of this. What we can say is that the theory is relevant to the social sciences and it is useful to examine it to understand what may be the new systems of work or the new corporate structures that are generated by analysing individual characteristics. For example, co-evolution allows us to explore new working methods, through a greater use of technology that influences a company both internally and externally, generating flexibility and a positive environmental impact. In turn, a new working method can imply a new company structure, not only in terms of hierarchy or organizational form, but also in terms of the possibility of being able to expand its staff without the need to expand the space available. In conclusion, the general framework provided by this theory allows us to understand how external events can generate opportunities and difficulties for organizations, which generally aim to reach a point of equilibrium but at the same time must continuously innovate and adapt to what happens in the external environment, regardless of sudden causes such as the virus or

elements introduced by other organizations and replicable internally. From the characteristics of complex adaptive systems it can be seen that, although the theory is generally applied to the natural sciences, its peculiarities can be replicated and transferred to the economic environment.

CHAPTER 5

CONCLUSIONS

5.1   THEORETICAL IMPLICATIONS

The pandemic is still ongoing and companies are dealing with human resources management in a different way, in addition to the tools to be made available to try to work more efficiently. The main objective of the thesis is to understand the possible application of complex adaptive systems to the economic world, as well as to analyse the main characteristics of virtual teams in order to compare them with the results obtained by Sinloc during the lockdown period. The theory related to complex adaptive systems results to be effective also in the economic world in order to analyse more dimensions related to an external phenomenon, such as the connectivity generated, the exploration of new possibilities, creation of new orders etc., thus the majority of the characteristics are all applicable to companies. As happened in the past in relation to previous crises, also in this case the impact that the pandemic has had on the company's organization has generated changes such as: an increase in the use of smart working, a consequent reduction in environmental impact and a greater search for feedback from resources within the company. Therefore, it is very important to analyse this theory not only from the point of view of natural sciences, because by shifting the concepts in the organizational field it is possible to understand what are the most relevant aspects to face a crisis. All the characteristics of complex adaptive systems make somehow reference to individuals, which can be almost considered as the "new trend" for companies. In the last years, as we have had occasion to see in the introduction chapter, it was more and more important the increase of the technology and the artificial intelligence inside the company. With the impact of this pandemic and the questionnaire carried out within Sinloc we understand instead how it is more and more fundamental to focus on the people you have within the company, trying to make them interact at their best and trying to have a good design fit between the social system and the technical system, as increasing only one of the two could generate negative results. The same thing can be said about virtual team, which has shown us the importance not only of the tools available, but the key role of the people who make it up. From this point of view, the majority of the characteristics of virtual teams are confirmed by the questionnaire, as the design of the virtual team suitable for the people within it leads to good results, communication leads to good results and the performance generated by virtual teams is the same as the one generated by traditional teams.

The only feature that differs from the theory refers to the longer and confused communications or misunderstandings, as it was not encountered by people who already knew each other within the company (instead observed by the people hired during the pandemic). Another important component of virtual teams is trust between their members: when the teams have a short duration, they are often able to immediately establish high trust, by exploiting the application of the swift trust model rather than the traditional model (Jarvenpaa et al., 1998; Jarvenpaa & Leidner, 1999). Considering the duration of the total lockdown as a short period, we can say that certainly in Sinloc there has been trust among people, especially generated by a certain corporate culture, inclined to stimulate cross-team work and to organize many moments of sharing. In terms of innovation we can say that the virtual team can certainly be considered for short-term projects, at the same time the pandemic may have generated a greater confidence in this tool and a greater consideration of it also in the long run.

5.2   MANAGERIAL IMPLICATIONS

The feedback obtained from the questionnaire allows us to understand how a small company like Sinloc has leveraged the skills and mutual trust present among all levels of staff, from people covering junior roles to team managers. Although there has been a radical change in the way people have worked, the company has been able to cope with a short-term situation in the best possible way. An easy to use technological equipment, a strong cohesion among the staff and a strong will to achieve the result have allowed to the company to face the pandemic. In Sinloc what will remain structural is a more widespread use of smart working, a tool that has proved effective and efficient in terms of results and communication both internally and externally. At the same time, however, the idea of implementing it in a holistic way is not strong yet, allowing people to stay at home only a one-two days a week, demonstrating a certain path dependence towards processes already established and used in the past. This factor is very important and should be taken into account for the future: for the most disadvantaged people in terms of distance from the workplace smart working can be an excellent tool, both to respond to some personal emergencies and to achieve greater flexibility. For the company, on the other hand, it can be an innovative tool to be able to expand in terms of staff while maintaining the same workspace through an efficient management. Linked to this there is a consequent need for the cloud server and the use of specific software for the organization and personnel management, stimulating a process of digitization by companies. A trend that could arise and be a source of future studies, especially in relation to small businesses, is the greater use of a system defined and measured by objectives, allowing greater flexibility in the general framework of working time but focusing on the results to be achieved. At this point we can

