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An Empirical Analysis of the impact of Covid-19 on Italian startups' Business Model.

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ABSTRACT

Abstract Italiano

L'ecosistema delle Startup e Piccole medie imprese in Italia è in costante crescita dal 2012. Questo sviluppo è stato fortemente minato dall'arrivo di uno shock esterno non predicibile, come il Covid-19 che da più di un anno sta gravemente affliggendo le compagnie italiane e non solo. Il nostro obiettivo in questa ricerca è quello di analizzare nel particolare questo shock, andando a confrontare le sue caratteristiche peculiari con altri shock del passato, per definirne la tipologia.

Abbiamo analizzato come la startup e le SMEs italiane hanno cercato di reagire a questa crisi e come il panorama dei finanziamenti in questo tipologie di aziende sia cambiato. La nostra analisi considera come queste abbiano dovuto adattare, modificare o innovare il proprio business model. In particolare tramite un questionario abbiamo chiesto a 255 startups, come fossero state impattate dallo shock e quale fossero state le innovazioni apportate al business model per rispondere. Inoltre abbiamo chiesto a queste aziende come si sono interfacciate con possibili finanziatori esterni prima e durante il Covid-19 per poter tracciare eventuali cambiamenti nei due periodi. Tramite le risposte del sample in questione abbiamo costruito un database strutturato formato da variabili collegate sia alla Business Model Innovation che ad altre caratteristiche fondamentali dell'azienda.

Tramite uno studio empirico dei dati ci è stato possibile suddividere le aziende in 5 fasce di impatto del Covid-19 e analizzare come le aziende appartenenti ad ogni fascia abbiano innovato il Business Model in termini di Depth e Breadth, per poi analizzare più nello specifico le singole dimensioni individuate: Value Proposition, Value Capture, Value Creation, Value Delivery.

Grazie a questa analisi abbiamo individuato alcune possibili atteggiamenti di reazione allo shock corrente e abbiamo individuato delineato dei comportamenti di innovazione comuni alle startup, basandoci sul tipo ti impatto sofferto.

Abstract English

The ecosystem of Startups and Small Medium Enterprises in Italy has been growing steadily since 2012. This development has been strongly undermined by the arrival of an unpredictable external shock, such as Covid-19, which for more than a year has been seriously afflicting Italian companies and not only. Our objective in this research is to analyze this shock in detail, comparing its peculiar characteristics with other shocks of the past, to define its typology.

We have analyzed how Italian startups and SMEs have tried to react to this crisis and how the funding landscape for these types of companies has changed. Our analysis considers how they had to adapt, modify or innovate their business model. In particular, through a questionnaire we asked 255 startups how they had been impacted by the shock and what innovations they had made to their business model to respond. In addition, we asked these companies how they interfaced with possible external funders before and during Covid-19 to track any changes in the two periods. Through the responses of this sample, we constructed a structured database consisting of variables related to both Business Model Innovation and other key company characteristics.

Through an empirical study of the data we were able to divide the companies into 5 bands of impact of Covid-19 and analyze how the companies belonging to each band have innovated the Business Model in terms of Depth and Breadth, and then analyze more specifically the individual dimensions identified: Value Proposition, Value Capture, Value Creation, Value Delivery.

Thanks to this analysis we have identified some possible attitudes of reaction to the current shock and we have outlined some innovation behaviors common to startups, based on the type of impact suffered.

EXECUTIVE SUMMARY

INTRODUCTION

The Italian startups ecosystem is growing since the Decreto Crescita 2.0 (2012) (Ministero Dello Sviluppo Economico, 2020). We decided to analyze such an ecosystem in the context of environmental turbulence brought by Covid-19, which has impacted the context considered. Our research focuses on Business Model innovation concerning an external shock causing environmental turbulence. The concept of BMI has been gaining great importance in recent years (Spieth, Schneckenberg, & Ricart 2014; Zott, Amit & Massa, 2011) in particular about startups and SMEs. These types of companies have been considered the key to rapid innovation in crises (Bessant et al., 2012, 2015). However, very little is known about the Covid-19 crisis as it is very recent, we believe it is important to analyze it concerning the topic of innovation in startups and SMEs since research is much more focused on established companies even if SMEs and Startups are considered to be the driving force behind the economy and de facto employ the most people (EASME, 2015).

