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## **BUILDING THE POST-COVID NEXT NORMAL THROUGH SERVICES AND DIGITALIZATION: AN EMPIRICAL STUDY OF ITALIAN MANUFACTURING COMPANIES**

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*Alla mia famiglia, che mi ha permesso di ottenere questo traguardo  
A Cecilia, la persona più importante conosciuta durante i miei studi  
Alla mia generazione, che sia sempre più protagonista del mondo di domani  
Grazie*



Il candidato dichiara che il presente lavoro è originale e non è già stato sottoposto, in tutto o in parte, per il conseguimento di un titolo accademico in altre Università italiane o straniere.

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## INTRODUCTION & SUMMARY

During the current year, the whole world has been hit by the spread of Covid-19, an event that will be marked in the history books. The effects of the health crisis have been dramatic, and have hit all the areas of human life, severely affected by the national lockdowns to mitigate the outbreak. An unprecedented crisis, incomparable to the previous ones, destined to upset people's habits and behaviours and to redesign new balances, from an economic point of view but also from a social one.

The Covid-19 will inevitably be a watershed, especially for companies characterized by a past of internationalisation and economic recessions. This event has inevitably put the organizations' financial resources in front of an unexpected test and also to face an even more uncertain future, the so-called "next normal", in which those who succeed first in adapting through innovative projects will build an important competitive advantage. Therefore, innovation represents the key point, and it can be undertaken only by resilient, agile, and flexible organisations, able to remain in the redesigned environment that will be day-by-day more competitive.

### *THE REASON OF MY DISSERTATION*

Through this paper, a practical analysis of a manifestation of resilience is attempted, with the empirical analysis of companies that have adapted their business models through services and digitalization.

Thanks to the sample composed by 80 companies operating in North-East of Italy and characterized by a B2B nature, collected through a survey led by Professor Paiola from the University of Padua, an investigation is carried out to understand the impact of the pandemic on these companies, and the role that services and digitalization will have in the companies' programme in the post-Covid world, the "next normal".

Given the opportunity of having a relevant sample on a current phenomenon such as the pandemic crisis, the author has conducted some specific statistical elaborations in order

to highlight the different future perspectives of companies according to the level of services offered.

### *CHAPTER 1 - RECENT CRISES' EFFECTS ON ITALIAN COMPANIES*

As mentioned, the Covid-19 crisis has reached the peak of a twenty-year period in which uncertainty, especially economic one, has played an important role. A high instability due to the most critical crises of recent years: from the 2001 Twin Towers attack, to the sub-prime mortgage crisis in 2008 and then up to the European sovereign debt crisis in 2012. They have all had the common characteristic of undermining the business stability and specifically the one of Italian companies, among the most affected. Through the Cerved Report, the various effects of each crisis on SMEs are given in detail, up to the strong impact of the current one, differentiating between geographical areas and company structure.

### *CHAPTER 2 - ORGANIZATIONAL RESILIENCE THROUGH SERVICE AND DIGITALIZATION*

The factor that is identified as distinctive is resilience. This concept, often abused and overused in recent years, is presented firstly through a literature review, and then focusing on the concrete ways in which an organisation can be resilient. One of the best known is Duchek's approach (2019) to define resilience in a company's ability to anticipate, cope and adapt to an external event. In this model, a specific application in tackling the Covid-19 crisis is provided by Rapaccini et al.(2020), who identify two different moments in the approach to the health emergency: reacting in the short term and building resilience in the long term. These qualities are indispensable in the proposed four-step model (calamity, quick & dirty, restart and adapt) for companies in pursuing agility, preparedness, elasticity and redundancy. After presenting these models, the dual role of services and digitalization is introduced, identified both as enablers of resilience and both as measurers to understand the level of resilience in the organisations.

### *CHAPTER 3 - EMPIRICAL ANALYSIS: "REAGIRE AL COVID-19 CON I SERVIZI E LA DIGITALIZZAZIONE"*

After the investigation of the role of services and digitalization through the literature, the survey "Reagire al Covid-19 con i servizi e la digitalizzazione" is presented, describing

its structure and main objectives. In the respondent companies' business, the range of services offered is on average less affected by the crisis than the range of products on offer, thus already showing a greater degree of resilience; the importance and role of certain technological equipment such as smart working platforms in managing the sudden emergency is also remarkable. After the decision to divide the sample into three classes, according to Baines' classification of services, it has been observed that in general companies with a greater range of services have started this process well before the Covid-19 crisis, and over time have gained the awareness that allows them to understand the importance of services and digitalization and to see them as tools to be more and more innovated day-by-day.

#### *CHAPTER 4 - FINAL RESULTS AND CONSIDERATIONS*

In the conclusion, the results obtained from the survey and the relative its statistical processing are explained. At the closing date of the report in October 2020, Covid-19 seems to be presenting the beginning of a new wave; the issues addressed in the survey will become even more topical again, and the need for companies to understand the importance of innovating towards a more resilient organisational structure, e.g. through services and digitalization, will be confirmed as indispensable.

The next normal will change the economic system, and only those companies that can keep up with tomorrow's initiatives will be able to stay there.



## **RECENT CRISES' EFFECTS ON ITALIAN COMPANIES**

### *1.1 TWENTY YEARS OF CRISES: FROM SEPTEMBER 11<sup>TH</sup> TO COVID-19*

The first twenty years of the new millennium have undoubtedly changed the history of the modern world. Innovation has reached levels that were unbelievable in the previous century, both from a technology point of view and a social one. Consequently, the economic system has reflected these changes, with the birth of new markets following the continuously changing people's needs. At the same time, not all the companies were able to follow the innovation process, and some of them failed, following a sort of natural selection process.

These companies and organizations were not able to stay in an environment characterised by a high level of uncertainty, as proved by the large number of crises that happened during the last twenty years, and that were totally unpredictable.

The so-called Black Swan, the metaphor that Nassim Taleb (2008), finance professor, writer and for many years Wall Street trader, coined for those random and unpredictable events, whose negative consequences are far-reaching for everyone.

Black swans with different natures, from terrorist attacks to the pandemic, but each one with a common feature: the capability to bring with them a disruptive change. The most drastic is the one that we are living in this year: the Covid-19 pandemic crisis, able to hit globally human health and the economies of all countries. After the pandemic, things will not be as before; let us think about the use of the mask, the lack of hugs between people, and the smart working, all measures that in these months have become the new normality, and nobody knows how long they will stay in our life.

While Covid-19 is one of the most shocking events in contemporary history, there have also been other crises in the last twenty years that have affected world economic growth. Just think of the main historical events that have characterised the new millennium, and

how the consequences of each one have easily proliferated throughout the world, thanks to the growing level of globalisation.

Just as the new millennium began, the terrorist attack of 11<sup>th</sup> September undermined world security certainties. In addition to the human, political, security, and social implications of the terrorist attacks on the World Trade Center, there were profound impacts on New York City's economy, its labour market dynamics, and individual businesses. Airlines and insurance companies took the hardest immediate hit, and U.S. stock markets initially fell more than 10% during the days after. Despite its lasting impact on the American psyche, the economic and financial impact of 9/11 was fairly muted, with markets bouncing back months after to new highs. This was helped, in part, by a resilient American economy along with support and stimulus from the federal government (Davis, 2020). Anyway, the 9/11 terrorist attacks on America caused significant economic damage in the immediate aftermath, rippling through global financial markets; in a just born European Union stocks markets fell, and a new climate of danger and uncertainty began to spread, the diffusion was also facilitated by the single currency created among all the countries of the Union, the Euro.

Few years later it was the turn of the global financial crisis of 2008, the worst economic disaster since the Great Depression of 1929. The financial crisis stretched over more than a year, culminating in the collapse of Lehman Brothers in September 2008 and the Wall Street bailout that quickly followed. In the United States, the stock market plummeted, wiping out nearly \$8 trillion in value between late 2007 and 2009. Unemployment climbed, peaking at 10 percent in October 2009. Americans lost \$9.8 trillion in wealth as their home values plummeted and their retirement accounts vaporized (Merle, 2018). In all, the Great Recession led to a loss of more than \$2 trillion in global economic growth, or a drop of nearly 4 percent, between the pre-recession peak in the second quarter of 2008 and the low hit in the first quarter of 2009, according to Moody's Analytics. While the Great Recession officially ended in 2009, many people felt its effects for years to come as the job market and home prices remained depressed.

The effect of the American Great Recession in Europe was even more shocking: the so called European sovereign debt crisis, a period in which several European countries (in particular Italy, Spain, Greece, Ireland and Portugal) experienced the collapse of financial institutions, high government debt, and rapidly rising bond yield spreads in government securities (in those years in Italy became famous the Spread, index between the yield of Italian bonds and the yield of the German ones, that reach the negative record). Countries



in difficulties received bailout funds from the European Central Bank in order to avoid the bankruptcy. As part of the loan agreements, these countries were required to meet austerity measures designed to slow down the growth of public sector debt. As a consequence, the Mediterranean members of the EU faced intense periods of high unemployment and lack of investments for the real economy; this led firstly to a loss of confidence in European businesses and economies, and secondly in the European Institutions.

This sentiment started to spread over other European countries (the movement of the so-called Eurosceptics); in June 2016, the United Kingdom voted to leave the European Union in a referendum and speculation soared that other countries would leave the EU. The UK referendum sent shock waves through the economy; investors fled to safety, pushing several governments yields to a negative value, and the British pound was at its lowest against the dollar. Market volatility was high in all the European markets; in the mid-2016 in Italy the situation worsened: a staggering 17% of Italian loans, approximately \$400 billion-worth, were junk, and the banks needed a significant bailout (Kenton, 2020). Thanks to the austere policies ordered by European directives, market confidence stabilised, but the Italian structure was destined to remain too weak financially.

In the following years, the worlds' economies rose again, until the beginning of 2020, when the pandemic caused by Covid-19 virus started to threaten the entire world.

The respiratory syndrome coronavirus 2 (SARS-CoV-2) was first identified in December 2019 in Wuhan, China. The World Health Organization declared it a Public Health Emergency of International Concern in January 2020, and a pandemic in March. As of August 2020, around 20 million cases of Covid-19 have been reported in more than 188 countries and territories (World Health Organization, 2020; Reichlin, 2019). There are several vaccine candidates in development, although none have completed clinical trials to prove their safety and efficacy; worldwide the lack of a vaccine is threatening the countries, especially in Europe where a potential return of the virus in winter represents a very feared risk.

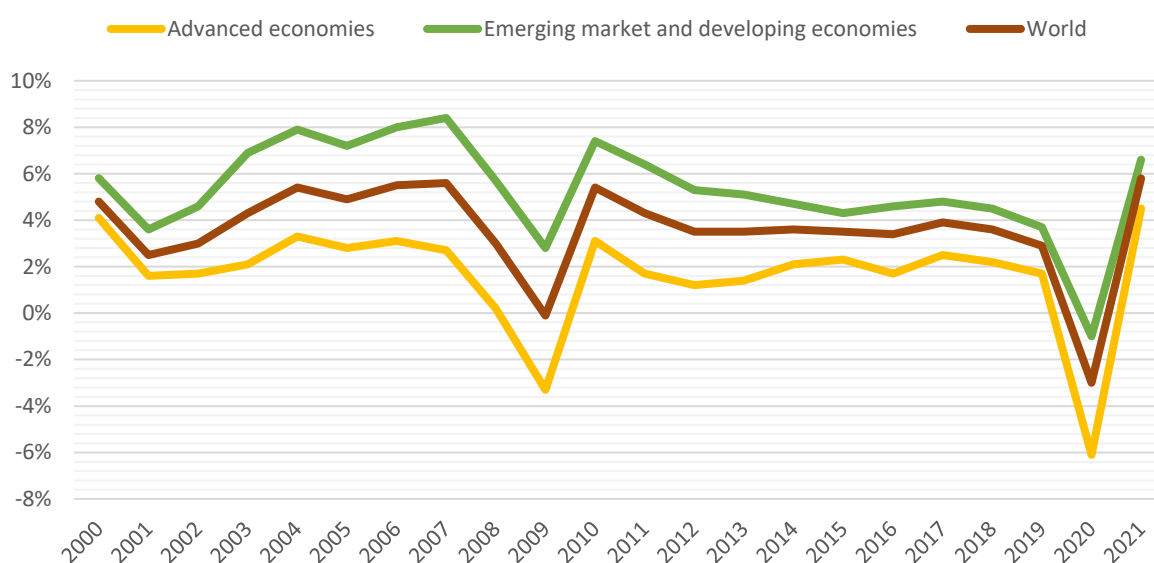
According to the IMF (International Monetary Fund), the impact of Covid-19 has been disruptive regarding also economy and sociality; it represents the largest global recession after the Great Depression, and it affects 265 million global famines. The measures implemented by the authorities like travel restrictions, lockdowns, workplace hazard controls and facility closure in order to slow the spread of the disease, have led to the cancellation of cultural, religious and sporting events, widespread supply shortages exacerbated

by panic buying and closing of schools and universities (98% of the students population worldwide has been affected by these measures).

According to the IMF, the world real GDP is estimated to decrease by 3% in 2020; worse the situation of developed economies (-6,1%). Euro area estimated loss of growth is around 7,5%, with Italy, one of the countries firstly attacked by Covid-19 and with the stricter legislation, at -9,1%.

As shown in Figure 1, the estimation for 2021 predicts a partial recovery, both for emerging and developed countries.

Figure 1 – Real GDP Growth over the last twenty years



Source: IMF

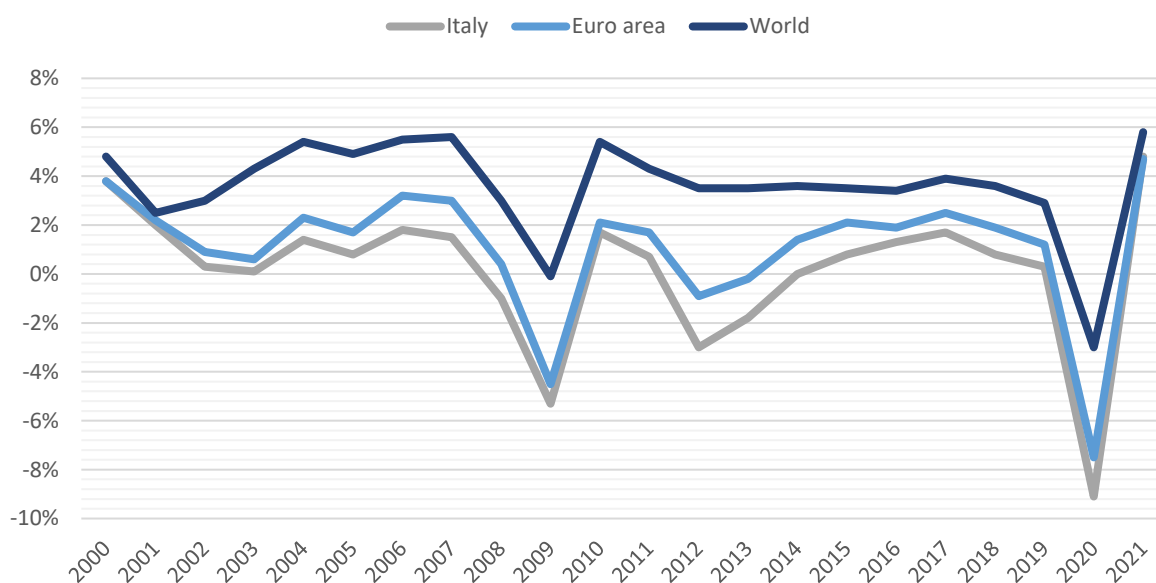
## 1.2 ITALIAN ECONOMY AND COMPANIES

As analysed in the previous paragraph, the impact of crises in the last twenty years have been particularly tough for Europe, and Italy has been one of the countries most affected. Italian economy has suffered a general period of stagnation, characterized by low growth stopped by the effects of the numerous crises.

Looking to Figure 2, the decrease in GDP of Italy has been higher than the averages of Euro area and of the World in each year of the last two decades, not only for Covid-19 crisis. In 2009, for the Great Recession, Italy lost 5,3 points in growth respect to Euro area with – 4,5 points and much worse than USA, the country in which the crisis

originated, that had a loss of 2,5 points. In 2012 Italy lived one of the most difficult moments of its history; GDP scored a – 3 points of growth, due to the concrete risk that one of the biggest manufacturing economies in the world could default for its unsustainable level of public debt. Thanks to a policy of austerity and to the help of the EU institutions, Italy was able to recover in the following years, but always at a slower pace than similar countries.

Figure 2 – Real GDP Growth over the last twenty years (UE and Italy)



Source: IMF

There are different theories behind the reasons for the slow growth rhythm of Italian economy, and all of them, looking at the historical clear pattern analysed in Figure 2, define the reasons as structural.

Reichlin (2019) affirms that the difficulties of Italy were born since the mid-1990s, when Italy entered “in a period of stagnating GDP and productivity, the so called economic decline”. To this decline, it has to be add that in the following years Italian policymakers had to make “painful and swift fiscal and institutional adjustments to correct economic imbalances and comply with the provisions of the Maastricht Treaty”, in order to have the prerequisites to enter the EU. These adjustments were incomplete and did not solve the two main problems that explain the fragility of the Italian economy: “stagnation of productivity and little internal adjustments (in terms of wage dynamics and reallocation of labour and capital across sectors and firms) to fend off the consequences of a loss of competitiveness in world markets”. At the basis of the productivity stagnation there is a

country that has a lot of difficulties to follow the new trends; Italy’s institutional model is inadequate to coping with the tensions generated by phenomena like globalization, technological revolution and monetary/commercial integration. The Italian model is defined as a “dysfunctional” variant of the coordinated market economies in Northern and Central Europe, due to a particular “weakness of its political institutions and an extreme fragmentation of interests and its productive fabric”.

Comparing some numbers between 1995 and 2016, Italy’s annual average GDP growth rate was just 0,5 percent, compared with 1,3 percent of Germany, 1,5 of France and 2,1 of Spain (Reichlin, 2019). Looking in more detail, if we focus the attention on the first period of economic stability (1995-2007) that lasted until the financial crisis, the Italian GDP growth is almost in line with the other European countries (1,5 percent, as the German one for the same period). The main difference in growth arises in the post financial crisis: Italy was not able to recover as the other European countries, both as we have already seen for the sovereign debt crisis that affected Mediterranean countries, and both for the inability to use in a proper way the forces of globalisation and of new technologies to recover.

At the basis of this inability could be imputed also the structure of the Italian economic fabric. The peculiarity of the Italian economic system is in fact to be composed almost entirely of micro, small and medium enterprises; looking at the last available report of ISTAT regarding the 2018, on a total of 4,4 millions of companies in Italy, the 95% are companies with less than 10 employees.

To understand what we mean by micro, SMEs, and large companies we have just to look at the classification given by the European Commission, and reported in the following table.

*Table 1 – European Commission classification*

	CATEGORY	EMPLOYEES		TURNOVER €		NET INCOME €
<b>SMEs</b>	<i>Large Enterprise</i>	> 250	<i>or</i>	> 50 mln	<i>and</i>	> 43 mln
	<i>Medium Enterprise</i>	< 250	<i>and</i>	< 50 mln	<i>or</i>	< 43 mln
	<i>Small Enterprise</i>	< 50	<i>and</i>	< 10 mln	<i>or</i>	< 10 mln
	<i>Micro Enterprise</i>	< 10	<i>and</i>	< 2 mln	<i>or</i>	< 2 mln

Source: European Commission

Looking in details to the data given by ISTAT regarding the 2018 report (Table 2), we can make the following considerations about the Italian economic fabric:

- In Italy there are more than 4 million of enterprises, comprehending different types from corporations to cooperatives;
- Micro enterprises represent the core of the Italian market, also in terms of people employed with more than 7 millions of workers;
- Small and Medium enterprises are also very important; even if they represent only the 5% of the total number of enterprises, their aggregate contribution in terms of turnover is almost the 40%;
- Large enterprises are few respect to the total, but they still have a great role in terms of turnover.
- SMEs (Small and Medium enterprises) and Micro enterprises hire almost 80% of workers, above the average of other EU countries (Prometeia, 2019).