therefore say that companies that find themselves in a situation similar to Sinloc do not necessarily have to find strategies that go beyond their resources, much less think of some magical solution, because often what is needed is already owned. In this case no one would have ever thought they could respond to such a crisis, but people and technology have always been within the company. What I recommend to companies that find themselves in these situations is to try to increase the feeling of integration on the part of the staff, because the inclusion in work generates a positive feeling in people, which leads to a greater connection by the individual to the company as well as greater productivity. From the technical point of view, on the other hand, it has been outlined as very simple and basic communication tools have allowed everyone to be fully operational, allowing to communicate both internally and externally without any problems, generating a new vision of project management with external clients and generating a certain confidence on the part of the workers.

5.3   LIMITATIONS AND FURTHER RESEARCH

The empirical analysis of this paper has some limitations at a quantitative and qualitative level. From the quantitative point of view one of the limits of this research consists in the sample of analysis, both from the point of view of the number of workers and the number of companies. Surely analysing a small company can define some typical traits, such as for example a lesser disposal of resources compared to a large consulting company, but at the same time there could be companies more inclined to digital than others, or companies that have been working for a long time exploiting the full potential of remote work. The small number of respondents, on the other hand, can be a problem from the point of view of the personality of a person: in some cases a person might prefer to work from home and therefore be totally autonomous, while others might prefer the opposite. A questionnaire carried out considering a larger number of people could give a more precise idea of what the general trend is. Another point on which there could be a greater deepening consists in the subdivision into age groups of the interviewees: in the questionnaire analysed this distinction was partly applied, by interviewing a senior manager and two junior figures, at the same time it may be interesting to understand if people in the same age group have the same perception of technology and the relationship with others through it. From the qualitative point of view, instead, there is a problem related to the time of the analysis, because the pandemic is still ongoing and many choices are made on the basis of indications from the national authority or on the basis of people's perception of the risk. It could therefore be interesting to make the same analysis when the pandemic will completely end, so as to understand if it has brought important changes in terms of organizational structure and working methods, in addition to being able to quantitatively examine the results obtained by companies.

At this moment, in fact, it is not possible to analyse the results of a consulting firm if not in terms of completed projects, but very often they are started before the pandemic and therefore "not relevant" in terms of performance.

5.4   FINAL RESULTS

Is COVID-19 the business game changer? In the historical context we are living, that is an increasingly important and common use of technology and a high attention to health, I believe that this pandemic has certainly brought elements of innovation to many companies in Italy. The smart working has been introduced at company level mainly because of decisions taken at national level, forcing the company to adapt to the new standard. However, when we returned to the company we noticed a significant return to the origins, giving little flexibility and showing how there are still strong doubts about the total implementation of the new working tool. With regard to the Sinloc case study, I think that the COVID-19 cannot be considered as a business game changer, at least not for the feedback we got in the phase directly after the lockdown. Certainly it has brought a breath of novelty and it has been a source of greater awareness for the company, both of the resources needed and of the resources already present in order to be able to face possible future crises.

In the short term, the use of a universal smart working, meaning a work totally done remotely and used by everyone, has helped to respond to a major crisis otherwise not solvable. In Sinloc, however, the importance of informal moments between colleagues and a lack of motivation in the long term have emerged. Nowadays we can say with no doubt that in the market there are already all the tools to work efficiently even remotely, but these are not enough to fill the gap with the face-to-face experience. What will be important to focus on is the attention and the creation of a continuous dialogue with people within the company, trying to understand periodically what the needs are and meet them in a personalized way. A combination of an intelligent use of technology and people empowerment is what can create a group resilient and able to respond to future crises in the long term.

REFERENCES

Alexander, S. (2000). "*Virtual Teams Going Global*," InfoWorld, Vol. 22, No.46, pp. 55-56.