This study aims to make a targeted analysis of the type of shock that companies are facing, starting from the basis of this and going to compare it with past shocks.

We created a structured database with data are taken directly from the startups involved, to have a starting point for future Covid-19 and exogenous shock research. Our data are peculiar since taken during the crisis. Besides, we analyzed the funding landscape in Italian startups, considering two different periods: from the birth of the company to February 2020 and afterward, asking founders and managers if they had sought and received funding.

Starting from the gaps identified during the literature review and using the data collection method mentioned above, we decided to pursue two main purposes.

Analyze how the Business model of the Italian Startups changed because of the Covid-19 impact and how the companies have tried to face such environmental turbulence. In this particular economic setting, we also studied the changes in the financing landscape for small and medium-sized enterprises and startups. Through our empirical analysis, we discovered interesting insights about the type of innovation companies achieved and how companies that have sought and received financing reacted to the crisis.

LITERATURE REVIEW

The research field of Business Model Innovation is constantly growing, in fact, nowadays there is a growing awareness that BMs can also be the object of innovation themselves (Chesbrough, 2010; Demil and Lecocq, 2010), and the concept of Business model innovation, has gathered importance in recent years (Spieth, Schneckenberg, & Ricart 2014; Zott, Amit & Massa, 2011). Researchers have given different interpretations and definitions of the Business Model and this concept has evolved over the years. We will report below the most important definitions given by scholars, noticing some general considerations that are widespread and accepted by academics:

- The business model is a combination of different design dimension and building blocks, not a model for revenue and cost (Osterwalder, 2004; Morris et al., 2005; Ballon, 2007; Johnson et al., 2008; Amit and Zott, 2009);
- Value, considered as what companies have to deliver to customers, is at the core of the business model and value capture is the second core concept of the business model, companies need to make a profit out of their customers;
- Business model and Company strategy are related: the business model is a useful tool to translate the directions given by business strategy into guidelines for the execution of it.

The business model represents the core and distinctive aspects of companies. Despite the growth of the business model knowledge, there is not homogeneity of definitions between the academics (Zott et al. 2011). Many authors over the years have tried to describe the Business Model considering its components, building elements, and the relations between them. Analyzing the elements identified by different researchers, four main dimensions of BM repeats through the literature: *Value Proposition, Value Creation, Value Capture, Value Delivery.*

The BMI literature is a recent outgrowth of the BM literature. Studies on the topic revolve around two main themes: BM design (entrepreneurs creating new BMs from scratch) and BM development (managers improving current BMs) (Zott and Amit, 2010; Schneider and Spieth, 2013; Ghezzi et al., 2014), to better understand the concept of BMI we will report further in the research definitions we found during our analysis of the literature

(Table 1). Considering the BMI literature as a whole it does not exhibit the characteristics of a well-defined cumulative research stream (Foss and Saebi, 2016).

Four different streams of research on business model innovation emerged from the literature: *conceptualizing BMI, BMI as an organizational change process, BMI as an outcome, Consequences of BMI*. There are two lines of thought: a *dynamic view* of BMI seen as a process and a more *static view* in which BMI is seen as a new type of innovative venture that can impact the company's performance.

The literature on BMI focuses more on large, stable companies (e.g. Bouwman et al., 2016; Heikkilä & Heikkilä, 2017; Clauss, 2020) than on start-ups and SMEs. A problem related to SMEs and startups is that those companies aren't aware of the engagement in Business Model Innovation, mainly because they will not label themselves in that way. Only a minority of SMEs are familiar with BM ontologies and with tooling (Bouwman, 2016).