Table 2 – Subdivision of Italian enterprises

Category	Enterprises Numbers	% on total	thousands		€ bn	
			Workers employed	% on total	Turnover	% on total
Large Enterprise	4.017	0,09%	3.919.422	22,67%	1081	35,50%
Medium Enterprise	23.647	0,54%	2.300.901	13,31%	597	19,61%
Small Enterprise	196.076	4,45%	3.505.189	20,28%	645	21,18%
Micro Enterprise	4.180.761	94,92%	7.562.378	43,74%	722	23,71%
<i>total</i>	<i>4.404.501</i>		<i>17.287.890</i>		<i>3.045</i>	

Source: Author's elaboration on ISTAT data 2018

These numbers make Micro and SMEs salient features of the Italian economy and reflect the traditions and entrepreneurship widespread in the territories. But there is also the other side of the medal. As Reichlin (2019) explains, especially micro companies “invest less in research and development and make less use of skilled labour”; this is the starting point of an economic basis that is reluctant to follow the modern trends such as globalization and technological improvements. Most of these micro companies have a familiar tradition, operate in a small market and don't have international relations. Not only workers are usually unskilled, but also the management.

With respect to micro companies, different is the role of the Small and Medium enterprises; most of SMEs follow the modern trends and for the availability of information and data, can be taken as indicator to measure the effects on the Italian

economy. These data and information about the Italian SMEs composition are especially analyzed in the annual report given by Cerved.

### *1.3 CERVED RELATION: ITALIAN SMALL AND MEDIUM ENTERPRISES*

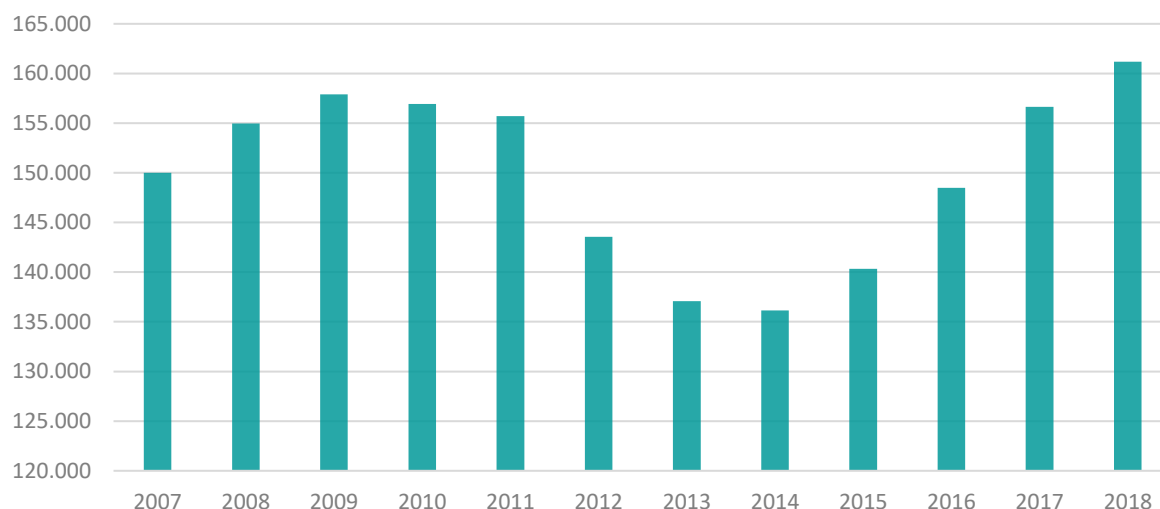
The relation “Rapporto Cerved PMI 2019” analyzes annually the evolution of the Italian small and medium enterprises. These companies (between 10 and 250 employees) are almost all well-structured corporations; the availability of their financial statement allows a deeper analysis than can investigate the financial and investing structure of these companies, understanding their strengths and weaknesses. With the aggregation of these results, it is possible to understand the key success factors of the most interesting players in the Italian economy.

SMEs in Italy are in fact the mirror of the economy of the country; they represent the type of companies famous all over the world under the brand of “Made in Italy”. Based on research conducted by Kpmg, if Made in Italy was a brand, it would be the third most famous in the world, after Coca-Cola and Visa. Based on Google Analytics, the term Made in Italy appears in 141 million of pages (Noci, 2014). Made in Italy not only as localized production in Italy, but as perception of the product in its entirety and of values such as beauty, passion, creativity, luxury, culture and quality, represents an asset with enormous potential.

During the last twenty years, SMEs in Italy had to deal with the difficulties and crises that have hit the entire Italian economy. Also about this point, SMEs can represent a good benchmark in analyzing how the production side of the economy has reacted to these difficulties.

In order to do that, it may be useful to compare the performance of SMEs with the general economic trend in the last years. As a measure of the performance, it can be used the total number of SMEs active in the Italian market, given by Cerved report. The growth or decrease of enterprises, depends on the balance between the new ones that enter in the market or that achieve the requisites to be considered as small or medium, and the ones that fail or have no more the requisites.

Figure 3 – Active SMEs in Italy in 2018



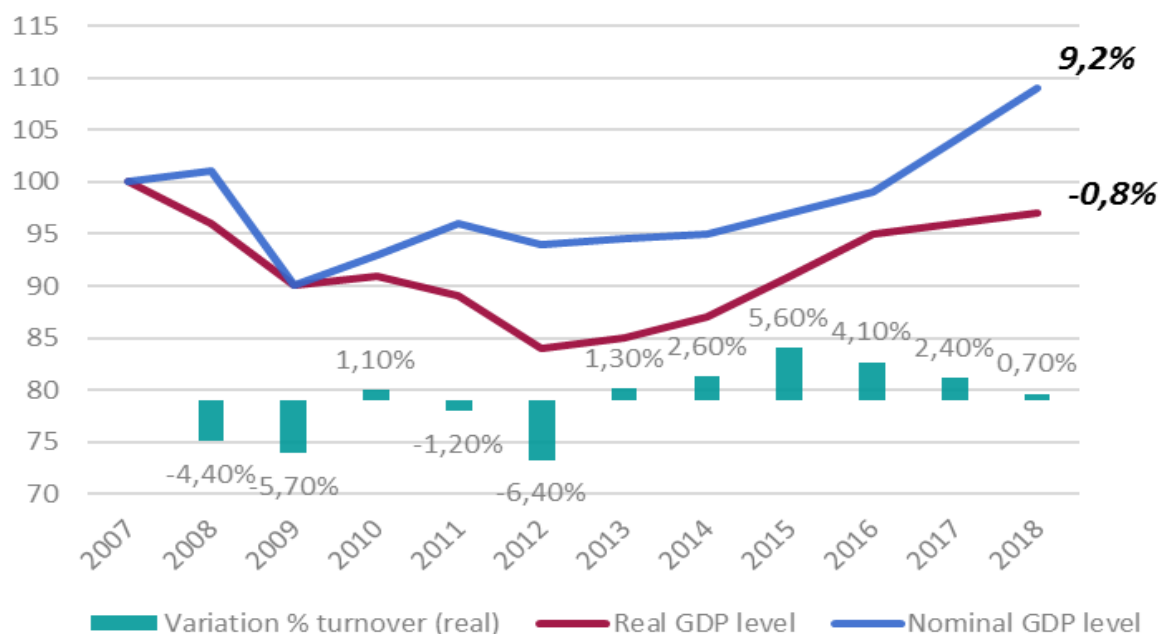
Source: Cerved Report (2019)

In Figure 3, there is the analysis of the period 2007-2018 given by the Cerved relation. In this period (before the Covid-19 crisis that will be analyzed specifically in the next paragraph) the two main economic events are the financial crisis of 2008 and the following sovereign debt crisis as a consequence in Europe. In 2009 the numbers of Small and Medium enterprises started to decrease, with a rapid fall in 2012-2013 due to the particular difficulties of the Italian economy (as seen before the threat of an unsustainable public debt). A lot of companies defaulted, and a lot of employees became unemployed. Since 2014, there has been a recovery in the number of enterprises, but year after year this growth has had a slower rhythm. Looking also to Figure 6, that analyzes the variation of the total Italian SMEs turnover per year, we see that the path is the same, with a maximum recovery in 2015 of the 5,6%, that has slowed progressively down in the following years.

One possible reason could be found in the continuous uncertainty of the markets; in recent years, the trade tension between the United States and China has led to slowdowns in the global market, with increased duties and greater export difficulties even for European countries. Many Italian SMEs had developed important trade relations with the Asian continent in the last decade, and these political conflicts have directly damaged their business.

To this must be added at European level also a slowdown in the German economy, to which the Italian economy is very much linked by subcontracting relationships.

Figure 4 – Real Italian SMEs turnover variation %



Source: Cerved Report (2019)

In Figure 4 the red line indicates the turnover variation of SMEs in real terms, including the effects of the inflation during the decade. This estimation is much more reliable than the blue line, that indicates the same turnover variation but only on a nominal value. The reason behind the different reliability of the two lines is simple: if the blue one shows in the aggregate period 2007-2018 a total recover of 9,2% in nominal terms, the red one for the same period taking into account the effects of the inflation shows that in the truth there has been no total recover, with a decrease of -0,8% in the period. This result is important and fundamental in analysing the impact and the effects of the financial and sovereign debt crises: after 10 years, the recovery of the Italian SMEs has been only partial, and they have not been able to return to turnover's level of 2007, the year before the beginning of the crises.

Although the SMEs are not the totality of the Italian economy, they can be taken as a proxy to represent the majority of companies.

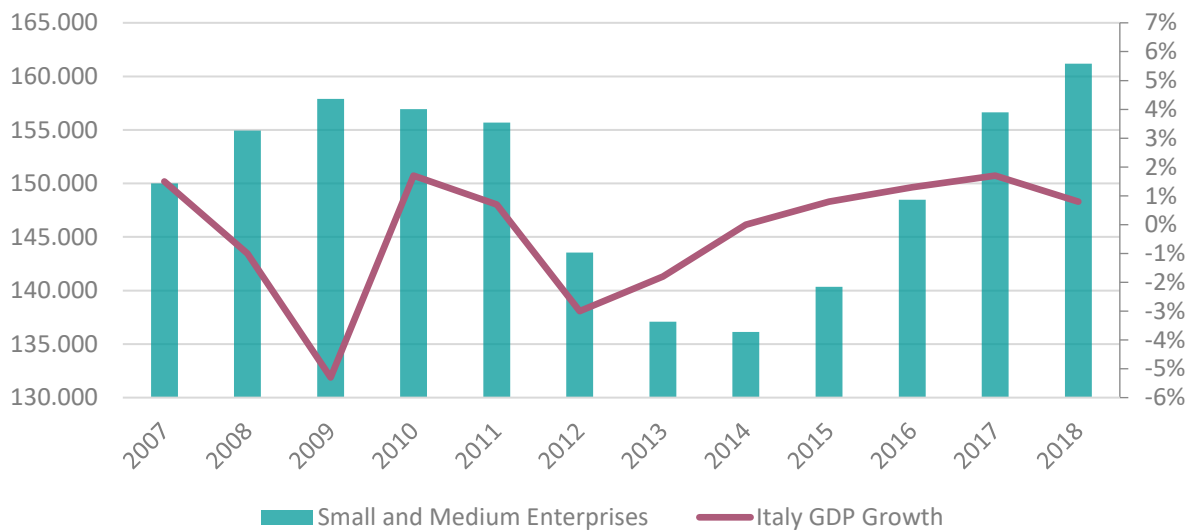
To confirm this assumption, it may be useful to compare the variation of the total numbers of active Small and Medium enterprises in Italy (represented before in Figure 3, taken by Cerved) with the Italian GDP growth in the same years (data taken by IMF).

In Figure 5, we see that graphically the two lines historical successions have a similar evolution; in details in the first years of the financial crisis, for example in 2009, the movement is opposite, because the first impact of the crisis was more on the financial



institutions. Inevitably it was only a matter of time that the crisis' effects spread in all the sectors, and starting from 2010 the balance of enterprises numbers started to be negative, due to an higher amount of companies that failed for the almost impossible access to credit, and for a lower demand caused by a difficult economic general situation. Since 2014, when the GDP started to recover with a positive growth trend, also the number of enterprises touched its lowest minimum, and started to recover thanks to the new economic stimulus from which the enterprises could benefit.

Figure 5 - Comparison between number of Italian SMEs and Italian GDP Growth



Source: Author's elaboration

To have an estimation of the graphic evolution of the two successions of data, it has been conducted a correlation between the two variables, presented in Table 3; excluding the first two years, in which the effects of the economic crisis were still to spread among Italian companies, the correlation in period 2010-2018 with a 0,59 indicates a common pattern in the two successions, confirming that the causes at the basis of the uncertainty of the time has impacted SMEs in a similar way as the Italian overall economy.

Table 3 – Correlation between number\_SMEs and Italy\_GDP\_growth between 2010-2018

	number~s Italy_~h	
number_SMEs	1.0000	
Italy_GDP_~h	0.5874	1.0000

Source: Author's elaboration through STATA software

Therefore, SMEs are a good indicator and the next step is to use them as a benchmark to analyse the impact of the current and most dramatic crisis: the Covid-19 one.

#### *1.4 COVID-19 CRISIS ON ITALIAN SMEs*

In order to understand the impact of the Covid-19 pandemic crisis on the core of the Italian economy, it has been decided to take as sample for the analysis one of the most recent relation about the economic effects of the outbreak, the “Rapporto Regionale PMI 2020” realized by Cerved and Confindustria. This report analyses 156 thousand of Small and Medium enterprises (so that have the requisites indicated in Table 1) active at the beginning of 2020 and that are divided in:

- 93 thousand in the Northern regions (in the specific 53 thousand in North-West and 40 thousand in North-East).
- 32 thousand in the Central regions.
- 31 thousand in the Southern regions.

It is useful to divide geographically these companies because, as we will see, they present different characteristics, and they react in different ways to Covid-19 crisis.

For example, of the 224 trillion of added value created by the total of SMEs, the 67% is created in the North, and only the 18% and the 15% respectively in the Centre and in the South. On average a Northern company produces an added value of 1,6 million, 30% higher than one in the Centre (1,25 million) and 50% more one in the South (1,09 million). In the North there is also a higher average of Medium enterprises, around 20% of the total, with respect to 15% in the Centre and 14% in the South.

As seen in the Cerved report of 2019, the Italian SMEs had already had signals of a slow growth before the pandemic exploited. In terms of turnover, estimates for 2019 are slower than in previous years; since 2017 the economic recovery from the financial crisis has been much weaker. To confirm a worrying scenario, in 2018 the increase in added value (4,1%) was lower than the growth in the labour cost (5,6%). Considering the net profitability, measured by the economic indicator ROE, after the maximum of 2017 with an average of 11,7%, it started to decrease in 2018-2019, up to 9,6% in the North and even worse in Centre (8,7%) and South (8,1%).

If the slowing down in the growth of turnover and ROE indicates that the companies had already reached the maximum of the recovery from the financial crisis (precisely in 2017), their financial structure teaches us that they have learnt the lesson from the previous crisis, and in 2019 they are much more solid than before. Financial liabilities have increased in the last years, but with a slower pace respect the increase in equity; as results the ratio between the two has decreased, meaning a higher financial solidity of the Italian SMEs. To have a comparison that can help us to understand if the companies have been more or less ready to face the Covid-19 crisis respect to the Great Recession, the weight of financial liabilities in 2018 was at 63% (with a positive trend respect the 66% of 2017) while in 2007, the year before the subprime crisis, it was at 116%, almost the double. Even if the improvement in the financial structure has been substantial in all the regions of Italy, it must be denoted that there are also clear differences between the 61% of the North companies, and the 76% and 79% of respectively Centre and South.

A stronger financial structure is reflected also in lower interest expenses, that in 2018 have reached the minimum level of the last twenty years, equal to the 13% of the gross margin. Another indicator of financial stability is the delay of payments; in this case there is also an improvement in the last years, but with consistent differences between the North and the South. In Italy, an average of 4,9% of SMEs have delay in payments that can result in insolvency; in some regions of the South this level reaches the 12%.

Financial solidity therefore presents different scenarios within the Italian territory. Some critical situations in the South, in correspondence with a violent shock such as Covid-19, could break out and put the company's liquidity in crisis.

In fact, based on estimation of national and international institutions, Covid-19 crisis will have an unprecedented impact on the economy, overcoming the effects of the Great Recession.

To assess the impact of the emergency on the Italian SME system, Cerved predictive model was used, which is based on a very granular sector analysis of the sales performance of over 1,500 sectors of the Italian economy.

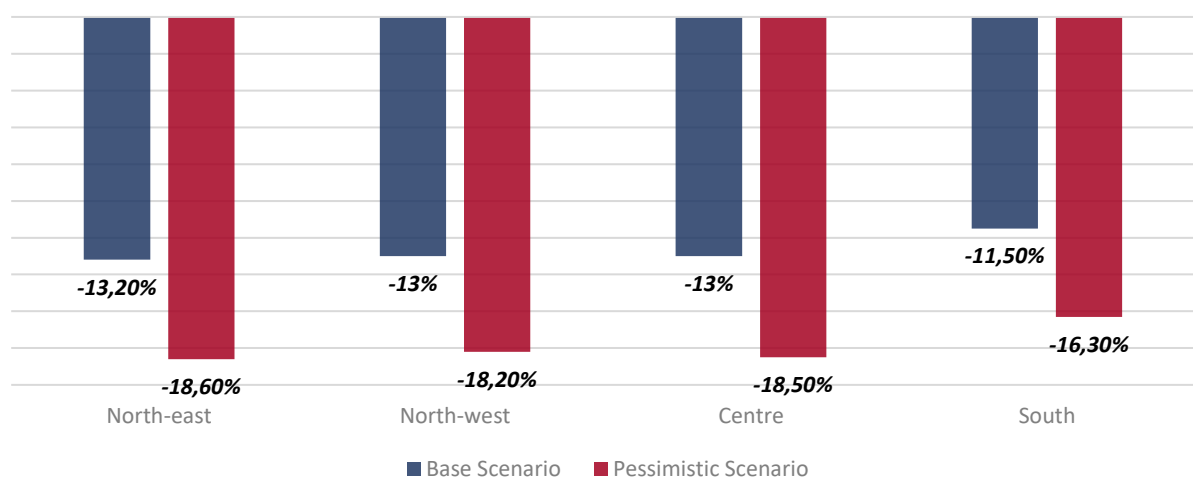
The model is based on a reference scenario, which estimates the impacts of Covid-19 on enterprises, considering the lockdown period (started the 9<sup>th</sup> March 2020) and the effects of government measures in a framework of progressive normalization of the national and international economic context. Given the high uncertainty regarding the evolution of the epidemic, a pessimistic scenario was also considered, in which a second wave of contagion and a new lockdown in the autumn are assumed, although smaller than the first one.

According to this model, Italian SMEs are expected to shrink their turnover of 12.8% in 2020, with a rebound in 2021 of 11.2%, insufficient to return beyond the levels of 2019. In the event of new waves of Covid-19, the decline in revenues is estimated at -18.1% for the current year (+16.5% in 2021). The impacts will be strongly asymmetric depending on the activity of the company: the forecasts are of major shocks for the sectors most penalized by the rules on social distancing, by the reduction of mobility, by the effects on international trade: for example, a decrease of 65% is expected for film projection activities and 51% for air transport. At the same time, for a small group of sectors, an increase in sales during the emergency is expected (+35% for online trade and +17% for artificial respiration devices).

The impact of Covid-19 on the territorial systems of SMEs will strongly depend on the sectoral specialisation. The forecasts are of major declines throughout all Italy, with slightly more limited negative effects in Southern regions, which benefit from the increased presence of companies in countercyclical sectors and in essential sectors, which did not have to close down their business during the lockdown phase.

In the following Figure 6, are presented in detail the expected turnover variation between 2019 and 2020, and as we can see the estimated percentage of the South regions are on average lower respect the others.

Figure 6 - Turnover % variation 2019-2020

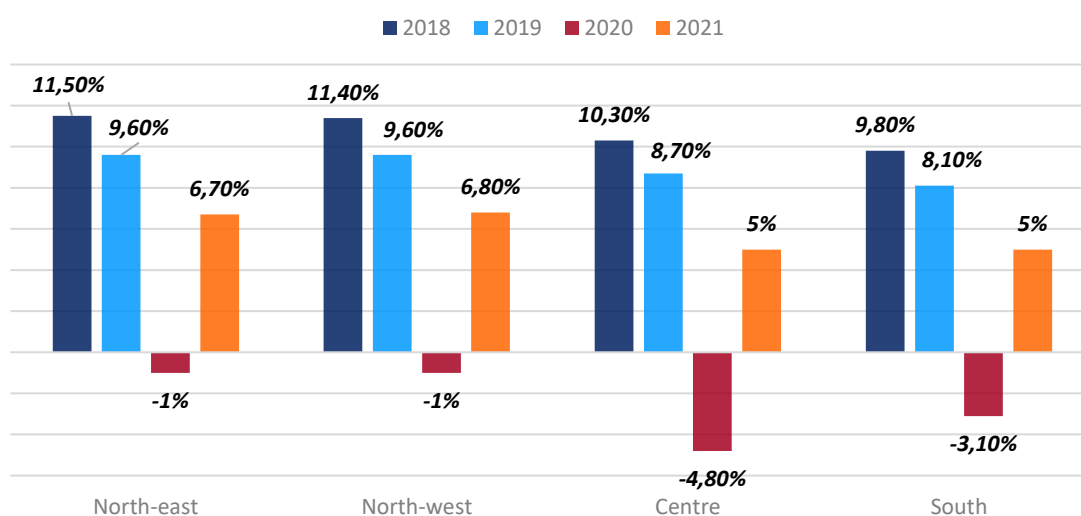


Source: Cerved Group and Confindustria (2020)

Considering the gross margin, the impact will be similar in all the regions, with an estimated loss of -40%.