Archer, N.P. (1990). "A Comparison of Computer Conferences with Face-to-face Meetings for Small Group Business Decisions," Behaviour & Information Technology, Vol. 9, No.4, pp. 307-317.

Arthur, B.W. (1990) *Positive Feedbacks in the Economy*. Scientific American, Feb.

Arthur, B.W. (1995) *Increasing Returns and Path Dependence in the Economy*. Michigan

Ashby WR. 1957. *An Introduction to Cybernetics*. Chapman and Hall: London.

Bechtold, B.L. (1997). *Chaos theory as a model for strategy development*. Empowerment in Organizations, 5(4), 193–201.

Burke, K. and Aytes, K. (1998). "*A Longitudinal Analysis of the Effects of Media Richness on Cohesion Development and Process Satisfaction in Computersupported Workgroups*," Proceedings of the Thirty- First Hawaii International Conference on Systems Sciences, Hawaii, pp. 135-144.

Burke, K. and Chidambaram, L. (1996). "*Do Mediated Contexts Differ in Information Richness? A Comparison of Collocated and Dispersed Meetings*," Proceedings of the Twenty Ninth Annual Hawai International Conference on System Sciences, Hawaii, pp. 92-101.

Burnes, B. (2005). *Complexity theories and organizational change.* International Journal of Management Reviews, Vol. 7, Issue 2, pp. 73-90.

Byrne, D. (1998). *Complexity Theory and the Social Sciences: An Introduction*. London: Routledge.

Caravantes G.R., Panno C.C., Kloeckner M.C., (2005). *Administração: teorias e processos*. Prentice Hall: São Paulo.

Chan, S. (2001). *Complex Adaptive Systems.* ESD.83 Research Seminar in Engineering Systems.

Cheng, J. (1983). "*Interdependence and Coordination in Organizations: A Role-system Analysis*," Academy of Management Journal, Vol. 26, pp. 156-162.

Chidambaram, L. (1996). "*Relational Development in Computer-supported Groups,*" MIS Quarterly, Vol. 20, No.2, pp. 143-163.

Chidambaram, L. and Bostrom, R. (1993). "*Evolution of Group Performance Over Time: A Repeated Measures Study of GDSS Effects,*" Journal of Organizational Computing, Vol. 3, No.4, pp. 443-469.

Chidambaram, L., Bostrom, R., and Wynne, B. (1990- 1991). "*A Longitudinal Study of the Impact of Group Decision Support Systems on Group Development*," Journal of Management Information Systems, Vol. 7, No.3, pp. 7-25.

Crampton, C. (2001). "*The Mutual Knowledge Problem and its Consequences for Dispersed Collaboration,*" Organization Science, Vol. 12, No.3, pp. 346-371.

DeMeyer, A. (1991). "*Tech Talk: How Managers are Stimulating Global R&D Communication*," Sloan Management Review, Vol. 32, pp. 49-59.

Emery, F.E. and Trist E.L., (1960). *Socio-technical systems. In Management Sciences, Models and Techniques: Proceedings of the 6th- International Meeting of the Institute of Management Sciences*, Churchman CW, Verhulst M (eds.), vol. 2. Pergamon: New York; 83–97.

Espejo R., Schuhmann W, Schwaninger M., Bilello U., (1996). *Organisational Transformation and Learning: A Cybernetic Approach to Management*. John Wiley and Sons: Chichester.

Faucher J.-B. P. L., A. M. Everett, and R. Lawson (2006a*). 'The LIFE Model: Towards a New Understanding of the Knowledge Processing Feedback System'*. Proceedings of the International Conference on Business Knowledge Management, Macao, China, 26-27 October, 155-168.

Faucher J.-B. P. L., A. M. Everett, and R. Lawson (2006b). *'Towards a New Understanding of the Knowledge Processing Feedback System: Introducing the LIFE Model'*. Proceedings of the 37th Annual Meeting of the Decision Sciences Institute, San Antonio, Texas, 18-21 November, 29411-29416.

Faucher J.-B. P. L., A. M. Everett, and R. Lawson (2007). *'Examining Successful Complex Adaptive Organizations via the LIFE Model: The Case of Wikipedia'*. Proceedings of the 38th Annual Meeting of the Decision Sciences Institute, Phoenix, Arizona, 17-20 November, 3181-3186.

Feitosa J. and Salas E., (2020). "*Today's virtual teams: Adapting lessons learned to the pandemic context*," Organ Dyn (2020), https://doi.org/10.1016/j.orgdyn.2020.100777.