Scholars have acknowledged the significant role that business models play in firm performance and in generating competitive advantage (Zott et al., 2011; Chesbrough, 2010). There is a large body of literature claiming that BM can be a source of competitive advantage (Markides and Charitou, 2004) and therefore affect firm performance (e.g. Afuah and Tucci, 2001; Aspara et al., 2010; Zott and Amit, 2007; Zott and Amit, 2008). Even the relationship between BMI and business performance has been confirmed by several previous studies (Zott and Amit, 2007; Aspara, 2010; Cuculelli, 2015; Volberda, 2017), but due to the lack of a well-defined construct of BMI, the past literature has obtained inconsistent empirical findings regarding its effect on firm performance (George & Bock, 2011; Pedersen et al., 2018).

The literature is more focused on competitive environments and competitive advantage. There is a lack of analysis on environments that are uncertain due to exogenous or external shocks, such as the one caused by the Covid-19 pandemic.

Crises Impact

Past studies argue that external factors have a big impact on BMI in SMEs (Hidayat and Pangaribuan, 2020). Disruptive changes, interrupt equilibria making this transformation possible for novel organizational mutations, intentional or random, to take hold (Corbo et al., 2018).

Academics who have studied the concept of opportunity and threat perception concerning the BM of startups and SMEs consider the concept of Business Model Adaptation to be fundamental. In particular, two opposing theories regarding the interpretation of opportunities and threats by managers emerge *Threat-rigidity theory* and *Prospect theory*. The core problem is whether managers are more apt to engage in change on disruptive opportunities embedded in crises. Alternatively, they stick with the old solutions, products, routines, and business models. Avoiding change and trying to ignore the crisis in the hope of a return to prior stability. The management literature is far from consensus on this issue (Sarkar and Osiyevskyy, 2017).

Financing

Venture capital is commonly defined as a form of private equity and a type of financing that investors provide to startup companies and small businesses that are believed to have long-term growth potential. The startups obtain two types of resources from VC: financial and intangible resources, including experience, knowledge, and networks (Pisano, 1994; Teece, 1992) fundamental to startups understand the market and commercialize their ideas (Carter, 1990; Shan W., 1994). Not everyone resorts to equity investments because even if they are very large they can unduly compromise the ownership of the company (Reid, 1996).

The correlation between venture capital investment and startup growth takes the shape of an inverted “U” (Cavallo et al., 2019), possible causes can be overconfidence and over-optimism, positive at the beginning, but can become detrimental in a short time.

The advantages of equity financing in this regard are twofold (Ou & Haynes, 2006):

- equity offers long-term financing with minimum cash outflow in the form of interest;
- receiving VC investment in the initial stage plays a significant role as a quality signal;

Studies revealed that the positive effect of VC on the growth of new ventures is especially evident in the first part of the life cycle and hi-tech new ventures (e.g.Bertoni et al., 2011; Colombo and Grilli, 2005; Stuart et al., 1999). As the company's objective becomes to expand business the need for external funds arises through formal external sources. The effects related to the receipt of funds are many and impactful, but in all the studies cited, the external environment was not considered as a critical factor

Environmental Turbulence

The literature of environmental turbulence has its foundation in the definition given by Ansoff and McDonnell (1990), which define environmental turbulence as the combined measurement of the changeability, instability, and predictability which is reflected in the complexity and novelty of change in the environment.

Environmental turbulence is an important contingency factor in the context of BMI, as it puts pressure on companies and forces them to adapt and react proactively (Clauss, 2019).

Researchers have highlighted in the literature the main differences between exogenous and endogenous shocks. Endogenous shocks arise from within the economic system, while exogenous shocks are natural catastrophe events that are not easily predictable and very often have disastrous consequences. (Atlantic Council, 2020). Shocks are unique, random, and unpredictable phenomena that have a large impact on the economy and are caused primarily by factors that cannot be controlled or predicted by market participants.

