# UNIVERSITA' DEGLI STUDI DI PADOVA

**DIPARTIMENTO DI SCIENZE ECONOMICHE ED AZIENDALI "M.FANNO"**

**CORSO DI LAUREA MAGISTRALE IN ENTREPRENEURSHIP AND INNOVATION**

**TESI DI LAUREA**

## "On the relationship between digital technologies and organizational resilience: insights from a multiple case study"

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**ANNO ACCADEMICO 2019 – 2020**

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Firma dello studente

*To every soul I shared my path with.*

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# INTRODUCTION

Early 2020 was marked by the arrival of the "Covid-19" virus. Therefore, people were encouraged to stay at home and a lockdown was imposed by governments, first in China, then in Italy and in country after country around the world. This situation has had a considerable impact on the economy. As can be seen from many news outlets, the consumption of goods has gradually decreased (Redazione ANSA 2020c); people have been buying less goods in brick and mortar outlets, but e-commerce has reached an all-time high (Redazione ANSA 2020b).
This endogenous shock has had a dramatic impact on firms. Employees were asked to stay at home and smart working was encouraged. In this situation, many firms have had to redesign internal processes (Redazione ANSA 2020d) or the way in which they sold products (Coletti 2020).

"The coronavirus is creating a new digital era" (Redazione ANSA 2020a).

Although digital transformation is extremely popular nowadays, it is not a recent trend. Some researchers think that we are in the third wave of such transformation (Legner et al. 2017), others believe that this is the fourth wave (Davidsson et al. 2016) but everybody agrees that digital transformation started in the 1980s with the spread of computers and with the process of transferring information from paper to digital form (digitization).
Since then, the technology evolved and in recent years the terms "SMACIT" (Social, Mobile, Analytics, Cloud and Internet of Things) and "industry 4.0" have emerged to indicate specific groups of digital industrial technologies such as the Internet of things, big data and analytics, robotics and more. (Strange and Zucchella 2017). The literature does not have an internationally agreed definition of "digital transformation" or "digitalization", but it is clear that these technologies could be really helpful for firms to resist and to survive the crises that will ensue after the Covid pandemic.
Enterprise resilience is the theoretical concept that analysis how firms can overcome crisis. The Covid pandemic has been a test of firms' resilience. Provision of masks, social distancing and smart working: were firms ready to face the coming needs and the high uncertainty?
Organizational resilience and digital transformation are two wide explored streams of research in the organizational literature. Nevertheless, the merge of the two topics has not been deeply

analysed by researchers. This paper elaborates on how digital technologies can help firms to better face crises (e.g. to be resilient). The paper is divided into four parts.

The *first chapter* presents a literature review of resilience. What is resilience? How can it be fostered? After analysing the history of concept, we will describe the cycle of resilience that is made up of pre, during and after crisis periods.

The *second chapter* is about digital transformation. According to the comprehensive theory that will be presented, digital technologies are both a source of disruption in the market and the solution that firms may adopt to survive. Digitalization is the key to improve value propositions, value networks, channels, and ambidexterity of firms.

In the *third chapter*, the two theoretical frameworks (resilience and digital transformation) will be combined; merging the two theories will lead to understand how digital technologies can foster firm's resilience.

In the fourth chapter our qualitative research will be presented. Through a multiple case study, we will analyse how digital technologies are, or could be, fostering the resilience during the – ongoing – Covid 19 pandemic. Exploring resilience in real world examples is useful to test the theoretical frameworks that were proposed after the literature review.

1. CHAPTER

# RESILIENCE

## 1.1 Introduction

The ability to deal with disruptions (i.e. resilience), is vital for businesses. As can be seen in the "Ericsson vs Nokia" case (see example 1), resilience may determine the survival of firms in the market, and result in competitive advantage.

"The Global Risks Report 2020" is a paper by the Word Economic Forum that presents a forecast of risk factors that will affect the activities of organizations in the following year. Starting from the risk of economic stagnation, cyber insecurity and climate threats, the uncertainty faced by companies will increase over time (World Economic Forum 2020). Furthermore, in last years, globalization fostered connections and interactions among firms of different countries; therefore, companies are more exposed to disruptions that may affect one of their stakeholders (interdependence risk). This huge risk exposure is often beyond the organization control (Starr, Newfrock, and Delurey 2003). In other words, business operations, reputation and processes can, as we saw in the Ericsson-Nokia case, be affected by the activities or disruptions of suppliers and stakeholders. In the ever-growing interconnected world, the power fluctuations in a small Chinese warehouse can dramatically affect the activities of American and European firms.

In addition, the crisis due to Covid-19 pandemic, that is still running on the World, has significantly increased the uncertainty faced by companies. At the time of writing, a second wave of infection is threatening European countries (and, in general, the whole world).

*Example 1 - Supply chain disruption: Nokia vs Ericsson*

**Supply chain disruption: Nokia vs Ericsson**

In early 2000, Nokia and Ericsson, the two European leaders in the Telecommunication sector, referred to the same supplier (a New Mexican Philips chips plant). When the American chips plant caught fire in March 2000, the supply chain was disrupted. The reaction of the two competitors was drastically different: Nokia set up a team of supply chain experts to search for new ways to have access to the needed chips, redesigned the product and found new suppliers. In the meanwhile, Ericsson was not ready to cope with a trauma like this. The great difference among the two competitors was the ability to spot the triggering factor that enabled disastrous cascading consequences. Ericsson trusted in communications coming from the Philips plant saying that in few weeks, everything would have been solved; whereas Nokia detected the signals and noticed the problem even before being told the supply delay. Then, Nokia deepened the reasons for the delay, understood the seriousness of damages faced by the supplier and activate some response actions. As a result of this event, Ericsson's market share plunged by 3%, whereas the one of Nokia boomed. The two firms faced the same disruption, but they had completely different outcomes: Nokia bounced forward, Ericsson collapsed. (Mukherjee 2008)

New government regulations are published almost every week to face the spread of the virus and firms must find ways to react to changing safety rules and procedures.

Referring to the unlikely situation of 2020, when Australia caught fire, the Covid-19 pandemic has affected the whole world and different protests have emerged and spread from the US to China, thus it would seem to be crucial to understand how to react to disruptions across the world.

In this chapter, we will first describe what enterprise resilience is, by providing a literature review on the topic; we will concentrate first on the historical evolution of resilience; then we will analyse its main aspects.

## 1.2 Definition

"Resilience" is a widely researched topic. Many disciplines are interested in this concept: from the medical sector to the ecological, psychological, military and many others (Bhamra, Dani, and Burnard 2011). Even if only the Business sector is considered, we still find a wide variety of topics. Resilience, for instance, can be analysed at different levels. Some research focus on individual or team resilience (Hartmann et al. 2019) others, as I will in this paper, consider the organizational perspective. Although the multidisciplinary nature of resilience, the concept and meaning of it remains generally unchanged.

"Enterprise resilience is the ability and capacity to withstand systemic discontinuities and adapt to new risk environments. A resilient organization effectively aligns its strategy, operations, management systems, governance structure, and decision-support capabilities so that it can uncover and adjust to continually changing risks, endure disruptions to its primary earnings drivers, and create advantages over less adaptive competitors."(Starr, Newfrock, and Delurey 2003, p.3)

In order to be effective, the concept of resilience must be spread throughout the whole enterprise: from the CEO to the board management. Hence, traditional risk management is no longer sufficient: it is not possible to separately face different risks in different organizational functions (e.g. only the CFO and COO deal, respectively, with financial and operational risk), but a more holistic approach is needed, because when disruptions come, they affect the whole organization. The ability to maintain business continuity is important not only to survive disruptions per se, but also allows firms to gain better access to capital in the financial market through the reduced likelihood of huge losses. (Starr, Newfrock, and Delurey 2003)

Before exploring the organizational field, let us briefly highlight the history of resilience. Knowing its history can be helpful to understand some features in the organizational field.

## 1.3 History of resilience

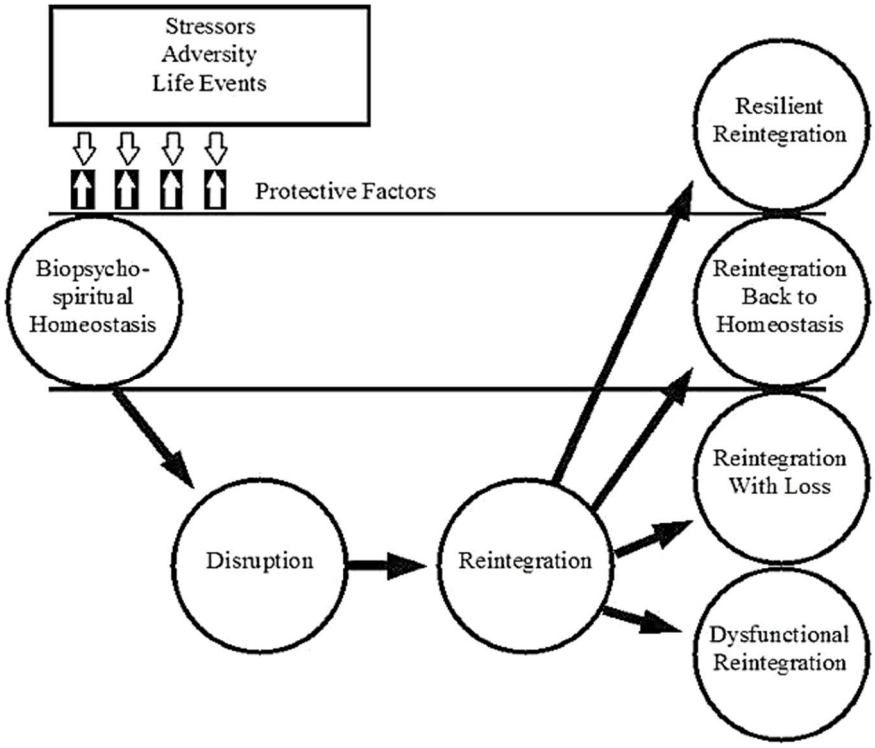
Resilience has its origins in physical science. In 1973 C.S. Holling, a Canadian professor of Resource Ecology, as well as one of the founders of the concept, defined resilience as the ability of an ecological system to absorb changes without ceasing to exist (C. S. Holling 1973). At about the same time, the notion was explored in the field of positive psychology through phenomenological studies that tried to explain why some people resist trauma and difficult living conditions better than others (Luthar, Lyman, and Crossman 2014) .

As explained in "The Metatheory of resilience and resiliency" (Richardson 2002), three waves of research can be distinguished.

In the first wave, the research focus was on the so-called "*resilient qualities*", hence internal (within a person) or external (related to the environment) characteristics that the people who positively react to adverse living conditions have. The outcome of the first wave of study was a list of the "resilient qualities" that underlie the resilience of an individual.

The second wave of research perceived *resilience as a process* that aimed to acquire more "protective factors" (resilient qualities) that help people to cope with adversities (see Figure 1). Some events, such as the loss of a relative or a new job offer, can cause a disruption in the status-quo that a person lives in. "Disruption" is a significant change in life that results in positive or negative outcomes.

*Figure 1 - Metatheory of Resilience and Resiliency*




*Source: Richardson, Glenn E. 2002. 'The Metatheory of Resilience and Resiliency'. Journal of Clinical Psychology 58 (3): 307–21. https://doi.org/10.1002/jclp.10020.*

During the "reintegration process" that comes after the disruption, a person may be reinforced thanks to the acquisition of new resilient qualities (resilient reintegration) or may return to the same status quo as before (reintegration). However, not all disruptive events result in positive outcomes: sometimes the final status quo may be slightly worse than the initial one (reintegration with loss) or even seriously worse than before (dysfunctional reintegration); these situations occur when people lose some motivation and, therefore, reduce their resilience.

The third wave lays emphasis on the *motivational force* that induces people to be resilient when changes occur in their lives. The energy needed for a resilient reintegration is studied by different disciplines: from philosophy to physics, sociology, theology and many others. The aim is to create a metatheory that explains what source of energy is needed to positively react to adversities in life.

## 1.4 Organisational resilience

The history highlights different approaches to resilience; even in the organizational field, resilience can be perceived as an outcome (the ability to bounce back to the pre-crisis equilibrium) or as a process (the ability to forecast disruptions, prepare for them, react to them and finally learn from the previous experience); it can be analysed focusing on resilience qualities or on the process that aims at strengthening protective factors.

Furthermore, resilience literature is interrelated with the crisis and crisis management research because they both focus on the same topic (resisting to adversities) but analyse different aspects. A slightly difference among the two theories is that resilience is focused on organizations and on the ability to maintain business continuity despite adversities, whereas crisis management starts from the analysis of crises and how firms may bounce back to a pre-crises equilibrium (Williams et al. 2017).

In order to have a broad perspective, I will first describe some relevant features of the crisis management literature and then, I will concentrate on the resilience field. The literature on crises management focuses on how organizations may return to normal functioning after disruptions. This literature is divided into two streams of research: one perceives *crisis as an event*, the other as a process.

### 1.4.1 Crisis as an event

The first stream conceives crises as a low-probability, high-impact event that threaten organization's activities. This field of study usually takes as unit of analyses the event, deepening the triggering factors and how they threaten the survival of the organization. Almost by definition, these events cannot be predicted. Therefore, the effective crises management focuses on the ability to readapt and redesign the organization in order to react to crises. Exceptional high impact events cause a disruption of routines, structures and capabilities; in this case, managers should foster coordination, communication and other activities that enable a better disaster response. Interorganizational collaboration, emergent organizing, disaster planning and prevention are the major topics that uses a "crisis as an event" perspective.

For instance, Covid-19 is a low probability, high-impact event because in less than two months it spread in the whole world and nobody predicted the possibility to face social distancing or lockdowns in such a short time. Crises as an event perspective incentivises to elaborate on modes to react to crisis using emergent management practises (Hardy et al. 2020).

### 1.4.2 Crisis as a process

The second view, "*crises as a process*", analyses the dynamic dimension of disruptions. This perspective highlights the importance of understanding the different phases of a crisis, considering the triggering events as the last phase of a series of organizational failures that cumulate in a disaster. Crisis starts with an incubation period, when firms fail to detect and manage the first signals of the disruption. The crises culminate in its acute phase and then reduces, leading the firm to a new normal.

The topics considered in this field of research are, for instance, the analysis of the environmental factors that foster crisis impacts, the processes of organizational weakening, the evolution of

the crisis and how organizations respond to the different stages. This perspective emphasizes that crises develop, evolve and change over time. Crises as a process perspective stresses the importance of pre-event, in event and post event crisis management (Williams et al. 2017).

One example of this type of crisis is digitalization. Firms may fail to detect the importance of the change in customer behaviours, resulting in an insufficient investment on research and product development. The first series of failures culminate when competitors come up with innovative and superior products. This is what happened to Nokia in the first decade of 2000, when it did not recognize the changing customer preferences that shifted from mobile device itself (hardware) to the software and the applications ecosystems. Even if we presented Nokia as an example of successful resilient organization at the beginning of this chapter, now we should analyse the decline of this company (see Example 2).

*Example 2- Crisis as a process: the decline of Nokia*

Crisis as a process: the decline of Nokia

In 2007 Nokia was the leader in the mobile phones industry, it produced more than half of the devices purchased in the world. Nonetheless, in the same year Apple came out with a new generation of mobile phones which included different customer experiences that exceeded the traditional functioning of phone calls and messages. Apple leveraged software in order to create platforms such as iTunes, including music, high quality cameras and offered a wide variety of apps within the same mobile device. The result was dramatic for Nokia, that in 2013 sold a fifth of the smartphones sold by Apple. In 2013, Nokia sold its mobile phone business to Microsoft.

The inability to spot changes in customer needs marked the decline of the giant of the mobile phone industry (Cuthbertson, Furseth, and Ezell 2015).

## 1.5 Resilience cycle

Now that we distinguished the different types of crises, we can concentrate on resilience literature. Resilience focus on how it is possible to maintain organizational functioning reliable despite adversities. As Philipp M. Darkow pointed out (Darkow 2019), resilience is a broad concept that can be split up by considering the time horizon: it can be studied in pre, during and post-crisis. Moreover, “Comprehensive Emergency Management” (CEM) is a commonly accepted model designed by United States National Governors' Association (1979) that separates the resilience umbrella into four phases: mitigation, preparedness, response, and recovery. By following this view, it is clear that the first two stages are related to the period before a crisis whereas the others refer, respectively, to the phases during and after.

By focusing again on the Covid-19 pandemic, this disruption can be analysed through the lens of resilience by considering the different phases: pre, during and post-crises. In the covid-19

period, firms have been shifting from using management practises of the three phases in an incredibly fast and continuous basis. Each day has seen a cycle of trying to prevent health risks from materializing and trying to comply with new government guidelines (pre-crises); addressing them in real-time, shifting from programming to improvising (during crises). Finally firms reflect upon previous actions and outcomes in order to recalibrate their actions only a few days later (post-crises) (Hardy et al. 2020). In the following paragraphs. We will analyse the different phases of resilience.

### 1.5.1 Pre-crisis: the plan to resist approach

Focusing on pre-crisis, we should concentrate on that part of the literature that uses a "plan to resist approach" (Darkow 2019), namely that which focuses on the resources and capabilities that organizations need to resist potential threats. This perspective relies on risk analyses and organization planning capacities in order to detect vulnerabilities in the operating environment. In other words, firms must know about the potential threats to operations and react by strengthening their resources and capabilities in order to be prepared when, or if, disruptions come.

Risk analysis is made up of three components: risk assessment, risk management and risk communication (Hardy et al. 2020).

*Risk assessment* is a process with the goal of detecting possible sources, opportunities and threats of different risks and quantifying their significance by using relevant criteria. The outcome of this phase is the exposure of the firm to different types of risks, expressed in probabilistic terms. The tools used in this phase are, for instance, statistics and hypotheses testing, stress tests, war-gaming, computer models for forecasting and scenario planning.

The second phase concern *risk management*. Once the potential risks have been identified, organizations must define the level of risk they are willing to accept. The goal is to explore opportunities and avoid huge losses coming from the risk factors in order to meet the chosen level of risk tolerance. Organizations must define different possible courses of action and choose the most appropriate one.

Finally, *risk communication* is aimed at helping stakeholders to identify, manage and avoid risks. A common understanding of risk exposure of the organization helps stakeholders to understand the management risk decisions and to change their behaviours in order to be aligned with the defined course of action. The last phase is particularly important considering that "risk" is not objective; not everything that could be seen as a risk, is considered and managed as one: almost everything that is sufficiently valuable to deserve protection is a possible source of risk. However, every firm decides what are relevant risk objects, considering its previous

experiences and following processes of negotiation and conflict resolution among experts or the public. Furthermore, risk objects may be difficult to assess, generating controversies among experts (data may lead to different interpretations), or among stakeholders that may disagree with expert interpretation (Hardy et al. 2020). It is therefore really important to inform stakeholders about the possible threats that may affect the organization, in order to share with them a common understanding of risks.