What it will be different and most relevant is the impact on the net margin (as seen before measured by ROE); the weak financial structure of businesses in the Centre and South will inevitably penalise the cost of recourse to new debt, which is unavoidable in many cases to overcome the impact of the lockdown. These unforeseen high costs will reduce the net profitability of Southern companies more significantly. Northern companies, with a more stable structure, will be able to have a smaller impact, as shown in the Figure 7 below.

Figure 7 - ROE Variation % (base scenario)



Source: Cerved and Confindustria (2020)

In 2021 in many regions of Italy, the net margin level will be half of the one previous the Covid-19 crisis.

The Covid-19 represents an unprecedented shock for Italian SMEs and for Italian companies in general, which could turn into a long recession with social consequences difficult to sustain in the event of mass bankruptcies and loss of production capacity. This will depend both on the effectiveness of the short-term measures, with which the government intervened in the emergency phase to provide liquidity to the system, and on those with a longer horizon, aimed at securing a solid recovery and stimulating new investment.

Cerved carried out an analysis on the balance sheets of SMEs indicating that more than a third of the 156,000 companies analysed (60,000 according to the baseline scenario and 70,000 in the event of a new wave of contagion after the summer) could enter a liquidity

crisis during 2020 as a result of Covid-19; between EUR 25 and 37 billion would be needed to overcome this phase, avoiding very significant social costs, with 1.8 million workers employed in SMEs with potential problems of liquidity.

Even in a more pessimistic scenario, of a new lockdown in the autumn, the allocations declared by the Government in the context of the *Decreto Cura Italia* (€80 billion at the Central Guarantee Fund plus €30 billion endowment for SMEs) are therefore largely sufficient to cover the needs of the SMEs. Even if the government's aid seems to be sufficient, many companies will still get into serious difficulties. If, as seen before, the financial stability of enterprises is greater today than in 2008, it is also true that the proportion of weaker businesses with a debt to equity ratio in excess of 100% could see this ratio rise by virtue of new aid, until it becomes hardly sustainable.

As a result of more fragile fundamentals, despite an initial revenue shock more contained thanks to a specialization in sectors less exposed to the impacts of the health crisis, the gap in terms of risk of Central-Southern regions with the rest of the country would widen further: in a pessimistic scenario, 26% of southern SMEs would be classified as risky (64.4% considering vulnerable and risky) and 22.9% of those of the Centre (58.7%), against percentages equal to 14.2% (42.6%) in the North-East and 14.8% in the North-West (43.8%).

### *1.5 NEXT FUTURE FOR ITALIAN SMEs*

Covid-19 pandemic is having a drastic impact on the whole world. Especially in Italy, as seen already marked before the Covid-19 by an evident stagnation, a heavy recession is underway, due to the impacts generated by the administrative lockdown of many production activities and the significant slowdown suffered by all other activities due, specifically, to the prevention, sanitation and physical distancing measures imposed at all stages of the production and logistics chains. That was also due to a general and inevitable fall in international and domestic demand, especially for capital goods and consumer goods, because of the collapse in turnover and income.

One of the main problems with this crisis is the uncertainty related to the future and consequently how long the economy will need to recover.

As analysed before, in 2017 the Italian economy had not yet been able to recover from the 2008's Financial Crisis, and in 2018 it started a period with lower growth due to the

commercial tensions. Therefore, it is difficult to estimate the time needed to recover from a crisis even worse.

At the basis there is the uncertainty that has characterized the first twenty years of the new millennium; a redundancy of crisis with different natures.

Knight (1921) gives an historical definition of uncertainty as a *lack of any quantifiable knowledge about some possible occurrence and, acknowledging some fundamental degree of ignorance, an essential unpredictability of future events* (LeRoy & Singell, 1987).

Defining uncertainty in these terms, it is easy to see that it is a variable strongly permeated by the current economic environment and which is perhaps the most decisive factor in the slowness characterising the post-crisis recovery phase. For this reason, it is useful to have a quantitative indicator able to give an estimation of uncertainty. The most known is the VIX index, a real-time market indicator representing the market's expectations for volatility over the coming 30 days. Created by the Chicago Board Options Exchange (CBOE), it provides a measure of market risk and investors' sentiments, associating volatility with future uncertainty. Even if it is associated with the American economy, thanks to the globalization and to the connection of the economies between various commercial relations, it can be used as a good proxy for the uncertainty worldwide,

In the following Figure 8, it is reported the trend of the VIX index since its creation. As we can easily see, the two peaks refer to two most dangerous crises: the financial and pandemic one. But it is also easy to see that the index scored on average higher values since the starting of the new millennium, characterising 20 years of uncertainty with respect to the time before.

Figure 8 - VIX Index



Source: Fred [fred.stlouisfed.org](http://fred.stlouisfed.org)

And the uncertainty is forecasted also in the near future; the most concrete threat is a new lockdown in autumn, with a new wave of economic depression and stop in consumption. And other crises are already on the horizon. Covid-19 has exposed the weaknesses of globalisation, and there is uncertainty about when and how relations between the various continents will return. Moreover, a future environmental crisis due to climate change is increasingly realistic; the price of oil has recently reached an all-time low, and the governments of the various nations can no longer avoid looking for concrete solutions towards a more sustainable world. A world in which new balances will probably reign, something that at present is difficult to predict (Serafini, 2020).

The natural question that arises is therefore how to react to this future uncertainty to the so-called next normal that will characterize the world after Covid-19.

The first step is to adapt the Italian context. In Italian history, political and legislative succession have been sources that have increased uncertainty even more, rather than decreasing it. A series of governments have alternated, often proving to be unsuitable for implementing structural reforms capable of solving fundamental problems such as bureaucratisation, which discouraged economic activity in Italy. One example was the management of the pandemic emergency: through the "*Decreto Rilancio*" the government was able to allocate funds to support businesses quite immediately, but a further "*Decreto Semplificazione*" was needed to ensure that this liquidity was effectively accessible to companies.

This is why at the same time Covid-19 could represent an opportunity for Italy: the possibility of creating an investment plan that is consistent with the far-reaching structural reforms that are needed with a new perspective of regional development and territorial cohesion needed to promote a national policy for SMEs, and that is capable of integrating the major goals dictated by the EU (sustainability, resilience and digitalisation) (Cerved Group and Confindustria, 2020). Only in this way will it be possible to bridge the gap between companies in the North and South; a gap that otherwise will continue to wide for each future crisis.

At the basis of this economic gap between Northern and Southern companies, there is the second step in understanding how to react to future uncertainty. Northern companies seem to have different characteristics, which have allowed them to react better to the continuous past and, as seen, to the current crisis. These characteristics are often identified in more dynamic, enterprising and robust companies; more resilient companies (CUOA Business School, 2018). Resilience is a very topical concept and together with sustainability and



digitalization are the directives provided by the EU that companies should follow (Cerved Group and Confindustria, 2020). In the next chapter we will analyse it in detail, starting from a literature review and then understand in concrete terms what are the resilient approach models of an organisation and how resilience can be concretely achieved, also by Italian companies.



## **ORGANIZATIONAL RESILIENCE THROUGH SERVICE AND DIGITALIZATION**

### *2.1 ORGANIZATIONAL RESILIENCE: LITERATURE REVIEW*

In recent years, the concept of resilience has become very widespread, even in everyday speech, and in some cases, it is often abused. Often resilience has been defined as the fundamental characteristic that individuals and organisations must have in order to overcome the increasing number of crises, even if it is difficult to study the concept properly and specifically investigate the concrete characteristics that make possible for an individual or organization to be resilient.

Therefore, it is useful to carry out a literature review of the evolution of the concept to date, and then focus specifically on the resilience of companies, the organizational resilience.

The term resilience has been around since the 1600's and comes from the Latin term "resilire" meaning *to recoil or to rebound* (MacMillan Dictionary, 2019). By the 19<sup>th</sup> century it had evolved to include a sense of elasticity; in 1973 Holling, an ecology scholar, classified two aspects of resilience: the first is Engineering resilience defined as the time an object takes to return to a state of equilibrium and the second is Ecological resilience defined as the amount of shock a system can absorb before it breaks down (Holling, 1973).

Another of the first applications of the concept occurs in psychology: resilience is a concept that indicates the ability to deal positively with traumatic events, to positively reorganize one's life in the face of difficulties, to rebuild oneself while remaining sensitive to the positive opportunities that life offers, without alienating one's identity. Resilient people are those who, immersed in adverse circumstances, succeed, despite everything and

sometimes against all odds, in coping effectively with setbacks, giving new life to their own existence and even reaching important goals. Applied to an entire community or society, rather than to a single individual, the concept of resilience is affirming itself in the analysis of social contexts following serious natural disasters or due to human activities such as, for example, terrorist attacks, revolutions or wars (Vale & Campanella, 2005).

From the original psychological meaning the concept has also spread to the economic one. Therefore, an organization (enterprise, company and similar) is resilient when it can face risks, seizing opportunities even in negative situations. In practice, it knows how to evolve out of a crisis as it can manage change.

The developments about resilience in business and management research are analysed properly by Linnenluecke (2017) that come back to the main literature about the topic. In the evolution of the concept, the author covers five different streams of resilience as concept:

- the first one as organizational response to external threats,
- the second as organizational reliability,
- the third as employee strengths,
- the fourth as adaptability of business models and
- the last one as design principles that reduce supply chain vulnerabilities and disruptions.

The conceptual origins are attributed to Staw et al (1981) and Meyer (1982), who both published on the “Administrative Science Quarterly”, but with a different point of view on how organizations respond to external threat. While Staw et al (1981) suggested that an external threat automatically places an organization at risk, Meyer (1982) contradicted the proposition affirming that organizations have two different types of responses: they can either absorb the impact of the environmental shocks by undergoing first-order change and single-loop learning (labelled “resiliency”), or they can adopt new practices or configurations through second-order change and double-loop learning (labelled “retention”). He further concluded that resilience is influenced by an organization’s strategy and its slack resources, while retention is shaped by an organization’s ideologies and constrained by organizational structures.

Between 1989 and 1990, large-scale external events such as Chernobyl, Exxon Valdez, Bhopal, and the Space Shuttle Challenger, shifted the interest in research to resilience as

reliability. Charles Perrow (1984) is one of the main contributors of this research, and he focused on the reliability of the new high-risk technologies that have caused some of the industrial accidents mentioned before. In his view these high-risk technological systems are vulnerable to failure because they are becoming increasingly complex and difficult for personnel to operate. Wildavsky (1990) put greater attention on operational safety and reliability in organizations; after the analysis of the considerable degree of safety that the society had thus far achieved, he concluded that resilience is *“the capacity to cope with unanticipated dangers after they have become manifest, learning to bounce back”* (Wildavsky, 1990). This definition described resilience as a generalized capacity to learn and to act without knowing in advance the situation or event that needs to be acted upon; this will be defined as an important aspect of High Reliability Organizing.

One of the following most cited contributions is the paper by Weick and Roberts (1993) in which the authors suggested that high-reliability organizations enact aggregate mental processes (information processes, heedful action and mindful attention) that are more fully developed than those in organizations that are primarily concerned with efficiency. The research on high-reliability organizations continued, and in 2001 Weick & Sutcliffe defined the High-Reliability Organizations (HROs) as those able to preserve flexibility in face of disturbances, and they prefer to respond with new learning rather than new rules or procedures. In HROs there is the first clear link between resilience and flexibility or adaptation and the necessity of the organizations to be ready and dynamic to the uncertainty of the environment.

With the 9/11 2001 disaster, there was a new stimulus in resilience research, and the attention shifted to coping mechanisms and response strategies under conditions of uncertainty, or even worse as in the case of the terrorist attack, under conditions of emergency. A new stream of resilience research can be found in the works of Couto (2002) and Luthans (2002) that put their attention on the potential of building resilience through employees' strengths. Couto analysed the capabilities of Morgan Stanley's employees in evacuating the offices of the World Trade Center just one minute later the impact of the plane; the company, one of the most famous investment bank with at the time 2.700 employees in 22 floors of the Center, lost only seven employees despite receiving an almost direct hit.

Luthans proposed research on how to develop and manage psychological strengths in employees. He defined resiliency as follow: *“the capability of individuals to cope successfully in the face of significant change, adversity, or risk”* and as *“the positive*

*psychological capacity to rebound, to 'bounce back' from adversity, uncertainty, conflict, failure or even positive change, progress and increased responsibility*" (Luthans, 2002).

Organizations are assumed to be able to build psychological capital through developmental processes, which improve employees' abilities to cope with change, adversity, or risk. The following stream of research regards the adaptability of business models, with a series of publications that focus on how companies adjust, adapt, and reinvent their business models in an ever-changing environment.

Sutcliffe and Vogus (2003) define resilience as "*the maintenance of positive adjustments under positive conditions*" (Sutcliffe & Vogus, 2003). These adjustments are the response to small interruptions and bigger disruptions due to exogenous events; organizations are more likely to be successfully resilient if they create the continuing ability to use internal and external resources to resolve issues.

Similarly, Hamel and Välikangas (2003) suggested innovation as another enabling condition, as it allows organizations to constantly anticipate and continuously adapt to a broad new range of turbulence.

Gittel et al. (2006) sum up all these theories in defining the viable business model, that allows organizations to collect financial resources in order to provide a strong commitment to employees during times of crises, and sustain relationships that act as enabling conditions for organizations to return quickly to full performance.

The last stream focuses on the resilient supply chain design: after 9/11 it was revealed the vulnerability of highly related supply networks. Jüttner and Maklan (2011) identified the main capabilities that lead to a resilient supply chain: flexibility or redundancy (modular designs, diversification across suppliers, multiple transport or production processes), velocity/reaction speed, access to timely information, and collaboration among supply chain members. For the authors, only thanks to these resilient capabilities, organizations can avoid or limit the impacts of adverse events on revenue, cost, and lead time.

To sum up the bibliographic research about the evolution of the resilience concept, it follows the Table 4, with the main authors' contributions analysed in the paragraph.

Table 4 – Summary of literature about resilience

Stream of Research	Author and year	Contribution
<i>Resilience as organizational response to external threats</i>	Staw & et al., 1981	External threat automatically places organization at risk.
	Meyer, 1982	Resilience influenced by the organization's strategy and resources.
<i>Resilience as organizational reliability</i>	Perrow, 1984	Reliability of high-risk technologies.
	Wildavsky, 1990	Resilience as learning to bounce back.
	Weick & Roberts, 1993	Mental processes in HROs.
	Weick & Sutcliffe, 2001	HROs: resilience as flexibility and adaptation.
<i>Resilience through employees' strengths</i>	Coutu, 2002	Importance of employee capabilities.
	Luthans, 2002	Resilience as capability of individuals to cope successfully in face of risk.
<i>Resilience as adaptability of Business Models</i>	Sutcliffe & Vogus, 2003	Resilience as maintenance of positive adjustments.
	Hamel & Välikangas, 2003	Resilience as innovation to anticipate turbulences.
	Gittel, et al., 2006	Availability of financial resources to provide commitment to employees.
<i>Resilient supply chain</i>	Jüttner & Maklan, 2011	Main capabilities that lead to a resilient supply chain.

Source: Author's elaboration

After the five streams of resilience research just analysed, the studies followed new directions, with a new line of researchers that put more attention on resilience as the capability to react and detect a threat. A threat that today is more probable due to the growing

uncertainty of the last decade (as seen in the first chapter), that has placed the concept of resilience as increasingly modern and current.

In addition to the literature about resilience as general concept and organizational resilience, some literature has started to analyse the role of entrepreneurship and enterprise resilience, trying to find out what are the main characteristics that make the individual, before the organization, resilient.

From the examination of the resilience research that followed the five streams analysed in detail, some conclusions can be made:

1. Resilience research has been highly context-dependent; depending on the context, resilience has been conceptualized in several different ways. For example, some studies view resilience as a way of engaging positively with internal or external failures, while other studies suggest that resilience is a way to avoid, resist or buffer against external impacts by implementing design principles. Another conceptualization emphasizes that resilience involves recovering from extreme events and disasters, the so-called bouncing back. It is not clear if all these contexts are complementary or competing.
2. Studies on resilience often propose ways of arranging and accumulating assets and resources that will be invested in the organization and in the individuals in order to become more resilient. Often quoted are the concepts of financial reserve and slack/redundant resources, that must be collected with this aim.
3. Rarely the conceptualization of resilience has translated in operationalization. Depending on the different types of organizations and their different resources, it is difficult to detect in detail the ways in which a company or an individual can be more resilient. Literature is lacking in empirically providing the theories; in other words, there is little on how organizations can achieve resiliency.

Therefore, the managerial challenge is transforming organizational resilience from a set of redundant preventive actions, involving resources management, into a proactive strategy funded on a set of practices capable of fostering daily effectiveness of operations and processes.

In order to do that, it is needed a deeper analysis and a new approach to the concept, capable to resume all the previous conceptualizations and to adapt to the challenges of today and of the next future.

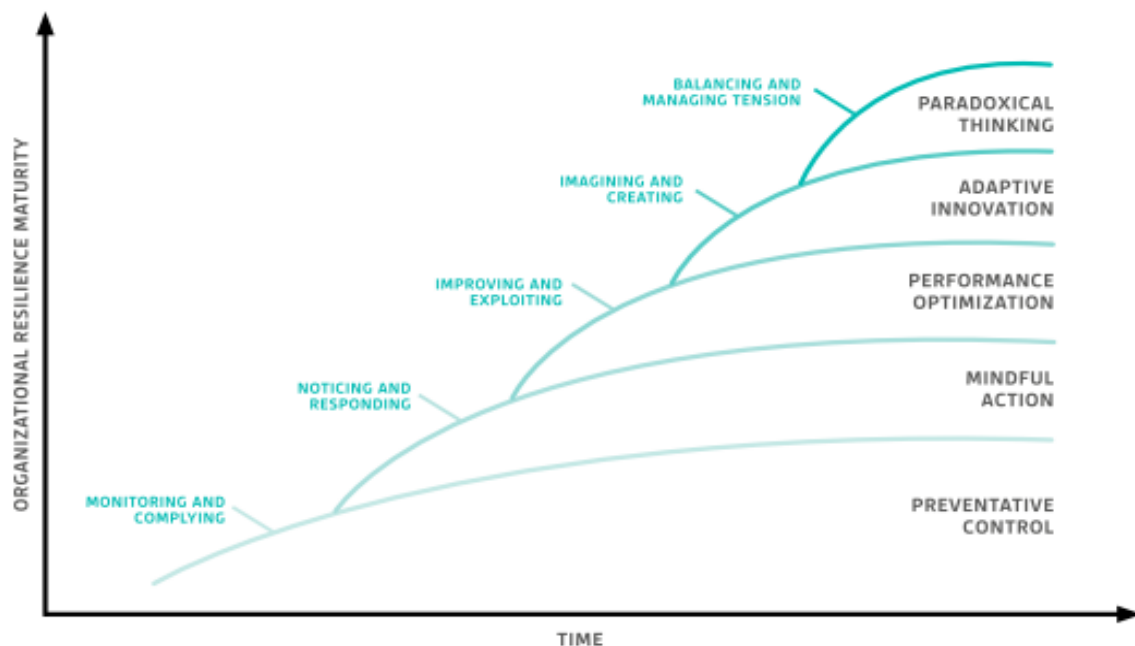


## 2.2 ORGANIZATIONAL RESILIENCE APPROACH

As discussed in the section before, resilience is a complex and dynamic concept. Sophisticated concepts are characterized by different elements or attributes, and as we have seen the literature give different interpretations. The thinking on organizational resilience has naturally evolved over time and can be split by two core drivers: defensive (stopping bad things happen) and progressive (making good things happen), as well as a division between approaches that call for consistency and those that are based on flexibility.

Professor David Denyer (2017) of the Cranfield School of Management analyses the last forty years of resilience research, identifying five distinct phases, with five contrasting perspectives (Figure 9); the first two phases are driven by a defensive perspective based on loss avoidance and value preservation.