Exogenous shocks cause major disruptions to economic systems (Hudecheck et al., 2020), and the COVID-19 pandemic, for instance, has generated disconnected supply chains, logistics challenges, shortage or unavailability of key resources, extreme price distortions, government restrictions on the functioning of many industries and markets and the need to redesign the working processes for many industries (Todd Morgan, Sergey Anokhin, Laurel Ofstein, Wesley Friske, 2020).

To understand the impact of Covid-19 on our economy researchers analyzed the channels of economic transmission, through which Shocks can affect (almost negatively) the market. Following the vision proposed by Carlsson-Szlezak et al.(2020a) and Carlsson-Szlezak et al. (2020b), there are 3 main channels of economic transmission: *Direct impact, Indirect impact, Negative effects on the supply curve*.

Starting from the analysis of the literature on BMI, in particular, focusing on startups and SMEs in a turbulent environment, we have noticed that it is often related to a competitive issue. Our study goal is to provide a comprehensive empirical analysis of how the business model of Italian start-ups has been modified in response to the crisis created by the Covid-19 virus, also focusing on the changes in the financing landscape for these types of companies.

METHODOLOGY

In this chapter, we will explain in detail the main steps of the research process we went through to reach the goal set by the thesis: to provide an empirical analysis of the innovation brought by startups on the Business Model to combat the crisis brought by Covid-19 and to analyze how funding in Italy was modified.

We will define the boundaries of the empirical setting, in particular, focusing on the concept of shock related to Covid-19, we will introduce our interpretation and definition.

Finally, we will show how we collected contacts through different tools and additional information regarding the survey respondents from an external database (AIDA).

Empirical Settings

As reported by the Italian Ministry of economic development: "The innovative startup is a young, high-technology enterprise with strong growth potential and therefore represents one of the key points of Italian industrial policy". Companies have to meet certain requirements to register themselves as innovative startups. Innovative start-ups can enjoy the benefits within 5 years of their establishment; after this period, they can transform into innovative SMEs, without losing the available benefits.

Within the literature review, we have proposed different definitions of shocks, doubt comes when the shock is extremely peculiar, as in the case of Covid-19, is not exogenous but endogenous to the economy, a shock co-created by humanity and the biosphere, due to the strict relationship. Thus, the covid-19 can be considered as a *hybrid shock* and has some characteristics of both types of shocks (exogenous and endogenous).

In terms of similarity with endogenous shocks, we can compare Covid-19 to the 2008 crisis. We noticed these common characteristics:

- *Uncertainty*: a non-quantifiable risk, whose impacts are difficult to predict.
- *Collapse*: declines in the stock markets of major countries
- *Reactions:* fiscal policies to provide massive support.

However, the virus is by nature an exogenous factor, not controllable and predictable. This is evidently observing the absence of short-term medical responses to the virus (either as vaccines or treatments.

Considering the discussion made above, we decided to consider Covid-19 as a hybrid shock, exogenous in its nature and endogenous in its consequences and impact on the economic system.

Startups are more affected by external shocks due to their not-yet-established organization, natural uncertainty due to competition, and the size of the company.

Considering these characteristics, our analysis aims to analyze how these types of companies have modified, innovated, or adapted their business model in response to a hybrid shock that they have never experienced before e if it has been perceived more like an opportunity or a threat.

It is believed that during a financial crisis, SMEs' access to finance tends to be reduced (Korab & Pomenkowa, 2015). These companies are more financially constrained due to problems with both cash flow and cash holdings. By financial constraints we mean frictions that prevent a firm to realize all desired investments but also due to the inability to issue equity or due to problems to issue new bonds (as suggested by Lamont et al., 2001). Our intention is to compare how and if these types of companies were seeking external equity funding before the pandemic and since the pandemic began.

Sample and Data Collection

To create a sample of Italian Startups and SMEs, our starting point was a database provided to us by the Digital Innovation Observatory of Politecnico di Milano.