Pre-crises resilience can be fostered in many ways. First, after risk analyses, it is essential to establish effective management of vulnerabilities by assessing the operating environment and keeping monitoring the key weaknesses. Robust, redundant or rapidly accessible resources are the second ingredient of the recipe to foster pre-crises resilience. Organizational resilience, especially in SMEs strongly depends on the individual resilience of people who work inside the firm (Bhamra, Dani, and Burnard 2011). Indeed, social capital is one of the most important resources because people embedded in an organization are more likely to support the firm, for instance by providing information or financial resources. Last but not least, close attention should be paid to both governance structures and decision-making processes, so that communication flows, adaptability and consensus in sensemaking allow for a rapid and effective reaction to a fast-changing environment.

Papers following the "plan to resist approach" assume that costs of resistance-increasing measures are lower than any potential losses coming from the impact of disasters; hence, it makes sense to invest financial resources in order to improve organisational preparedness to potential threats.

As happens for every theory, the plan to resist approach has some limitations; first, the strongest underlying assumption is that risks can be assessed. This quantitative conception states that disruptions can be predicted by calculating the "real" probability of any event. However, even the best risk assessment fail to find or manage all the variables that may lead to a catastrophe (Bhamra, Dani, and Burnard 2011). There is inherent risk in every business that cannot be reduced in advance merely by better planning and risk assessment (Darkow 2019). Social distancing of employees, for instance, was one of the main issues during the reaction to Covid-19 crisis since almost nobody was able to predict this need in advance.

In addition, this view has led to the paradox that organizations are now more preoccupied and careful about risk, but less able to manage it. There has been lot of effort to find right tools to rationally calculate, predict and assess risks, but usually, the most damaging disruptions arises from what we do not know and, therefore, cannot be calculated (Beck, 2006, quoted by Hardy et al. 2020). Furthermore, redundant resources may increase firms' rigidity, limiting the flexibility that is needed in times of crisis. Even considering all these limitations, the pre-crises

phase is still really important because, even if plans can't be perfect and perfectly applicable in the future, they may be changed according to the specific disruption faced by firms. Adaptable and flexible plans are the key for a proper management of adversities.

Before concluding the pre-crises resilience, it is necessary to talk about the differences between two approaches that may be followed to analyse potential risks: *normalizing* and problematizing. The former, is the most suited approach, it refers to the transformation of future uncertainties into calculable and manageable risk. *Problematizing*, on the other hand, relies on scientific uncertainties; it questions the ability of the actual knowledge to predict the uncertain future; it incentivizes experts to explore new scenarios by sailing in uncharted waters. It is important to balance both of the approaches because, while normalizing lead to the identification of familiar risks, problematizing is useful to manage novel and unfamiliar risks because it enables action even if science is uncertain (Hardy et al. 2020).

Planning is key but not sufficient to ensure business continuity. It is important to consider the next approaches, to avoid focusing only on pre-crises resilience.

### 1.5.2 During crises: containing crisis approach

A second strand of literature follows the "containing crisis approach", therefore it focuses on how firms react when mishaps occur. No matter how advanced risk analyses is, firms will always, soon or later, face some unpredicted disruptions. This phase is characterized by a constant difficult choice among two opposite approaches: controlling and improvising.

*Controlling* refers to the implementation of predetermined plans and actions developed during the pre-crises phase. Following this view, once the first signals begin to materialize, firms must centralize control in order to implement the planned actions. In this phase it is drastically important to effectively design communication flows and hierarchical power, such that the top-down commands are rapidly implemented, allowing for a coordinate action and a fast transformation of routines.

The opposite view, *improvising*, incentivizes decentralization; frontline workers are given more responsibility and authority because they have a privileged position to spot the first signals of crises and disruptions. Exceptional and out of schemes actions are incentivized in order to rapidly face crises. Improvising relies on the idea that plans are useful to provide general guidelines for coming risks, but disruptions may manifest in different and unpredictable ways according to the conditions and contexts of the present situation. Therefore, improvising allows firms to better react and change the organization according to the specific disruption. While controlling is the best way in the case of already known and predicted risks incidents, improvising allows to better face unfamiliar and unknown risks.

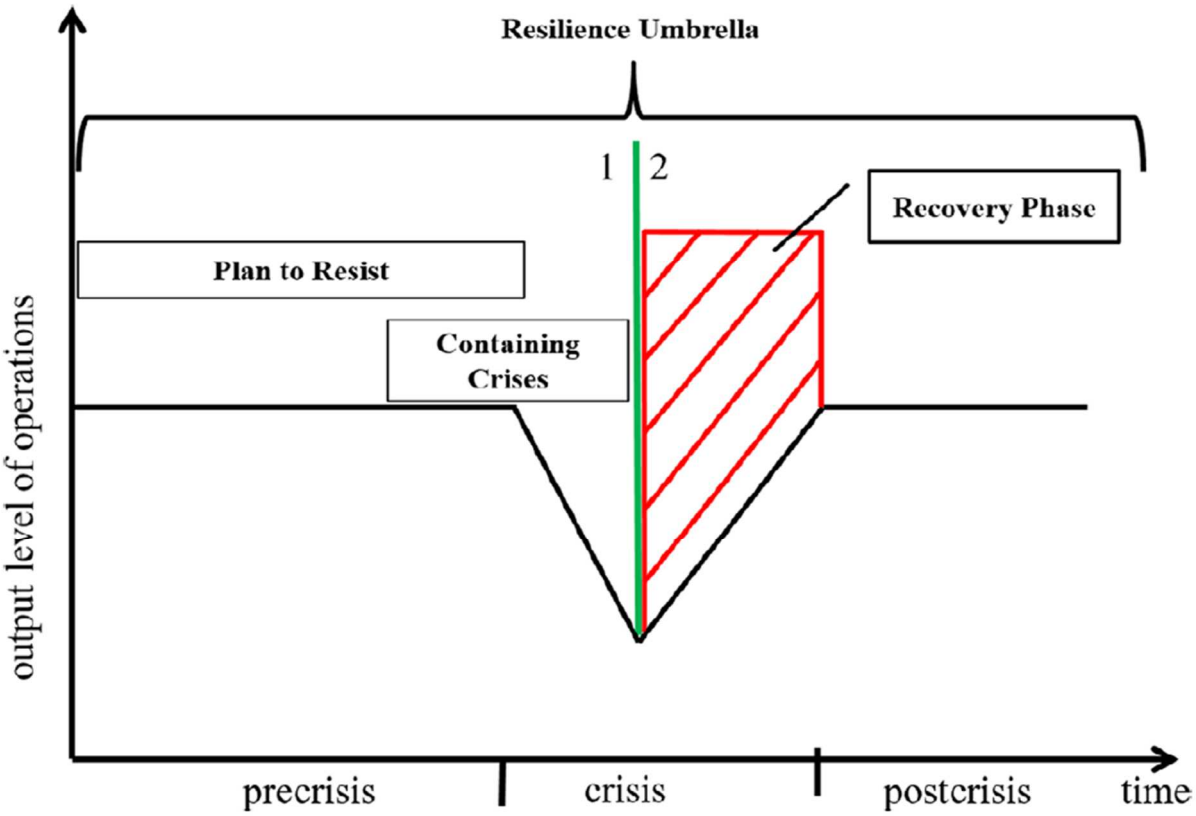
A significant problem is that shifting from controlling to improvising is not easy because the structure of the firm can obstacle the shift. For instance, employees that deviate from plans may be reliable for their actions and blamed for not following plans in a "controlling" environment. Most of the study following the "plan to resist approach" focus on High Reliability Organizations (HROs) and the procedures they use to deal with uncertainty. HROs, also defined as resilient organisations, perceive risk as an inherent part of the business; they know that uncertainty cannot be eliminated, therefore they try to be ready to react when disruptions occur. Almost by definition, HROs, such as fire brigades, nuclear power plants or commercial aviation have zero tolerance for errors even if they operate in a dynamic, ever changing and highly uncertain environment. But what are the best practises that HROs follow to maintain stable operations? Almost all the study outcomes in this field can be categorized under "the 5 hallmarks of HROs". (Darkow 2019) The first hallmark refers to the importance of carefully monitoring operations in order to spot every small deviation; concentrating on the smallest variations and further investigating the reasons why they occur is essential for avoiding bigger mistakes. Different tools such as risk mapping or risk matrices may be used to keep monitor the level of risk. The second hallmark focus on frontline workers and their technical knowledge; if they have all resources and capabilities they need, they can solve all problems at the early stage, avoiding any cascade effects that may result in catastrophes. Third, it is essential to avoid narrow minded perceptions of reality; in order to do this, HROs must analyse the operating environment and develop a more comprehensive perspective to make effective decisions. Fourth, resilient organisations should foster improvisation and bricolage in order to be more resistant to unexpected events; organisations must be able to shift from vertical orders and pre-defined practices to improvisation, according to the situation. Last but not the least, governance and decision making are fundamental aspects of resilience. Effective communication and information flows allow for both the coordination and joint sensemaking that are essential for a fast response to crises.

There are mainly two limitations to the "containing crisis approach". HROs have heterogeneous characteristics. This heterogeneity within the group makes it difficult to find the common best practices that help organizations to be resilient. The second limitation concerns the external validity of the studies. For instance, fire brigades constantly deal with adverse events; however, these events may not be considered as disruptions in that they are already part of organizational operations. Therefore, the transferability of HROs best practices to other firms could be misleading.

### 1.5.3 Post-crisis: bouncing back or forward?

The recovery phase starts with the adaptation of old structures, processes and operations in the new risk environment. It is not only about reactiveness, but it also involves a proactive effort aimed at overcoming the consequences of crises.

*Figure 2 - Resilience model - Bounce back*




*Source: Darkow, Philipp M. 2019. 'Beyond "Bouncing Back": Towards an Integral, Capability-based Understanding of Organizational Resilience'. Journal of Contingencies and Crisis Management 27 (2): 145–56. https://doi.org/10.1111/1468-5973.12246.*

Here we come to the most difficult question: When does a crisis end? Researchers generally refer to the recovery phase by applying the concept of "bouncing back": organisations overcome mishaps when they return to the pre-crisis status quo. This view is rather restricted and misleading; in order to understand why, let us "bounce back" to Holling and the difference between ecological and engineering resilience (Crawford Stanley Holling 1996). *Engineering resilience* is defined as the ability of systems to remain stable close to state of equilibrium; this ability focuses on efficiency and can be measured through resistance to disruptions and speed of recovery. On the other hand, *ecological resilience* emphasises the existence of multiple equilibriums; when disruptions occur, systems shift to another stability domain where critical variables and the structure of the system change. The two paradigms have really different consequences when it comes to measurement, goal setting and management of change.

Therefore, moving back to the organizational field, a single interpretation of resilience as a "bounce back" process can be compared to engineering resilience. This outcome-oriented perspective is a limited concept because firms are ever-changing and complex systems and sometimes the pre-crisis status quo may simply not be reachable because of evolution in the environment. Moreover, the concept of "bounce back" does not include the huge opportunity to evolve after crises.

Resilience is the "umbrella" that includes all the three above described approaches that aim to protect organizations. In this comprehensive perspective, crises are seen as a great opportunity to adjust processes and operations in order to gain competitive advantage and stability. "Bounce forward" instead of bouncing back.

In order to bounce foreword, organizations need to screen all the facts happened during the crises to understand what went wrong and might be changed and what are the lessons that may be learned to improve how risk is organized in the future. Learning from errors is a difficult process both for organizations and individuals. It requires a careful retrospective analysis to spot all the happened facts and to understand how what went wrong may be prevented. This phase is one of the most difficult to go through and one of the less successfully perceived (Hardy et al. 2020). The reasons are manifold; some researchers attribute this failure to the type of knowledge that is produced in the post-crisis phase. Reviewers, indeed, should reconstruct facts investigating on the partial knowledge of many people, generating a general view that represents what happened. The reviewers, who have the outcome of the story in their mind, may find difficult to understand why the behaviour of actors made sense at the time when the incident occurred. Furthermore, the review of the facts usually is aimed at finding the responsible for the happened facts, in order to attribute the blame to the right people. This fact disincentivizes people to admit their mistakes and to be willing to reflect on them. Blaming seems to preclude learning because managers and workers are less willing to report errors, thereby avoiding learning opportunities (Hardy et al. 2020).

## 1.6 Conclusions

This overview of resilience literature is aimed at providing the theorical background to analyse the case studies that will be presented in the last chapter.

The takeaways are manifold. First, resilience is a wide and multidisciplinary concept. From the organizational perspective, it can be analysed as a cycle that is made up of three phases: pre, during and post crises. The first phase is related with risk analyses and planning; "during crisis" concerns a difficult choice among controlling and improvising practices; last, "post crisis" is related to what the firm learnt from the crisis and what are the structural changes that will be made thanks to the gained experience.

Even if these three parts are presented as different and divided subsets, they interact and overlap each other. Plans that are made in the pre-crisis phase, are implemented and adapted in the period during the crisis; furthermore, post crisis is essential to improve plans and the pre-crisis resilience. Therefore, every firm need to foster all the three dimensions, because they are essential to improve the ability to overcome crisis. (Darkow 2019)

In the next section we will focus on digital transformation, providing a brief review of the literature. Then, after merging resilience and digital transformation, we will present the multiple case study to understand how digital technologies can help firms to deal with adversities.

2. CHAPTER

# DIGITAL TRANSFORMATION

## 2.1 Introduction

The chapter of digital transformation cannot start in other ways than describing what probably is one of the all-time most successful stories of digital transformation: the history of Netflix (see example 3). This example shows how relevant is digital transformation. First of all, digital technologies lead to disruptive changes into the competitive market; as it happened with Netflix, the DVD market almost collapsed in a matter of few years because a new technology emerged. Moreover, digital transformation is not the simple adoption of innovative technologies; it involves changing processes, operations, products or services and, potentially, the whole business model.

Firms may engage in digital transformation for many reasons; for instance, to improve their products or services, to make more flexible operations or to better interact with stakeholders.

However, digitally transform the business is not easy: according to McKinsey, the 2018 successful rate of this effort is less than 20%. In other worlds the 80% of firms that engage in digital transformation failed to foster their performance (Boutetière, Montagner, and Reich 2018).

The digital transformation of NETFLIX

Although Netflix is perceived as a new, digital and innovative company, its origins date back to 1997, when it was born as a "DVD sales and rental by mail" business. This business idea was already disruptive at that time: customers ordered the preferred DVD on Netflix website, received it by post in exchange of the payment of a monthly fee. The business idea innovates the classic conception of renting DVDs in brick and mortar stores: due dates or late fees did not exist, the subscription allowed customers to keep a maximum of 3 DVDs and if the customer wanted to see other movies, they were required to return one DVD to the company. Since its first years, Netflix recognized the importance of data and analytics to predict customers preferences and developed a recommendation algorithm to suggest movies that customers may like. In early 2000' Netflix developed a well-established distribution and logistics chains with more than 50 regional warehouses to deliver DVDs. By 2007 the company shipped its billionth DVD; the business had grown significantly, and the success should have trapped Netflix to maintain that kind of business, fostering and relying more and more on logistic and distribution as their core capabilities. As we said so far, the business model was successful but Netflix, despite continuing with the DVD rental business, in 2006, started to offer streaming video services. This move saved Netflix from the sharp decline of DVD market that occurred in the following years. Netflix successfully predicted the potential of online streaming and the changing customer preferences. As a consequence, it leveraged its digital technologies and offering, by re-designing its business model (Venkatraman 2019).

In this chapter we will describe what is digital transformation. We will take the broadest perspective by analysing a comprehensive model to give the reader all the knowledge to understand the following chapters. We will first present the history of digital transformation literature; then we will introduce the comprehensive model. The model starts by questioning at the macro level what the *consequences* of digital technologies in the competitive market are; then, it explores *what digital technologies are* and *why firms should adopt them*. Finally, it analyses at the micro level what are the *organizational benefit* of digital technologies adoption, *what organizations should do* in order to digitally transform and what are *organizational barriers* that threatens the transformation.

## 2.2 History of digital transformation

To start with, it is necessary to distinguish between "digitization" and "digitalization" (Legner et al. 2017). Although sometimes they are used interchangeably, these two terms have some relevant differences. *Digitization* is the technical process of transforming analog signals into digital form. It refers to the dematerialization of data and information, shifting from paper to computers. *Digitalization*, together with digital transformation, refers to the adoption of digital

technologies by organizations, people, industries or societies. As we will describe later, digitalization is about changing processes, cultures and behaviours inside the firm.

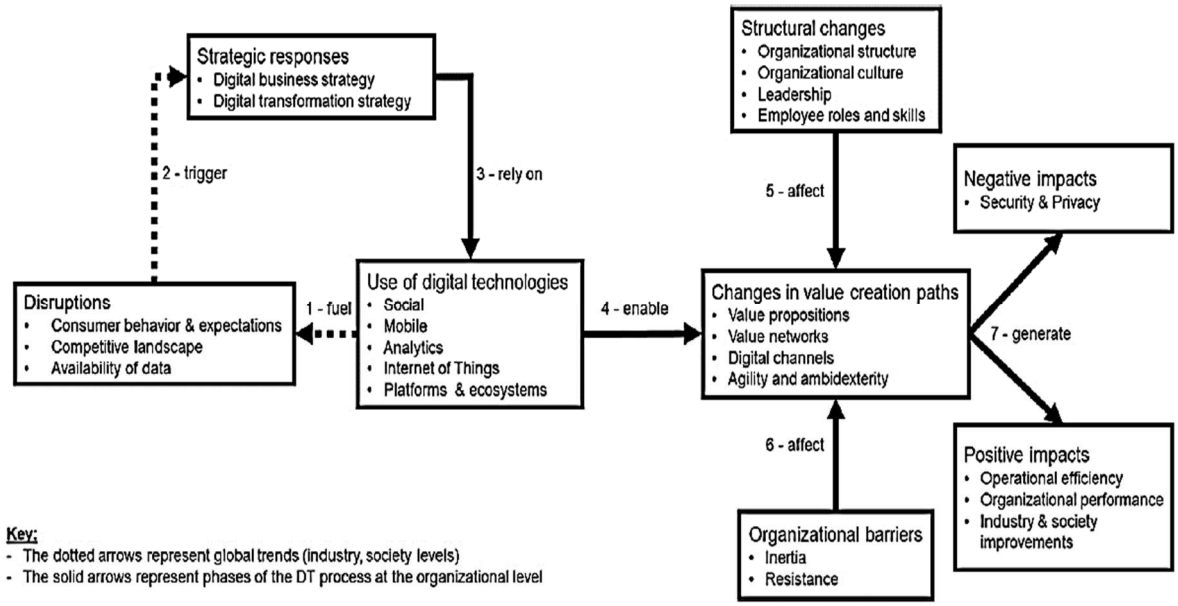
Digital transformation is not a recent trend; different waves have occurred in history. The first wave, in 1980s, concerned the diffusion of computers that allowed for the replacement of papers as physical carrier of information. The second concerned the spread of internet that allowed for new ways of communication, e-commerce and the naissance of new types of businesses completely based on digital services. The third one involved mobile internet that enabled the access to the net everywhere, no matter of the location of the user. The fourth, and current wave, concern new digital technologies that will be explained in the following paragraph and that are recognizable under the name of "SMACIT" or "Industry 4.0" (Legner et al. 2017; Davidsson et al. 2016)

## 2.3 Definition

"Digital transformation is a process that aims to improve an entity [i.e. organization, society or industry] by triggering significant changes to its properties through combinations of information, computing, communication, and connectivity technologies" (Vial 2019: 121).