Figure 9 – Five distinct phases and perspectives about resilience



Source: Organizational Report – A summary of academic evidence. Denyer (2017)

- Preventative control. Resilient organizations take precautionary measures in face of potential problems; basic activities as monitoring and complying and more specifically physical barriers, redundancy, systems back-ups and standardized procedures protect the organization and allow it to bounce back from disruptions and to restore a stable state. *Defensive + consistent.*

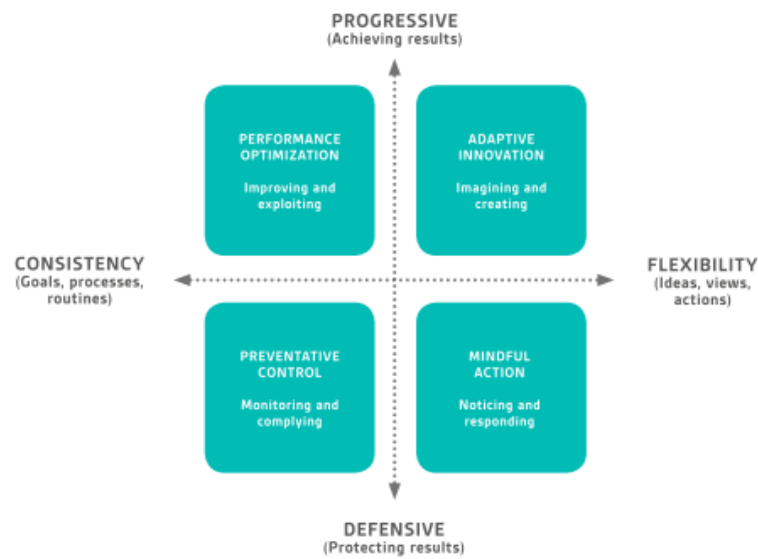
- Mindful action. Organizational resilience is produced by people, who notice and react to threats, and respond effectively to unfamiliar or challenging situations; when employees have experiences that add to their growth, competence/expertise, and efficacy they are more likely to exercise behaviours such as judgement, discretion and imagination. *Defensive + flexible*.

The next two phases do not stop to bounce back but recognize that a resilient organization needs also to *bounce forward*, to grow and to prosper in the future.

- Performance optimization. Organizational Resilience is formed by continually improving, refining and extending existing competencies, enhancing ways of working and exploiting current technologies to serve present customers and markets; optimization also of processes becomes the key word that controls the change when it occurs. *Progressive + consistent*.
- Adaptive innovation. Organizational Resilience is created through creating, inventing, and exploring unknown markets and new technologies. Organizations can be the disruption in their environment; the main ability is to adapt to the rapid production of knowledge and innovation of today's business environment. *Progressive + flexible*.

Thinking on Organizational Resilience has been split between behaviours that are defensive (stopping bad things happen) and those that are progressive (making good things happen), as well as between behaviours that are consistent and those that are flexible. These four viewpoints form an integral part of a framework, the "Tension Quadrant".

Figure 10 – Tension Quadrant



Source: Organizational Report – A summary of academic evidence. Denyer (2017)

These perspectives and behaviours have been a source of disagreement and misunderstanding; therefore, most recently a new fifth strand of thinking on organizational resilience has emerged that integrates, balances, and seeks fit between the other four perspectives.

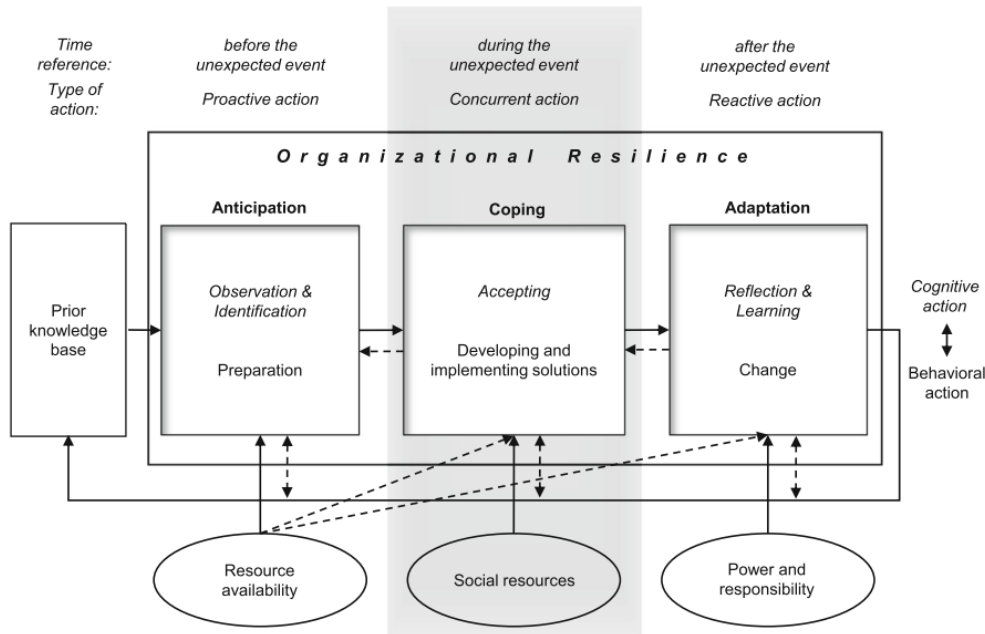
- Paradoxical thinking. Organizational Resilience is achieved by balancing preventative control, mindful action, performance optimization and adaptive innovation, and managing the tensions inherent in these distinct perspectives.

From these perspectives, and thanks to the paradoxical thinking, the capability to merge and integrate them, we are ready to focus in concrete to a new conceptualization of organizational resilience that defines a set of capabilities by which firms anticipate, cope with and learn from unexpected events. These three dimensions of organizational resilience can be distinguished, since resilient organizations respond not only to current or past issues, but also to the future one.

Duchek (2019), after having recognized that most of the past resilience literature is perspective and normative, defines two potential approaches that can describe a more concrete resilience: (1) processual approach that define different resilience stages and recognize the dynamic nature of the concept and (2) academic approach that provide insight into internal workings of resilience. In combination these two approaches can foster a comprehensive understanding of the resilience phenomenon with the aim to develop a

conceptual framework that illustrates the main stages of the resilience process and points to underlying capabilities that together constitute the meta-capability of organizational resilience. At the basis of this framework there is the interaction between the organization and the environment.

*Figure 11 - Conceptual framework*



Source: Organizational resilience: a capability-based conceptualization. Ducheck (2019)

Ducheck (2019) analyses and recalls three successive resilience stages (anticipation, coping and adaptation) and assigns important organizational capabilities to each of these stages.

In details:

### *1. Anticipation capabilities*

Anticipation is the first dimension of organizational resilience and it refers to the ability to detect critical developments within the firm or in its environment and to adapt proactively. Some firms can see the unexpected faster than others, and they are able to immediately react to it while others “wait and see”. Systems need anticipation capabilities to avoid threatening situations or at least minimize potential negative consequences.

Anticipation stage comprises three specific capabilities: the ability to observe internal and external developments, the ability to identify critical developments and potential threats, and as far as possible to prepare for unexpected events.

In literature, the activity of observation and identification is also called as environmental scanning, that means acquiring information that involves exposure to and perception of information. To gather this information, some practiced routines can be useful, like market research, end-user surveys and the use of gatekeepers.

In addition to the observation and identification of actual changes and upcoming crisis, a focus on potential future developments is important. For example, scenario planning practices can help firms to think about different futures - even if they are unrealistic or unthinkable - and ways to handle them.

Preparation derives from the literature and specific ability of HROs. High-reliability organizations are technologically complex organizations operating in high-risk environments, in which even small failures can have dramatic consequences (e.g., nuclear power plants, aircraft carriers, or chemical firms). In such organizations, failure prevention takes top priority and performance reliability rivals' productivity as a dominant goal. Being prepared means that a company is equipped to deal with unforeseen adversity, and it is ready to capitalize on unexpected opportunities.

## *2. Coping capabilities*

In addition to anticipation and preparation for critical events, resilience means also coping with unanticipated dangers before they have become manifest (Wildavsky, 1990). The overall ability to cope with the unexpected is closely related to crisis management and can be separated into two sub-categories: the ability to accept a problem and the ability to develop and implement solutions.

Often organizations require too much time to realize and act on unexpected events, and only if they develop the ability to accept, they can face critical situations and react quickly. The acceptance dimension of organizational resilience consists of three elements: understanding the environment in which the system operates, defining a reference state for the system, and being aware of and accepting system failures. These elements show some overlap with the previously discussed anticipation capabilities. Thus, it can be assumed that anticipation and coping capabilities are closely connected, and that the

promotion of anticipation capabilities may also have positive effects on the ability to accept a problem.

When a crisis occurs, organizations must put their crisis plans into action and develop ad hoc solutions that always result as a combination of sensemaking and acting. Sensemaking means that individuals or groups try to make things rationally accountable to themselves and others. Only if people understand the crisis situation, they can act on it.

The ability to develop solutions depends essentially on two factors: idea generation, that can be realized through different techniques such as bricolage/improvisation, and more important the coordination of these ideas. A good balance between formal structures and clear responsibilities and openness and freedom for flexible and creative action needs to be found.

Last step regards the implementation of the solution, seen as the ability of an organization to realize a previously developed solution. Especially crisis requires precise and quick implementation. In order that these solutions will lead to the change, they must be widely accepted and adopted.

### *3. Adaptation capabilities*

Beside the first two phases, resilience also includes the ability to adapt to critical situations and to use change for own purposes. Adaptation is defined as long-term learning; learning in the aftermath of a crisis starts with the reflection and the evaluation of the disaster, its causes, and effects.

Adaptation includes two types of learning: reflection and learning, and organizational change capabilities.

Reflection process includes four stages: articulation of the problem, analysis of the problem, formulation of a theory to explain the problem, and action. Learning that does not only refer to internal practices, but that look also to the external: for example, organizations can learn from the vicariously experienced incidents from related or similar organizations.

Organizational change can only be achieved by a higher-level learning which results in the development of new norms, values, and practices. To produce organizational change, it is particularly important to act on previously generated knowledge. Organizations must be able to exploit a newly developed solution and transfer it to their individual parts. To

achieve that, change management capabilities are needed. Soft managerial practices such as effective communication and relationships within the organization seem to be particularly important to enhancing an organization's resilience.

It is important to highlight that the three stages cannot be separated; they show some overlaps and they strongly depend on each other at the point that they build on each other (anticipation influences coping, and coping influences adaptation). However, there is also backward influence. Organizations need to develop capabilities of all three resilience stages that together form the meta-capability of organizational resilience.

As seen, the resilience capabilities are extremely complex and deeply embedded in social contexts; this is why Duchek (2019) defines some main antecedents (knowledge base) and drivers (resource availability, social resources and power/responsibility) that help to understand better the concept:

- *An organization's knowledge base is an important antecedent of organizational resilience. It builds the foundation for the anticipation of critical developments (as well as coping and adaptation). In turn, an organization's knowledge base may be enhanced through the accomplishment of the three resilience stages.*
- *Resource availability positively influences the resilience of organizations. Specifically, it fosters the development of anticipation capabilities (as well as coping and adaptation capabilities).*
- *Social resources positively influence the resilience of organizations. Specifically, those resources foster the development of coping capabilities.*
- *Power based on expertise and shared responsibilities positively influence the resilience of organizations. Specifically, they foster the development of adaptation capabilities.*

After these clarifications, Duchek (2019) concludes his paper highlighting the need for more empirical studies by investigating the presence or absence of organizational resilience by retrospective analysis after a threatening situation. The pandemic Covid-19 represents the perfect case to study how organizations have responded to a crisis with unforeseeable consequences.

To summing up the literature review conducted on the evolution of resilience's concept, we have arrived to the Duchek' approach, that gives a recap definition:

*“The organizational resilience is the organization’s ability to anticipate potential threats, to cope effectively with adverse events, and to adapt to changing conditions.”* (Duchek, 2019).

### 2.3 RESILIENCE APPROACH IN RESPONSE TO COVID-19

The literature review just conducted about the concept of organizational resilience is now applied to the most drastic crisis of the year: the pandemic one. As seen in the first chapter, Covid-19 pandemic has represented a disruptive crisis with unpredictable consequences, especially as the economic breakdown has affected the entire world. Customer demand and confidence and industrial production have collapsed reaching negative records above all in the Eurozone and US.

Focusing on the manufacturing sector, one of the most affected by the crisis according to the International Labour Organization (2020), servitization – the shift from a product-centric to a service-centric business model and logic (Kowalkowski, et al., 2017) – has often been a lifeline in helping manufacturing firms to stabilize their businesses in turbulent times (Kwak & Kim, 2016). This is what happened with the financial crisis of 2008-09, when even if a buyer could not afford to buy a new product for a short in liquidity, the products in use still required regular service; this to testify that the service side of a business was much less disrupted, and the providing of high-margin field services such as maintenance, repair and overhaul (Kowalkowski & Ulaga, 2017) have let manufacturing companies to survive in their worst times.

But the Covid-19 has presented different characteristics: the lockdown, the interruption of supply chain and the general imposition on travels that have made impossible the proximity to the customers have consequently affected not only the product businesses but also the service ones. In this context for example also the field services have been unfeasible.

One possible solution to overcome these difficulties and that can let the firms recover and return to a “next normal” and build resilience is found in the *digital servitization*. *“Digital servitization is a service strategy that exploits extensively digital breakthroughs such as smart connected products, industrial internet platforms, predictive analytics, digital offerings, and advanced services”* (Paschou, et al., 2020). Only by adding digitalization to a business model focused on servitization can companies overcome Covid-19’s barriers.



Rapaccini et al. (2020) in their paper “Navigating disruptive crises through service-led growth: The impact of COVID-19 on Italian manufacturing firms” provide guidelines on how industrial firms can react against disruptive crises like Covid-19, differentiating the impact of product and service businesses. The authors point out on two different times how organizations react to Covid-19:

- In the short term the attention is on how firms can recover faster.
- In the longer term the attention is on how firms can become more resilient.

After an empirical part with the findings about the impact of Covid-19 on a dataset of companies of North-Italy (the European region first and most extensively affected by the pandemic), the core of the research is the elaboration of a four-stage model for managing crises such as Covid-19.

At the basis of this model, there is (as it has been for the Duchek’s approach (2019)) the conceptualization of resilience, through its defining elements. Rapaccini et al. (2020), starting from the idea that servitization itself is a way to adapt to a new disruptive environmental change, identify four key elements to enhance resilience (Figure 12):

*Figure 12 – Elements enhancing resilience*



Source: Navigating disruptive crises through service-led growth: The impact of COVID-19 on Italian manufacturing firms. Rapaccini et al. (2020)

- *Agility* is the ability of an organization to adapt or respond rapidly to a changing environment both in terms of volume and variety, which is fundamental in situations of high uncertainty like a crisis.

- *Preparedness* is the ability of an organization to be ready to satisfy the new needs that may arise after a crisis, from a change in the business model to a search of new opportunities or new ideas.
- *Elasticity* is the ability of an organization to increase the exchangeability and flexibility of relationships among people and things.
- *Redundancy* is the ability of an organization to have slack of modular resources (as production facilities or stock of materials) that can be rapidly activated to re-configure the value network.

A specific element of resilience is assigned to each stage of the four-stage model, elaborated from the authors in order to provide a useful tool to support the management of any organizations in case of emergency or disruptive events, irrespective of its cause.

The model (Figure 13) has four phases – calamity, quick and dirty, restart, adapt to next normal – described in detail as follow:

#### *Phase 1: Calamity*

The first phase concerns awareness of the phenomenon, the so-called *Black Swan* (Taleb, 2008); the priority for the managers of companies was to understand this new type of crisis, collect the related risks and needs and elaborate different potential scenarios. In this phase to react against Covid-19, *all firms activated task forces and crisis units for the daily management of the emergency at both the local level and the corporate level. Except in rare cases, the central task forces had no operational responsibilities and tasks, being mostly limited to gathering information, coordinating decisions, and transferring knowledge* (Rapaccini, et al., 2020). At this stage, the attention on the impacts on products and services has been the same. This stage is in line with the concept of *preparedness*.

#### *Phase 2: Quick and dirty*

This phase corresponds to the ability to implement simple solutions to provide the continuity of the business, as much as possible. Thanks to the incredible spirit of cooperation and support between all the parties of the company involved, the implementation of these quick and dirty solutions was much easier. *There is no time to develop new solutions; or this reason, firms tried to make the most of the resources and technologies they had*

*already developed or introduced* (Rapaccini, et al., 2020). As an example of this, the more consolidated technologies were the one that have been subject to the highest acceleration, like for example the smart working. This stage is in line with the concept of *agility*.

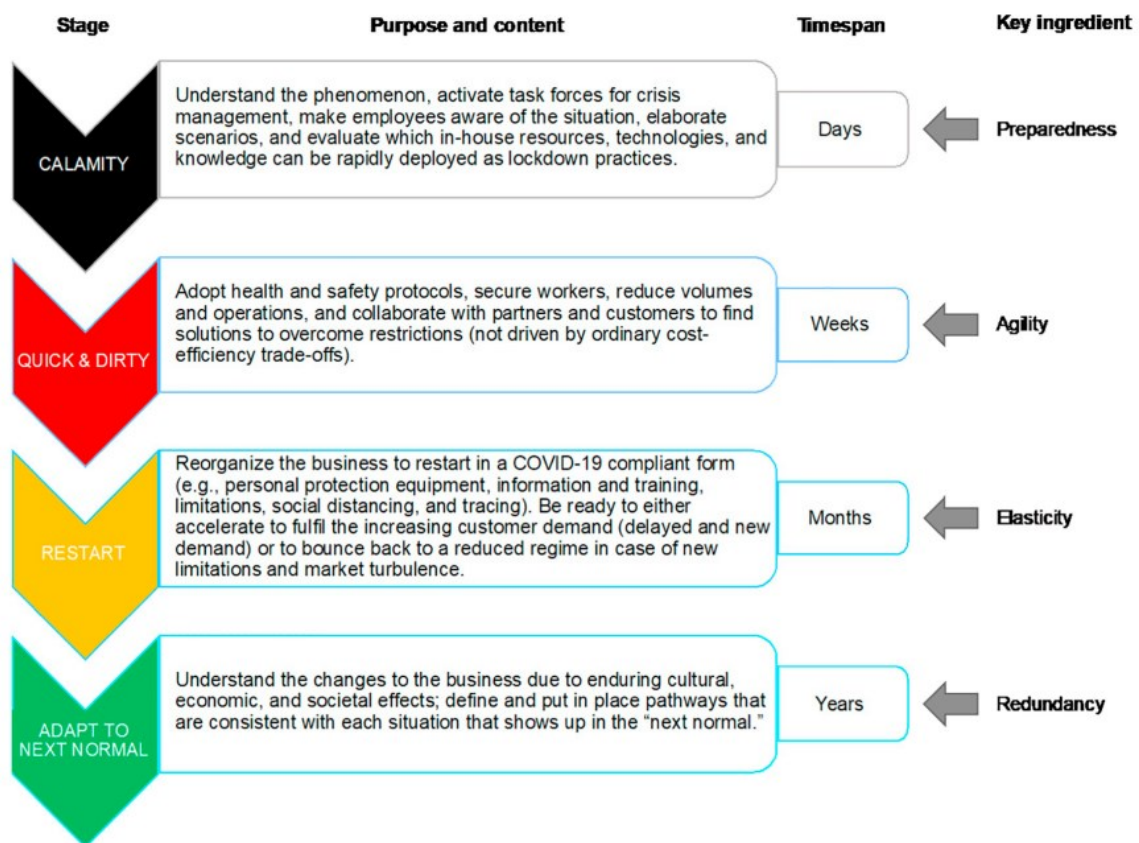
### *Phase 3: Restart*

On May 4<sup>th</sup>, 2020, the industrial businesses in Italy were reactivated, although with obligations to ensure social distancing and workers protection. In this stage it was fundamental to design the most flexible new business architecture to effectively secure the working environment with the lowest impact on performance, costs and delivery times. In this stage the main concept is *elasticity*, especially referred to potential scenarios like persistence of limitations and potential lockdown's bounce back in the next months.

### *Phase 4: Adapt to the next normal*

Post-Covid-19 world will not be the same, and companies therefore need to be ready to evolve and adapt. Organizations need to be more resourceful and in general more resilient; the major changes will be reflected in logistic pipelines (the threat of supply chain interruptions will move from globalization to regionalization), in reorganization of the workplace (boom of the remote working), in digitalization (the overcome of last barriers to the digital technologies), in competitiveness of product-service solutions (more bundled offerings consisting of both traditional services and new digital components) and in opportunities for new full-risk and outcome-based solutions (offer of risk-mitigation-related services to cover the uncertainty and potential disruptions of a Covid-19 bounce back in next months). This stage is in line with the concept of *redundancy*.