The following variables were present in the Database: *Company name, Incorporation year, NUTS3, Telephone, Email, website.*

To gather the highest number possible of emails or other contacts we used different tools:

- *Pitchbook:* used to extract data regarding startups and SMEs of Italy in the high-tech sector;
- *Website searching and Contacting*: we contacted companies through generic emails to gather managers/funders contacts;
- *AIDA*: is a financial and personal analysis database with information on shareholdings and management. We gathered the names of managers and

founders, to contact them through LinkedIn or to ask directly for them in the email sent to generic contact of companies.

- *Innovative start-ups and SMEs - Company Register*: we decided not to use this tool after analyzing the efficiency of extracting contacts compared to the effort needed.

We contacted a total of 2670 companies.

Measures

Based on the literature review carried previously and in line with the line of thought that conceptualize the Business Model as value architecture of the firm. we decided to adopt the Business Model Canvas, conceptualized by Osterwalder and Pigneur (2010) (*fig 6*) as the starting point to create a construct to measure the Business model innovation of each company.

We asked with the survey how much each element of the BM has changed due to the Covid-19 pandemic shock on a scale of 0 to 5 (Likert-scale measures), in which they had to respond 0 if none of the element has changed and 5 if in their opinion has changed drastically.

In the following table (Tab. 6) it is summarized how we created different layers of measure for BMI

BUSINESS MODEL INNOVATION MEASURE		
1st Layer	**2nd Layer**	**3rd Layer**
Business Model Innovation Breadth	Value proposition	
	Value creation	Key Partners
		Key Activities
		Key Resources
Business Model Innovation Depth	Value delivery	Customer Relationships
		Customer Segments
		Channels
	Value capture	Cost Structure
		Revenue Streams

Table 6: Business Model Innovation Measures

1st Layer: General measures to capture the level of horizontality and verticality of innovation.

- *BMI Breadth*: the number of elements that have been changed by the companies, the range goes from zero elements to nine (all of them). This variable will permit to distinguish between companies that move away from their usual Business Model and radically change and companies that try to survive to the shock and improve their Business Model locally with few minor adaptations;
- *BMI Depth*: Through this variable it is possible to understand what is the extent of the change made by the company due to the Covid-19, not considering how many dimensions have been changed, but focusing on how much they have been changed.

2nd Layer: Breakdown of the BM into 4 dimensions

- *Value proposition:* the set of products, services, and solutions offered to the market that creates value for customers by solving a problem or satisfying a need.

- *Value delivery*: it describes how the firm's activities are articulated to deliver the value proposition to the customer. Including *Customer Relationships, Customer segments, Channels;*
- *Value creation*: it relates to how the firm organizes itself to create value for its target customers in terms of internal and external activities, processes, and resources needed. Including *Key activities, Key partners, Key Resources.*
- *Value capture*: how the firm monetizes the value created and then delivered it to its customers, and how eventually it generates profit. It includes *Revenue stream, Cost structure.*

In order to measure the impact of Covid-19, we asked the respondents how much the pandemic has impacted their business: from 1 (strongly and severely negatively influenced) to 5 (positively impacted), relating the response to what they generally consider to be normal market conditions.

To analyze how the financing from external financial investors has changed during this period of crisis, we decided to divide the analysis of this factor into two different periods: from the founding of the company to the start of the pandemic (February 2020) and from February 2020 since the day the answered the survey.

We repeated the same questions asking for the two periods:

- *Capital seeking* (binary response): yes, if they searched external financing
- *Capital received* (binary response): yes, if they received external financing (answered only if the previous one response was yes)
- *Financing impact*: We asked the respondents how much their company's business model has been influenced by the support and involvement of external funders on a scale from 0 (BM not influence by investors) to 5 (BM greatly influence by investors).

We extracted other variables/measures using the Aida database:

- *Firm age*
- *Firm size*
- *Italy's Zone/Region/Province*
- *Industry*
- *Revenue's growth*

Data analysis

The database has been created and populated with all the different types of data. In this section, we will present the methodologies followed to move from the raw data collected to a consistent set of the business model characterizing variables, and to the actual values that those variables can assume.