In other words, digital transformation is the process that aims at improving businesses, societies or industries through the use of digital technologies.

*Figure 3 - Understanding Digital Transformation*




*Source: Vial, Gregory. 2019. 'Understanding Digital Transformation: A Review and a Research Agenda'. The Journal of Strategic Information Systems 28 (2): 118–44.*

Vial, in his paper "Understanding digital transformation: a review and a research agenda" analyses more than 280 papers in order to build a comprehensive theory of digital transformation. The aim of the researcher is to create the most general and holistic model of digital technologies; therefore, as shown in figure 3, he analysed the full process. The starting point is the diffusion of digital technologies throughout societies. These technologies create disruptions at global levels. From the analyses of resilience literature, it is already clear that many factors may generate a disruption; Vial argues that the spread of digital technologies may be one of those. Yet, organizations, in order to remain competitive or gain competitive advantage, adopt digital technologies. By doing so, they undergo structural changes and overcome barriers to modify their *value creation paths*. Digital transformation is implemented for its positive impact both on organizational and societal level, but sometimes it may lead to undesirable outcomes, such as security and privacy issues.

Before explaining the process step by step, let me present one simple example. When social media became available in mobile phones, firms started to use them to create better communications with customers and to convey more information about their products and values. This global trend disrupted the market since it changed customer habits and expectations; firms responded to this change by modifying their communication strategy and by employing social media managers. By doing so, firms transformed the way they previously communicate, resulting in the improvement of customer relationships (*The Economist* 2011). To react to the global trend of the spread of social media, firms adopted this technology.

### 2.3.1 What are digital technologies?

Digital transformation starts from the adoption of new, so called "digital" technologies. But what are digital technologies? Two theoretical concepts are useful to answer the question: industry 4.0 and SMACIT.

SMACIT is an acronym used to indicate the recent trends of digital technologies adoption by big traditional companies when they incur in digital transformation. It stands for Social, Mobile, Analytics, Cloud and Internet of Things. We can include in this group also platforms (Vial 2019).

"Industry 4.0" was first used in 2011 by the German government to define its policy aimed at stimulating firms' adoption of emerging technologies in order to boost production. (Romanello and Chiarvesio 2018) The first industrial revolution occurred in the second half of 1700 thanks to the use of steam and water power to mechanize production; the second industrial revolution allowed for mass production thanks to electric power; the third one was the "digital revolution", where computers, digitization and information technologies allowed for automate production.

The fourth revolution has been based on the third, but the pace of evolution has significantly increased. Moreover, this revolution is affecting every sector and every industry worldwide. (Schwab 2016)

Nowadays, Industry 4.0 refers to the adoption of automated industrial systems that improves production processes, supply chain and, in general, the management of the business (Buchi, Cugno, and Castagnoli 2019). There is not an internationally agreed definition on what technologies are part of industry 4.0 group. However, the more comprehensive group includes: advanced manufacturing, augmented reality, internet of things, big data analytics, cloud computing, cyber security, additive manufacturing, simulation, horizontal and vertical integration (Buchi, Cugno, and Castagnoli 2019) and autonomous and collaborative robots (Romanello and Chiarvesio 2018).

## 2.4 Macro trends

### 2.4.1 Disruptions

Following this view, digital technologies are both the trigger that enables disruptions in society and the solutions that organizations can adopt to resist. Focusing on the former aspect, digital technologies can create three different sources of disruption.

First of all, they *change customers behaviours and expectations.* Customers are empowered in that they have full access to information, so they can compare many products in the global environment and get in touch with the seller before buying. Moreover, customers can review products and brands via social media, affecting the communication strategy of organizations. The expectations about services that should be provided are increasing over time. Therefore, it is essential for firms to anticipate changes in customers' expectations in order to avoid dissatisfaction.

Second, digital technologies (DT) affect *the competitive environment* in different ways. Firms have redesigned their offering creating new digital services and entry barriers and the competitive advantage of incumbents has been reduced. For instance, platforms such as Spotify drastically changed the competitive environment of music industry.

Last, digital technologies have increased *the availability of data*. Firms collect data for their own benefit or to sell them to third parties. Availability of data can be a source of competitive advantage because it allows firms to better meet customer needs and to produce in a more efficient way.

### 2.4.2 Strategic responses

Firms can react to these disruptions by adopting digital technologies. The pressure to digitally transform is increasing over time. Firms are incentivized to adopt digital technologies to maintain the competitive advantage that is threatened by the adoption of the same technologies by competitors. This concept of risk is called “digital Darwinism”: only firms that are the most responsive to digital innovations survive in the market ( Schwartz, E. I. (2002) quoted by Van Veldhoven and Vanthienen 2019).

## 2.5 Micro trends

### 2.5.1 Changes in value creation path/business model

Digital transformation is a journey that involves the re-design of processes, products, flows and business strategy in general (Digital Transformation Strategy). This evolution is not only about one-time transformation but involves a change in the way firms do business: there must be a fusion between business strategy and Information Systems strategy (Digital business strategy). Therefore, digital technologies must become part of everyday life of the business.

Digital technologies can be a great source of value, but “is a firm organized to exploit the full competitive potential of its [digital] resources and capabilities?” (Barney 1995: 56) In order to leverage digital technologies, it is not sufficient their simple adoption; technologies must be incorporated in the whole business; therefore, firms must redesign their *value creation process.* For this reason, most of digitalization-related research focuses on changes in business models. Business model reinvention may involve the radical change of what firms sell, how they sell it or the way they make money from it. Input, output and processes may be redefined when digital technologies are implemented within firms.

Executives see potential for value creation in business model reinvention for at least three reasons. First, reinvention can radically change the competitive environment, shifting the power from incumbents to other firms that adopted digital solutions (see Example 4 – London Taxi Market) (Westerman, Bonnet, and McAfee 2014).

**Incumbent vs digital natives: the London taxi market**

In 2011 Hailo disrupted the London taxi market. The market had been stable for many years: companies had 24/7 call centres and GPS equipment integrated in the vehicles. Despite the expensive infrastructure, the system was not efficient: drivers spent from 30 to 60% of their time without passengers. The founders of Hailo saw an opportunity in this lack of efficiency. They focused on two aspects that determined the work of drivers: maximization of occupancy and isolation of drivers. Hailo offered a social community to engage drivers and create a lock in effect. It was a sort of Facebook for taxi drivers. In addition, Hilo used analytics to calculate and provide drivers with better view of available jobs, suggesting the most efficient way to get passengers considering traffic updates in real-time. Drivers could see in the app some management data like the earnings per hour, the percentage of time they were occupied and others. Hailo also developed a simple app for customers, where they could call, see the photo and mobile number of drivers. Hailo asked 10% flat fee on the ride, there was not subscription fee. Digital technology allowed Hailo to have low-cost operations. As a result, by 2013 more than 60% of taxi drivers became part of the community (Westerman, Bonnet, and McAfee 2014).

Second, well executed business model reinventions are difficult to be replicated. Last, today's pace of innovation continuously challenges firms' processes with opportunities and threats. For instance, the adoption of 3D printing has drastically changed the manufacturing processes of many firms (Laplume, Petersen, and Pearce 2016).

Despite these advantages, not all executives are willing to change the business model because of the high risk it involves.

The paper "Understanding digital transformation: a review and a research agenda" (Vial 2019) indicates four changes of the business model that are viable through the adoption of digital technologies.

The first radical change in business model due to digital technologies concerns the ***value proposition***. Thanks to DT, firms can change their offering, adding services to their physical products in order to increase customers satisfaction. One great example is what Nike did with the introduction of Nike+ (see Example 5).

*Example 5 – Fostering value proposition: from Nike to Nike +*

**Value proposition improvement: from Nike to Nike +**

Nike+ was a completely new business model introduced in 2006 and developed over time by NIKE inc., that aimed at fostering the digital technologies to improve the offering to its clients. The basic idea was to connect shoes to an internet platform using sensors. Shoes could communicate with different devices such as iPods, iPhones, Xbox consoles, GPS watches and FuelBand. With all these devices connected, users are able to track burned calories, the taken steps or share the preferred routes, goals and activities with Facebook or Twitter friends. In the meanwhile, Nike gains lot of information about users' activities, the usage of its products, but also more general information like what music users listen during their training activities. With Nike+ the organization offered additional valuable services to their customers while they gained lot of data to improve their core products, offering and communication (Westerman, Bonnet, and McAfee 2014).

Second, ***value networks*** may evolve in different ways thanks to digital technologies. There are three main "mediation strategies": disintermediation strategy, remediation strategy and network-based mediation. Digital technologies may allow participants of a value network (e.g. producers and customers) to directly communicate each other, without intermediaries ("*disintermediation strategy*"). "*Remediation strategy*" is implemented in order to reinforce and simplify relationships among participants of value networks, allowing for better communication and coordination. Platforms for coordination with different suppliers are examples of this strategy; in this case, all the relationships (e.g. suppliers, distributors and customers) are preserved, but digital technologies are used to reinforce the link between participants. "*Network-based mediation*" is the use of DT to manage complex relationships with new or existing stakeholders that may have contrasting interests in order to increase benefits to customers. DT favour the inclusion of customers in the production and value creation process (so called "prosumers").

Many automakers, for instance, operate in the B2B sector: they sell cars to dealers who relates with the end user. By operating as B2B companies, firms completely depend on intermediaries. In addition, firms lose the relationship with the final customer and they are not able to promptly gain information about customer needs and behaviours. Volvo solved these issues with the implementation of digital solutions (see example 6).

*Example 6 - Value Network improvements: the Volvo case*

**Value Networks improvements: the Volvo case**

In 2012, the Swedish car corporation Volvo aimed to reduce the distance with final customers. At that time, it relied on a network of more than two thousand dealers to sell its products. In order to establish a closer relationship with the end user, Volvo decided to transform its business model from B2B to B2B2C. With this business model, Volvo sells the core product (cars) to other organizations (dealers), but some services are provided directly to end users. This strategy is not a "disintermediation strategy" in that it was created for the benefit of both drivers AND dealers. The first move in this win-win strategy was the use of social media platforms (Facebook, Twitter and YouTube) to embed customers and increase their interaction, loyalty and trust. Volvo does not compete with its dealers because it does not sell cars directly through the web. However, the company support dealers by creating a community of end customers that shares their information and experiences throughout the web. Volvo, then, incorporated a "push-to-talk" button into its cars; this added service is a direct highway that link users to the automaker. With this button, drivers are now at one click away from the company. Volvo set up a call centre to provide different assistance services such as finding where the closest retailer is, calling the police, autonomously alert in case of accident, stolen car tracking, car locator service and others. Through this innovation, Volvo is now improving information that comes from dealers with those directly catches from users. This new database is useful to provide better services to both end users and dealers; for instance customers are sent maintenance remainders with the indication of opening hours of dealer offices (Westerman, Bonnet, and McAfee 2014).

Third, ***digital channels*** can substitute or support pre-existing, non-digital channels. Digital technologies may increase the efficacy and efficiency of communications with customers and final users. For instance, with social media firms can better interact with customers, supporting and enabling an omnichannel strategy that merge the online and offline communication; sensors and data analytics allow firms to collect lot of data about customer needs and behaviours. With the improved databases, firms can take better decisions that are based on truthful and high-quality information. Moreover, throughout algorithmic decision making, software can communicate each other to effectively coordinate activities among subsidiaries and organizations. Better coordination among firms improves the supply chain efficiency and flexibility. In this way, firms may save costs and enhance customers satisfaction. Last, business processes standardization, optimization and efficiency can be enhanced by the transformation of traditional processes into digital.

Last, ***Agility and ambidexterity*** can be fostered by digital technologies. Ambidexterity is the ability to balance exploration and exploitation in order to pursue flexibility and efficiency at

the same time. Digital transformation affects intrafirm and interfirm processes. First, business process automation facilitates exploitation thanks to the improvement in operation efficiency; second, it leverages collaboration among business units within and across firms to facilitate explorative innovations. Large firms, that are usually complex systems with centralization of power and decision making, are generally designed to maximize efficiency. Digital transformation can foster collaboration among departments, leveraging intrafirm collaboration. Once the intrafirm collaboration is high, digitalization can help to foster interfirm strategic alliances. Through the collaboration with other firms, it is possible to access external resources that are not available internally. In other words, digital transformation may solve problems of strategic myopia by leveraging operation efficiency (exploitation) and collaboration among business units (flexibility and exploration) (Park, Pavlou, and Saraf 2020).

### 2.5.2 Structural changes

In order to change the value creation process, organizations need to face some structural changes.

*Organizational structure* should enhance cross-functional collaboration in order to promote flexibility and ambidexterity. Many different solutions can be adopted such as the creation of competence networks that goes beyond organizational formal structure; the creation of separate and independent units that are devoted to the fusion of business and IT strategy together or the creation of cross-functional teams.

*Organizational culture*. As it happens most of the times, changes in the structure of a firm require changes in organizational culture. Organizational practices may promote separation between IT and general business strategy. In order to change this phenomenon, it would be useful to experiment on a small scale the introduction of digital technologies before sharing the successful practices with the whole organization.

*Leadership*. Leaders may spread throughout the organization a digital mindset. In particular, they must encourage the use and adoption of digital technologies, being aware of disruptions related with the use of these resources. New positions, such as Chief Digital Officer may be created, both as temporal figures to manage introductions of DT or permanently to recognize the strategic importance of IT at the corporate level.

*Employee roles and skills.* With digital transformation, the importance of IT department has increased. In the meanwhile, other workers (and future employees) should develop new skills in order to be able to effectively work on technology-intensive projects.

### 2.5.3 Barriers

Changing the value creation path is not easy, it can be considered a disruption for the organization. Firms must face many difficulties, from cultural changes to re-design of processes. In their way for the change of the value creation process, firms must face two major barriers: inertia and resistance.

*Inertia* stress the relevance of path dependences; it occurs when current processes, culture or values, hinder the innovation of the business. The sources of inertia are manifold, and the consequences may be dramatic, as it happened to Polaroid (see example 7).

*Example 7 - The inertia of Polaroid*

**The inertia of Polaroid**

The American Polaroid was the leader of the instant photography market. Since the technology evolved, Polaroid invested in the research and development of digital cameras. The company had really advanced technological capabilities to compete in digital imaging market and, by the late 1990s, it was a top seller of digital cameras. Nevertheless, the company was not able to capitalize on this market. Polaroid's management followed the so called "razor/blade" business model: they made profits by selling consumables whereas their hardware (cameras) was not really profitable. The "razor/blade" business model was not suited for digital cameras in that they required a focus on high quality and high-priced hardware. However, Polaroid was not able to leave the "razor/blade" business model since it was perceived as the most successful and profitable at that time. This inertia marked the decline of the firms, which had been the leader in the sector, and which had all the capabilities to become a potential leader in the digital camera market (Tripsas and Gavetti 2000).

*Resistance* is the second possible barrier to the change of the value creation path. Resistance refers to employees and their difficulties to use digital technologies when they are adopted by firms. Organizations may face this issue with the empowerment of the CDO, through explaining employees the importance and benefits coming from DT or through making processes more flexible to change.

### 2.5.4 Impact of digital transformation

The adoption of digital technologies (DT) has different consequences in every firm. It could generate radical changes in the business offering, structure, or strategy. Papers have found evidence of improvement of organizational efficiency and performance (Vial 2019). Looking at the efficiency, the adoption of DT is found to improve business processes, automation and cost-saving. Many indicators of Business performance are found to be fostered from the adoption of DT, such as financial performance, innovativeness, firm growth, reputation as well

as competitive advantage. On the other side, the adoption of digital technologies showed some threats when it comes to security and privacy issues.

## 2.6 Conclusions

In this chapter, we presented a comprehensive theory of digital transformation. The most important takeaways are that digitalization is not the simple adoption of digital technologies. It involves changes in processes, operations, structures and relationships. The digital transformation can lead to a change of the value proposition, value networks and digital channels, it can also foster agility and ambidexterity. In order to enable the transformation, firms should enable some structural changes in structure, culture, leadership and employees' skills. In addition, they should overcome barriers like inertia and resistance to change.

Digital transformation can be the key to survive and compete in the markets, but what is its contribution on organizational resilience? In the next chapter, we will answer this question.

3. CHAPTER

# DIGITAL TRANSFORMATION AND RESILIENCE

## 2.7 Introduction

In the period of covid-19 pandemic, digital adoption by consumers and businesses has boomed. The lockdown allowed to increase the pace of digital adoption, jumping over five years in a matter of two months (Baig et al. 2020). It is therefore not clear if and how this phenomenon may foster organizational resilience.

Digital transformation and resilience are two independent widely researched topics, but how can they be combined? Even if the merge of these two streams of research is not widely explored from the theoretical perspective, we argue that there could be a great potential for firms to foster organizational resilience by adopting digital technologies.

In this chapter, we will first propose a merge of the two theoretical frameworks; then we will analyse the so-called plug-and-play automation system and finally, we will describe some structural changes that have occurred in the market after the spread of Covid-19 pandemic.

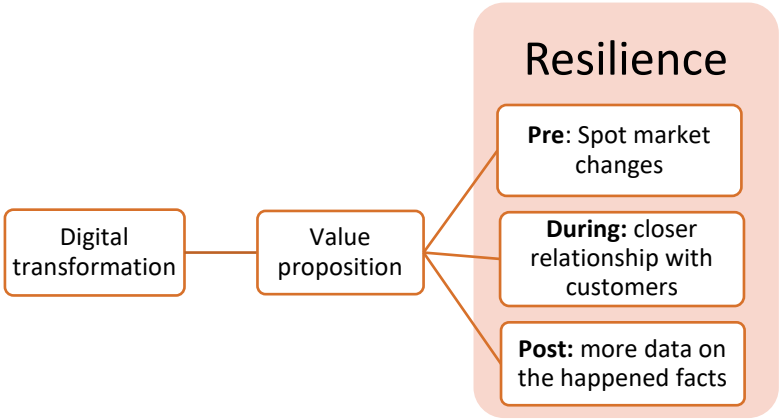
## 2.8 The merge of the theories

Digital transformation, as we said in the theory, lead to changes in the value proposition, value networks, traditional channels and in the agility and ambidexterity of the firm. How can these changes affect the pre, during and post crises resilience?