Figure 13 – The four stages model



Source: Navigating disruptive crises through service-led growth: The impact of COVID-19 on Italian manufacturing firms. Rapaccini et al. (2020)

#### 2.4 RESILIENCE THROUGH SERVICES AND DIGITALIZATION

In the previous two paragraphs have been analysed two different models that explain how an organization must approach a disruptive event like a crisis. The model proposed by Duchek (2019) at three step – anticipation, coping, adaptation – and the model at four-stage proposed by Rapaccini et al. (2020) – calamity, quick and dirty, restart, adapt to next normal – present similar characteristics; it can be said that the Duchek’s model represent the general case, while the Rapaccini ones a specific application for Covid-19 crisis. The four-stage model in fact has been designed to cope with an urgent situation, and to provide a useful tool to organizations that were suffering the disruptive effects of the pandemic. Based on a dataset composed on Northern Italy companies, the results can be “relevant also for firms in other countries and regions that have (so far) not experienced

*the same radical lockdown measures or economic devastation as well as for situations involving building long-term resilience (with its diverse nuances) and preparing for future pandemics and economic crises” (Rapaccini, et al., 2020).*

In the four-stage model, the conclusion focuses on the importance of digital services to enable a different type of revenues and growth (respect to the classic one linked to the physical product) that is more resilient to the impact of crises.

The main concept here is that through service and digitalization companies can be more resilient, and at the same time analysing the level of service and digitalization of a company could be a good proxy to measure the level of resiliency.

The measure of resilience is in fact another important issue to deal with. The quantification or the individuation of the main variables that affect the organizational resilience are very difficult to be found, since the resilience concept is defined variably in different contexts.

In the past literature there are various proposed techniques to compute the intensity of resilience, some of them based on indicators, organizational outcomes, or organizational recovery.

#### *Measurement based on indicators*

There are two main streams: the measurement of organizational resilience potential and the measurement of resilience after a disruptive event has occurred. Lee et al. (2013) provide a complete benchmark tool to do the evaluation process analysing through a proposed questionnaire adaptive capacity and planning of the organization.

#### *Measurement based on the organizational outcomes*

Watanabe et al. (2004) proposed to use the Operating Income to Sales to measure resilience. If the sales come from the operating income of the company, so the core business is generating revenues, the firm should be in a good situation. Dalziell & McManus (2004) suggested measuring resilience based on Key Performance Index (KPIs) defined considering the organization’s objectives. Normally KPIs are various and different depending on the company. There are financial KPIs as profit, cost, COGS, day sales outstanding or sales by region. These if we are dealing with operational indicators. Other commonly important are cash flow from financing activities to demonstrate an

organization's financial strength, or EBITDA measurement of revenue after expenses are considered and interest, taxes, depreciation, and amortization are excluded.

Markman & Venzin (2014) suggested measuring resilience following a more stock-based approach, considering the Return on Equity (ROE) and volatility. ROE is considered a measure of how effectively management is using a company's assets to create profits. Return on equity (ROE) deemed good or bad will depend on what is normal for a stock's peers. Volatility is the degree of variation of a trading price series over time as measured by the standard deviation of logarithmic returns. The higher the volatility, the riskier is the stock and so the company. A low volatility suggests a good stock performance and so lower possibility of default.

#### *Measurement based on the organizational recovery*

For this type of measurement, organizations need to suffer failures to assess their resilience. Rose & Liao (2005) propose to determine a quotient of failure probability, reduced consequences from failure, and reduced time to recover. Probability of failure is selected as a metric which indicates the ability to prevent disruptive events, reduced consequences from failure is a metric of the ability to prevent the consequences of that disruptive event, and finally the reduced recovery time is the metric for ability to recover from a disruptive event. Westrum (2006) classifies disruptive events based on their predictability, their potential to disrupt a system, and the origin of that disruptive event whether it is internal or external.

To measure the level of resilience after a disruptive event, Henry & Ramirez-Marquez (2012) propose to evaluate the level of recovery of the organization against its losses. They suggest measuring resilience quantitatively as the ratio of Recovery and Loss.

Loss is the deterioration from the original state after the disruption and Recovery is the amount it bounces back from the disruptive state to the recovered state. The authors acknowledge that the limitation is to not to consider the money and time to recover. They do not consider what we should evaluate to measure loss and recovery.

Erol, Henry, Sauser, et al. (2010) also include the recovery time, the initial vulnerability and the potential loss averted. They proposed to measure resilience based on recovery time, level of recovery, initial vulnerability and potential loss averted. However, they do not indicate how to assess these items and the importance to define start and stop points in recovery time.

All these techniques analysed are proposals that are valid depending on the resilience context; they are based on indicators, outcomes, or recovery time, but none of them give a complete and certain measure of resilience.

And this is also the case of thinking about resilience in terms of service and digitalization; as Rapaccini et al. (2020) affirm there is *“no evidence to assert that digital servitization could also be a weapon to make any business more resilient in the face of a crisis”* (Rapaccini, et al., 2020), but at the same time there is evidence that *“services have helped manufacturers to navigate through various financial crises, such as the Great Depression in the 1930s and the global recession of 2009”* (Rapaccini, et al., 2020). The servitization literature already pointed out that there are differences in terms of revenue stability in times of economic crises between products and services (Adrodegari, et al., 2018) and that servitized business models and advanced services are more resilient. As Kwak & Kim (2016) stated, during economic fluctuations, servitization strategy can play a key role as countercyclical stabilizer.

After having understood the importance and role of services and digitalization, in the next chapter we will try to investigate through an empirical analysis the level of digital servitization offered by companies in the North-East of Italy, and what role Covid-19 played in this process.

The focus will be verifying if after a disruptive crisis such as Covid-19 one, companies have understood the importance of services and digitalization, and through them they have conceptualized a form of organizational resilience.





## **EMPIRICAL ANALYSIS: “REAGIRE AL COVID-19 CON I SERVIZI E LA TRASFORMAZIONE DIGITALE”**

### *3.1 METHODOLOGY AND SURVEY'S STRUCTURE*

As we have seen in previous chapters, services and digitalization have played a key role in creating an escape route for companies in times of greatest difficulty, such as during economic crises.

The Covid-19, however, represented an entirely new crisis, with unpredictable times and ways and drastic impacts on society and economies in general.

In Italy, the first European country to have known about the virus, the measures of social restriction have already been in place since March; the famous Italian lockdown has put in serious difficulty the economic fabric of the country, characterized mostly by small-medium enterprises.

Except for some ATECO codes linked to essential services, most companies had to close for a period of almost two months (from March 9 to May 3, following the Prime Ministerial Decree issued by the government).

This forced closure has created imaginable damage for many Italian companies, especially production ones. The closure of factories and the quarantine of families had the dual effect of blocking both supply and demand for products.

In many cases, even the companies that remained open by ATECO concession had many difficulties due primarily to logistical problems resulting from the lockdown, like the resulting blockages of mobility between regions and between countries, and the short-gages in the value chain, from supply and sourcing of material to delivery to the customer.

The feeling that has developed in this situation is that the business focused exclusively on the product offering has been the one most affected by the pandemic. Many companies

linked to the service offering were better able to survive, thanks in many cases to their ability to continue their offering with a digitized system that allowed them to maintain their business even during the lockdown.

From this theory it was therefore decided to investigate whether companies with a business model that is product-centric but also offers services in combination with the same product have somehow managed to survive better during the lockdown period.

To do so, it was therefore decided to propose research that would analyse the consequences of the Covid-19 crisis on manufacturing companies through a survey conducted in the field in order to have an extensive and relevant sample.

The survey, called “Reagire al Covid-19 con i servizi e la digitalizzazione” was conducted in the period immediately after the lockdown, with the aim of understanding in what way companies would adapt to what has been defined as the next normal.

Going into detail, it is important to focus on both the methodology used and the structure of the survey.

Professor Paiola of the University of Padua is in charge of the survey, where he coordinated a group of 3 master students (one of whom is the undersigned) in the various stages of the process: development and writing of the questionnaire, email campaign for delivery to companies, collection and coding of responses and elaboration of results. In detail, the timeline of the whole process is represented in Table 5.

*Table 5 – Timeline (2020)*

<i>March – May</i>	Lockdown in Italy regions
<i>June</i>	Writing of the questionnaire
<i>July - August</i>	Delivery of the survey to companies
<i>August - September</i>	Collection and coding of responses
<i>September</i>	Elaboration of results
<i>October</i>	Delivery of the Final Report to companies

Source: Author’s elaboration

The survey began to materialize immediately after the end of the lockdown and developed in the months immediately following, with the aim first of all to quantify the real impact of the health crisis due to Covid-19 on manufacturing companies, and then to understand the gradual process that led companies to a *new normal*; a process characterized by an

unforeseen crisis that was able to create a real watershed between *business as usual* and a new status quo in which health care attention and restrictions are an integral part of our lives.

Central themes of this new normal have become the revision and innovation of business models, the modernisation and digitalisation of industrial value creation processes and the stabilisation of remote or smart working in organisations.

Even more central is in general the future that awaits these companies; an increasingly uncertain future, in which it becomes essential not only to be content with an immediate reaction to the crisis, but where a strategic resilience must be developed that prepares companies for what will be the *next normal*.

The survey has precisely this objective: to assess in depth the impact of the crisis on companies' business models and the role of digital technologies and customer services as an element of re-reading their relationship with business and the market in the near future. Specifically, to investigate these objectives, the survey “Reagire al Covid-19 con i servizi e la trasformazione digitale” was structured as follows:

- Section 1: Master data, focusing on the size and scope of the company, the type of services offered and the relative percentage made up of services on turnover, the hardware-software technological solutions used and the optimistic or pessimistic perception of the Covid-19 crisis, between opportunities and threats.
- Section 2: Impact of the crisis and restrictive measures, with focus on companies forced to close during the lockdown, the resulting losses during that period, and the ability to react as effectively as possible.
- Section 3: Reopening, where depending on the response period of each company (between July and August) an attempt was made to understand what adjustment there was on both the supply and demand side, and what were the main challenges to be faced.
- Section 4: Digital transformation and reaction to the crisis, with particular attention to the companies' interpretation of what will be the main opportunities and challenges as a result of Covid-19, how much budget will be invested and how it will be divided between investments related to digitalization processes, supply chain relations, production systems, after-sales services, the product-service system, the sales network and the relationship with the market.

In total a survey composed of 45 multiple-choice questions (excluding the personal data part), with most of the questions having a seven-rung Likert scale answer structure, with the aim of detailing the different perceptions as much as possible. The study was addressed to medium-large companies in Northern Italy, specifically manufacturing companies (of any sector), companies that market industrial products and companies that provide services associated with industrial products (e.g. installation, maintenance and repair, remote control, etc.). The respondents are owners, managing director, IT, sales, post-sales and service managers, in general the Top Management Team of the companies.

The research has respected the highest procedural and methodological seriousness. However, like any exploratory analysis of a phenomenon in continuous evolution, the present survey has its limits, due to the fundamental choices made by the researchers (the focus on medium-large manufacturing companies) and the need to compress the survey time (which necessarily limits the number of companies in the sample).

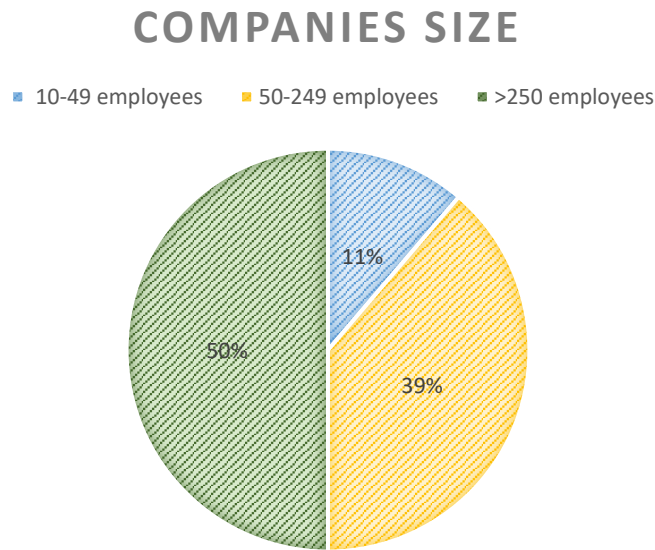
The information and evaluations obtained are however of great interest, both for their topicality and for their specificity on productive themes and contexts in which in-depth analyses on the impacts of the Covid-19 crisis are a rare commodity.

### *3.2 GENERAL RESULTS*

The survey collected 80 valid responses from the Top Management Team of Italian companies operating in the B2B, mainly from North-East Italy, which provided detailed information about a number of effects of the crisis on their operations and on planning and strategic investments in technology and services in the future.

In detail, entering specifically into the characteristics of the companies that responded, the sample is divided exactly in half between small-medium enterprises (between 10 and 250 employees) and large enterprises (with more than 250 employees), while no responses were collected from micro companies (less than 10 employees), also because it was considered that they could not be indicative with regard to the two main themes of the research: services and digitalization; in detail in the Figure 14 the composition according to size.

Figure 14 – Companies size

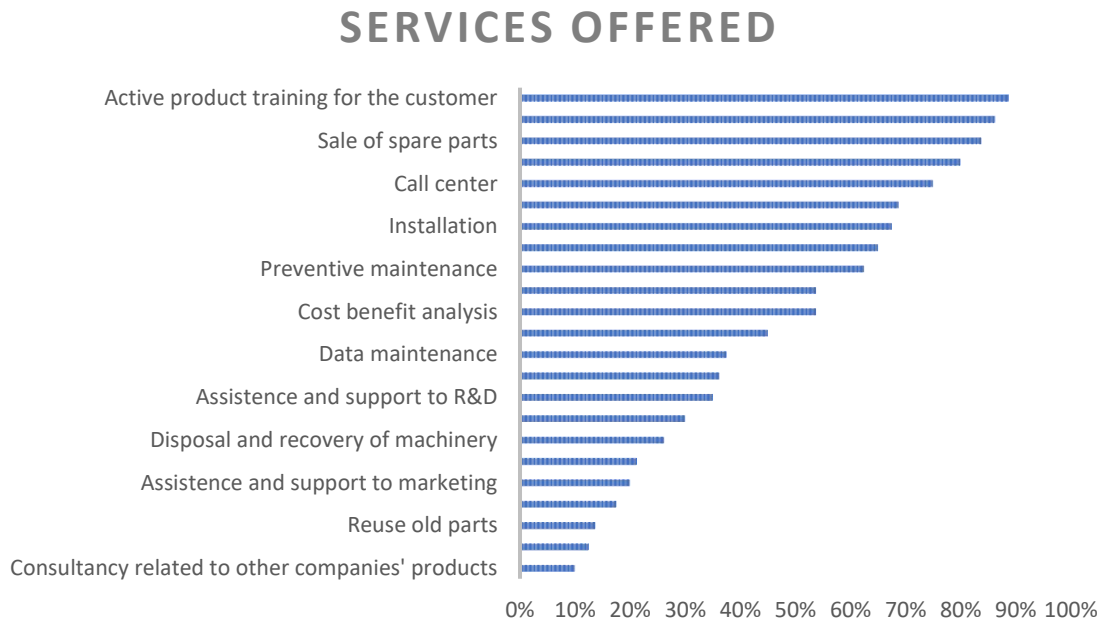


Source: Report “Reagire al Covid-19 tramite i servizi e la digitalizzazione”

As regards the specific sector to which they belong, thanks to the ATECO classification, 75% of companies belonging to the machinery and equipment manufacturing sector can be distinguished (of which 12% are food and beverage machinery), 5% are involved in the manufacture of metal products (excluding machinery and equipment), while 6% are involved in the marketing of wholesale products (excluding motor vehicles and motor-bikes). The remaining 14% of companies are always in B2B with ATECO codes that do not fall under the previous ones, ranging from sectors such as the manufacture of plastic or leather products to maintenance and repair activities.

After the general part of the master data, Step 1 goes into more detail on the levels of services and digitalisation present in companies. Starting from the offer of services, those more widely present are the so-called *Product Life-cycle Services (PLS)*, i.e. those services oriented to the product and that facilitate its use, such as product warranty (86% of the companies offer this service), sale of spare parts (84%), online documentation (80%), and active product training for the customer (89%). Among the less widespread services in the offers are the more complex ones, the so-called *Process Support Services (PSS)* such as consultancy related to other companies' products (10%), and assistance and support to both marketing processes (20%) and R&D processes (35%). Figure 15 shows in detail the services offered by companies, in decreasing order of frequency.

Figure 15 – Services offered



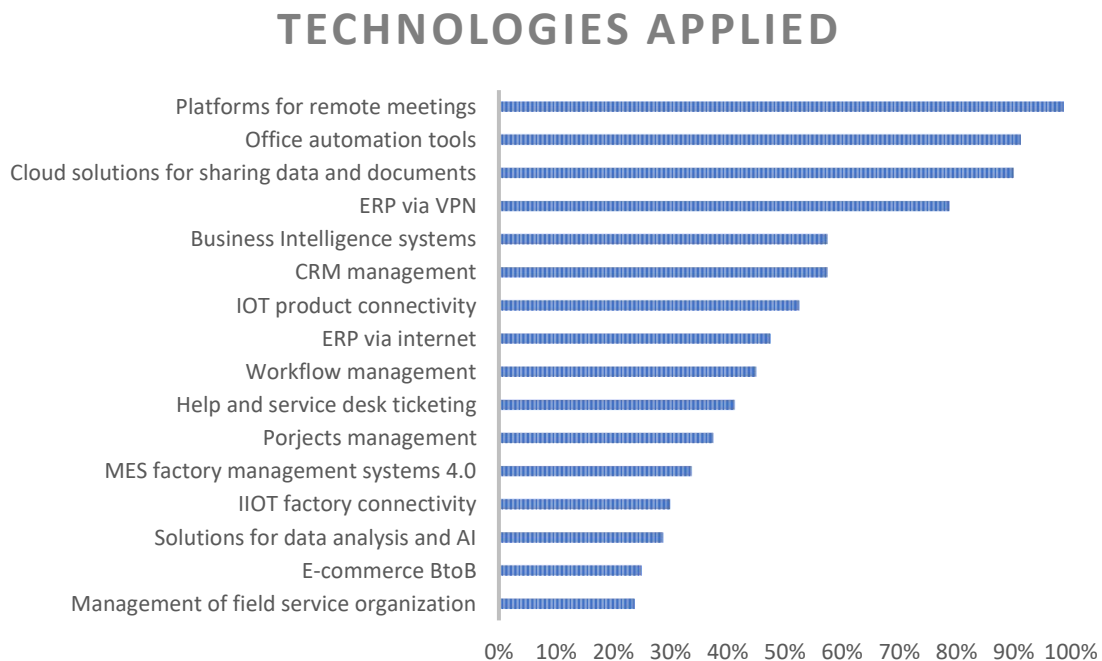
Source: Report “Reagire al Covid-19 tramite i servizi e la digitalizzazione”

Still rather infrequent are solutions and revenue models linked to innovative aspects such as cradle to cradle circularity models (with used take-back and end-of-life recycling) and those based on product-service systems oriented to use or result (pay-per-use or performance); relevant is the importance of relatively modern value proposition elements linked to remote condition monitoring and digital technological retrofitting of products, to the use of e-commerce platforms in the relationship with the market, and to the implementation of maintenance services based on data analysis (which tend to be predictive).

With regard to organisational coordination between product and service, the sample shows a rather traditional approach, with a high integration of service activities with the product function: for 56% of companies, all service activities are carried out by the same BUs that develop the products. However, the fact that the interviewees perceive that there is ample room for improvement in the offer and in the share of turnover of services within their company (in the specific for 55%) is counterbalanced by the fact that 75% of the companies in the dataset have a service turnover that contributes less than 20% to the total business. These dynamics, which also represent aspects of causality between them, will be analysed specifically in the statistical approach part.

Turning to the organizational-technological aspects, as regards the level of digitalization, and in particular the hardware-software equipment, almost all companies (91% and 99% respectively) usually use office automation tools (such as Ms Office, Suite Office 365) and platforms for remote meetings (such as Skype, MS Teams, Zoom); very present (90% and 79%) are also cloud solutions for sharing data and documents (as Google Drive and Dropbox) and ERP systems accessible via VPN: the presence of these systems seems to guarantee a basic equipment that has allowed most companies to adapt to smart working without too many difficulties. More difficult is the situation with regard to advanced computerization systems of processes that require specific and large investments: among these, those less used (24% of companies) are those for the management of the Field Service Organization and solutions for data analysis and Artificial Intelligence (29%). As far as the implementation of the Internet of Things is concerned, at the good levels of IoT systems for the connectivity of products sold (53%) there are lower levels of IIOT on factory connectivity (30%). Noteworthy is the use of e-commerce in B2B, with one in four companies (25%) having a dedicated platform. In Figure 16 are represented the hardware-software technological solutions in decreasing order of importance.