Galegher, J. and Kraut, R.E. (1994). "*Computer-mediated Communication for Intellectual Teamwork: An Experiment in Group Writing,*" Information Systems Research, Vol. 5, No.2, pp. 110-138.

Goodwin, B. (1997) LSE Strategy & Complexity Seminar. Retrieved from http://is.lse.ac.uk/complexity [Date accessed 15/07/2020].

Gupta, A. & Anish, S. (2014). *INSIGHTS FROM COMPLEXITY THEORY: UNDERSTANDING ORGANIZATIONS BETTER.* Indian Institute of Management. Retrieved from https://tejas.iimb.ac.in/articles/12.php [Date accessed 02/07/2020].

Haselhoff, F., (1981). Novo paradigma para o estudo das metas organizacionais (C. R. V. d. Araújo, Trans.). In *Do planejamento estratégico à administração estratégica*, Ansoff HI, Declerck RP, Hayes RL (eds.). Atlas: São Paulo; 28–40.

Hollingshead, A., McGrath, J., and O'Connor, K. (1993). "*Group Task Performance and Communication Technology: A Longitudinal Study of Computermediated versus Face-to-face Groups,*" Small Group Research, Vol. 24, No.3, pp. 307-333.

Jarvenpaa, S., Knoll, K. and Leidner, D. (1998). "*Is Anybody Out There? Antecedents of Trust in Global Virtual Teams,*" Journal of Management Information Systems, Vol. 14, No.4, pp. 29-64.

Jarvenpaa, S. and Leidner, D. (1999). "*Communication and Trust in Global Virtual Teams,*" Organization Science, Vol. 10, No.6, pp. 791- 815.

Jenner, R.A. (1998). *Dissipative enterprises, chaos, and the principles of lean organizations.* Omega: International Journal of Management Science, 26(3), 397–407.

Johansson, C, Dittrich, Y., and Juustila, A. (1999). "*Software Engineering Across Boundaries: Student Project in Distributed Collaboration,*" IEEE Transactions on Professional Communication, Vol. 42, No.4, pp. 286-296.

Kaiser, P., Tullar, W., and McKowen, D. (2000). "*Student Team Projects by Internet,*" Business Communication Quarterly, Vol. 63, No.4, pp. 75-82.

Kauffman, S. & Macready, W. (1995) *Technological Evolution and Adaptive Organizations.* Complexity, Vol 1 No 2 pp.26-43.

Kayworth, T. and Leidner, D. (2000). "*The Global Virtual Manager: A Prescription for Success,*" European Management Journal, Vol. 18, No.2, pp. 183-194.

Kezsbom, D. (2000). "*Creating Teamwork in Virtual Teams*," Cost Engineering, Vol. 42, No.10, pp. 33-36.

Krumpel, K. (2000). "*Making the Right (Interactive) Moves for Knowledge-producing Tasks in Computer-mediated Groups*," IEEE Transactions on Professional Communication, Vol. 43, No.2, pp. 185-195.

Lind, M. (1999). "*The Gender Impact of Temporary Virtual Work Groups*," IEEE Transactions on Professional Communication, Vol. 42, No.4, pp. 276-285.

Lipnack, J. and Stamps, J. (2000). *Virtual Teams: People Working Across Boundaries with Technology.* New York: John Wiley & Sons.

Lurey, J. and Raisinhgani, M. (2001). "*An Empirical Study of Best Practices in Virtual Teams*," Information & Management, Vol. 38, No.8, pp. 523- 544.

MacIntosh, R. and MacLean, D. (2001). *Conditioned emergence: researching change and changing research.* International Journal of Operations and Production Management, 21(10), 1343–1357.

Mainzer, K. (1996). *Thinking in Complexity: the Complex Dynamics of Matter, Mind and Mankind*. Second Edition, Springer.

Majchrzak, A., Rice, R., King, N., Malhotra, A., and Ba, S. (2000a). "*Computer-mediated Inter-organizational Knowledge-sharing: Insights from a Virtual Team Innovating Using a Collaborative Tool*," Information Resources Management Journal, Vol. 13, No.1, pp. 44-53.

Majchrzak, A., Rice, R., Malhotra, A., King, N., and Ba, S. (2000b). "*Technology Adaptation: The Case of a Computer-supported Inter-organizational Virtual Team*," MIS Quarterly, Vol. 24, No.4, pp. 569-600.