Thanks to digital transformation, **value proposition** can change by adding services to physical goods. Intelligent products usually include sensors that enable to capture and share data with firms and customers. For companies, data collection and analyses are valuable activities since they provide high-quality information on markets, customer needs, behaviour and usage of the product. This activity is relevant in *pre-crisis resilience* to spot threats and potential disruptions in the changing customer needs and to avoid cascade effects. It helps the risk assessment to monitor vulnerabilities. In addition, services are useful to increase the post-sales activity, leading to the continuity of relationships and offering even if physical products are not sold. Strong relationships with customers are the key for loyalty and may create a lock-in effect that ensure stability of orders even in times of crises. Therefore, *during crisis,* firms benefit from

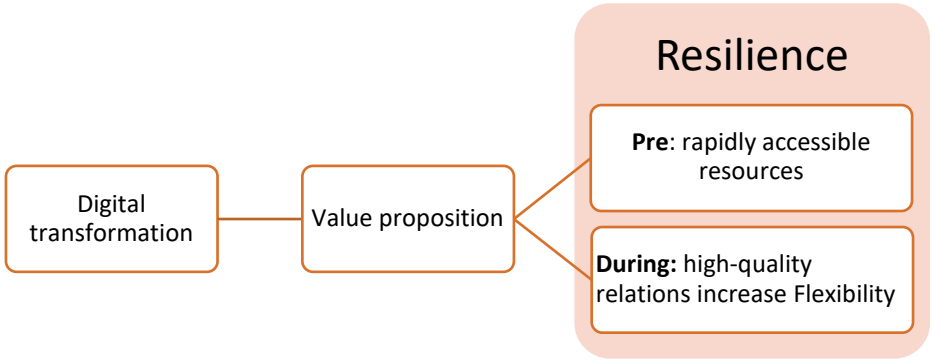
the closer relationship with customers. Finally, even *post-crisis resilience* can be improved from a higher availability of data in that firms may have a better understanding of the evolution of the situation during the crisis. Therefore, firms can detect what have happened, in a better way.

*Figure 4 – DT, Value proposition and resilience*




**Value network** is the second factor that may change with digitalization. Disintermediation, remediation or network-based mediation strategy can be adopted; however, regardless the type of transformation firms go through, the aim is to improve relationships and closeness with stakeholders. Relationships are one of the key elements of resilience. First, a great relationship with suppliers can ensure rapidly accessible resources in case of disruption. In addition, it can increase flexibility to respond to the variability of the market demand. For instance, the automated integration of customer orders in the production planning makes it easier to manage the variability of the market demand. In the opposite case, the integration of orders with suppliers' production planning guarantee the reduction of delivery dates. Integration of business units among firms can foster flexibility.

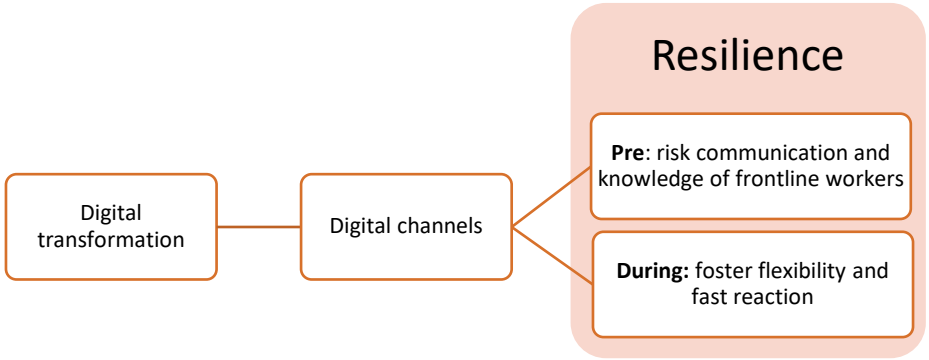
*Figure 5 – DT, Value proposition and resilience*




Third, communication and sales, distribution, project development, and, in general, traditional channels can be transformed into **digital channels**. Digital channels can lead to cohesion and collaboration in business units. The cohesion improves the consensus in sensemaking; this is

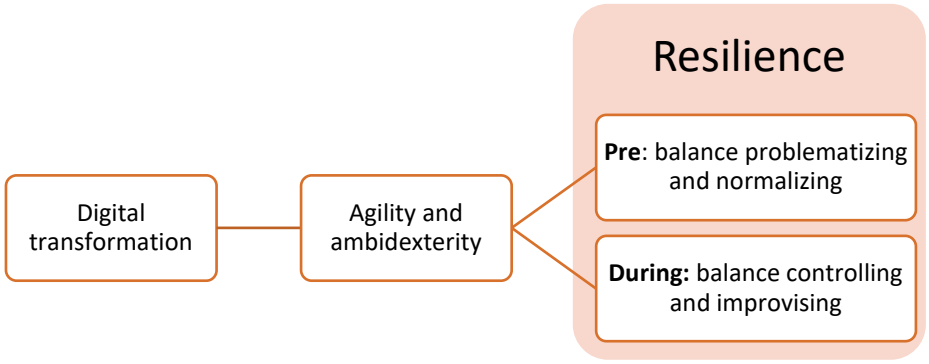
relevant for the *pre-crisis resilience* when it comes to build a common understanding of risk exposure to facilitate risk communication. Also *during-crisis resilience* can benefit from digital channels. In fact, digital and standardized processes are designed to be faster than traditional ones. In addition, process simplification and control may improve flexibility. Furthermore, frontline workers have the technical knowledge to interpret data and solve problems when they occur. More knowledge of frontline workers can lead to the development of innovative and rapid solutions. Last, Digital channels can improve and make faster communication and information flows; this is essential to adapt the organization to the new needs coming from the crisis.

*Figure 6 - DT, digital channels and resilience*




Last, digital transformation affect business agility and **ambidexterity**. Digital technologies are used to improve the efficiency of business processes, leading to a better exploitation of resources. In addition, digitalization improves collaboration of business units within or among firms; this increase in collaboration facilitate the development of innovative solutions (exploration). We argue that the ability to balance contrasting approaches, such as exploration and exploitation, can help the firm to face disruptions. As we said in previous chapters, resilience is about balancing opposite approaches such as problematizing and normalizing (*pre-crises resilience)*, controlling and improvising (*during crisis resilience*). The ability to explore new scenarios is essential in the period before the crisis to explore the possible threatening factors, to design proper solutions and to avoid narrow minded perceptions of reality; it is also useful in the period during the crisis to design innovative and creative solutions to face the coming needs. On the other side, exploitation is essential when it comes to maintaining the focus on efficiency and continuity of the core business activities. Before the crisis, exploitation help to normalize and control familiar risks; during crisis it is useful for the controlling approach to maintain efficiency and continuity of business activities.

*Figure 7 - DT, ambidexterity and resilience*




## 2.9 Digital transformation vs Plug-and-play automation

All these considering, we should bear in mind that digital transformation is not easy, it requires changes in operations, culture, structure, processes and it may take months or even years to be successfully perceived. New technologies need time and investments to be implemented. It is not only about technological aspects, but also the so-called productivity J-curve: radical new technologies require high investments for the redesign of business processes and for the change of employee's skills and organizational transformation (Brynjolfsson and Beane 2020). The difficulties in the implementation relates also with the degree of process standardization: workers can quickly invent new processes for new arisen problems, deal with exceptions and make improvements. Indeed, it is really difficult to digitally transform processes during a period of crisis. We propose, therefore, a sequential relation: digital transformation may help resilience of the firm, if it is enabled before the coming of the crisis. Digital transformation, therefore, aims at improving the resilient qualities of firms.

One example of digital transformation that helped resilience is what happened to RXR Realty (see example 8).

*Example 8 - Resilence and DT: the RXR Reality case*

**Resilience and DT: the RXR Reality case**

The company is a commercial and residential real estate owner, investor, operator and developer based in New York. Even before the spread of the pandemic, the company started to invest in digital capabilities, creating a digital lab. One of the main projects aimed at developing an app to offer additional services to both the residential side (enable move scheduling, dog walking, rent payment and deliveries) and the commercial side (real-time analytics on cooling, heating and floor space optimization). This added services were really successful and highly useful in times of covid-19. The digital lab redesigned the app in order to meet the health protocols required by the government and allows to make users safer. Nowadays, the app provides additional information on air quality and on how crowded the restrooms or conference rooms are (McKinsey 2020).

It is important to say that some implementation of digital technologies during the crisis are possible. But in this case, instead of digital transformation, it would be better to speak about "plug-and-play automation systems"(Brynjolfsson and Beane 2020). To face new issues related with the crisis, some firms adopted digital solutions, mainly implementing robots. These solutions seem reasonable since robots can operate effectively without the same risk conditions (e.g. infection) of human beings. In addition, the access to the technology is getting cheaper thanks to "robot as a service" model, that allows firms to pay the service without incurring in huge investments.

During crisis, plug-and-play automation have been more useful and feasible than other solutions. Plug-and-play systems have small physical footprint, are easy to connect to power and to the existing IT structure. These technologies are rapidly set up and reconfigurable when things change. They require low effort and provide fast results. The problem of the implementation of plug-and-play technology is that they require intense customer support, therefore providers found easier to work with customers they already had, without finding new ones. Vendors must precisely know customer's needs. One example of it is the Agrosuper SA case (see example 9).

*Example 9 - Agrosuper SA: a plug-and-play solution*

Agrosuper SA: a plug-and-play solution

The Chilean food company Agrosuper SA needed 12000 workers to ensure the business continuity and the food supply to its customers during the period of lockdown. In this situation, the firm was required to ask the government a pass for the free transit of each employee from their home to the production plant or offices. In order to gain the 12000 passes, the C-suites decided to invest in a robotic process automation (bot) that took employees data from a company database to fulfil the form to obtain the passes. In 5 hours, the bot gained all the issued passes, allowing the firm to be operative from the following day. The same operation would have taken days to be fulfilled by the hands of many employees (Loten 2020).

In this example, the adoption of the bots was essential to react to the disruption in order to ensure the continuity of the business activity.

## 2.10 Covid-19 structural changes

Following the suggestions of McKinsey: "The covid-19 recovery will be digital" (Baig et al. 2020), three structural changes are transforming markets after the pandemic.

First, firms should improve their digital offering in order to meet the changed customer needs and expectations and to face the threats of competitors. Businesses must adapt channels and flows to offer a fluid digital experience, coherent with the physical channels, leading the firm

to a multichannel strategy. Customer journeys must be the focus of the strategy. Looking at the cost side, firms must transform fixed costs in variable costs, where it is possible.

Second, the recovery of the demand to pre-crisis levels is unpredictable. Many are the uncertainties, like the threat of new waves of infection that may lead to a new lockdown. Depending on the sector, geographical area and product categories, firms may face overcapacity issues or exponential temporary growth of the demand (e.g. medical sector). In this situation every already existing forecasting model or algorithm must be changed according with the new level of demand. New third-party data and completely new analytical models will be required to support operational decisions. In order to do so, firms must significantly increase IT spending.

Last, many organizations have used and enhanced remote ways of working as a first reaction to the lockdown. This experience can be improved and prolonged also after the covid-19 emergency in order to exploit benefits of remote working.

## 2.11 Conclusions

In this chapter we proposed the combination of resilience and digital transformation literature. But does theory reflect the real world? How firms reacted to the covid-19 crisis? Were digital technologies useful?

In the next chapter, our empirical analysis will be presented. The theory described so far will be useful to understand the real cases analysed.

4. CHAPTER

# MULTIPLE CASE STUDY

## 4.1 Introduction

In this chapter we will present the multiple case study analyses. After describing the methodology used, we will focus on the resilience of every firm. For every company we will present some general information, the digitalization path and, finally, how they face the period of crisis. After the description of every company, we provide a table that summarizes the main aspects that contributed to resilience and the roles of digital technologies. Resilient qualities are grouped in five rows: "planning" (did the firm used already existing plans to face the crisis?), "value proposition" (that includes every aspect related with customers and markets), "value networks" (related with suppliers and other stakeholders), "digital channels" (related with internal processes) and "employees".

In final sections, we will propose some takeaways from the qualitative research.

## 4.2 Methods

To contribute to the literature, we conducted an empirical research using the "multiple-case study" approach (Yin 2009). Qualitative research is used to analyse a phenomenon by exploring the whys and how it happens. Through the analysis of real cases, researchers set the basis for theories that will be proven by quantitative research in the future; this methodology can be used also to deeply analyse a phenomenon by focusing on the reasons why it exists.

The aim of this research is to explore the relationship among digital transformation and resilience by analysing real cases to develop a theory proposal and to create different research questions that will guide future research.

### 4.2.1 Sample

The five firms presented in this chapter were selected according to their characteristics. The aim of the selection process was to increase the variability in the sample in order to explore different scenarios. All the companies are based in Veneto region; therefore, they were subject

to the same regulations and health protocols related to Covid – 19 pandemic. The characteristics considered were:

- *Type of crisis:* for two firms – Caseificio Elda and Stevanato Group – the market demand boomed and they were not required to close plants since they operate in sectors that are essential for the country. Other firms were required to stop the production process for some weeks and their market demand decreased at least temporary.
- *Type of digitalization*: Caseificio Elda, Sariv and Stevanato are mainly related with digitalization of business processes, whereas Baxi and Dab Pumps are primarily related with product digitalization.
- *Size:* Stevanato, Baxi and Dab Pumps are big companies whereas Caseificio Elda and Sariv are small (less than 50 employees)

### 4.2.2 Semi-structured interview

In order to collect data, we conducted semi-structured interviews to CEOs or managers that deal with processes digitalization. The four questions we asked to every manager were:

a. *General questions:* can you tell us how the firm operated during the emergency period? Was the firm forced to close its plants? What were customer needs during and after the lockdown?
b. *Planification:* Did you followed some emergency plans to react to the crisis? Did managers privileged improvisation and problem solving over plans implementation? Were digital technologies useful in order to create or adapt plans?
c. *Reaction:* During the emergency, were digitalization that has been implemented in past years useful? Did you developed new solutions or discovered new applications of technologies? Did you encounter any barriers?
d. *Future:* what do you learnt from the period of crisis? What are you planning to change in the future? Are you thinking to introduce some structural changes to the organization?

## 4.3 CASEIFICIO ELDA

### 4.3.1 General inforrmation

Caseificio Elda was founded in 1917 by Giuseppe Zerbato for the production of cheese and Ricotta (whey Italian cheese). Nowadays, the business is carried on by the third generation of the Zerbato family and is specialized in the production of Ricotta bio in private label and with its own brand. In addition to this core dairy product, the firm has recently enlarged its offering with spreadable Ricotta, Ricotta desserts and Mascarpone cheese.

Caseificio Elda sells its products to industrial firms and to large retail chains. The whole production is localized in the north-east-Italian plant in Vestenanova (VR). The plant, with its 9,000 tons yearly production capacity, is highly automated in order to respond to all the requirements of the market demand.

The company is composed of 32 employees, and its annual revenues reached 12.6 million Euro in 2019. A quarter of its output is sold in 20 foreign countries in Europe and overseas (mainly USA, Korea, Japan and Australia).

### 4.3.2 Digital

In order to understand the reasons why Caseificio Elda invested in the automation of its processes, it is useful to explore some key facts of its history.

1990 was an important year for the company that was affected by a severe crisis. Two main factors contributed to the crisis. First, one of the core products of Caseificio Elda, the aged cheese, was a low margin business: it did not produce enough profits to ensure business continuity. Second, the family business was in the middle of a generational transition that complicated the management and control of its activities. In addition, the firm suffered from the poor management experience of senior managers and from some unbalanced contracts that favoured suppliers.

Nonetheless, crises sometimes are the best opportunity for change. Thanks to a market analysis the firm found that some industrial food companies used ricotta in their products, therefore, they decided to specialize in the production of Ricotta. The new customers of Caseificio Elda were big corporations with huge bargaining power; this is why the company simply could not make mistakes and was required to keep high quality and controlled production. Zerbato family decided, therefore, to invest in technology in order to automate the production processes. Thanks to process automation the firm was able to reduce human error and to gain more control over the production process, costs and qualitative standards. All of these changes were essential

to gain trust and loyalty from the most prestigious companies in the sector and lay the basis for entering in the large retail chain.

In order to automate production, the firm re-designed its internal processes. This transformation occurred in two phases. First, in the so called "simple automation" phase, the firm adopted some Programmable Logic Controller (PLC) so as to have a better control over the production process. In addition, employees working on the machines were asked to monitor some parameters to check whether the required quality standards were being met. Through the simple automation phase, the firm was able to monitor some steps of the process. In the following phase the firm adopted a centralized control of the whole production process. Nowadays, all the plants are connected to one single management system and workers have remote control of the whole process. In other words, automation and standardization of processes have led to real process innovation.

The firm has benefited from digital transformation for many reasons. To start with, the firm has more control over the whole production and logistic processes, from the receipt of raw materials to the storage of the finished product. Second, automation has empowered the collection of real-time data that are useful to increase knowledge of the processes. At present, Caseificio Elda can take more rapid, precise and specific decisions that are based on high-quality data. As a consequence, the firm has increased the efficiency of the process: for the same input, it produces more output than its competitors. All these aspects are the basis of the competitive advantages of the firm. From the market side, more control over the processes has allowed the firm to improve the value it offers to customers. Low errors, innovative solutions to clients' problems and high-quality standards have increased the loyalty and trust of customers and, therefore, re-shaped the bargaining power with industrial firms; the result has been an increase in profit margins. In addition, automation helped to enter in new distribution channels and in new foreign markets. Until 1998, the firm produced only for industrial companies that used ricotta in their products (e.g. tortellini). After 1998, the firm has started producing for the large retail chain in private label. Zerbato family took this decision in order to be closer to the final customer and to increase the profit margins.

In 2000 the firm gradually abandoned industrial clients in order to start to sell almost exclusively to large retail chain and directly to final customers. At present, Industrial firms are not the main clients of Caseificio Elda, only few of them are currently supplied by the company. The automation of processes made possible the shift to the large retail chain, because the firm became fast to respond to the market demand and improved the control over the production process. Caseificio Elda has operated as a problem solver in the market thanks to the knowledge it acquired over the years.

The firm also implemented an automated warehouse for different reasons. When the company started to sell directly to final customers, the increase in variety of products and product codes rose the complexity to be managed. In addition, the firm must be very fast in the production process in that the value of its products decreases with time. Furthermore, Caseificio Elda is located in a geographical zone that makes impossible to increase the size of the building. The automated warehouse was the solution to all these problems, and, in addition, it improved integration among departments.

Nowadays different systems communicate each other: the automated warehouse is connected to the ERP, production system and to the management system of customers' orders. Furthermore, some clients are directly connected with the firm: when they send an order, the planned production updates in real time. Even the laboratory that analyses raw materials is connected to the production system. The lab analyses raw materials to be sure that standards are met and send all the data to the production system. The complexity of the firms is increasing because the production of more products involves the management of more raw materials. All this complexity is managed thanks to the automated processes and the ERP.

The excellent knowledge of processes has allowed the firm to extend the shelf life and the expiry date while maintaining the high quality of products. These were essential in order to export some products in the foreign market. In 2003 the company entered in the British market because Ricotta was already known there. It would have been too difficult to enter a market where Ricotta was not known, because it would have required too much investment for Caseificio Elda. Nowadays, the situation is different because Ricotta entered in other markets thanks to some local distributors.

Caseificio Elda exploited a great opportunity when the plant of a big Italian company was closed because of the problem of "mozzarella blu", a contamination of mozzarella cheese. That company asked Caseificio Elda to supply Ricotta. The firm was ready to increase production volumes, therefore it accepted the request. Once the contract with that customer had been concluded, Elda had some extra capacity and workers were employed in the Research and development of new Ricotta-based products. In 2013, Elda introduced the first series of products under its own brand.

Caseificio Elda is an interesting case in that it started with a process innovation that, after some years, enabled product innovations. By innovating the production process, Elda overcome a period of crises and then it gained visibility from the major clients in the market. With product innovation the firm successfully differentiated its offering in order to be less substitutable by creating a lock-in effect with customers. All these improvements would not have been possible without the automation and digitalization of the production process.