We organize the raw data with the following method to create comprehensive measures:

Bmi Depth: We divided the scores (from 0 to 5) into four innovation bands, using the equal width method.

- ***The company has innovated very little***: we consider all those companies whose average depth is between 0 (i.e. they have not changed anything) and 1.25.
- ***The company has innovated moderately***: in this band are considered those companies whose average depth is between 1.25 and 2.5;
- ***The company has innovated significantly***: in this range are considered those companies that have a depth score between 2.5 and 3.75;
- ***The company has innovated in a radical way***: in the last band are included those companies that have implemented radical innovations to their business model, innovating most of the elements in a strong way. The score ranges from 3.75 to 5 which represents the maximum;

BMI breadth: we counted the number of BM elements changed to create 5 bands:

- Companies have ***innovated from 0 to maximum 2 dimensions***: these companies have innovated only a very small part of the dimensions
- Companies that ***have innovated from 3 to 4 dimensions***
- Companies that ***have innovated from 5 to 6 dimensions***, in this case, we consider companies that have innovated more than half of the BM
- Companies that **have *innovated from 7 to 8 dimensions***, we can consider in this range the companies that have changed most of their BM
- Companies that ***have innovated all dimensions of the BM***, all 9 elements.

All the elements of the BM were presented in the survey asking how much they have been changed in response to Covid-19 (from 0 no change to 5 very important change).

Value proposition: considering how the application was presented, this measure is already divided into categories

Value delivery: We calculated the average score of the elements of the business model that belong to this dimension: Customer Relationships, Customer Segments, and Channels. We rounded the score to identify the bands.

Value creation: We calculated the average score of the elements of the business model that belong to this dimension: Key Activities, Key Partnerships, Key Resources. We rounded the score to identify the bands.

Value Capture: We calculated the average score of business model elements belonging to this dimension: Revenue streams, Cost structure. We rounded the score to identify the bands.

Financing: We created a dummy variable for the first question concerning the actual seeking of funding by outsiders. The second dummy variable depends on the answer given in the first question. In particular, if respondents stated that they had sought funding, they had to answer whether they had received funding. The impact of external financiers on the company's business model was asked if the second dummy was positive.

Zone of Italy: We identified 4 macro-areas thanks to the NUTS code: North-West, North-East, Centre, and South.

Industry: we divided the responding companies according to the industry they belong to. 3 industries, in particular, emerged from the sample: *Manufacturing activities, Information and Communication Services, Professional scientific and technical activities*. all those not belonging to these 3 industries have been collected under the category *Other*.

Firm size: Taking into consideration the classification provided by the European Union (see Table 9) we divided companies into three categories: *Medium-sized enterprise, small enterprise, Microenterprise.* The breakdown by enterprise size is skewed towards micro-enterprises. We have therefore decided not to analyze this data.

EMPIRICAL RESULTS

In this chapter, we will report the empirical results of the research process. As a first step, we will describe the composition of our sample. Next, we will empirically analyze how our sample reacted in response to Covid-19 by modifying their business model. We also decided to consider the impact of external financing that the interviewed companies may or may not have received, before and after the arrival of Covid-19.

Sample of Reference

The sample of companies representing the starting point of our study on the impact of covid on business model innovation consists of 255 Italian innovative startups.

Analyzing the distribution of the companies participating in the survey in detail, we can see that most of them belong to the northwest zone (37%) since this zone includes Lombardy, which is home to most of the Italian startups. The most represented after the north-west area is the north-east area (29%). The last two areas considered, the center and the south, represent 34% of the sample, with a percentage of 20% and 14% respectively.

Results from the Survey

To show the results of the survey, sent to the target sample, dealing with:

- How much they have innovated their BM in response to Covid-19,
- How much they have been impacted by Covid-19
- The financing landscape change before and during the Covid-19 crisis.