Malhotra, A., Majchrzak, A., Carman, R., and Lott, V. (2001). "*Radical Innovation Without Collocation: A Case Study at Boeing-Rocketdyne*," MIS Quarterly, Vol. 25, No.2, pp. 229-249.

Malik, P. (2003). *Business Transformation through the Creation of a Complex Adaptive System.* Journal of Human Values 9:2. New Delhi/thousand Oaks/London: Sage publications.

Mark, G. (2001). "*Meeting Current Challenges for Virtually Collocated Teams: Participation, Culture, and Integration*," in Chidambaram, L., and Zigures, I. (Eds.), Our Virtual World: The Transformation of Work, Play and Life via Technology, Hershey, PA: Idea Group Publishing, pp. 74-93.

Maznevski, M. and Chudoba, K. (2001). "*Bridging Space Over Time: Global Virtual Team Dynamics and Effectiveness,*" Organization Science, Vol. 11, No.5, pp. 473-492.

McDonough, E., Kahn, K., and Barczak, G. (2001). "*An Investigation of the Use of Global, Virtual, and Collocated New Product Development Teams,*" The Journal of Product Innovation Management, Vol. 18, No.2, pp. 110-120.

McElroy, M. W. (2003). *The New Knowledge Management: Complexity, Learning and Sustainable Innovation*. Amsterdam: KMCI Press and Boston: Butterworth-Heinemann.

Mitleton-Kelly, E. (2003). *Complex systems and evolutionary perspectives on organisations: the application of complexity theory to organisations*. Elsevier.

Mitleton-Kelly, E. & Papaefthimiou, M-C (2000). *Co-evolution and an Enabling Infrastructure: A Solution To Legacy?'* In Henderson P (Ed) Systems Engineering for Business Process Change, Springer-Verlag, ISBN-1-85233-222-0.

Mitleton-Kelly, E. and Papaefthimiou, MC. (2000). *'Co-Evolution of Diverse Elements Interacting within a Social Ecosystem'*, FEAST 2000 International workshop on Feedback and Evolution in Software and Business Processes, London, U.K., July 10-12, 2000, sponsored by EPSRC. Retrieved from http://www-dse.doc.ic.ac.uk/~mml/f2000 [Date accessed 04/06/2020].

Mitleton-Kelly, E. and Papaefthimiou, MC. (2001). *Co-evolution of Diverse Elements Interacting Within a Social Ecosystem.* In Henderson P (Ed) Systems Engineering for Business Process Change, Springer-Verlag, ISBN 1-85233-399-5.

Montoya-Weiss, M., Massey, A., and Song, M. (2001). "*Getting It Together: Temporal Coordination and Conflict Management in Global Virtual Teams*," Academy of Management Journal, Vol. 44, No.6, pp. 1251-1262.

Morgan, G. (1997). *Images of Organization*, 2nd edition. London: Sage.

Nicolis, G. and Prigogine I. (1989*) Exploring Complexity*. W.H. Freeman.

Nicolis, G. (1994). *Physics of far-from-equilibrium systems and self-organisation.* Chapter 11 in 'The New Physics' ed. by Davies, P. Cambridge University Press, 1989 (reprinted 1994).

Parker, D., and R.D. Stacey (1995). *Chaos, Management and Economics: The Implications of Non-Linear Thinking*. St. Leonards, NSW, Australia: Centre for Independent Studies.

Powell, A., Piccoli, G. and Ives, B., (2004). "*Virtual Teams: A Review of Current Literature and Directions for Future Research,*" Database for Advances in Information Systems, Vol. 35, No.1, pp. 6-36.

Prigogine, I. & Stengers, I. (1985) *Order Out of Chaos*. Flamingo.

Qureshi, S. and Vogel, D. (2001). "*Adaptiveness in Virtual Teams: Organisational Challenges and Research Directions,*" Group Decision and Negotiation, Vol. 10, pp. 27-46.

Ramesh, V. and Dennis, A. (2002). "*The Objectoriented Team: Lessons for Virtual Teams from Global Software Development,*" Proceedings of the Thirty-Fifth Annual Hawaii International Conference on System Sciences, Hawaii.

Robey, D., Khoo, H., and Powers, C. (2000). "*Situated Learning in Cross-functional Virtual Teams,*" IEEE Transactions on Professional Communications, Vol. 43, No.1, pp. 51-66.