Figure 16 – Technologies applied



Source Report “Reagire al Covid-19 tramite i servizi e la digitalizzazione”

In Step 2 of the survey, the impact that the restrictive measures have had on the various company businesses is analysed in detail. Out of 80 companies, 44 had to close because of legislative decrees. Of these companies, 39 closed once, while 5 had to close and reopen more than once. The average closure time was between 2 and 4 weeks, depending on when the companies were able to reopen, following the different ATECO codes of regulations.

The impact of the crisis on these companies has been important: an average loss is estimated between 25-50% on production, orders and maintenance and repair services, and between 10-25% on spare parts turnover and all other services (contract, training, financial, rental and advanced).

It is very clear how much the whole after-sales area suffered decidedly less than the product area, starting from the spare parts business, passing from the rental business, to maintenance contracts and more advanced services.

Remote working has been one of the aspects most accelerated by the crisis: considering the different types of activities, on average remote working has involved between 50 and 75% of the time of each activity, with some company functions such as sales and marketing that have almost totally moved to a home working mode for employees. This accelerated adaptation has also been made possible by the use of company resources and staff skills that have proven to be more than adequate to deal with the emergency and specifically with the new way of working. In the companies that have remained open in particular, in addition to IT services, the most fundamental in guaranteeing the technological equipment to convert all the new needs, the merit is also acknowledged in particular to the after-sales services, which have contradicted each other for the effectiveness with which they have operated in a context that is even only logistically much more complicated.

In Step 3 of the survey, there is the theme of reopening, which together with the construction of the next normal, is the specific focus of the research.

The activities that have returned to full speed (operations between 75-100%) are those of factory production and spare parts sales, while for the others (new orders and various services) operations do not fall below 50%. The use of smart working with the reopening has physiologically decreased, even if it continues to be between 25-50% and much higher than pre-Covid, especially for commercial-administrative and marketing roles.



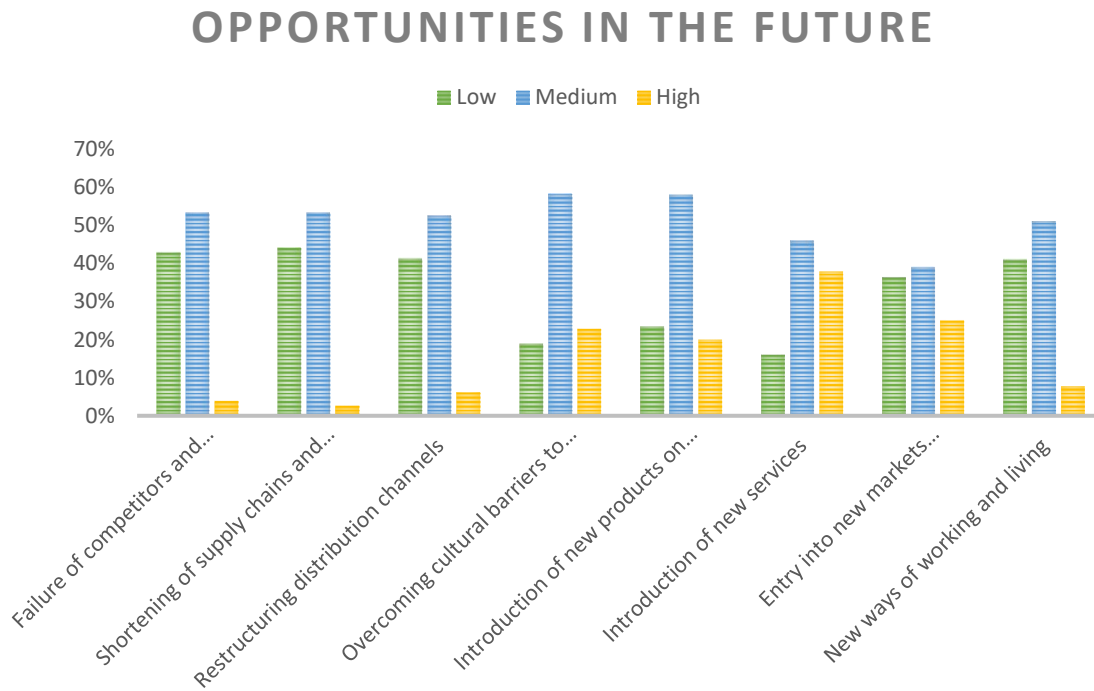
As far as the forecast of market trends and demand in the near future is concerned, more than 50% of companies are confident of a gradual increase after the crisis and leading to normality, while 30% are worried about the risk of a protracted reduction of the market even after the crisis. In this context, the attitude in facing the new strategic challenges - unimaginable when thinking about pre-lockdown globalization levels - such as travel restrictions (both for commercial activities and field services) and the impact of the international phase shift of lockdowns on the supply chain and markets will be fundamental. Remaining on the subject of future prospects and analysing the challenges of implementation and maintenance of the investment budgets planned in the pre-crisis period, slight delays are expected due to Covid-19 on the implementation of 4.0 technologies (from IoT-IIoT, to AI, Robots, VR, 3D printing), while the digitalization of internal processes has been accelerated, thanks as seen before to the fundamental role that has played in responding to the emergency.

In the fourth and last Step of the survey, the objective is to understand if and how the reaction to the crisis can accelerate the digital transformation, the one towards services and in the supply chain relations as strategies to face the next normal.

In assessing different opportunities related to the future, one of the main ones is to overcome the cultural barriers to digitalisation still existing within companies, indicated as a real prospect by about 80% of companies. Even stronger (about 85%) is the perceived opportunity to introduce new services in the offer: here we note that the proportion of respondents who consider the moment highly suitable to introduce new services (38%) is almost double that of those who consider it for the introduction of new products (20%). One company out of 4 (25%) also considers the moment highly suitable for entering new markets (diversification).

In the next Figure 17, the answers on the evaluation of various opportunities provided by companies on a Likert scale from 1 to 7, are represented by grouping the values into low (corresponding to values 1, 2), medium (3, 4, 5) and high (6, 7) opportunities.

Figure 17 – Opportunities in the future

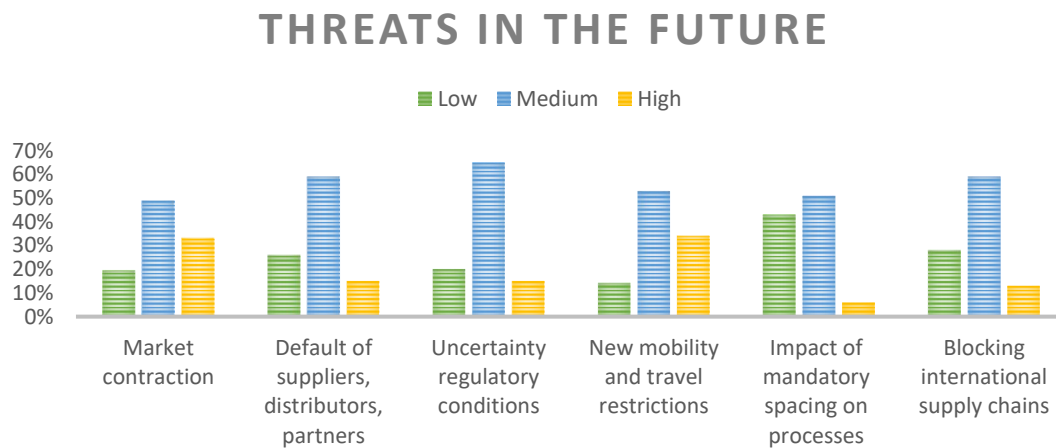


Source: Report “Reagire al Covid-19 tramite i servizi e la digitalizzazione”

Conversely, as seen before, the most real perceived threats concern the risks of market contraction and the uncertainty linked to new mobility.

In details in the next Figure 18 are presented the different perceptions of companies about threats, with the same way of grouping as before.

Figure 18 – Threats in the future



Source: Report “Reagire al Covid-19 tramite i servizi e la digitalizzazione”

After assessing opportunities and threats, a series of questions analyse various areas of investment and initiatives over a time horizon that places them as planned within the year, in an undefined future, unforeseen or as a fourth case that they are already in place or undertaken before Covid-19.

With regard to future digitalization processes, one of the most active areas of investment are data analysis and Artificial Intelligence solutions, with 13% of companies planning to carry them out within the year, and 27% in the future; in the near future investments are also planned for CRM management (25% of companies) and for factory 4.0 MES systems (22%). Specific investments in FSO management solutions and B2B e-commerce platforms remain contracted.

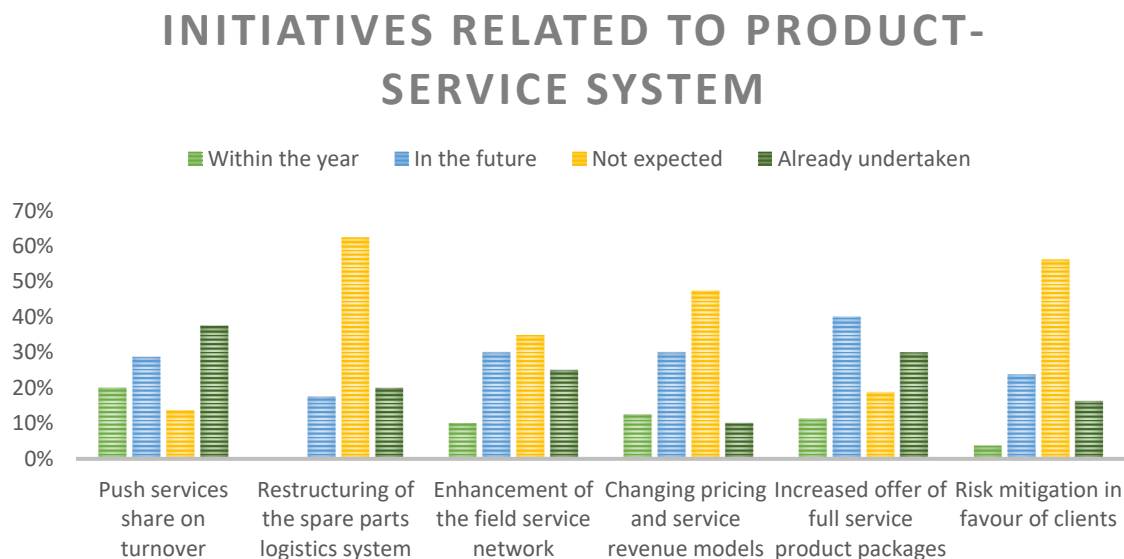
As regards supply chain relations, there is a certain urgency to restructure relations with partners in terms of economic conditions (to be carried out within the year for 36% of respondents), while the opening of new branches or offices abroad is a future option for 13% of the sample. The closure of foreign branches or the centralisation of nodes and greater autonomy to existing branch offices do not seem to be priorities of the next normal.

As concerns after-sales services, spare parts and field services, the structuring of the technical knowledge base is the most planned initiative to be carried out by the end of the year (16% of companies); in the short term there are also initiatives relating to predictive maintenance (46%) and the use of AI and ML for better customer service (35%). A good part of the companies in the sample already have remote control of products distributed with IoT systems (47%) and ticketing and helpdesk systems (50%). The use of 3D printing for spare parts is not a priority (not expected in 75% of cases).

As far as strategies relating to the product-service system are concerned, around 50% of companies intend to strengthen the service component in the offer (20% with the aim of pushing the services share of turnover within the year); the figure shows that, in particular, one company out of two (51%) will increase the offer of complete service product packages such as full-service contracts or advanced maintenance contracts (in 12% of cases within the year); finally, 13% will implement urgent changes in pricing and service revenue models (within the year), while 30% intend it as a future commitment. Interesting though contrasting is the figure relating to the need to operate in the mitigation of client business risks: more than half the sample does not consider it, but almost one in three companies think it is something to be tackled in the future, a sign that the perception that the crisis is part of a next normal is perceived as real by a not insignificant number of

companies. On the other hand, initiatives concerning the restructuring of the spare parts logistics system with a greater decentralisation of quantities do not seem urgent.

Figure 19 – Initiatives related to product-service system



Source: Report “Reagire al Covid-19 tramite i servizi e la digitalizzazione”

As for the relationship with the market and the commercial network, the picture is still interlocutory on advanced and digital initiatives, but not without interesting signals. Apart from the positive fact that almost two out of three companies declare to make use of social tools for corporate communications, other contrasting factors to be interpreted characterise the future choices of companies on a series of prospectively relevant issues. In fact, if the search for and recruitment of specific commercial figures for after-sales services and the investment in the training of figures for complex services are not foreseen by a significant part of the companies (39% and 29% respectively), it should be underlined that the same initiatives have already been addressed by almost as many companies (33% and 28% respectively). It should also be noted that training initiatives dedicated to commercial figures dedicated to after-sales and complex services are in any case considered a strategic choice - certainly to be tackled in the future - by 43% of companies (one out of five considers it urgent).

The latest questions of the survey concern the dedicated budget for the investments and initiatives just described; more than 40% will remain within an investment of 100,000 euros, 35% will invest between 200 and 300,000 euros; a significant 20% of companies,

or one in five, plan to allocate a budget of more than 500,000 euros to the investments described in the preceding paragraphs. The relevance and impact of the current crisis on budgets is clearly sensitive (almost 40% of companies state that at least 25% of the responsibility for the levels of this budget lies with Covid-19); however, the number of companies claiming that investments expressly due to the emergency represent less than 10% of the budget is 62%, i.e. almost two companies out of three; this testifies that the process of modernisation, service and digitalization has become part of the ordinary mindset of a part of manufacturing companies, even regardless of emergencies.

However, the emergency has played a crucial role in these companies, as have services and technologies to mitigate its impact. Thanks to this report, a series of data and information from a complex process of investigation into the response of manufacturing companies to the health emergency by Covid-19 have been presented, and represent an excellent opportunity to empirically deepen studies on these aspects. In fact, comparing the results of the survey with those obtained from the literature review conducted in the previous chapter, with particular reference to the paper by Rapaccini et al. (2020) and the four-step model of reaction to the crisis, further evidence can be drawn to confirm and implement a series of conclusions that describe the experience gained by Italian manufacturing companies in tackling the Covid-19 crisis and what are the action plans in program to deal with the next normal.

### *3.3 STATISTICAL APPROACH*

Before presenting these conclusions, which will be described in the final chapter, it was decided to use the sample, given its good size with 80 respondents on 45 responses, to carry out a more in-depth analysis that could provide more specific information through the use of basic statistical tools. These statistical tools have been applied using STATA as statistical software.

Given the number of questions to which the various respondents were subjected, and which belonged to the different 4 steps of the survey on different moments and themes, it was decided to select only some of them, among other things verifying that they had a more quantitative character (and in this case the evaluation of the answer with the seven-rung Likert scale was very useful) compared to other more qualitative variables.

The starting point was to adopt a specific focus on services, continuing the line of Adrodegari et al. (2020) that in their paper come to point out the importance of services in the difficult process that leads a company to be more resilient. In times of crisis in particular, the authors noted that the sale of services has less impact than the sale of products. And among the services, the more advanced and digitized services are even more resilient.

It was therefore spontaneous to reflect on whether, depending on the type and mode of services offered, the companies in the sample have actually acted in a more resilient way, and were able to cope better with the health emergency.

After the part of master data, the first question of the survey specifically investigated the types of services offered by the companies to their clients, whether they were final or intermediate (remembering that the sample is composed of B2B companies). The 80 responding companies were asked in detail whether or not they offered 23 different types of services, with a distribution already shown in the previous paragraph in Figure 15. The idea was therefore to subdivide the sample of companies according to the type of services they offer; to do so it is therefore necessary as a starting point to classify the services, based on some objective criteria.

To do so, a literature review was conducted on the models that characterize the different types of services; the most authoritative one has been found in the division of services between basic, intermediate and advanced proposed by Baines & Lightfoot (2013), which in their book *"Made to Serve - How manufacturers can compete through servitization and product-service systems"* define in detail the three levels of services.

Their classification starts from the point of view of the companies (manufacturing companies offering services are described in detail, and thus perfectly match the companies in our sample) and their relationship with the customer.

Rather than the interplay of products and services, Baines & Lightfoot (2013) base their distinction on the value proposition to their customers; there are three kinds of customer-organization that offer the service (identified by *us*) relations:

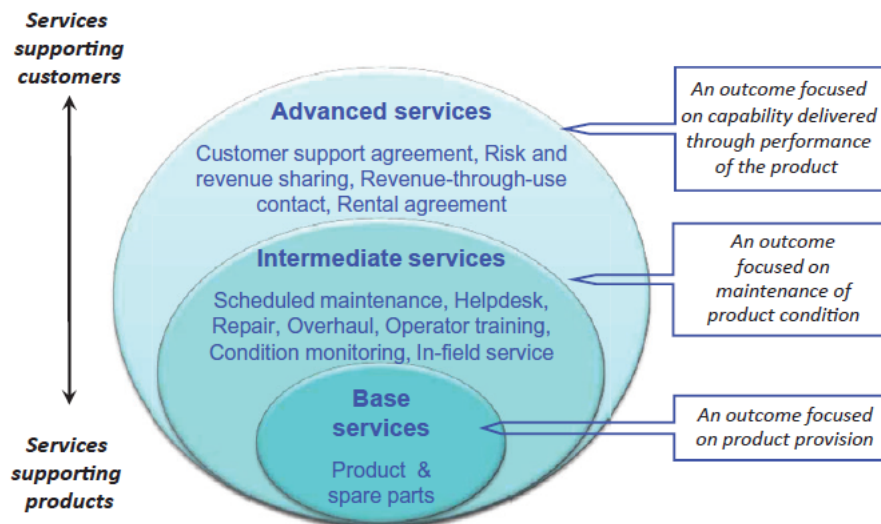
- *Customers who want to do it themselves,*
- *Customers who want us to do it with them, and*
- *Customers who want us to do it for them.*

From these three types of client needs, three types of services have been created that are adapted to the needs with the aim of satisfying them.

In details:

- Base services are defined by an outcome focused on product provision and they are based on an execution of product competence (i.e. we know how to build it). Examples of base services are product/equipment provision, spare part provision and warranty.
- Intermediate services are defined by an outcome focused on maintenance of product condition and they are based on exploitation of production competences to also maintain the condition of the product (i.e. because we know how to build it, we know how to repair it). Examples of intermediate services are scheduled maintenance, technical helpdesk, repair, overhaul, delivery to site, installation, operator training, operator certification, condition monitoring and in-field service.
- Advanced services are defined by an outcome focused on capability delivered through performance of the product and they are based on translation of production competences to also manage the product's performance (i.e. because we know how to build it we know how to keep it operational). Examples of advanced services are customer support agreement, risk and reward sharing contract, revenue-through-use contract, and rental agreement.

Figure 20 – Services classification



Source: Made to Serve - How manufacturers can compete through servitization and product-service systems, Baines & Lightfoot 2013

Following the indications proposed by the two authors, it was therefore decided to classify the services requested in the survey question according to the characteristics of the three

clusters just described. In some cases, an adaptation was mandatory, as technological progress has led to the offer of new services that did not exist at the time of Baines & Lightfoot (2013). This is how the 23 services of the survey have been divided as follows:

*Table 6 – Base, intermediate and advanced services*

BASE SERVICES PROMISE A PRODUCT PROVISION	INTERMEDIATE SERVICES PROMISE A PRODUCT CONDITION	ADVANCED SERVICES PROMISE A PRODUCT / PROCESS PERFORMANCE
Installation	Product demonstration	Warehouse management
Product warranty	Cost/benefit analysis	Consultancy related to other companies' products
Online documentation	Remote condition monitoring	Financial services
Sale of spare parts	Products retrofitting	Assistance and support to marketing
Disposal and recovery of machinery	E-commerce	Assistance and support to R&D
Sale of used parts	Active product training for the customer	Data maintenance
Reuse old parts	Call center	Pay per use per performance
	Inspection/maintenance	Preventive maintenance

Source: Author's elaboration

After this subdivision of services into basic, intermediate, and advanced, the next step was to classify companies according to the services they offer. In order to do so, we started from the basic assumption that companies offering advanced services will probably also offer intermediate and basic services, whereas the two opposite cases are not true; this is because, as represented in the Figure, the three types of services are in fact each a subset of the other, with advanced services representing the larger set that includes the other two. For this reason, in order to classify companies with objective criteria, it was decided to start from those with advanced services. Specifically:

- Advanced companies have been defined as those offering at least three out of the eight advanced services defined in the Table 6.
- Intermediate companies, excluding advanced companies, have been defined as those offering at least five out of the eight services defined in the Table 6.
- The remaining basic companies are those not categorised as advanced or intermediate.