The results will be presented considering first the more general variables of business model innovation depth and breadth. Then we drill down considering the four dimensions, identified in the methodology, concerning the business model: *Value Proposition, Value Creation, Value Delivery* and *Value Capture*.

BMI DEPTH

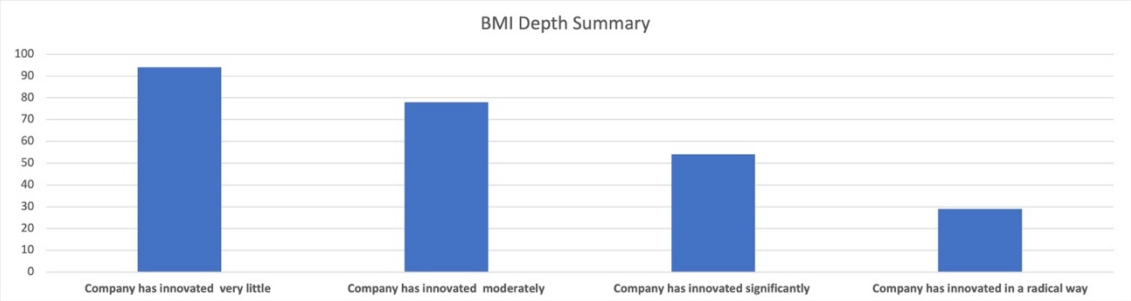


Figure 6: BMI Depth summary

Considering BMI depth in companies the first two bands of innovation together account for 68% of the sample and at a significant level include all companies that reported low or no innovation. The remaining 32% of the sample is divided over the two bands identifying a medium and high level of innovation. There is a thinning in terms of the population of the bands that is directly proportional to the increase in the level of innovation declared.

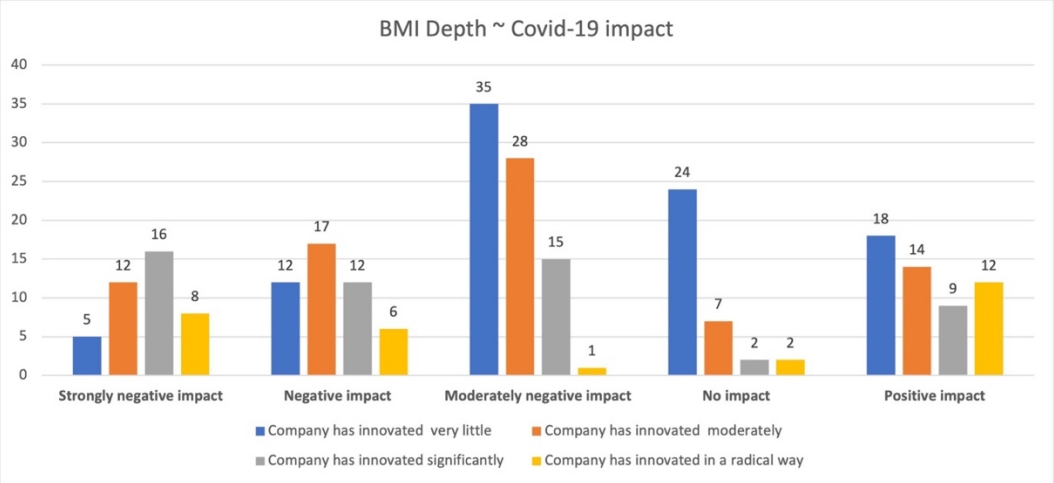


Figure 7: BMI Depth ~ Covid-19 Impact

Considering the impact of Covid-19 concerning BMI depth there is no evidence in the first two bands of impact. The distribution is decidedly skewed to the right regarding moderately negative impact companies (just 1% innovated radically). Companies that stated that they were not impacted by the crisis caused by Covid-19 mostly fall in the low innovation band, more than 50%.