Digital and standardized processes, interconnected machines, centralized control and automated warehouse: were these technologies useful during the covid-19 crisis?

### 4.3.3 Resilience and Covid-19

"Cheese superstar of lockdown sales (+246 million of euros)"(Marzialetti 2020). Caseificio Elda was allowed to operate during the crisis given that food sector was considered indispensable to ensure essential goods and services to the country. However, it would be wrong to think that the company was not affected by the crisis: its market demand increased by 40%. This sharp expansion was due to two reasons. First, during the lockdown the market demand of restaurants and out-of-home food was absorbed by home consumed products. Second, within the food sector there has been an increase on the consumption of basic products such as bread, rice, pasta, cheese and others (Sgambato 2020). The company has faced a "crisis" different from others. The risk was of not being able to exploit the opportunity offered by the increased demand. However, as reported by Eleonora Zerbato, the CEO of Caseificio Elda, "We have been able to fulfil all the request, we had no backorders". But how has it been possible? Have digital technologies helped?

> *"We are a highly automated company. The automation helped us to have all the information we needed to quickly respond to the increased market demand. Our Austrian supplier has been able to supply all the raw materials we needed to face customers' demand. We reacted to the crisis thanks to all the things we did in the previous years." Eleonora Zerbato*

All the resources, capabilities and processes that were operative before the crises have been the key to success to face the crisis.

There are different factors that have contributed to resilience: knowledge of the production process, the relationship with suppliers and employees.

#### 4.3.3.1 Knowledge of the production process

The firm has always operated with a mid-long-term perspective: before the crisis Caseificio Elda used 80% of the production capacity, in order to keep 20% extra capacity for the opportunity of growth. During the crisis, the extra capacity has been essential to face the sharp increase in the demand; but still, it was not enough to fulfil the customer request. In this period of change, the firm was able to react and increase the extra capacity in order to respond to the whole market demand.

> *"The past sales data were useless during that period because the market demand was literally crazy. Our clients were not able to plan orders even if they have many*

*algorithms and software that support this activity. If the downstream firm cannot plan in a proper way, we need to face the problem by being ready with the daily production. We do not operate like other firms, where production and raw materials can be planned according to the received orders. We need to have raw materials in stock and workers ready in order to face coming orders. After the production, we must rapidly ship the product. However, we cannot – and we do not want - to increase the available stocks, because, as we said, we work with fresh products. The only solution was to improve production planning and to increase the pace of production cycles. Efficiency is the key." Eleonora Zerbato*

As Eleonora Zerbato reported, production planning is a complex task given that the company works with fresh products: some goods need a daily planning, others allow for a weekly plan. Managers decided to draw up a weekly ideal production plan that was integrated with customer orders on daily basis. Planning was not the only problem, Caseificio Elda needed to increase the speed of production cycles. First, more production lines have been activated at the same time. Second, the firm acquired more capabilities on the production of different products. Last, but probably the most important change: managers optimized aggregate production planning by changing the mix of products in order to increase daily productivity. This complex activity was possible thanks to the experience and knowledge on the production process that the firm acquired over the years. Data collection and analyses helped Caseificio Elda to build this knowledge. The firm knows exactly how much time the raw materials will take to be transformed in the final product. For instance, thanks to the automated vertical warehouse, used at the end of the production process for the cooling of Ricotta, the firm knows exactly when the product is at the right temperature to be shipped. This warehouse was implemented to increase the storage capacity, but during the crises it turned out to be essential to reduce the lead time. Information and knowledge of the production process were the key to efficiency.

#### *4.3.3.2 Relationship with suppliers*

Knowledge of the production process is not the only determinant of Caseificio Elda's resilience. To increase outputs, firms must rise the availability of raw materials. When there is lot of variability in demand, firms should be able to face the downstream noise by dealing with suppliers. There are two ways to ensure flexibility from the supply side: controlling suppliers (through acquisitions or special contracts) or relying on strong relationships. Caseificio Elda followed both ways. Whey, the main raw material to produce Ricotta, is supplied by an Austrian company which has been controlled by Caseificio Elda since 2011. For the company, whey supply was not a problem since the control of the supplier gives all the required flexibility. The

second supplier deals with packaging. The strong relations that the company had built up over the years, was essential during the crises.

> *"The relationship was built on respect: no late payments and frequent and continuous orders; but the key factor has always been the human relationship. We have never searched for the lowest price, but we have always paid attention to the services, capabilities and abilities of our suppliers. Even if our supplier had lot of absenteeism during the crisis, it worked to fulfil our request. This is our power. The prices of our products are a bit higher compared to competitors, but reliability is our key advantage. We ask suppliers the same reliability that we offer to our customers*". Eleonora Zerbato

Excellent knowledge of the production process and strong relationships with suppliers; what other factors did the company had to face the crises? The last engine to the "resilience machine" is about Elda people: workers may have been the bottle neck of the process but, in fact, they have been the power of the firm.

#### *4.3.3.3 Employees*

Elda's people have been the real power of the firm; Caseificio Elda has always paid lot of attention to employees. When workers are well motivated and proud of being part of the firm, they are ready to invest more effort for the benefit of the organization. Different factors contribute to the embeddedness of the employees. First, the size of the firm, almost 40 people, makes it possible to foster human dimensions and relationships among Elda's employees. Nevertheless, it is not only about size: the attention, respect and care of employees is part of the culture and philosophy of the firm. Workers are all equal and all of them deserve respect, regardless of their hierarchical position. Modesty and common sense are core values of the firm. Zerbato family lead the way in that they act for the benefit of the firm and not only for their own interests.

> *"Our love for the company is instilled in the employees and everyone works for the good of the company". Eleonora Zerbato*

One direct consequence is the absence of absenteeism during the pandemic. People understood the relevance of their work for the business activity; therefore, the crisis has been a period of cohesion among workers, who "fought" together against the common enemy: the crisis. Some days, employees worked 12 or 13 hours consecutively in order to continue production and nobody was upset about it. The plant was operative 24 hours per day despite the pre-crises 19 hours, with almost the same number of workers (Caseificio Elda employed some new workers but the workload was still heavy). Since the enterprise is highly automated, there were no problems of social distancing in the plant. Work schedules were changed in order to minimize

the number of people in the building. The firm organized four different entries for the registration of employees and for measuring body temperatures (only one was available in pre-crisis). Caseificio Elda did not implement smart working in that it was not necessary, and it would have complicated the management of processes.

### 4.3.4 Digital technologies vs crisis

To summarize, digital technologies have been essential in many ways. First of all, digital channels enable the firm to capture a huge amount of data and knowledge about the production process. This knowledge allowed to increase the efficiency and the pace of the cycle by planning the production in a new way: mixing and optimizing the aggregate production of different products. Second, value networks were improved by digital technologies, for instance, the real time data management of orders helped to deal with suppliers in that Caseificio Elda was able to send them precise orders even if the variability of customers demand was really high. Orders were so precise that one supplier defined this way of working as "surgical". Furthermore, given that the production process was highly automated, firms had no problem of social distancing because machines carried on the production of ricotta from the beginning to the end of the process.

From this case study we can develop different considerations. First, all the investments in automation in the pre-crisis period were essential for the resilience of the firm. Second, digital technologies were the enabling factor of Caseificio Elda's resilience; however, employees were the real power of the firm during the emergency. Third, resilience, was not only the way to exploit the best opportunities from the crisis, but it was also a signal for customers. The proven reliability has been a signal for potential customers in both the Italian and foreign markets. Some industrial companies have been attracted by the reliability of Caseificio Elda and signed new supply contracts with the firm. The crisis has forced industrial firms to consider factors such as the resilience, flexibility and reliability of their suppliers: the lowest price is not the only determinant for choosing suppliers. Even in the foreign market, the successful story of Caseificio Elda attracted some new partners. The firm was able to enter in the list of Mark and Spencer's suppliers. M&S is the best seller in ready meals. Every company that wants to sell through the M&S retail chain must buy raw materials from one company included in this list. These new channels (industrial company and foreign markets) will be useful in the post-covid 19 period if the market demand of the large retail chain reduces, as family Zerbato expects. Nevertheless, the new capabilities, way of working and relationship with stakeholders will remain in the future and will affect overall turnover that, in 2020, will probably reach 14,5 million Euro.

*Table 1 - Caseificio Elda: Resilience & DT*

| **RESILIENCE** | | | |
|---|---|---|---|
| | Pre crises | During crises | Post crises |
| Planning | 20% extra capacity for growth opportunities | Increased extra capacity | New level of efficiency |
| Value proposition | Thanks to process digitalization it was possible to introduce also product innovations | | Resilience was a signal to gain new customers & partners. |
| Digital channels | High knowledge of the production process | Increased extra capacity thanks to:<br>- Fast production cycles<br>- Production planning | The firm learnt new capabilities and made production more efficient. |
| Value Networks | Strong relationships | Continuity of the supply despite difficult working conditions | Continuity to work and invest on the relationship |
| Employees | Embedded in the organization and highly motivated | No absenteeism and high workload | Continuity to work and invest on the relationship |
| **What were the roles of digital technologies?** | | | |
| The automation of production process allowed the firm to avoid the problem of social distancing among workers.<br>The management of customers' orders helped the firm to place orders to suppliers in a precise way.<br>Provide real time data to increase the knowledge of the production process. | | | |

## 4.4 SARIV SRL

### 4.4.1 General inforrmation

Sariv is an enterprise based in Padua (Veneto region, Italy) which offers solutions for fastening problems with the production of blind rivets, blind river nuts and riveters, mainly for the automotive sector. The firm was created in 1990 as part of a family owned group that operated in the mechanical sector. In 2019 Sariv had 42 employees, produced more than 2 million pieces per day and reached almost 6.5 million revenues. The firm has always operated in the international market: 85% of its products are sold in foreign countries. The firm has its administrative and production plant based in Padua and 5 other warehouses located in Russia, Poland, Czech Republic, Slovakia and Croatia; these warehouses are useful to sell products in local markets.

### 4.4.2 Digital

Tablets for employees, automized warehouse and digital production process: Sariv's digital transformation was enabled to respond and survive to the economic crisis of 2008.

The reasons for investing in automation were manifold. First, the company operates in a commodity sector, where there is little space for increasing profit margins through diversification. Second, since the company works with the automotive sector, it is required to ensure high quality standards, product tracking and to respect strict safety and environmental regulations. Furthermore, the company operates in many countries therefore the need for adaptation to different customer needs and law requirements is significantly high.

Digitalization was the best solution to these problems: it allowed for better control on processes, reduction of human errors but mostly, it was essential to change the business model by offering additional services to increase customers value. In 2009 Sariv abandoned mass production to embrace product customization and to become a real problem solver for the automotive sector by offering different and personalized solutions for fastening problems. In other words, digital transformation allowed to customize products, even in a market that is usually perceived as highly standardized. Nowadays, Sariv's core operations are not related exclusively to the production, but also (and mainly) to services and other activities that added value to customers.

The production process is highly automated: machines are connected to a centralized cloud system that capture real-time data. With the Manufacturing Execution System (MES) the firm can manage and control the production process and track goods during the whole cycle. MES communicate also with a digital sorting machine for the quality control. This machine has 3 cameras for the side, top and down view, that scan 350 pieces per minute. If one piece does not

comply with quality standards, it may go back to the beginning of the production process or it is rejected. From the logistic point of view, the firm has a vertical fully automated warehouse that allows to verify in every moment the stock level. The system is able to distinguish among semi-finished products, final products and products to be packed. The high control on the entire production process and on the single product allows to collect lot of data that are useful for instance to calculate the real time efficiency level of the plant (Overall Equipment Effectiveness). Data analytics are then analysed to increase knowledge of the production process and to strengthen efficiency and the consequent competitive advantage in the market.

Digital transformation is not only about machines and technologies but also about people. Sariv promoted some training courses to develop digital competences.

> *"The transferring of knowledge is not easy, specifically if we consider tacit knowledge. We found difficult to integrate digital natives (who have digital competences, but not mechanicals) and seniors (with mechanical competences but not digital)".* Nicola Sartore, Sariv CEO

Thanks to digital transformation, Sariv increased the number of its employees because more people were required to manage and analyse data that the firm could collect. The digital transformation created new job positions, such as the Chief Digital Officer or the Product Data Manager. CDO must plan the digital journey and communicate to employees the short-term benefit of the transformation in order to let them understand why it is important. The Product Data Manager is responsible for the management and improvement of the database that collect all the products-related data.

Some people demonstrated some inertia to accept the transformation. However, the business culture contributed to the development of digitalization. During training activities, people were free to interact each other in order to share their knowledge, problems and idea to create a common understanding of the technology.

### 4.4.3 Resilience and Covid-19

The economic crises due to the pandemic was added to the revenue shrink that affected the company in the last years. The automotive sector, in fact, reached a plateau in 2018 and 2019; for 2020 a reduction in the demand was already expected. The Covid-19 pandemic worsened the whole situation. Nevertheless, the firm reacted to the crises thanks to its emergency plans and its advanced technology. The company stopped the production for few weeks, but not for all the lockdown period; since 80% of its products are sold in foreign markets, Sariv was allowed to operate to avoid disruptions in the global value chain.

#### *4.4.3.1 Planning*

Every company that operates with the automotive sector is obliged to have an emergency plan to guarantee the continuity of the business. As it happened for most of the firms, pandemic was not considered among the possible threatening factors. However, plans were adopted and implemented to face the crisis. For instance, the automotive sector requires firms to have a minimum level of safety stock (that is higher than what is needed in normal conditions); the availability of this extra resources and products was essential to ensure the sales continuity. Furthermore, the firm was required to have a system that enable remote working: data are available in cloud and internal mirroring systems allow workers to do their job from home. The firm was ready to use data (even sensitive business information) from a remote position. Workers could remotely control servers that are responsible for the functioning of production lines. Nevertheless, machines need people to operate, therefore blue collars were required to work directly inside the plant.

Thanks to the emergency plan, every person is substitutable: if one key manager gets ill, the substitute person is already known. For the white collars, only essential meetings were face to face, others occurred through internet platforms such as zoom or Microsoft teams.

#### *4.4.3.2 During crisis - plan adaptation*

Emergency plans were successfully implemented but some adaptations were required to solve operational problems. The firm changed the shifts and workspaces to avoid people to contaminate each other.

In order to respect government's regulations, the firm adopted "the rule of 48 hours". According to the health protocol, if one person is affected by coronavirus, the firm need to present a list of all the people who met that person over the previous 48 hours. Since the firm wanted to preserve relations among workers while ensuring business continuity, it duplicated some activities: some employees have worked from home, others (doing the same activity) worked from the office; every two days, positions were inverted, so that if one group of workers needed to be in quarantine, the activity would have been carried on by the other group. In addition, departments have been segregated: every department has its own entry. Canteen service is provided, but different shifts have been set, employees have 40 minutes to eat and then they continue their break in other outdoor or open-space places.

Digitalization of processes has been essential during crisis. For instance, the firm has a software that digitalize projects development; usually there are 5 or 6 people that work on the same project. The software shows advancement levels and the different tasks that every person of the

group should do. This technology allowed teams to operate even if they do not meet in person because everyone was able to work on his or her task without the need of a face to face meetings.

> *"Everything has been possible because processes are manageable from remote; the availability of digital data has been essential to work outside the firm. If we were working with paper documents, we would not be able to work from home." Nicola Sartore*

#### *4.4.3.3 Stakeholders*

Employees were initially worried for the economic aspect: they were afraid to lose their job. Managers organized meetings every two weeks to inform workers about new health rules and protocols and about the business and industry situation. From the organizational perspective there has been the need for power decentralization because less people could enter inside the firm. This gain in autonomy and independence has been positively perceived by workers since they ended up more motivated and the collaboration within departments increased.

Most of Sariv's suppliers are Italian, therefore they were in the same conditions of the firm: it was not difficult to deal with them. Some problems arose with Taiwanese and Czech Republic suppliers, where the supply chain was disrupted for a while. However, no substantial changes were needed.

Some customers are adopting new rules, such as that every plant should have at least one of its suppliers in the same country where it is located. This sort of "regionalization" of the supply chain, constitute opportunities for Sariv in that Asiatic firms that operate in Europe, need to find new European suppliers.

#### *4.4.3.4 Post crisis*

> "Flexibility of working hours will be the key for efficiency and employee's welfare" Nicola Sartore

Work organization has changed during the crisis. This change was useful to respond to the need for flexibility of employees and to gain efficiency in productive process.

First of all, the flexibility that workers needed during this period was unexpected because, for instance, people had to take care of their children most of the day: some of them were ready to work during the night, early in the morning or late in the afternoon. During this period, it was useful to improve the management of different working hours. According to the possible slot of time that people could work, the firm assigned different activities; in other words, the job content for some workers has changed. Fortunately, there was not the need to rapidly train employees because they already knew different activities. The increased flexibility required by

employees allowed managers to explore new opportunities: they understood that some activities such as order recording, can be done in different times (also at night). Thanks to different KPI, managers can track if a person works productively or not. This experience will be useful to improve the welfare of employees in the future; in fact, working accordingly with their preferred slot of time may improve their work-life balance.

Second, crisis was an opportunity to gain efficiency in the production process. The enabling factor was, again, the increased flexibility of employees working hours. Employees that works in the production process normally have a rigid time schedule. The need to minimize people inside the firm made possible to change worker shifts; this change was accepted by all workers, even by senior ones that have been working in the same way for 30 years. In normal conditions there are only 2 shifts: one starts at 7 am, the other at 8.30 in order to cover almost 12 hours. Then there is a shift without people, where machines work at a slower pace. With the new shifts, some workers started at 6 am, others at 9 and others at 11. The firm considered the working time of employees as a constraint when they planned the production: set up operations must be done while employees are working. By the way thanks to the flexibility that was required during the pandemic, the constraint become a variable: working hours can be done when it is more convenient to do set up operations. By considering working time as a variable and not a constraint, the firm was able to gain efficiency.

> *"Our aim is to maintain the flexibility even after the crisis: we can ask for more flexibility by giving employees different benefits and permissions: if one worker is asked to start at 6.30 am, he or she will gain half an hour bonus on his/her daily workload. The firm will design the right incentive system. Workers can come 30 min earlier or go to eat 30 min later. This flexibility will be the key to gain efficiency."*
>
> *Nicola Sartore, Sariv CEO*

The emergency created the sense of urgency on employees. This external partner favour the acceptance of change. Resilience helped the firm to explore new routes that were not considered before.

### 4.4.4 Digital technologies vs crisis

The implementation of digital technologies improved value proposition, thanks to the customization of products; furthermore, it increased knowledge and control of the production process. The implemented technologies were useful to face the crisis for different reasons.

First, the advanced systems of the firm allowed workers to do their job from home without any problem. Even sensitive data were available outside the company. People could use software to manage the production lines from a remote position. Given that all data were available in cloud

and the IT infrastructure was ready to enable smart working, the firm duplicated operational activities in order to respect the rule of 48 hours. Digital channels and processes reduced the importance of workers location: they could easily shift from smart working to office work.
Second, during the crisis, people could carry on projects without the need to meet each other thanks to a software that digitalized project development. Digitalization allowed to improve cohesion among workers regardless of their geographical location.
Third, smart workers needed an increased flexibility in their working hours during the crisis. Thanks to different KPIs, managers could trace if a person worked productively even if the activity was carried out at night. This control allows the firm to let employees work whenever they want.