Sarker, S., Lau, F., and Sahay, S. (2001). "*Using an Adapted Grounded Theory Approach for Inductive Theory Building About Virtual Team Development,*" Database for Advances in Information Systems, Vol. 32, No.1, pp. 38-56.

Sarker, S. and Sahay, S. (2002). "*Information Systems Development by US-Norwegian Virtual Teams: Implications of Time and Space,*" Proceedings of the Thirty-Fifth Annual Hawai International Conference on System Sciences, Hawaii, pp. 1-10.

Saunders, C.S. (2000). "Virtual teams: Piecing Together the Puzzle," in Zmud, R.W. (Ed.) *Framing the Domain of IT Management: Projecting the Future Through the Past*, Cincinnati, OH: Pinnaflex.

Savicki, V., Kelley, M., and Lingenfelter, D. (1996). "*Gender, Group Composition, and Task Type in Small Task Groups using Computer-mediated Communication,*" Computers in Human Behavior, Vol. 12, No.4, pp. 549-565.

Sharda, R. Barr, S.H., and McDonnell, J.C. (1988). "*Decision Support System Effectiveness: A Review and an Empirical Test,*" Management Science, Vol. 34, No.2, pp. 139-157.

Solomon, C. (2001). "*Managing Virtual Teams,*" Workforce, Vol. 80, No.6, pp. 60-65.

Sproull, L. and Kiesler, S. (1991). *Connections: New Ways of Working in the Networked Organization*. Cambridge, MA: MIT Press.

Stacey, R.D. (2003). *Strategic Management and Organisational Dynamics: The Challenge of Complexity.* Harlow: FT/Prentice Hall.

Stacey, R.D. (1996). *Complexity and Creativity in Organizations*. San Francisco: Berrett-Koehler.

Stacey, R.D., (1995). *The science of complexity - an alternative perspective for strategic change processes*. Strategic Management Journal 16(6): 477–495.

Stacey, R.D., Griffin, D. and Shaw, P. (2002). *Complexity and Management: Fad or Radical Challenge to Systems Thinking*. London: Routledge.

Styhre, A., (2002). *Non-linear change in organizations: organization change management informed by complexity theory*. Leadership and Organization Development Journal, 23(6), 343–351.

Suchan, J. and Hayzak, G. (2001). "*The Communication Characteristics of Virtual Teams: A Case Study*," IEEE Transactions on Professional Communication, Vol. 44, No.3, pp. 174-186.

Tan, B., Wei, K, Huang, W., Ng, G. (2000). "*A Dialogue Technique to Enhance Electronic Communication in Virtual Teams,*" IEEE Transactions on Professional Communication, Vol. 43, No.2, pp. 153-165.

Tetenbaum, T. (1998). *Shifting paradigms: from Newton to chaos*. Organizational Dynamics, 26(4), 21–32.

Thompson, L., (2018). "*Making the Team: A Guide for Managers*", Sixth Edition, pp. 4.

Trist E.L., Bamforth K.W., (1951). *Some social and psychological consequences of the longwall method ofcoal-getting: an examination of the psychological situation and defences of a work group in relation to the social structure and technological content of the work system*. Human Relations 4(1): 3–38. doi: 10.1177/001872675100400101.

Van Ryssen, S. and Hayes Godar, S. (2000). "*Going International Without Going International: Multinational Virtual Teams*," Journal of International Management, Vol. 6, pp. 49-60.

Varela, F. (1995) paper given at the 'Complexity & Strategy Conference' London May.

Varela, F. and Maturana, H. (1992) *The Tree of Knowledge*. Shambhala.

Walther, J. (1995). "*Relational Aspects of Computermediated Communication: Experimental Observations over Time,*" Organization Science, Vol. 6, No.2, pp. 186-203.

Walther, J.B. and Burgoon, J.K. (1992). "*Relational Communication in Computer Mediated Interaction,*" Human Communication Research, Vol. 19, No.1.

Warkentin, M.E., and Beranek, P.M. (1999). "*Training to Improve Virtual Team Communication,"* Information Systems Journal, Vol. 9, No.4.

Warkentin, M.E., Sayeed, L. and Hightower, R. (1997). "*Virtual Teams versus Face-to-face Teams: An Exploratory Study of a Web-based Conference System,"* Decision Sciences, Vol. 28, No.4, pp. 975-996.

Yin, Robert K. (2003). *Case study research: Design and methods*. Sage publications,.