Through this clustering, three comparable sub-samples have been obtained, not only in terms of units (respectively 26 advanced, 28 intermediate and 26 base companies) but also in terms of size of companies composing these samples.

*Table 7 – Base, intermediate and advanced companies*

	BASE	INTERMEDIATE	ADVANCES
<b>Tot companies</b>	<b>26</b>	<b>28</b>	<b>26</b>
Small (10-50 employees)	3	3	3
Medium (50-250 employees)	13	13	5
Large (>250 employees)	10	12	18

Source: Author's elaboration

As represented in Table 7, the three subgroups are homogeneous also in terms of company size, which makes them comparable.

This consideration is very important and should be underlined; there could in fact be a certain causality between the large size of a company and its ability to offer advanced services, which would make the clustering actually ambiguous with a variable "type of services offered" which in reality would only be a slightly different manifestation of a division based on company size.

As represented in Table 7, this is not the case. The three groups are clustered according to the services they offer, and company size does not contribute to this division.

According to this classification it was also interesting to verify that depending on the three groups there were no significant differences in terms of companies that had to close or stay open during the health emergency, following the corresponding specific survey question. As shown in the Table 8 below, within the groups around half of the companies had to close, with slight differences in the advanced (65% of the companies closed), which however cannot be considered significant.

*Table 8 – Closed/opened companies during Covid-19 crisis*

	BASE	INTERMEDIATE	ADVANCES
<b>Tot companies</b>	<b>26</b>	<b>28</b>	<b>26</b>
Closed during crisis	13	14	17
Opened during crisis	13	14	9

Source: Author's elaboration

In the following pages some variables of interest, associated with specific questions of the survey, will be investigated with the specific objective of observing whether or not there were different effects depending on the level of service offered by a company.

It was decided to classify companies according to the type of services offered, given the centrality of the topic, treated as the main subject during the survey. The technologies and the level of digitalization of a company could also be safely adopted as a variable to cluster the sample; services and technologies have a certain correlation, which would have made the subdivision of the sub-samples based on technologies very similar to that carried out according to the services.

To confirm this, the correlation has been conducted between the variable `tot_services` and `tot_technologies`, i.e. between the variable representing the sum of the services offered by companies, out of a maximum of 23 identified in the survey, and the variable representing the sum of the technologies provided by companies, out of a maximum of 16.

As shown below, a simple correlation was first carried out, and then one using Spearman's coefficient, in order to have an additional proof of the significance of the test.

*Table 9 – Correlation between tot\_services and tot\_technologies*

Variable	Mean	Std. Dev.	Min	Max
<code>tot_services</code>	10.9	4.309542	2	20
<code>tot_technologies</code>	8.4	3.239784	2	16

	<code>tot_services</code> <code>tot_technologies</code>	
<code>tot_services</code>	1.0000	
<code>tot_technologies</code>	0.4408	1.0000

Source: Author's elaboration through STATA software

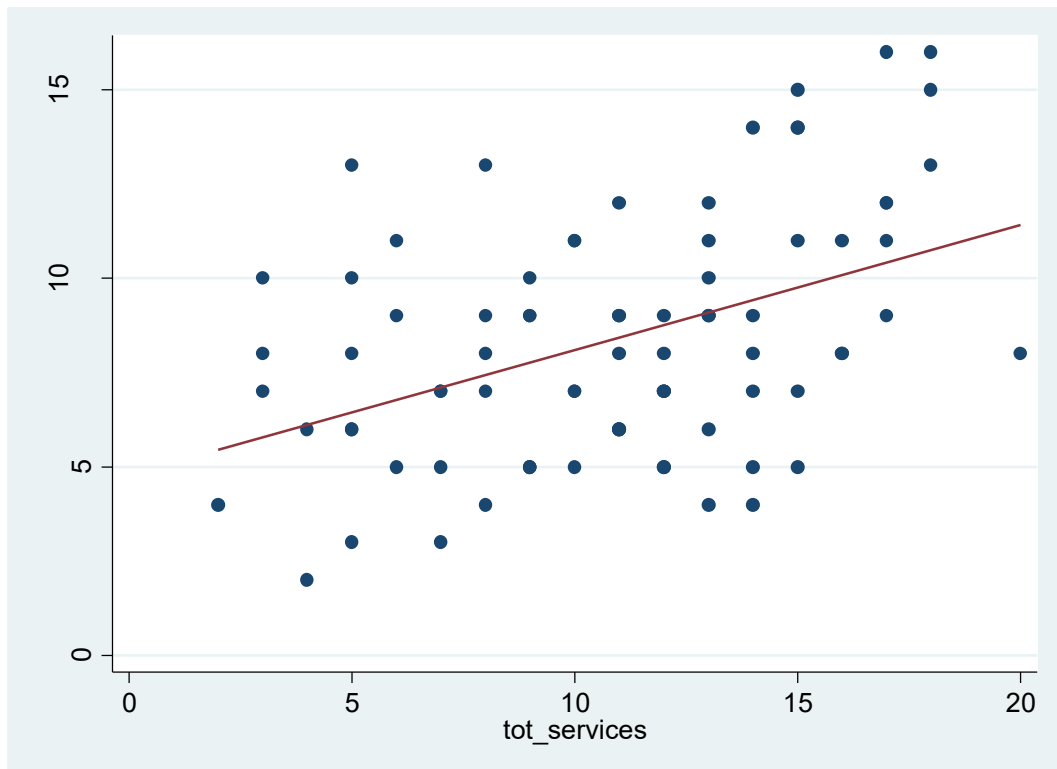
Table 10 – Spearman's correlation between tot\_services and tot\_technologies

```
Number of obs =      80
Spearman's rho =     0.4093

Test of Ho: tot_services and tot_technologies are independent
Prob > |t| =         0.0002
```

Source: Author's elaboration through STATA software

Figure 21 – Graphic correlation between tot\_services and tot\_technologies



Source: Author's elaboration through STATA software

The figure above also depicts the 80 equipment of the companies of the service-technol-ogy pair through a double-axis graph.

The correlation of 0.4 is moderate, and higher values could be expected. However, as seen by Spearman's index, since the hypothesis of the two variables independent is false at the 99%, a positive correlation even if not very strong may be sufficient to conclude how the classification according to services or technologies would have produced results if not equal, very similar. This is to further confirm that the choice to classify according to services and not technologies has been purely arbitrary and motivated by the fact that in this paper there has been a greater focus on services than technologies, even if compa-nies tend to have similar levels of both.

Therefore, services and technologies often merge into a single offer and equipment by companies: digital servitization, introduced at the end of Chapter 2. Digital servitization which, as already seen in the description of the general results of the survey, appears to have an important relevance as an activating factor of resilience in companies. Precisely for this reason it was considered important to focus on the perception that companies will have of the next normal post-Covid, looking at the differences based on the level of services, that implicitly represent diverse levels of resilience.

One of the first variables taken into consideration concerns the total number of services offered by companies.

The `tot_services` variable is an aggregated variable, which includes the sum of the services that each company has claimed to offer; as represented in the Table , out of a potential maximum of 23 services, it manifested itself with a minimum of 2 and a maximum of 20 services. On average, one company offers almost 11 services out of the total number of services offered.

*Table 11 – Summary of variable tot\_services*

Variable	Obs	Mean	Std. Dev.	Min	Max
<code>tot_services</code>	80	10.9	4.309542	2	20

Source: Author's elaboration through STATA software

In order to specifically observe whether, depending on the different levels of the companies' service provision, even the total average value is proportional, it was decided to conduct an ANOVA oneway test on the variable `tot_services` as the `service_level` varies, which is shown below.

Table 12 – ANOVA test on tot\_services, factor variable service\_level

service_level	Summary of tot_services				
	Mean	Std. Dev.	Freq.		
1.base	6.1538462	2.4607691	26		
2.intermedi..	11.321429	2.0737079	28		
3.advanced	15.192308	2.2806882	26		
Total	10.9	4.309542	80		

Source	Analysis of Variance			F	Prob > F
	SS	df	MS		
Between groups	1069.66978	2	534.83489	103.60	0.0000
Within groups	397.53022	77	5.16273013		
Total	1467.2	79	18.5721519		

Source: Author's elaboration through STATA software

The differences in total service values depending on the defined levels are statistically significant at 100%, as demonstrated by Fischer's F value.

This variable is in fact defined as control and serves only to testify that, for example, companies at the advanced level generally have a more structured offer of services, which leads them on average to have a good offer of intermediate and basic services as well.

On the contrary, companies at the basic level have an offer of services which is characterised by basic services, but which, as we have already seen, is lacking compared to advanced and intermediate services.

This assumption is very important because it gives validity to the operational selection made earlier on how the companies have been clustered in three groups.

Another variable that for the same logic could be defined as control is the percentage of turnover due to services. This variable corresponds to a specific survey question and had to be coded as the response options included percentage ranges of different sizes. The encoding Table 13 shown below was based on taking for each percentage range the maximum value as the encoding value.

Table 13 – Encoding table for services\_turnover%

Services turnover share	<5%	5-10%	10-20%	20-30%	30-40%	40-50%	50-60%	60-80%	80-100%
services_turnover%	0,5	1	2	3	4	5	6	8	10

Source: Author's elaboration

Once the encoding has been determined with a choice that can be defined arbitrary, but which in any case respects the dimensionality of the intervals, the ANOVA oneway test is carried out to verify that the turnover is proportional to the total number of services, and in turn proportional to the three different service level.

*Table 14 – ANOVA test on services\_turnover%, factor variable service\_level*

service_level	Summary of services_turnover%		
	Mean	Std. Dev.	Freq.
1.base	1.3461538	1.5281965	26
2.intermedi..	1.8928571	1.2645973	28
3.advanced	2.1730769	1.3110477	26
Total	1.80625	1.3950495	80

Source	Analysis of Variance			F	Prob > F
	SS	df	MS		
Between groups	9.21253434	2	4.60626717	2.45	0.0926
Within groups	144.534341	77	1.87706936		
Total	153.746875	79	1.94616297		

service_level	Summary of services_turnover%		
	Mean	Std. Dev.	Freq.
1.base	1.3461538	1.5281965	26
2.intermedi..	1.8928571	1.2645973	28
Total	1.6296296	1.4114932	54

Source	Analysis of Variance			F	Prob > F
	SS	df	MS		
Between groups	4.02940578	1	4.02940578	2.06	0.1569
Within groups	101.563187	52	1.95313821		
Total	105.592593	53	1.99231307		

service_level	Summary of services_turnover%		
	Mean	Std. Dev.	Freq.
2.intermedi..	1.8928571	1.2645973	28
3.advanced	2.1730769	1.3110477	26
Total	2.0277778	1.2827472	54

Source	Analysis of Variance			F	Prob > F
	SS	df	MS		
Between groups	1.05860806	1	1.05860806	0.64	0.4277
Within groups	86.1497253	52	1.65672549		
Total	87.2083333	53	1.64544025		

service_level	Summary of services_turnover%		
	Mean	Std. Dev.	Freq.
1.base	1.3461538	1.5281965	26
3.advanced	2.1730769	1.3110477	26
Total	1.7596154	1.470262	52

Source	Analysis of Variance			F	Prob > F
	SS	df	MS		
Between groups	8.88942308	1	8.88942308	4.39	0.0413
Within groups	101.355769	50	2.02711538		
Total	110.245192	51	2.16167044		

Source: Author's elaboration through STATA software

The test shows that the percentage of turnover due to services is significantly different in 90% of cases compared to the classification of companies according to their service level. The test conducted according to the three service levels indicates that at least one of the clusters is significantly different from the others; analysing specifically the three clusters in pairs shows that the difference on average between the values of the base and advanced companies is significant. This confirmation is very important, and in fact makes the `services_turnover%` variable also a control variable with good significance.

It can therefore be said that the three clusters of companies created represent groups of companies with significant diversity, both in terms of services offered and in terms of turnover deriving from these services.

Understanding the relevance of the groups, and the justified differences that characterize them, one of the first relations that it has been decided to analyse is the couple of questions about the perception of the Covid-19 crisis first as an opportunity and then as a threat. The two questions, divided in the survey, were both measured through a Likert scale with increasing intervals from 1 to 7 and are analysed together to try to understand which of the two prevailed in the different groups of companies according to the service level. The different results divided by group are represented below, and the graphic representation of the boxplot has been used to get an instant representation of the different distributions.

Table 15 – Summary of relation between crisis\_opportunity and crisis\_threat

-> service\_level = advanced

Variable	Obs	Mean	Std. Dev.	Min	Max
crisis_opp~y	26	4.576923	1.553656	1	7
crisis_thr~t	26	3.846154	1.804268	1	7

-> service\_level = intermediate

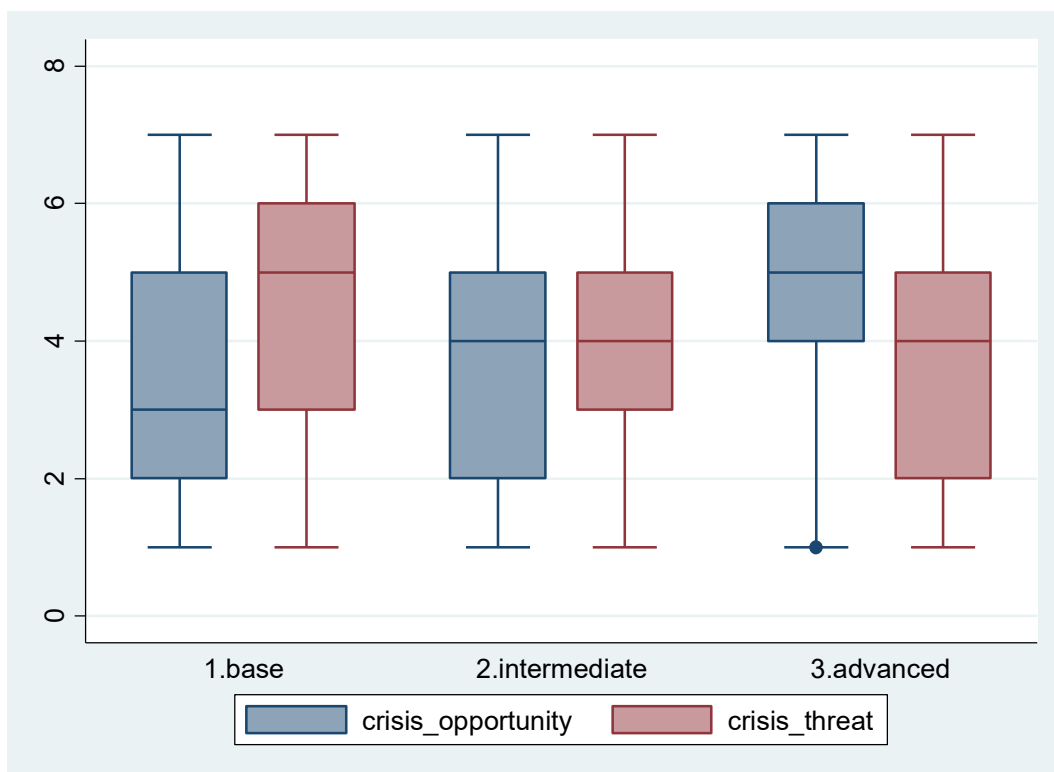
Variable	Obs	Mean	Std. Dev.	Min	Max
crisis_opp~y	27	3.740741	1.831195	1	7
crisis_thr~t	27	4.074074	1.838183	1	7

-> service\_level = base

Variable	Obs	Mean	Std. Dev.	Min	Max
crisis_opp~y	26	3.653846	1.765045	1	7
crisis_thr~t	26	4.5	1.655295	1	7

Source: Author's elaboration through STATA software

Figure 22 – Box plot relation between crisis\_opportunity and crisis\_threat



Source: Author's elaboration through STATA software



As can be seen from the graphic representation, the distributions of the answers to the two questions vary greatly according to the three clusters. If, in fact, in companies offering basic services, the crisis appears more as a threat than as an opportunity, in those with medium and advanced services the trend is gradually reversing, with the latter perceiving the crisis more as an opportunity.

Also, in this case, to understand whether the differences between the sub-samples are relevant or not, the ANOVA oneway test was conducted, first on the crisis\_opportunity variable and then on that crisis\_threat.

*Table 16 – ANOVA test on crisis\_opportunity, factor variable service\_level*

service_level	Summary of crisis_opportunity			F	Prob > F
	Mean	Std. Dev.	Freq.		
1.base	3.6538462	1.7650452	26		
2.intermedi..	3.7407407	1.8311953	27		
3.advanced	4.5769231	1.5536557	26		
Total	3.9873418	1.7504115	79		

Source	Analysis of Variance			F	Prob > F
	SS	df	MS		
Between groups	13.5713874	2	6.78569368	2.29	0.1084
Within groups	225.415954	76	2.9659994		
Total	238.987342	78	3.06394028		

Source: Author's elaboration through STATA software

*Table 17 – ANOVA test on crisis\_threat, factor variable service\_level*

service_level	Summary of crisis_threat			F	Prob > F
	Mean	Std. Dev.	Freq.		
1.base	4.5	1.6552945	26		
2.intermedi..	4.0740741	1.8381832	27		
3.advanced	3.8461538	1.8042684	26		
Total	4.1392405	1.7667454	79		

Source	Analysis of Variance			F	Prob > F
	SS	df	MS		
Between groups	5.73188719	2	2.8659436	0.92	0.4044
Within groups	237.736467	76	3.12811141		
Total	243.468354	78	3.12138916		

Source: Author's elaboration through STATA software

Looking at the test results, the differences in terms of perception of the crisis as an opportunity between the different groups are almost 90% significant, while the differences in terms of perception of the crisis as a threat are not significant.

These results are interesting, and can be interpreted by detecting a similar perception of the crisis as a threat between the three groups, while there is a significant difference in the view as an opportunity, with advanced level companies likely to see in the acceleration forced by Covid-19 the opportunity to continue to progress in the direction of digital servitization, already undertaken by these companies as seen in the previous chapter.

To confirm this trend, it has been decided to undertake an in-depth analysis on another specific variable, linked to the previous one and which is based on the specific demand of the survey on assessing through the usual seven-rung Likert scale the opportunity to include new services in companies' offer in the future.

Also here on the first impact it would seem appropriate to expect a solution that sees the base companies in the front row towards the opportunity to increase their services and therefore to close the gap with the most served companies. But as the ANOVA oneway test below reveals, awareness of the importance of services seems to be winning out, and advanced companies recognise the opportunity to expand further probably due to the fact that they already have a substantial supply of services for their clients, they understand the importance and sure evolution in the future to implement them further.

*Table 18 – ANOVA test on new\_services\_opp, factor variable service\_level*

service_level	Summary of new_services_opp			F	Prob > F
	Mean	Std. Dev.	Freq.		
1.base	3.5769231	2.1572775	26	7.79	0.0008
2.intermedi..	4.5714286	1.6426846	28		
3.advanced	5.4230769	1.1017469	26		
Total	4.525	1.8278783	80		
Analysis of Variance					
Source	SS	df	MS	F	Prob > F
Between groups	44.4005495	2	22.2002747	7.79	0.0008
Within groups	219.549451	77	2.85129157		
Total	263.95	79	3.34113924		

service_level	Summary of new_services_opp		
	Mean	Std. Dev.	Freq.
1.base	3.5769231	2.1572775	26
2.intermedi..	4.5714286	1.6426846	28
Total	4.0925926	1.9548538	54

Source	Analysis of Variance			F	Prob > F
	SS	df	MS		
Between groups	13.3337403	1	13.3337403	3.66	0.0611
Within groups	189.203297	52	3.63852494		
Total	202.537037	53	3.82145353		

service_level	Summary of new_services_opp		
	Mean	Std. Dev.	Freq.
2.intermedi..	4.5714286	1.6426846	28
3.advanced	5.4230769	1.1017469	26
Total	4.9814815	1.4600432	54

Source	Analysis of Variance			F	Prob > F
	SS	df	MS		
Between groups	9.77818478	1	9.77818478	4.93	0.0308
Within groups	103.203297	52	1.98467878		
Total	112.981481	53	2.13172607		

service_level	Summary of new_services_opp		
	Mean	Std. Dev.	Freq.
1.base	3.5769231	2.1572775	26
3.advanced	5.4230769	1.1017469	26
Total	4.5	1.9352256	52

Source	Analysis of Variance			F	Prob > F
	SS	df	MS		
Between groups	44.3076923	1	44.3076923	15.10	0.0003
Within groups	146.692308	50	2.93384615		
Total	191	51	3.74509804		

Source: Author's elaboration through STATA software

The resulting test has a 99% significance considering the three groups together, and this result is translated in three tests considering only two groups at time that are each one significant: advanced companies consider the opportunity to include new services in their offer on average one rung higher on the Likert seven scale than intermediate companies, and almost two rung higher than base companies.