*Table 2 - Sariv: Resilience & DT*

| **RESILIENCE** | | | |
|---|---|---|---|
| | Pre crises | During crises | Post crises |
| Planning | - Emergency plan<br>- Safety stock level<br>- Pre-defined substitute workers | Plan adaptation and adjustment | Improvement of business continuity practices |
| Value proposition | Improved relationships with customers thanks to customization | | |
| Digital channels | - Data and management systems available in cloud<br>- Digital project development | - Different blue collars' work shifts to respect government regulation<br>- Activities duplication: "rule of 48 h" | Increase in efficiency by changing working shifts |
| Value Networks | | | New opportunities coming from the regionalization of the supply chain |
| Employees | Smart working | - Flexible working hours to increase welfare<br>- Decentralization of power | - Improvement of work-life balance<br>- Employees more motivated |
| **What were the roles of digital technologies?** | | | |
| KPI to control employees to allow them to operate whenever they want<br>Enable customization that improved relationship with customers<br>Enable smart working; Even sensitive data available in cloud<br>Software to track advancements in project development | | | |

## 4.5 DAB PUMPS

### 4.5.1 General inforrmation

Dab Pumps offers technologies for the movement and management of water for residential and commercial buildings but also for agriculture and irrigation purposes. Its headquarter is based in Mestrino (PD) since 1975, when the firm was created. In 2019 the firm reached a turnover of €326 million and had 1700 employees that operated in the 6 production plants and 14 commercial branches spread in the 5 continents.

### 4.5.2 Digital

Digitalization is a key element of Dab Pump's strategy. Over the last years, it committed to create an interconnected system that link products to consumers, distributors, installers and stakeholders in generals.

The digitalization path started in 2014 and boosted in 2017 thanks to the creation of the DAB Digital Committee (DDC) and a manifesto to show what is the digitalization for DAB and what are the goals it wants to achieve.

The committee is composed by five people, each one responsible for a specific business area:

- The group IT Manager is responsible for IT and Finance;
- The Group Logistic Director is responsible for operations;
- The Product manager is responsible for the digitalization of the product from R&D to marketing;
- The Group Communication Director is responsible for sales and communications;
- The HR manager is responsible for selection and training of Human resources.

The role of DDC is to coordinate the digital transformation among all business areas, departments and functions. It does not have a budget to create new projects in order to avoid that digital transformation become a 5-people work. Dab Pumps strongly believe that digitalization must include the whole organization in order to maintain a high integration among all the functions. The objective of DDC is to: spread the digital culture to the whole business group; align digital transformation among all the business areas in order to have a homogeneous digital transformation and growth; support the management and execution of projects related with digital transformation. The contribution of the DDC was essential to design and carry on the digital journey of the firm.

One of the first goals and one of the greatest successes was the increase in connectivity with stakeholders. For this reason, the firm developed the D.Connect system to offer different services to maintainers, sellers and end users. The system links products to the cloud: lot of

data are collected, analysed and shared with maintainers and installers. Data are essential to increase knowledge of the production process, of the functioning of products and to support installation, remote control and customer services.

Dab Pumps has been able to improve its value proposition offering digital services to increase the customer value. End users can download the D. Connect app on their mobile device to control the status of the pump, send remote commands, manage emergency solutions and plan maintenance services. All of this has been possible thanks to sensors that allows to trace every pump from the beginning of the production, to the end of the shelf life. All the data available allow Dab Pumps to take better decisions and to guide the research and development to continuously improve products. In order to increase the availability of data, the firm has implemented a paperless way of working (digitization).

Digital processes have a crucial role also to link the different actors of the value chain. This connection reduces the impact of the geographical distance and allows for the naissance of a global value chain. For instance, suppliers are able to know in real-time the raw material requirements of Dab Pumps and to plan the supply furniture according to their production cycles.

The firm is investing on digital technologies also to support production. 17 robots have been implemented in the production process; a 3D printer is used in the initial phase for prototyping. Digitalization is creating a gap with competitors and is opening to the firm new possible markets.

“Think global, act local” is the slogan of the firm. Digital technologies require and enable standardization of processes among different branches. In this way, processes become easier and standard, but they leave some space to adaptation to the local market. The sensor inside the pumps, in fact, allows the firm to collect data on foreign markets and to analyse behaviours and needs of local customers. In addition, foreign subsidiaries can be remotely controlled, without the need of a General manager. Therefore, the international presence of the firm is another factor that benefited from digitalization.

While from the production side, process standardization is possible and allows for a global management, from the customer side, the situation is different. A digital product is difficult to be spread whole over the world because digital services need to be adapted to the local user needs and law requirements.

In its digital journey, Dab Pumps encountered some cultural barriers: many professionals (sellers and installers) found difficult to accept a technology like D.connect. Many plumbers were not used to work with such technology, therefore they criticized sensors and the new digital services. The difficult part is to let people with different backgrounds work together. To

face this problem, employees of Dab Pumps are required to have at least basic digital competences and are trained during their working period. Training is only useful if the firm has a digital culture to support digital transformation. In order to improve the digital culture, Dab Pumps has committed to increase dynamic capabilities and technological skills. The firm decided to generate internally some digital competences and technical knowledge. Other digital solutions are outsourced to improve processes, products and services; however, employees must have a basic knowledge of digital technologies in order to understand their functioning and potential when they deal with suppliers and strategic partners.

## 4.5.3 Resilience and Covid-19

The initial impact of the crisis was dramatic. The firm stopped the production for one week, but then it was allowed to operate since the water value chain was considered as one of the essential sectors for the country. Nevertheless, the extraordinary costs due to the covid pandemic was calculated as €900.000 at the beginning of October. This number was calculated considering direct costs such as masks provision, sanitizing and others like the delta cost of raw materials. Problems started way before the Italian emergency, when the Chinese supplier interrupted its furniture. But as Sandro Stramare, the CEO of DAB Pumps reported to his employees: "guys, this could be a great opportunity".

> *"Crises are opportunities to show customers our value, our diversification with respect to competitors. In "normal" periods there is market for every firm, but downturns leave the space to the firms that have always operated doing their best". Sandro Stramare*

For one month the market demand was halved. After that period, the recovery was fast and, at the beginning of October, total sales of 2020 were predicted to be higher than 2019 sales. By the way, the overall production from January to October 2020 was higher than the production on the same period of the previous year, therefore, the recover was fast.

### *4.5.3.1 Planning*

The firm had a recovery plan, but it did not fit with the happened crisis, therefore it was not implemented. However, Dab Pumps had already worked on many projects related to digitalization. Therefore, the firm did not implement a pre-defined plan, but it accelerated different projects that it designed over previous years.

Dub Pump's projects were related to 4 main areas: *digitalization of customer journey* (web sales, digital touchpoints and digital marketing), *smart solutions* (Internet of Pumps-Iot, servitization, integrated solutions to connect pumps with other smart home devices, data analytics to support new product development and to face malfunctions), *process automation* (ERP, MES, end-to-end integration: digitalization of interaction with customers and suppliers,

data excellence) and *people and organization* (people mindset, organizational design, tools such as smart working, workplace etc.)

One project, for instance, aimed at promoting smart working in all the offices. It introduced flexible working hours and job evaluation on results: some people around Europe could already work whenever they want. The structure was ready to enact smart working for all the activities but manufacturing ones. The firm committed to become more agile. To reach this goal, it created multinational teams of work that operated without the need to geographically move. The firm was therefore ready to develop projects without the need of face to face meetings.

The Dab digital committee had a fundamental role before the emergency. Nevertheless, during the crisis it was not useful since there was not the need and time to develop new solutions. Thanks to the implemented projects, physical offices became an optional.

*"Our power was to have already planned our digital strategy, the only need was to accelerate and implement the designed projects." Sandro Stramare*

### *4.5.3.2 During crisis*

The first action of the firm was to create a Covid committee for the safeguard of people. The committee designed different protocols aimed at the protection of employees; these protocols were stricter than rules set by the Italian government and were published even before.

After this, the firm focused on the business. Production workers were asked to come to the plant, whereas for others smart working was imposed. Blue collars were almost the only people in the firm together with the CEO and other managers that commit to support employees. During the period of great uncertainty and scare of the virus, CEO and managers commited to speak with workers and reassured them almost every day.

From the supply side, some disruptions occurred when the virus spread in China. Since the firm had some Chinese suppliers, they needed to find European substitutes or produce components internally. The only problem was the delta cost: Chinese prices are lower that European ones. This increase in costs constitutes almost half of the calculated covid expenses (€900.000). It was interesting to realize that some low-cost components that were not considered as critical, became a scarce resource and a key element when the supply chain of Chinese companies was disrupted. The firm had a single source in China, so it will probably keep more than one supplier in the future in order to ensure business continuity.

The implementation of projects allowed to design new interventions, such as the elimination of landline phones in the offices. The IT department integrated the phone line to Microsoft Teams, so that employees could answer the phone from their pc or their mobile phone through Teams platform.

There is always some resistance, but the emergency accelerated the acceptance of change. Digital solutions were an option before crisis, but, after that, they became a need. However, some changes, such as smart working, encountered problems: some workers prefer to go back to offices because they experienced bad consequences of smart working (home space, work-life balance management and others); therefore, the firm need to work on these aspects in order to promote the acceptance of change.

#### *4.5.3.3 Post crisis*

Even if many projects have been implemented, the firm perceives the external pace of change as higher than the internal ability to evolve.

> *"From the crisis we learnt that we are too slow. We need to be more agile, so we must work on our flexibility and speed. In order to increase the speed, the firm will focus on the simplification and standardization of internal processes. We have been working a lot on human resources, but now the key to increase the speed will be the improvement of master data management. Having updated analyses based on real-time data will improve our decision making and speed. We need to use the logic of single source: every data is only in one place; no replication or redundant data are possible. Reduction of personalization of the ERP is another project that runs in this direction: customization means complication. Every personalization needs to be managed when the ERP is updated." Sandro Stramare*

Data analytics, strong master-data and process optimization and simplification will be the focus of the future. The firm already collects high-quality data, its aim for the future is to improve data management to extract value.

### 4.5.4 Digital technologies vs crisis

Even if the recovery plan was useless, the firm reacted to the crisis thanks to the digitalization projects that were implemented in previous years; the Dab Digital Committee was fundamental to design the digital journey that, during the crisis, substituted the recovery plan.

Digitalization led Dab Pumps to change its value networks in order to create a system that connects consumers, installers, suppliers and different stakeholders. Well-established relationships are useful when crises occur. For instance, interactions among business units of Dab Pumps and its stakeholders have reduced delivery times; suppliers know exactly raw material requirements of the firm and can plan their production processes accordingly.

In the meanwhile, Dab Pumps improved the value proposition, adding services to physical products to increase customer satisfaction. This differentiation strategy has been possible thanks to the sensors embedded in the pumps and to the cloud-based data collection. Services

were useful during the lockdown period to maintain relationships with customers; furthermore, the analyses of data coming from intelligent products enabled to analyse the different needs of foreign markets.

Employees have – at least – basic knowledge of digital technologies; during the crisis this knowledge was essential to accelerate the implementation of digital projects (i.e. the implementation of smart working).

Digitization of processes is aimed at increasing the number of data available in cloud and to be able to manage from remote almost every internal process. Digital channels allowed to collaborate closely with foreign subsidiaries even without the need to move people from one country to another. Dab Pumps was ready to implement smart working and to develop projects with multinational teams.

*Table 3 - Dab Pumps: Resilience & DT*

| **RESILIENCE** | | | |
|---|---|---|---|
| | Pre crises | During crises | Post crises |
| Planning | DDC designed the digital journey | - Acceleration of digital projects development<br>- A Covid committee was created | The firm reached a new level of digitalization |
| Value proposition | D.Connect app to offer services. | Data analyses to understand market needs | |
| Digital channels | - Many sources of data<br>- Digitization<br>- Digital production process | Easy interaction among Subsidiaries | Foster simplification and standardization of processes to be faster. |
| Value Networks | - Interconnected system with stakeholders (D.Connect)<br>- Integration of BU with suppliers | - Fast supply<br>- Find new suppliers or produce internally | Supply chain: avoid single sourcing |
| Employees | IT infrastructure for SW | - Smart working (SW) was imposed<br>- Managers reassured workers every day to keep the motivation high. | Work to solve SW problems. |
| **What were the roles of digital technologies?** | | | |
| Sensors & digital processes enabled cloud-based data collection. Data were useful to spot market needs and foster subsidiaries collaboration.<br>DT improved value networks: they mediated the integration of BU with suppliers and interactions with customers and installers.<br>Employees' digital knowledge and skills made easier to accelerate digital projects. | | | |

## 4.6 BAXI

### 4.6.1 General inforrmation

Baxi designs and produces air conditioning systems in the domestic and commercial environment for heating and cooling: boilers, heat pumps, hybrid systems, solar power systems and others.

In 1925, the German family Westen founded “Smalterie Metallurgiche Venete”, one of the major producers of enamelled products, such as dishwashers and bathtubs. In 1999, the company became part of the English group Baxi Ltd, which was leader in the heating sector. In 2009 De Dietrich Group (composed by Remeha and DeDietrich) merged with Baxi group; in 2012 “BDR Thermea” was born thanks to the consolidation of the merge of the three companies.

Baxi S.p.a. is based in Bassano del Grappa, where it has the biggest European plant of the sector. More than 770 people work in the plant, with a production capacity of 4000 boilers per day and 500 thousand per year. The company is part of BDR Thermea Group BV; the group has an annual turnover of 1,8 billion euros and employs more than 6.400 workers. Nowadays one third of the turnover of the group is made in Italy. BDR Thermea Group operates in more than 70 countries in particular in UK, France, Germany, Spain, Netherlands, Italy, Turkey, Russia, North America and China. The Group operates in the whole world thanks to the commercial branches, that include different brands such as Baxi, De Dietrich, Remeha, Heatrae Sadia, Brötje, Potterton, Chappée, BaxiRoca and Baymak. In the whole Italy, Baxi S.p.a. opened assistance centres to offer continuative and high-quality training and services to partners (installers and maintainers).

### 4.6.2 Digital

In order to make the production more flexible, Baxi invested in the digitalization of production processes. By doing so, it improved the quality of its products and increased the availability of data within the group.

In Italy Baxi explores new digital solutions and new products in order to spread the best practices and solutions within the whole group. First, production flexibility is guaranteed by 15 “universal” production lines: they all have the same characteristics but are also ready to respond to different customization needs. For instance, if products need to be personalized to meet customers’ or foreign countries’ requirements, some production lines are entirely dedicated to them, in order to foster efficiency. These innovative lines were designed following the lean manufacturing principles and to foster the flexibility of the production process. With this

technology, the market demand drives production. The lines run at a predefined speed that is calculated according to planned production.

The company introduced Radio Frequency IDentification (RFID) in order to keep track of products and components from the production to the end of their shelf life. Baxi needs to know where a boiler was produced and tested, where it was shipped, when it was activated and if a component is substituted. Sensors are the perfect answers to these needs.

The possibility to trace products is really important for safety reasons since boilers use gas for their functioning. Component tracing is not a new activity for Baxi: the company has always traced each product, but digitalization allowed to change and make easier the method used. The firm needs to conduct some tests in order to verify the perfect functioning; the tolerance for errors is almost zero. For instance, in case of substitution of a component, the local assistance centre is responsible to send the component to the plant in order to be repaired or substituted. If the disfunction threaten customer safety, the company may decide to intervene by controlling the other customers boilers. When information was collected in paper carriages, the service was subject to error and the process was not efficient. In addition, digitalization helped to face the problem of fake products, because the firm can track if components are substituted with original or other spare parts.

One of the greatest advancements that are possible thanks to digital technologies is the huge quantity of data that Baxi can use to better meet customer needs and to support production processes and business strategy. Once boilers are installed, they are activated directly from the central headquarter of Baxi; in this moment the “commissioning” phase starts together with the shelf life of boilers. Baxi and assistance centres can remotely monitor the functioning of the products. Collected data have a huge value for Baxi: they create new opportunities to increase customer value; data analysis and statistics are combined to create a system of Predictive Maintenance to anticipate potential problems of boilers and to let assistance centres intervene in time. Thanks to available data, Baxi can simplify processes by allowing assistance centres to operate in a more independent way. Furthermore, data analysis gives more control on markets, internal processes and products for a continuous improvement. From the market side, perceptions and opinions of installers – who are in direct contact with customers – are combined with data collected from sensors in order to have more precise, objective and high-quality information.

Thanks to digital technologies, the firm was able to offer new services. Nevertheless, Baxi is still at the beginning of digitalization. For the future, the goal is to increase the standardization of processes and promote a better integration among assistance centres and installers.

"*It is not possible to go on with a team that is not on the same level. The role of training centres is to uniform competences and update partners and operators. Installers know how to deal with mechanics, but their digital competences must be updated. Today boilers are hybrid systems, so knowledge about electric parts and digital diagnostic is essential." Alberto Favero, CEO of BDR Italy*

From the organizational point of view, some changes were required; for instance, the firm does not have a rigid structure with new functions devoted to digital transformation but it has created different projects developed by multifunctional groups that have the right pace to design solutions. Once one project is over, new groups are created for the development of new projects. Managers believe that it is not necessary to have the CDO but it is better to have teams made up of people with different competences that work on single projects.

Obviously, some barriers have limited the transformation. First, regulations change from one country to another. Second, the firm implemented different technologies in different times, therefore it is difficult to let software communicate each other. Last, Baxi is a complex system because it is the result of a merge of firms created in different times that operate in different sectors. The group needs to find a common platform to integrate all the management systems of the branches. In its digitalization path, the firm encountered some difficulties to find standard technologies not only for the internal organization but also for the external environment. Baxi, like other companies that work in the living sector, wish to integrate its product with other home devices that use Iot technology. However, nowadays every device follows different protocols. In order to let devices communicate each other it is necessary to create a common language that does not exist so far. These kinds of alliances require the transfer of know-how among firms to let technologies interact.

### 4.6.3 Resilience and Covid-19

Baxi S.p.a. operates in 52 countries. The disruption perceived by the firm changed over time in relation with the spread of the pandemic; for instance, in Russia the virus arrived later than Spain or France. The market demand was difficult to be predicted: while some customers reduced their operations and orders, others increased the request because they wanted to augment their stock to be prepared in cases of supply chain disruptions. This demand variability was faced thanks to a close collaboration with suppliers and to the redesign of the production and logistic processes.

The plant remained closed for two weeks; however, during this period, a little part of the firm operated to produce spare products that were essential for some organizations such as hospitals.

In addition, some employees continued to operate in order to provide basic services or, at least, information to customers.

> *"We suffered less than other sectors: we stopped the production only two weeks. From the second half of April we started again to operate at 50-60% of our production capacity. We operated at full capacity from the second week of June. Luckily, the technology system was already in place, in the past years we worked to improve information flows and our data transfer capabilities. The technology allowed the firm to operate and to be connected to others even if people could not move from their home." Alberto Favero, CEO of BDR Italy*

#### *4.6.3.1 Planning*

Baxi's resilience started years before the crisis, when the firm designed the register of emergency plan that analysis how to react to different possible disruptions. The emergency plan register considered different scenarios such as what to do in case of earthquake, floods and others. Unfortunately, the risk of pandemic was not taken into consideration. Nevertheless, as we analysed in the previous chapters, emergency plans were useful even if they were not made to deal with the happened crises. Having a pre-crisis reaction plan is very useful to rapidly define and adopt changes in the structure and organization; the plan re-defines responsibilities and roles of the people: who does what and at what moment.