SITOGRAPHIC REFERENCES

Baker, M. (2020, March 19). *Gartner HR Survey Reveals 88% of Organizations Have Encouraged or Required Employees to Work From Home Due to Coronavirus.* Retrieved from https://www.gartner.com/en/newsroom/press-releases/2020-03-19-gartner-hr-survey-reveals-88--of-organizations-have-e [Date accessed 21/06/2020].

Katzenbach J., Smith D., (1993), *The discipline of teams*. Retrieved from https://hbr.org/1993/03/the-discipline-of-teams-2 [Date accessed 05/07/2020].

Meister, J. (2020a, March 31). *The Impact Of The Coronavirus On HR And The New Normal Of Work.* Retrieved from https://www.forbes.com/sites/jeannemeister/2020/03/31/the-impact-of-the-coronavirus-on-hr-and-the-new-normal-of-work/#4857634d2b60 [Date accessed 16/06/2020].

Meister, J. (2020b, January 15). *Top 10 HR Trends That Matter Most In The 2020 Workplace.* Retrieved from https://www.forbes.com/sites/jeannemeister/2020/01/15/top-10-hr-trends-that-matter-most-in-the-2020-workplace/#38b71bc57dfc [Date accessed 28/06/2020].

OECD (2020), OECD Economic Outlook, Volume 2020 Issue 1, OECD Publishing, Paris, https://doi.org/10.1787/0d1d1e2e-en.

Reeves, M., et al. (2020, April 03). *Sensing and Shaping the Post-COVID Era.* Retrieved from https://www.bcg.com/publications/2020/8-ways-companies-can-shape-reality-post-covid-19#close-modal [Date accessed 22/06/2020].

https://www.sinloc.com (2020)

APPENDIX 1

Q1: How was the work organized within the company? More precisely, how was work organized within the same team, between different teams and with external clients? Was the interaction between all components within the company somehow stimulated?

Q2: Was there interaction with all members of the company or did you interact mainly with members of your team? Also, virtual teams are considered more task-focus than social-focus. Was this problem encountered?

Q3: How will you deal with smart working and the possible effect on organizational design? Will there be changes or will everything remain the same?

Q4: What was the biggest emergency during the pandemic and how was the problem solved?

Q5: Through the lockdown the company has been moved from its point of equilibrium, having to find a new system to keep the business going. Also based on the information gathered through the first question, what has the company learned and what are the new behaviours?

Q6: Resuming the question 2 and connecting also to the theory of virtual team, through the virtual interactions have been faced more problems of incomprehension, besides longer and confused communications? If so, how were they solved? Since communication is fundamental to the success of the team, were problems such as delays in response, lack of a common structure to respect, low participation during meetings?

Q7: Not considering the lockdown period (a period in which one was forced to work in smart work) but moving to the next phase in which the return to the office was granted, was there ever any hesitation on the part of the company to implement such a system due to lack of confidence or fear of a reduction in productivity? During lockdown, were there any checks on people's hours worked?

Q8: Given the time of crisis, is there interest in investing in new markets and technologies, what might the cloud be like?

Q9: Has the company considered hiring staff during lockdown? If there were new entries, what was it like to manage them compared to the presence in the office?

Q10: What are the soft skills required to work as a virtual team?

Q11: In terms of performance and satisfaction, how do you rate smart work compared to working in the office?

Q12: How was the work within the team organized? What were the main problems addressed?

Q13: What are the soft skills required to work in a virtual team? In the absence of some skills, would you consider some training courses to be useful to increase them?

Q14: If you can compare work integration in presence and smart working, what were the main issues you faced? Have you ever had the feeling of a lack of teamwork or an uncommon corporate culture? In terms of technological equipment, did you feel you had the right tools?

Q15: What are the benefits and problems you have experienced using smart working? In terms of productivity, communication, relationship with colleagues.

Q16: Was the interaction between all members of the company or only between members of the same team stimulated? Were there "coffee breaks" organized by colleagues?

Q17: The virtual team theory says that through virtual interactions more problems of misunderstanding are faced as well as longer and more confused communications. Have you had this problem? If yes, how was it solved?

Q18: The theory says that virtual teams are more task-focus than social-focus. Have you noticed this difference between the studio experience and the virtual experience?

Q19: The theory says that communication is fundamental for the success of the team: were there problems such as delays in responses, lack of a common structure to respect, low participation during meetings?