Always following the same line of reasoning, and therefore observing what the companies intend to do in the next normal and with what differences between the different groups, the last variable that we decided to analyse corresponds to one of the last questions of the survey, concerning the investment budget that companies intend to allocate for a series of initiatives aimed specifically at preparing themselves in the best possible way for what will be the next normal post Covid-19.

The proposed investment ranges are in absolute value, and of different sizes, which is why a coding is required for statistical processing. The following proposed coding follows the opposite logic to the one made for *services\_turnover%*, and takes as coding value the minimum value in range scales; this choice is due to the attempt to maintain proportionality in the last range, which being open left few coding alternatives.

*Table 19 – Encoding table for investments\_budget*

Investments budget	0-50.000	50.000-100.000	100.000-200.000	200.000-300.000	300.000-500.000	>500.000
investments_budget	0	0,5	1	2	3	5

Source: Author's elaboration

Following this coding, the summaries of the variable's distributions according to the different groups and the ANOVA oneway test to understand the significance of the differences between groups are shown below.

*Table 20 – ANOVA test on investments\_budget, factor variable service\_level*

service_level	Summary of investments_budget			F	Prob > F
	Mean	Std. Dev.	Freq.		
1.base	1.64	1.6987741	25	4.29	0.0172
2.intermedi..	1.1964286	1.2644666	28		
3.advanced	2.5384615	2.0876929	26		
Total	1.778481	1.7772545	79		

Source	Analysis of Variance			F	Prob > F
	SS	df	MS		
Between groups	24.9822364	2	12.4911182	4.29	0.0172
Within groups	221.391181	76	2.91304186		
Total	246.373418	78	3.15863356		

service_level	Summary of investments_budget				
	Mean	Std. Dev.	Freq.		
2.intermedi..	1.1964286	1.2644666	28		
3.advanced	2.5384615	2.0876929	26		
Total	1.8425926	1.8244257	54		

Source	Analysis of Variance			F	Prob > F
	SS	df	MS		
Between groups	24.2808557	1	24.2808557	8.30	0.0057
Within groups	152.131181	52	2.92559964		
Total	176.412037	53	3.328529		

service_level	Summary of investments_budget				
	Mean	Std. Dev.	Freq.		
1.base	1.64	1.6987741	25		
3.advanced	2.5384615	2.0876929	26		
Total	2.0980392	1.9416993	51		

Source	Analysis of Variance			F	Prob > F
	SS	df	MS		
Between groups	10.2882655	1	10.2882655	2.83	0.0990
Within groups	178.221538	49	3.63717425		
Total	188.509804	50	3.77019608		

service_level	Summary of investments_budget				
	Mean	Std. Dev.	Freq.		
1.base	1.64	1.6987741	25		
2.intermedi..	1.1964286	1.2644666	28		
Total	1.4056604	1.4873072	53		

Source	Analysis of Variance			F	Prob > F
	SS	df	MS		
Between groups	2.59865903	1	2.59865903	1.18	0.2827
Within groups	112.429643	51	2.2045028		
Total	115.028302	52	2.21208273		

Source: Author's elaboration through STATA software

The results presented are very interesting, also because they are slightly contrary to what one might expect from the analysis of previous tests. In fact, if it is confirmed that advanced companies have a greater awareness of the importance of services and a strong and convinced reaction in overcoming the Covid-19 crisis, which is confirmed by the higher investment budget of around 300,000 euros on average; the difference lies in the difference in budget between intermediate and base companies. If in fact, as one might

also expect from the tests carried out previously, the intermediate companies should invest more than the base companies, the empirical evidence is the opposite, with the base companies investing on average more than 200,000 euros, while the intermediate companies are around 100,000 euros lower.

This final result seems to be a source of pride for the base companies, which, despite the general difficulty shown by a perception of Covid-19 more as a threat and less room for expansion for services, allocate a larger budget, probably due to the fact that given the seriousness of the post-crisis situation, they understand how strong and decisive their reaction must be.

The conclusions drawn from this variable must in any case be taken with caution, first because the test conducted between intermediate and base companies is not relevant and secondly because the investment capacity of companies, for example due to total turnover, is not being taken into account. This question was not present in the survey, but it was nevertheless decided to analyse the investments\_budget variable taking into account that the three sub-samples were homogeneously distributed according to company size in terms of number of employees. In fact, company size is often related to company turnover, which is confirmed by the micro-small-medium-large company size classification in Chapter 1, which takes both criteria into account.

It is in any case necessary to reiterate how the results obtained by this sample have some fragility mainly due to a very good number of responding companies, but which sometimes does not reach the full statistical significance. On the other hand, the opportunity to have recent data on a current and sudden phenomenon such as Covid-19 could not but be exploited; the author's further personal choice of dividing the sample among companies with advanced, intermediate and basic service levels has made it possible to reach interesting results through statistical analysis, which give indications on the current situation and what will be the next normal for companies in Italy in terms of services and digitalization.

In the next chapter the results obtained are summarised, starting from those of the survey in general up to the specific ones of the elaborations, and the final conclusions are drawn.

## **FINAL RESULTS AND CONSIDERATIONS**

### *4.1 THE RESULTS OF THE SURVEY*

In Chapter 3, as seen above, the empirical part of the work has been analysed, presenting the survey conducted by the research group of the University of Padua and adding some additional statistical elaborations proposed by the author. The results obtained from these elaborations have been deliberately only introduced, as they will be discussed and deepened in this final chapter.

Starting from the survey, it should be remembered that its starting aims were very closely related to the ones of the paper by Rapaccini et al. (2020). In this paper, "Navigating disruptive crisis through service-led growth: the impact of Covid-19 on Italian manufacturing firms", the authors focused on an analysis of the impact of the health emergency on the business of manufacturing companies in Northern Italy, one of the worst affected regions in Europe, through a questionnaire and interviews. The unpredictability of the crisis and its drastic effects led the authors to theorize the four step model (calamity, quick & dirty, restart, adapt) already presented in chapter 2, as an evolution of previous crisis response models, specifically adapted to face this year's emergency and support in managing it.

From the questionnaire and the interviewees, the most interesting results relate specifically to the role of services, which seem to increase their importance particularly in times of crisis; the service business is in fact more resilient than the product sales business, with the latter being hard hit especially in the industrial sectors analysed. Among the services, the most advanced ones are those less impacted by the crisis, also given their nature, which very often allow to offer the greatest value to the client with reduced physical presence of the supplier, which adapts to past lockdown times and which have often

involved the entire value chain, from the first supplier to the final client. Very often these advanced services have a strong digital component that becomes essential as a way of offering the service or as a true service itself. That is why, for example, technologies such as IoT, cloud and analytics make it easy to talk about digital servitization.

In the wake of the paper of Rapaccini et al. (2020), the survey "Reagire al Covid-19 con i servizi e la digitalizzazione" has begun to be built up, with the aim of providing a further sample of data that focuses more on companies mostly from North-East of the country and have specific characteristics such as B2B operations.

As can be deduced from the title, of the survey, a careful focus has been placed not only on services but also on the levels of digitalization of companies; services and digitalization have been studied in detail as elements of strategic resilience that emerged in the phases immediately following the lockdown, with an express and specific focus no longer on the immediate reaction to the crisis (the calamity and quick & dirty phases), but on the foreshadowing of how organizations expect the future and what they intend to do to prepare for it; in other words on the challenges of the transition to the next-normal that awaits manufacturing companies (the restart and adapt phases).

Some very important general conclusions can be drawn from the specific analyses carried out on the main and most significant questions of the survey conducted in Chapter 3:

- The importance of technological and organisational preparation; in uncertain and unpredictable times which, as seen in Chapter 1, lead to crises with increasingly recurring economic repercussions and much shorter cycles, is it important for a company to have adequate preparation to react adequately and quickly to possible negative external stimuli. Often this preparation, which leads companies to be more resilient, is implemented through suitable technological equipment and a flexible business ready to adapt. A classic example of preparation that has become fundamental in tackling Covid-19 has been the use of smart working, which from one day to the next required a series of organisational changes and technological equipment that not all companies have been able to offer to employees. Remote working has become fundamental above all in the ability not to lose efficiency in relations with other companies, suppliers and above all customers, relationships usually managed vis-a-vis each other and which have now been replaced by remote meetings on dedicated platforms.



- Technology and services are resilience enablers; the centrality of connectivity technologies has been fundamental during the crisis to keep the service offering active for its clients. In fact, while during the lockdown the sale of the product was in many cases physically blocked even just because of transport limitations, the services continued to function. Even basic services such as maintenance and repair, which in any case require a physical presence on the part of the seller, have often become essential for customers who continued to produce during the lockdown phase. While for customers who have stopped, services have nevertheless represented the possibility of maintaining the relationship between supplier and customer, especially when it comes to advanced technologies such as IoT, data analysis and the Cloud. Companies that managed to diversify their offerings and showed good levels of digitalization were inevitably more resilient than companies that, for example, were only product focused, saw their revenues fall to zero during lock-down.
- A more mature awareness of the real challenges of the crisis; the Covid-19 crisis has uncovered financial and operational fragilities for many businesses that were present long before the pandemic. Companies have finally become aware of the economic uncertainty of recent years, and the importance of diversifying their business and making it as agile as possible. On this point, the statistical elaborations in the next paragraph will specifically focus on the perception of the crisis as an opportunity or a threat, demonstrating how, depending on the different levels of servitude and therefore resilience, even the perception of the crisis can change.
- Technology and services are complementary keys for interpreting the future; given the importance and indispensability of these two factors to face what will be the next normal, it is also necessary to clarify how in reality services and technologies are two sides of the same coin; digital technologies can in fact automate and make scalable a whole series of reporting, monitoring and remote control activities that until recently had to be carried out specifically on the territory. At the same time, the offer of services, from basic to advanced ones, requires an adequate technological endowment, confirming the close relationship between the two factors. Moreover, digitalization, as never before in recent years, seems to have no limits, with the frontier of what can be digitised or not being in continuous evolution.

The survey therefore highlighted the importance of Covid-19 impact on companies, often highlighting the positive aspects that such a major crisis could create in an economic fabric of companies that are often too immobile. The pandemic will characterize the next normal to be an accelerator or activator of digitalization and service-processes in companies.

These processes will affect the entire ecosystem, from the market to customers and suppliers who will change habits following a crisis that is bound to reward only those who demonstrate a resilient attitude.

#### *4.2 THE RESULTS OF THE EMPIRICAL ELABORATION*

After the results obtained from the survey in general, it has been decided, as seen in the previous chapter, to exploit as much as possible the opportunity to have a current sample with a good number of observations to conduct more detailed analyses, investigating the diversity of some specific variables after classifying companies according to their service offer. The classification of services was decided because the topic is seen as one of the main focus of the paper, but clustering would have been similar even if it was decided to classify companies according to digital technologies, another big topic of the analysis. Taking up also one of the conclusions just described by the survey in general, services and digitalization often go hand in hand; a correlation between the distributions of the two variables aggregating the total offer of services and the total technological endowment has been made. The resulting correlation is a positive average value, not too high also due to the elaborate nature of the two variables created, which inevitably do not differentiate within each of the two variables the specific services and technologies. However, when Spearman's test is carried out, the correlation is significant, especially thanks to the reliable number of the sample made of 80 observations.

The empirical confirmation is limited, however, but useful to be able to state that the services-based classification also takes into account the level of digitalization, and as seen as these two factors activate resilience, by transitive property the three clusters of companies represent three different levels of resilience.

To cluster according to services, the classification of services provided by Baines, one of the most established and reliable sources on the issue of service-based services, has been

adopted. The 23 services in the questionnaire to which the companies were subject were divided into basic, intermediate, and advanced services.

Once these three groups had been determined, following a criterion as much objective as possible, specific analysis was carried out on some variables corresponding to specific questions, observing the different results among the groups.

The first analyses were carried out on variables that can be defined as confirmatory, as they try to testify the goodness and correctness of the subdivision. For this reason, it was necessary to have confirmation of the homogeneity of the three groups both as regards the size of the company (measured by the number of employees) and whether or not it was closed during lockdown. These two variables in fact could have interfered with subsequent analyses, while having confirmation that each of the three groups has similar proportions of small, medium and large companies, and that about half of the companies in each group had to close (slightly more as far as the advanced ones are concerned), and the other half managed to keep open confirmation that the characteristics of the three sub-groups are not caused by these two effects.

Another variable that can be defined as control concerns the percentage of total turnover explicitly due to services; also here the resulting values are in line, with advanced companies that have a higher average percentage of turnover from services than intermediate companies, with the latter in turn having higher levels than the base. The results are in line with the forecast, which confirm that as the offer and type of services increase, the relative percentage of turnover also increases. Statistically, the difference in average values between advanced and base companies is significant. It would have been interesting to investigate specifically whether there are differences in profitability depending on the type of services, investigating whether advanced services are more profitable than intermediate or base services. This was not possible, as the classification between the different types of services was made ex-post by the survey, and the questions did not allow to specifically analyse this effect, which remains a good starting point for further research.

One of the most interesting results concerns the perception of the Covid-19 crisis, between opportunity and threat. As widely anticipated, the analysis of these responses sees a prevalence of the perception of the crisis as an opportunity for advanced companies, a general balance of responses in intermediate companies, and a prevalence of the crisis as a threat to base companies.

These results confirm the line already drawn, and add an important link between what is the present for companies, represented by their equipment and level of supply, and what will be the future, the next normal of the coming months characterized by uncertainty and the profound changes that the pandemic has brought and will bring. Advanced companies that have anticipated a resilient organisational structure characterised by services and digitalization, have much brighter prospects for the future and look at Covid-19 as an accelerator that will enable them to implement new solutions involving digital servitization and improve those already implemented. They are also confident that the whole ecosystem of suppliers and customers understands its importance, as has been the case with remote working and meeting platforms, for example, which have become part of companies and will remain for many a permanent solution in corporate working practices.

For base companies, however, Covid-19 is of much more concern; these companies have had difficulty implementing adaptation solutions in dealing with the crisis, which in many cases have been emergency, and without adequate preparedness. There is not yet the awareness that Covid-19 may have given the necessary push to innovate the Italian economic system, and instead the pessimism linked to the financial difficulties that these companies, like all of them, are suffering, linked to the reduction in sales and the consequent slowdown in production, prevails. The next normal that is in prospect for them is darker, uncertainty prevails and the main risk for these companies is not finding adequate solutions to renew their business and be more resilient; in this way the gap between advanced and basic companies is destined to increase.

As confirmation, there are significant results on the variable in which companies have assessed the opportunity to introduce new services in the near future (which may coincide with the next normal). The results are perfectly in line with the previous point; advanced companies, already proven in the world of service-based services, know that Covid-19 has brought drastic changes also in terms of ways and customer preferences, and for this reason it will become fundamental to push the offer of services, both product-related and non-product-related, with the aim of having a generally more diversified offer, to normalize revenues and make them less and less dependent on economic cycles, and thus make the company more resilient.

The core point that is still not perceived and understood by the base companies, which, depending on the financial level in which they are, risk leaving a market where digital

innovation will no longer be a choice, but a requirement to be part of what will be the next normal.

Intermediate companies, so far not analysed in detail, represent average values between the two classes defined above; here they perceive the crisis as an opportunity and threat at about the same level, and evaluate the offer of new services with significantly lower values from advanced companies, but also significantly higher from base companies.

This last consideration is very relevant: the statistical validity of the tests conducted on the variable `new_services_opp`, and the significance of the differences between the values of each group and the others, testifies that these results are reliable, and can be an efficient tool to anticipate and predict the behaviour of companies towards digital servitization in what will be the next normal.

The last variable considered concerns the budget that will be expressly allocated for investments to react to Covid-19; here too advanced companies confirm with facts their expectations to implement the offer of services and the equipment of new technologies, and are ready to invest on average higher amounts than the other two groups.

Intermediate and grassroots companies, however, are not losing too much ground, and in any case have good levels of investment expected, although significantly lower than advanced companies.

Between intermediate and base companies there is the partial final surprise, with base companies investing on average more than base companies. It is, in fact, credible that in any case the base companies, warning of the threatening situation brought by Covid, believe they will have to make necessary investments in the future, above all linked to survival as long as the emergency lasts. To this is probably added a delicate financial situation, which sees in these investments the opportunity to recover in the immediate future. What is worrying, therefore, is where these investments will be directed, but above all with what purpose: to satisfy short-term needs or to begin to undertake a project that will lead the company to a more innovative and flexible business, characterized by resilience based on services and digitalization, a criterion that seems to be increasingly fundamental for the next normal to come.

### *4.3 LIMITS OF THE EMPIRICAL ANALYSIS*

The results just summarised are of undoubted and unquestionable interest, and represent real observations obtained by similar enterprises concentrated in a unitary geographical area, where the consequences due to the impact of the Covid-19 crisis had similar and comparable times and ways.

However, it is also necessary to point out the limits of the empirical analysis carried out; first of all, the survey collected the responses of 80 companies, which, although representing a good-sized sample, cannot represent the totality of the companies. As a second point, it should also be pointed out that the structure of the survey was based on questions that assessed the perceptions of a single respondent for each company, which makes the answer subjective according to the individual's perception. Precisely the survey was addressed to the Top Management Team of each company, trying to have the most reliable answers given the level of experience and skills of each individual in relation with their company.

As far as the statistical elaborations are concerned, the author decided to further subdivide the total sample into three groups (base, intermediate and base companies); if on one hand this choice made it possible to obtain results that differed according to the level of services of the companies, finding interesting cues such as the different perception of what the companies will do in the next normal, on the other hand the total sample described above was further divided, with three sub-samples of 26, 28 and 26 companies respectively, which although homogeneous, represent small numbers for sample elaborations. Even with these numbers, most of the tests selected and presented in the elaboration have presented significant results, which can therefore be taken into consideration. However, it should also be pointed out that, as in the case of the ANOVA oneway test conducted, the underlying hypotheses provide for a similar variance of each variable (and this criterion was respected) and also a normal distribution (which was not verified given the small number of observations).

The limitations just described represent a weakness of the elaboration carried out; against the opportunity to have a sample however with a good number, especially considering that the answers are of companies and not of individuals, and concerning a current phenomenon and carried out in a short time, it allows to have a characteristic and unique analysis, with equally unique results, which can be useful first of all for companies to understand the importance and the role of services and digitalization as resilience factors,

and how much the latter is now a requirement for the post Covid-19 world, the next normal.

#### *4.4 FINAL CONCLUSIONS*

In conclusion, it is necessary to retrace the main steps of this work. In fact, starting from the economic crises that have characterised the last twenty years, we have arrived at what is destined to be the crisis that will change the economic world most in the coming years. The Covid-19 pandemic has totally changed the habits and behaviours of all market players, with production companies that have suffered the effects of this crisis in the first place, but are also those with more opportunities and potential for improvement.

One way to do this is to use services and digitalization, factors that are increasingly evolving and that together make companies more resilient.

Organizational resilience is in fact the main antidote to combat the uncertainty that has characterized the last twenty years and that is destined to characterize the post-Covid world, the next normal.

Through the empirical survey and the related statistical elaborations, it was first of all confirmed how resilience can be achieved through digital servitization, a new concept that provides for the offer of services that need suitable digital tools to implement them, and also how services and digitalization are actually two sides of the same coin.

After dividing the sample into three groups according to the levels of services offered by companies, it was also discovered that services and digitalization are more and more sources of competitive advantage; an advantage that was built up over time, before the Covid-19 crisis, and that allows the most resilient companies to look with greater optimism at the near future, identifying the outbreak also as the opportunity to accelerate an innovative process that is too late in our country. Services and digitalization are undoubtedly two areas with great potential in the market over the next few years, and companies that fully understand this phenomenon will be able to benefit more from it.

Those companies that did not take this path before the crisis will inevitably find themselves in difficulty; in November 2020, the time of conclusion of this work, the health emergency is returning, the discovery of a vaccine seems still far away and new legislative decrees alternate from week to week making the near future increasingly uncertain.

The hope is that the next investments will not only focus on bridging the gap in the emergency, but that they will have a look to the future, laying the foundations for adapting to what will be the next normal.







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