Plans are useful if they are flexible: while the implemented structure was perfectly equal to what the firm predicted, there has been the need of adaptation for some operative aspects. For instance, the concept of "social distancing" was not part of Baxi emergency plan, therefore some adjustments were essentials: the canteen service was stopped for some weeks before designing a safe way to provide the service; measuring body temperatures, masks and personal protective equipment provision, were all operative aspects that the firm solved rapidly at the beginning and improved in the following period. In this phase of plan adaptation, it was useful to speak with other firms, Ussl (the local health unit) and INAIL (National Institute for Insurance against Accidents at Work) to define together the way to operate.

#### *4.6.3.2 Change in the ERP*

Baxi planned to change the business management software at the end of February. Unfortunately, this period was affected by the crises, the Italian lockdown was imposed the 9$^{th}$ of mars. Changing the management system is a delicate operation because of the need to synchronize with the other firms of the group. The switch was made in few days, but the spread of the lockdown complicated the situation. A group of 50 Indian technical consulters came to

Italy to support the firm. However, since India was not affected by the virus, whereas Italy was at the peak, the group of Indian programmers, who arrived at the Italian airport, did not want to go inside the firm. Managers thought to post pone the change in the ERP for a moment, but then they decided to go on with the operation. Programmers were relocated in Netherlands, where the pandemic was not significantly spread. For this reason, all the consulting services were carried on through remote working. Some disfunctions happened but after few weeks the ERP was successfully operative. Fortunately, information is collected in cloud and supporters were able to work thousands of kilometres away. Baxi did different simulations of remote assistance during the years, but changing the ERP involves interactions with managers and employees to understand where supporters should intervene. The ERP is operative, but it was difficult to solve some dysfunctions of the system, the so-called "fine tuning" works better if consulters are inside the firm and can interact with Baxi's people. Some final adjustments need to be done and will be solved once Indian programmers will be able to go inside the firm.

*Employees*

After the two weeks of stop, the firm was allowed to start operating again in order to guarantee the continuity of the global supply chain and avoid losing important customers and partners. The most difficult part to start again operations was to convince and to dialogue with people in a period marked by uncertainty and scare of the virus. People needed to be reassured.

> *"We dialogued with labour unions to share our needs and problems and we searched together for solutions. The relationship was always constructive and positive: they helped us to implement work safety practices and to reassure employees. We worked together to create a safe workplace. After the stop, we started operating progressively to guarantee safety conditions and to manage the people flow in a better way. Workers participated actively and helped us to design and respect the new safety rules." Alberto Favero*

### *4.6.3.3 Smartworking*

Baxi is an industrial company, therefore, smart working is not applicable to all the workers. Nevertheless, the firm introduced remote working for many employees from the beginning of the emergency. Before the crisis smart working was used in the service part, but during the crisis it reached its greatest expansion.

> *"I would prefer the word "Home working" instead of "Smart working" because what we implemented was not a different, flexible and smart way of working; it was a simple reaction of the impossibility to operate in the building. It is not sufficient to adopt the technology in order to implement a smart way of working." Alberto Favero*

Baxi used Home Working during the crisis, but now it is implementing a system of smart working. To doing so, the firm needs to work on cultural and structural aspects to transform business processes. Managers are designing, together with HR department, new job roles and reliabilities that fit with remote working e.g. focusing on goals, expectations and results instead of hours spent in the office; introducing coaching to support workers and supervisors; promote a frequent interaction to maintain the sense of community and relationships among employees.

> *"We don't need to count working hours and minutes, we only need to create different settings, redesign the working processes and job positions and valuation." Alberto Favero*

#### *4.6.3.4 Remote assistance*

During the crises there was the need to set a remote way to train partners (installers, maintainers and assistance centres). Remote meetings and conferences are not new to the firm, but "the real jump" of these practices occurred during the crisis. In addition, the remote control and assistance had a sharp increase in use since final users were reluctant to welcome installers and maintainers in their home to avoid potential virus infections. Since only the new generation of Baxi's products is remotely controllable, the firm is working on a way to extend this service to previous generation products in order to be able to monitor all the existing products that are used by end users. This activity, in fact, has improved the value for customers, and is helpful especially in times of pandemic. Remote assistance was an established activity, but it was not expanded because of the resistance of strategic partners. In fact, assistance centres prefer to meet customers face to face in spite of using this opportunity. This occur mainly for economic reasons. If installers or maintainers interact face to face with customers, the provided services are quantifiable in terms of working hours and customers are willing to pay for it. However, remote control, even if it has the same efficacy, it is more difficult to be sold for a fair price. However, since people were reluctant to welcome workers in their houses, assistance centres were forced to provide remote services. The great expansion will come in the next months, but the period of crises was a good opportunity to accelerate the adoption of remote services and to test the systems.

#### *4.6.3.5 Predictive maintenance*

Predictive maintenance is the complementary part of the product diagnostic that have been implemented mainly in "central heating systems" (a system of boilers that serves many customers at the same time). The firm decided to do only urgent assistance and maintenance services and to postpone others, in order to minimize the interaction with customers inside their

houses. Predictive maintenance was useful to understand the urgency and priority of the need for interventions. It helped the firm to decide what services were necessary to be done and what could have been postponed. Predictive maintenance and digital services are really valuable for customer; for this reason, the firm is working to extend them to past generation products.

#### *4.6.3.6 Future*

During the crisis it was essential to maintain the control. The firm was not able to predict when the market demand would have recovered. By dealing with uncertainty the firm found that operative aspects (masks provision, surfaces sanitizing) were quite easy to solve, but the most important and difficult part was to keep employees motivated.

> *"My peers and me, we travelled around the enterprise every day. The building is 10.000 square meters - it was not really easy - but speaking with people and reassure them, share problems and solutions, foster human dimension and relationships was essential. We shared all the difficulties and worries that people were facing. The main take out of this experience is to keep our attention on our employees. Some people are more scared, others are more brave – not irresponsible – but we need to keep the motivation of the whole team high and to recognize and appreciate the value of our people" Alberto Favero*

### 4.6.4 Digital technologies vs crisis

Thanks to digital technologies, Baxi improved its value propositions. Through the collection of data, it was able to provide different services, such as predictive maintenance, remote control and assistance. Baxi also changed its value networks: digital data allowed assistance centres to operate more independently; in addition, digital channels arose since Baxi provided digital training to its strategic partners (installers and maintainers).

Therefore, also in this case study, digital technologies enabled the reaction to the crises.

During the crisis, the remote control of its products allowed Baxi to better meet customer needs since the assistance services were provided without entering in customer houses. In addition, Baxi planned to do or postpone interventions according to the urgency of boiler needs that were calculated by predictive maintenance. The cloud-based data collection and the simulations that Baxi did over the years allowed the firm to benefit from the technical support that helped to change the ERP. Employees continued operating through "home working" and now the firm is committing to design proper practices of smart working. All these considering, as Alberto Favero reported, *"Technology was a necessary but not sufficient condition to resist the crises: workers were the key factor that fostered the resilience of the firm"*.

*Table 4 - Baxi: Resilience & DT*

| **RESILIENCE** | | | |
|---|---|---|---|
| | Pre crises | During crises | Post crises |
| Planning | Design of emergency plans | - Implementation of predicted structure<br>- Plan adaptation | Improved plans |
| Value proposition | - RFID to collect data and provide services<br>- Spot changes in market and customer needs | - Continuity of Customer relationships<br>- Minimize in-house interventions to meet customer needs | Improved digital services |
| Digital channels | - Simulation of remote support<br>- Cloud-based data collection<br>- Remote control/monitoring and predictive maintenance | - Remote technical support (ERP)<br>- Expansion of remote services | Update of past generation products |
| Value Networks | Limited adoption of digital services by customers and strategic partners | Adoption by assistance centre & users | New level of digitalization |
| Employees | Smart working implemented in some areas | - "Homeworking"<br>- Managers commit to reassure people<br>- Deal with Ussl & INAIL to design actions | Implementation of smart working |
| **What were the roles of digital technologies?** | | | |
| Provide remote services to assistance centres, installers, maintainers and enable home working for employees.<br>Design the quantity and quality of intervention through diagnostic and predictive maintenance.<br>Receive technical support by programmers. | | | |

## 4.7 STEVANATO GROUP

### 4.7.1 General information

Stevanato Group has a consolidated experience in the production of glass and plastic packaging for the pharmaceutical sector. In 1949 OMPI, the first firm of the group was created in Venice. After that, the group has followed a growth path with the construction of new plants and acquisitions of different firms more or less related with the core business. One of the most recent acquisitions was with BALDA, specialized in the work of plastic. The group is composed by 7 brands and is divided into two divisions: pharma and engineering, that operates with lot of synergies. The pharma division is specialized in the production and commercialization of plastic and glass packaging for the diagnostic, pharmaceutical and medical sectors. The engineering division, thanks to the in-house competences, designs machines for glass manufacturing, assembling, inspection and packaging systems. The firm has 14 plants (9 for pharma and 5 for the engineering division) in 9 countries. Its headquarter is based in Piombino Dese (PD), the group reached in 2019 €570 million revenues, and had more than 3800 employees.(Stevanato Group 2020c)

### 4.7.2 Digital

Digital technologies have to do with many areas within Stevanato's company, including marketing, communication, management and control of operations and foreign plants. The digital transformation of the company started in 2016; digitalization has been necessary for the company's growth and to achieve levels of efficiency and flexibility that would enable it to maintain a leading position in the sector.

The main paradigm of Stevanato's company is to be flexible, dynamic and elastic to maintain the competitive advantage. To support the growth process, it was necessary to equip the company with a solid infrastructure. Some of the main partners installed the 10 Gigabit network and provided cloud services. The company decided to outsource some activities and develop the most critical value creation ones in-house. For instance, the company kept data analytics and intelligence activities under its control.

A fundamental part of Stevanato's activity concerns product innovation. The firm has always focused on changes in the physical and chemical structure of materials but, more recently, product innovation refers to new ways of administering medicines and the development of smart wearable products. But behind innovations, there are processes and people and it is here that Stevanato has decided to undertake digital transformation. The Stevanato's case

demonstrates how agreements between business strategy and IT strategy can create a "digital strategy" that supports business growth.

#### *4.7.2.1 From IT to I-Digital IT*

In 2017 the IT function changed its name into I-Digital IT because the company wanted to put the emphasis on I-digital, where the "I" stands for the transition from an IT system to a system that generates personalised information. Therefore, the current role of I-Digital is to implement technological solutions able to improve the effectiveness of the information that the company has, to support business development.

The group is building an international organisation with a data driven perspective. Today companies have and can collect large amounts of data to support decision-making processes. Sales reports, market analysis, forecasts, production cycle analysis are produced daily. The company captures a large amount of information during the typical operational processes of purchasing, production and sales. Inside and outside the company lot of information is created, which if processed, would lead to a greater personalization of the product and decision making. Stevanato's aim is to gather information from as many sources as possible. In addition, the firm gained lot of experience in data analysis and it is now trying to use data in an active way, by making predictions and using a prospective logic.

#### *4.7.2.2 IT for every firm*

Considering the group's international development, an IT infrastructure has been created, which now allows the company to centralise the management and control of its offices. The geographical relocation of the Group's sites made it necessary to create a platform to connect all the plants. Through a video link it is possible to have a live view of what is happening in the other plants and interact with the people who work there, to solve problems and share information. Becon sensors have been installed in all the plants and each plant has been mapped to recognise the position of the individual operator. The aim of this project is to encourage collaboration at group level between the various plants and create information flows in a co-working logic. The implementation of this project has operational implications, since it facilitates people's work, guaranteeing continuity in the company's activities even if workers are geographically distant, and creates synergies between the plants. Thanks to the integration of the plants, Stevanato can carry out a pilot project in China, Brazil or another country and then, thanks to the connectivity between the plants, it will be possible to replicate the project in another location or centralise it in the Piombino Dese site.

The implementation of this technology has therefore required a strong commitment to the standardisation of the processes and systems adopted, which has made the digital transformation even more complex. Achieving a level of standardisation is necessary when the organisation undertakes the path of digitalization, also considering the perspective of making future acquisitions and therefore having to integrate new processes. Digitalization also means imposing common operating standards to all the plants; all the branches follow a single way of acting and the processes are managed in a uniform manner. This can happen because digital is easy to disseminate in processes and speaks a common language in all locations. This is not the case for digital products, which, as we saw in the Baxi case, must consider local adaptation to the preferences and needs of local users.

#### *4.7.2.3 Marketing & communication*

The digital transformation that the company is facing today involves also marketing and communication activities. In the era of big data, Stevanato wants to extract value from information. The data driven logic has also been applied in marketing and communication to increase the knowledge of its customers and to be able to approach them through dedicated actions. The way communication and marketing activities were managed reflected the practices usually implemented in the manufacturing sector: brand promotion and the launch of new products typically took place during exhibitions and ad hoc events. In order to stimulate debate, dialogue and the creation of a relationship with new clients, Stevanato Group promoted a series of webinars during which scientific topics and the latest trends in the sector were discussed; these moments were outside the scope of any type of promotional activity.

Since 2016, it was necessary to set up a digital infrastructure to support the launch of the Stevanato brand via the web. Up to that point, customers were mainly familiar with OMPI, the company in the pharma division with expertise in the supply of glass products.

The Group is deeply committed to raising awareness of its main brand and communicating the value of its products, changing the way it approaches its customers, especially international ones. Digital channels have been used to create new market opportunities. In addition to the large pharmaceutical companies, with whom Stevanato has had a consolidated relationship for almost 70 years, and the medium-sized companies directly followed by commercial operators, with responsibility by geographical area or customer, there is also a substrate of small companies that is particularly attractive to Stevanato. These are small biotech companies, university spin-offs and mainly American start-ups, which are highly focused on drug development. Many of these fail, but those that succeed sooner or later enter the orbit of large pharmaceutical companies. So, it is clear that this substrate represents a huge opportunity for

Stevanato. Digital communication must make Stevanato's products known to the large and medium-sized pharmaceutical companies with which the Group is already in contact, but it must also create new market opportunities by making the Stevanato name known among small biotech companies.

The Stevanato family has always had clear objectives to achieve through communication and marketing; these are now measured in terms of ROI, branding and market knowledge. However, they lacked the tools to achieve these goals. In this sense, the digital infrastructure alone was not enough for a successful marketing campaign, but it had to be combined with content that could attract the interest of target customers.

Stevanato relies on two partners to maintain a high visibility of its brands and products on the web. Thron, a digital asset management (DAM) that distributes content uploaded on a cloud platform between channels and offers specific content to customers according to their preferences. This platform also carries out intelligence work to understand who has viewed the content, from which geographical area, with which device, on which channel, for how long. The platform provided by Thron has a dual value, this is used both to publish web content and to collect quantitative information about customers viewing web pages. The second partner, which guarantees the effectiveness of communication and marketing campaigns, is Hubspot, a marketing automation platform through which all marketing content can be managed centrally. The platform creates a database parallel to that of CRM, where all contacts and marketing actions are stored in a person's record, in order to keep track of all relationships and strategies aimed at a specific customer. In this way, the company is able to trace all the information collected during customer meetings, all this data is digitized and converged on Hubspot, which centralizes it and integrates it into CRM.

In order to be able to provide the right content to the customer, Stevanato needs to know its interlocutors; users often view the content after logging in to their personal profile, so the company can easily trace the customer's details. Alternatively, when it is not possible to trace the customer's web profile, the company creates a system of incentives for customers to provide their information.

Stevanato has replicated in a B2B sector a typical marketing strategy used in B2C relationships. Thanks to this system, it was possible to build a complete master data of each customer. The information collected is then transmitted to the sales function, which uses it to complete the commercial transaction.

This mechanism also makes it possible to measure in terms of ROI the objectives that the company intends to achieve in the field of communication. Each time a sales manager completes a sale with a customer, it must be determined whether this result is attributable to the

sales or marketing function. If a sales manager has completed a sale with a customer that has been achieved through the work of the marketing function, then the sale is recorded as a result of the marketing function and is responsible for calculating the marketing ROI. Otherwise, the sale will not contribute to generate the marketing ROI. The importance of this method of evaluating and allocating results is instrumental to the choice of the most profitable activities. In fact, the company can know which marketing and communication activities have generated the highest number of sales and choose the most profitable strategic initiatives to invest in, to the detriment of those that have not stimulated the purchase by the customer.

In Stevanato they have understood that it is no longer possible to create mass and generalizable content, but marketing must create something specific to capture the needs of different clients, with a view to a one-to-one relationship. Only by communicating a message in the right way and with the right incentives you can get valuable information about your clients. The human experience therefore arrives where digital is not able to create value, this testifies to the increasingly close relationship that is being created in the working environment between man and machine. Without man-made content, any infrastructure for digital communication is completely ineffective, because without someone to set it in motion it cannot reach the customer, so human action is also necessary in the context of actions involving the use of digital tools.

The other fundamental element is the complete personal data of the client: name, address, interests, origin. Without a complete personal data of the client it is difficult to reach him/her and propose contents that may be interesting for his/her needs. This information is therefore fundamental to the success of marketing and communication campaigns.

It should be noted that although digital is attracting new clients, traditional events and trade fairs will not be abandoned but will continue to play an important role in creating relationships and understanding the needs to be transformed into digital content.

A company like Stevanato, owner of several geographically scattered brands and factories, must also coordinate marketing and communication activities at corporate level. The different brands of the Stevanato group guarantee a diversified offer for the different needs of customers, in this sense the Piombino Dese headquarter centrally manages the marketing and communication strategy, to ensure greater speed in terms of decision-making and execution. The marketing managers located in the different plants, on the other hand, have the function of executing the decisions taken centrally and maintaining links with the reference customers. In fact, Stevanato's products are not geographically customised, but are personalised according to the customer. This has required the Group to maintain a certain operational flexibility in order to supply the required product.

The results of these strategies have been consistent; many indicators have achieved double digit growth, especially in the US and India. These markets, in particular, had a significant impact even before the digitalisation of communications activities began. However, it has been instrumental in capturing new market needs and, above all, in attracting new clients internationally, which otherwise would not have been possible. In particular, the company has focused on reaching smaller clients in the biotech, spin-off and stat-up sectors, which represent a great future opportunity. Only through the new digital communication strategies, the proposed content and the construction of a complete client registry was it possible to intercept and satisfy the needs of this segment of the market.

The Stevanato family has always been visionary, both in terms of product development and the group's digital transformation. Managers have always found the Stevanato family and the company board to be the main supporters of digital projects. Thanks to this, the Group has reached digital maturity in just a few years. Despite this, numerous resistances have slowed down the adoption of new technologies. This bears witness to the importance and impact that corporate culture can have on digital transformation processes. A culture that is still rooted in more traditional working methods limits the adoption of new technologies.

### 4.7.3 Resilience and Covid-19

Stevanato Group continued the production during the whole period of emergency. Since pharmaceutical sector is essential for the functioning of the country, the company was not obliged to close its plants. By contrast, Stevanato Group significantly increased its production capacity because of the rise in the market demand. Vials and syringes are needed to support the distribution of vaccine against Covid 19, therefore Stevanato, together with other leading pharma packaging companies, commit to ensure ample supply of pharmaceutical containers for any Covid-19 vaccine; it already signed up a contract with the Coalition for Epidemic Preparedness Innovations (CEPI) to provide pharma glass vials for 2 billion doses of COVID-19 vaccines under development. (Stevanato Group 2020a; 2020b)

Even if the firm continued to operate, some changes has been adopted to respect new regulations and safety rules such as social distancing, the usage of personal protection equipment, smart working and others.

#### *4.7.3.1 Planning*

Companies that works with the pharmaceutical sector are required to have a business continuity plan. This plan considered different scenarios where one or more plants are not able to operate for different reasons, such as political crisis, fire, civil wars or others. In the case of Stevanato

Group, the most similar scenario was an epidemy, that has been adapted to the happened case of pandemic. The plan provided a series of general guidelines that needed some adjustments to be implemented. For this reason, the firm created a coronavirus task force: a group of people coming from different functions who designed an action plan to increase the production capacity.

#### *4.7.3.2 Production*

Stevanato Group benefited from its global presence: it fostered the production in those countries that were not strongly affected by the pandemic. The firm invested new capital to install new production lines and to optimize production processes. The shift of the production from one plant to another was possible because every plant is equipped to produce every product of the firm. However, given that every plant serves mainly the local market, it is specialized in the production of particular products. In order to refresh competences, the firm offered some ad hoc training to those plants that were required to change their production.

#### *4.7.3.3 Virtual audit*

In this sector, customers need to validate not only products, but also production processes. Therefore, clients of Piombino Dese plant cannot buy from the Brasilian plant – even if products are the same – because they need to check and validate every step of the production process. The risk was to be forced to reduce or stop the production in the plants located where the Covid 19 was spread the most. To face this potential disruption of supply, Stevanato developed some virtual audit to let customers validate the production process of other plants. By doing so, even if the Italian plant would have been required to close, customers were ready to purchase products from other subsidiaries. Virtual audits were carried on using Microsoft glasses for virtual reality; the auditor could see production lines, primary and secondary packaging, documents and certifications and speak with quality managers of a plant located in another continent, without moving from his or her office. This completely new activity will remain in the future as a possible way to deal with auditors; it is a powerful tool in case of emergency when people cannot move from one country to another. Once the crisis will be over, the firm will introduce again face to face audit to welcome auditors inside the firm.

#### *4.7.3.4 Logistic & marketing*

The coronavirus task force was essential not only for production planning, but also for other functions, such as logistic and communication.

For the logistic function, some operational problems needed to be solved. For instance, some products in USA were blocked at the borders; the taskforce was required to deal with local

institutions to declare its products as essential since they were part of the pharmaceutical value chain.

The communication part of the task force aimed at the continuity and development of relationships with customers and stakeholders. The company committed to maintain weekly meetings with customers and to digitalize every interaction with stakeholders:

> *"Everything we did face to face has been transported in a digital form. Conference calls, zoom and teams meetings: everything was carried on in a remote way. All the 70 events that we organized for the year were transformed in digital events. Conferences became webinars; exhibitions were transformed into digital events with all the physical elements changed in a digital way: partners and customers could digitally walk through the Stevanato "stand"; people could click on led walls to watch informative videos; they could chat with sellers instead of speaking with them. All of this was possible because we already had digital tools and we searched for creative solutions to avoid cancelling events." Chiara Pasqualetto, Marketing and communication specialist*

#### *4.7.3.5 People*

Given that Stevanato is a manufacturing company, some people were required to work directly in the plant, smart working was not possible for everyone. However, the firm was ready to implement smart working: it has been introduced and incentivized from the beginning of the emergency.

The firm responded promptly to regulation and safety rules e.g. provision of personal protective equipment, social distancing of 1 and then 2 meters, management of entry and exit flows.

The absenteeism index did not change; this is a signal that workers are motivated. In addition, the firm was able to improve its internal communication to foster cohesion among workers to collaborate to the fight against the pandemic. Stevanato's products, in fact, have a direct role in the spread of the vaccine against Covid 19. Workers were moved by a sense of responsibility and wanted to contribute to protect the health of the community. In addition, some incentives and benefits were given to employees for their working routine.

#### *4.7.3.6 Takeaways*

From the limits imposed by the crises Stevanato has learnt to leverage digital solutions and digital technologies when the face to face interaction is not possible. The second lesson for Stevanato is that it is essential to have different scenarios of possible reality that are not predictable. The firm reacted rapidly to the crisis:

*"We were transparent with shareholders: we knew our strengths and our limits, we tried to find a solution that would have been appreciated by our customers. By doing so, we gained and confirmed the trust of our clients. There has been collaboration between different plants of Stevanato Group, everyone acted simultaneously, in a coherent and organized way." Chiara Pasqualetto*

In the future, the firm will go back to some traditional practices: face to face meetings, one to one interaction, but it will be able to adopt all the digital solutions that it explored in this period. Technology tools were already part of the firm, but they were not used at their full potential. The sense of urgency fostered the change in processes.

#### *4.7.3.7 Resilience cycle*

The task force is still operating even if employees have learnt how to behave and operate in these conditions, the new way of working is already considered part of the "business as usual" and not as an emergency. This fact is interesting because it is the signal that the resilience cycle already ended and is repeating over time. The firm designes some emergency plans; It implements and adapts plans to react to the coming government regulations; employees learn how to behave in the new normal; once a new way of working is established, the firm gain experience and foster its resilience and its emergency plan to face new change in the environment. Since new government regulations are published almost every week according to the fast-changing situation, this cycle repeats with a really fast pace. Firms need to adapt their operations to an extremely uncertain and changing environment.

### 4.7.4 Digital technologies vs crisis

Digital internal processes improved the cohesion of Business units. Stevanato did not had any problems to create teams of different functions that collaborated each other since, before the crisis, the technological infrastructure to communicate and work with people of different plants was already implemented. Collaboration among subsidiaries was essential during the period of crisis; the firm created new production lines to increase the capacity in those countries that were not strongly affected by the pandemic. Some training courses were organized to the plants that were required to change their production; however, machines were already designed to enable the manufacturing of every product of the firm.

Probably the most interesting application of digital technologies relates with virtual reality. The company used Microsoft glasses to allow customers to validate the production process through virtual audits. This possibility enabled the firm to be ready if disruptions would have come. This solution will help in the future to face every disruption that will affect plants; in other words, this digital solution that changed value networks will foster resilience in the future.

Last but not the least, the firm discovered new opportunities for marketing and communication functions. Crisis fostered creative solutions to communicate and engage customers. Once the crisis related to Covid 19 will be over, the firm will go back to more traditional events like exhibitions or others. However, the exploration of digital solutions allowed the firm to maintain every planned event and will enable Stevanato to foster digital touchpoints to engage a large quantity of customers with few investments. In addition, this solution fostered the resilience, since the emergency plan will be updated considering the solutions developed in this period.

*Table 5 - Stevanato: Resilience & DT*

| **RESILIENCE** | | | |
|---|---|---|---|
| | Pre crises | During crises | Post crises |
| Planning | Business continuity plan | Action plan and coronavirus task force | Plan updating with new solutions |
| Value proposition | - Product customization<br>- Webinars | - Product customization for Covid-19<br>- Weekly meeting with customers<br>- Digital events<br>- Virtual audits | - Foster digital presence<br>- Virtual reality to enable virtual audit will be used in case of disruptions |
| Digital channels | - Data driven processes<br>- Centralization of management & control of different plants<br>- Collaboration among plants<br>- Digital channels for marketing | - Improved production capacity<br>- Shift of customer orders among plants<br>- Improved digital marketing | New digital solutions experienced and learnt. |
| Value Networks | | Deal with local institutions to avoid supply chain disruptions | |
| Employees | Infrastructure for smart working | - Expanded smart working<br>- Internal communication to increase motivation and cohesion | Improved cohesion and collaboration among plants. |
| **What were the roles of digital technologies?** | | | |
| DT enabled interaction among plants; smart working was imposed to most of workers.<br>Virtual reality enabled the validation of production processes in distant plants through virtual audits.<br>Marketing and communication's events were not cancelled but transformed into digital touchpoints. | | | |

## 4.8 Discussion

This research does not claim to study the causal relationship among digital transformation and resilience; however, from the analyses of the five case studies, different considerations can be highlighted. We suggest three propositions that need to be further investigated in future research.

- *Proposition 1*:

*"Digital transformation is a necessary but not sufficient condition to enable resilience"*.

As can be seen in table 6, digital technologies were one of the key elements of firms' resilience: they helped Elda to collect orders, Sariv to develop projects, Dab Pumps to interact with suppliers, Baxi to change the ERP and Stevanato to let customers validate production process. Without digital solutions - as managers reported - "Everything we did, would have not been possible".

*Table 6 - What were the roles of digital technologies?*

| What were the roles of digital technologies? | |
|---|---|
| ELDA | Provide real time data to increase the knowledge of the production process;<br>The management of customers' orders helped the firm to place orders to suppliers in a precise way;<br>The automation of production process allowed the firm to avoid the problem of social distancing among workers. |
| SARIV | KPI to control employees to allow them to operate whenever they want;<br>Enable customization that improved relationship with customers;<br>Enable smart working; Even sensitive data available in cloud;<br>Software to track advancements in project development. |
| DAB PUMPS | Sensors & digital processes enabled cloud-based data collection. Data were useful to spot market needs and foster subsidiaries collaboration;<br>DT improved value networks: they mediated the integration of BU with suppliers and interactions with customers and installers;<br>Employee's digital knowledge and skills made easier to accelerate digital projects; |
| BAXI | Design the quantity and quality of intervention through diagnostic and predictive maintenance;<br>Provide remote services to assistance centres, installers, maintainers and enable home working for employees;<br>Receive technical support by programmers. |
| STEVANATO | DT enabled interaction among plants; smart working was imposed to most of workers;<br>Virtual reality enabled the validation of production processes in distant plants through virtual audits;<br>Marketing and communication's events were not cancelled but transformed into digital touchpoints. |

Digital technologies were necessary to face the crisis; however, they were not the only enabler. During the period affected by the pandemic, pre-established relationships with customers and suppliers were really important to ensure business continuity. For instance, high-quality relationships were determinant for Caseificio Elda to increase production volumes.

Nonetheless, during the crisis, the most powerful resources, according with the interviewed managers, were employees. Since both digital and traditional processes cannot run without people, workers are the key for resilient organizations. Digital processes enable remote working and facilitate reaction to crisis. However, workers define the level of resilience: they can choose

to work productively to face disruptions or to give up and minimize their effort. Workers are the key factor; for this reason, firms invested to increase the motivation of employees: some managers committed to speak daily with workers to support and reassure them; others accurately designed internal communication to increase cohesion and embeddedness.

- *Proposition 2*:

> *"Crises create a sense of urgency that enable firms to accelerate the development and expansion of digital solutions. The sense of urgency helps firms to overcome barriers."*

Covid-19 crisis promoted a sense of urgency for many reasons. First, even if Covid-19 spread in the whole World, it affected some countries more than others, and in different times. Therefore, Italian firms – that have been affected earlier and more seriously compared to European companies – faced increasing threats of international competition. Second, the crisis boosted the perceived uncertainty. Firms that were required to close their plants, did not know when they would have open again; after the first wave of contamination, a second one is threatening business activities. For these reasons, firms cannot wait for the emergency to pass, they needed to rapidly react and to operate despite the new level of uncertainty.

The sense of urgency changed the priorities of firms. Even if before crisis digital projects were an option, they became an essential need to operate. There are different examples of this phenomenon: Stevanato designed creative solutions to promote events in a digital form and introduced virtual audits; Dab Pumps expanded its digital offering and is now exploring different possibilities to extend remote services to its past generation products; four firms over five extended smart working to the majority of employees.

Firms accelerated digital projects, but this is not the only consequence of the sense of urgency. Indeed, even if from one side, managers were forced to promote changes, from the other side, employees were ready to accept them. Workers felt the health and economic emergency; therefore, they understood the importance to respect rules and health protocols, also for their safety. Firms had an external "partner" to promote change. The situation of emergency enabled firms to explore different solutions that had never been considered before. By doing so, some cultural and cognitive barriers have been overcome. For instance, assistance centres of Baxi provided their services in a digital way even if they were reluctant to do it before the crisis. Furthermore, Sariv asked its blue collars more flexibility in time shifts, and this change improved its efficiency. In addition, Caseificio Elda activated different production lines at the same time.

Exploring different solutions is a powerful activity to overcome barriers. Crises are opportunities to deviate from path dependence processes; they can lead to permanent changes that will remain after the period of crisis.

But if digital technologies were so essential, why there has not been an exponential growth in the implementation of new technologies?

- *Proposition 3*:

*"Digital transformation fosters resilience only if it has been initiated before the crisis"*

Digital transformation takes time; it is not possible to design, implement and complete digital transformation in few days to face emergencies. Nonetheless, digital transformation is one the core activities that foster the pre-crisis resilience. This resilience is about finding and acquiring resources to face crises. Here is where digital transformation is the leading actor: investments on digitalization over the years were essential to foster firms' resilience. Through the improvement of value proposition, networks, channels, agility and ambidexterity, firms acquire core capabilities and structural characteristics to face crisis.

One example from the case study is what happened to Baxi. The company already had the IT infrastructure to implement smart working. However, it is almost impossible to set up a proper practice of smart working in few days, since it requires transformation of processes, job positions and job valuations, to be effective. This is why managers implemented the so-called "Home working", a simple reaction to the need of social distancing. However, now the firm is committing to implement a real system of smart working. The crisis enabled the digital transformation of processes that will require time to be implemented. During the crisis some changes are possible and essential to adapt to new requirements, but, after the crisis, firms may plan to introduce some structural changes.

## 4.9 Resilience cycle

To conclude, it is interesting to highlight some final considerations on the resilience cycle.

First, it is generally useful to have emergency plan. Even if the right threatening factor is not perfectly predicted, disruption plans are not waste in time. Plans are easier to be adapted, rather than to be created during crisis. Regardless of the name they have – emergency, recovery or business continuity plan – every firm that has been analysed benefited from the plan (or projects) designed before crisis. Having a pre-crisis reaction plan is useful to rapidly change the structure of the organization; the plan re-defines roles and reliabilities.

Second, even if from the theoretical perspective, it makes sense to separate the three different types of resilience, in the real world, the phases overlap. Resilience cycle repeats over time until the crisis is over. Firms design some emergency plans; they implement and adapt plans to react to the changing environment (i.e. new government regulations); employees learn how to behave in the new normal; once a new way of working is established, the firm gain experience and foster its resilience and its emergency plan to face new changes in the environment. Considering

the covid-19 crisis, the environment is continuously changing, and firms need to evolve accordingly; the level of uncertainty has significantly increased and firms need to foster flexibility to face the new changing conditions.

Last, "bouncing forward" is possible. Crises are not only something that threaten organizations but could bring great opportunities. Caseificio Elda's resilience has been a signal to attract new customers in the Italian and foreign markets; Sariv learnt from this experience how to improve efficiency and how to improve employees' welfare; Baxi understood the importance of its digital offering and it is committing to extend the offering to its past-generation products; Stevanato improved its digital communication and marketing activities whereas Dab Pumps is working to improve its data management to foster agility.

## 4.10 Conclusions

In this chapter we presented the case study to explore the relationship among digital transformation and resilience. Some interesting takeaways should be highlighted. First, *"Digital transformation is a necessary but not sufficient condition to enable resilience";* second*, "Crises facilitate change and the exploration of new solutions that overcome barriers"* and third, *"Digital transformation foster resilience only if it has been initiated before the crisis"*.

# Contributions, limitations and future research

This paper aims at contributing to the emergent field of research that support firms in the delicate situation that the world is living. In particular, the purpose of this thesis is to create different research questions that may guide future research.

In the first three chapters, by reviewing the existing literatures, we proposed an integration among the two fields of research: resilience and digital transformation. Digital technologies, through the changes in firms' value proposition, networks, channels and ambidexterity, contribute to foster resilience. Nevertheless, since the literature on the topic is not widely explored, it has been necessary to conduct the empirical research.

The analysis of multiple case studies was conducted to explore the possible relationships that occur among digital technologies and resilience. From this research, we highlighted three outcomes: "*Digital transformation is a necessary but not sufficient condition to enable resilience*"; "*Crises create a sense of urgency that enable firms to accelerate the development and expansion of digital solutions. The sense of urgency helps firms to overcome barriers*" and "*Digital transformation fosters resilience only if it has been initiated before the crisis*".

Nonetheless, we should consider some limitations of this study that leave some space for improvements in future research.

First, every firm was affected by different crises. Even if the period was marked by Covid-19, every firm perceived a different type of crisis. Many factors were relevant to the determination of the crisis faced by firms. First of all, the government decided what sectors were allowed to operate; this fact created significant heterogeneity on the effects of the crisis. Second, even if the crisis affected all the people, some products saw a sharp increase in the demand, such as Ricotta and pharmaceutical vials; market demand variation and, eventually, the pace of recovery, were significant elements that determined the quantity of disruption faced by companies. This differentiation makes difficult to generalize results of this research, because every crisis needs to be contextualized according to the disruption faced by each firm. In addition, every firm is different from the other; in this study it was not possible to compare how the relationship of digital technologies and resilience changes according to different

characteristics of firms. However, future research may collect some comparable data useful to understand changes in the relationship according to the size and sector of the firm.

Second, in this study we considered mainly firms that are mature from the digital point of view. Therefore, results may change when firms with different levels of digital maturity are considered. We found that new technologies were difficult to be implemented during the period of crisis. However, less developed firms may have more incentive to enable digital transformation during the period of crisis. For example, they need to implement smart working to ensure business continuity. It would be interesting to analyse how the pace of transformation change with the level of digital maturity of firms. In addition, for different levels of digital maturity it would be interesting to understand the variations of the ability to face crises. Does resilience changes according to the level of digital maturity?

Third, at the time of writing, the covid 19 pandemic is still affecting the world. The qualitative research that we presented in the previous chapter was concluded when the period of emergency was not finished. Therefore, it would be interesting to confront our findings with future research to analyse how firms' resilience may change in time.

Last, digital technologies are different from one to another. The same technology can be used in many ways. This is why analysing digital technologies as a group can be misleading and lead to misinterpretations. A future research may consider as unit of analysis a single digital technology.

This paper contributed to the dominant literature by suggesting some possible combinations of the two theoretical frameworks. In addition, this research provided data from the empirical analysis to explore the relationship among digital transformation and resilience, suggesting some research questions for future analyses.

In this period of uncertainty, science has been the only way to face the emergency. It has been fundamental for the development of vaccines, it has guided governments decisions and people's lives. With this research we contributed to the creation of knowledge by exploring firms' solutions to face the crisis. With the proposal of different research questions, we hope to support future studies to convert uncertainties into common and acquired knowledge.

Research is, indeed, the most powerful tool to overcame darkness.

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