BMI BREADTH

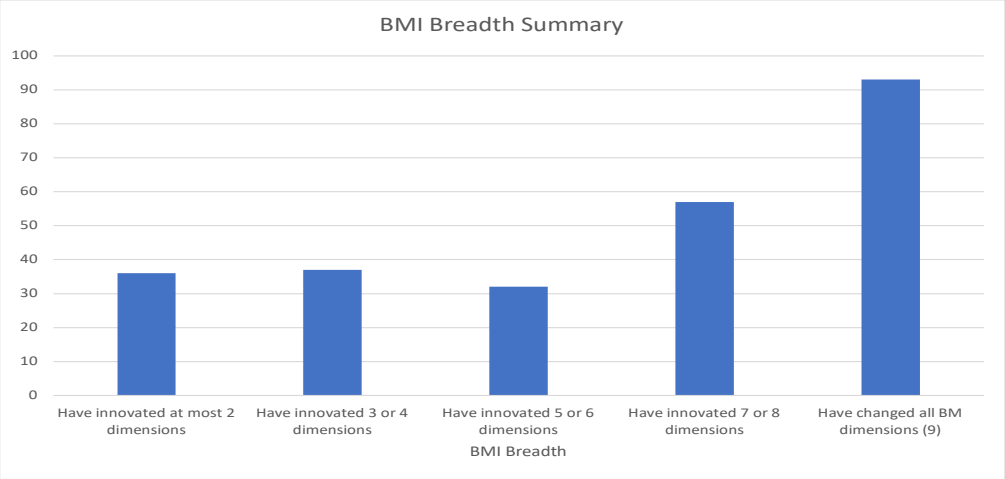


Figure 8: BMI Breadth summary

Considering the number of the dimensions of the BM changed by the companies, the majority declared to have modified all nine dimensions of the business model. Moreover, 71% of companies have changed more than half of the business model dimensions indicated in the survey. The remaining companies in the survey are very similar, with 14% having changed a maximum of two elements and 15% having changed three to four blocks of the business model.

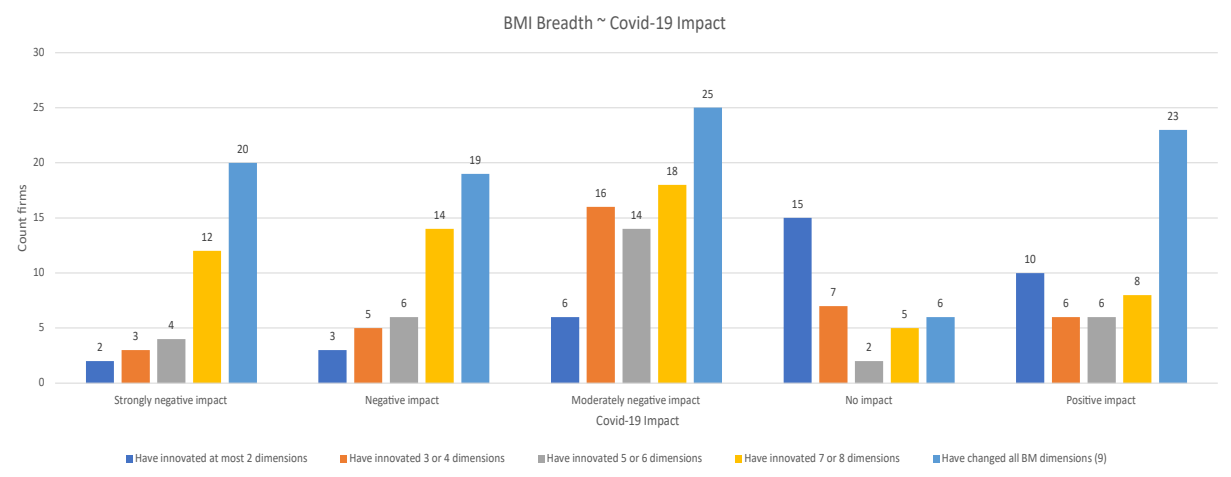


Figure 9: BMI Breadth ~ Covid-19 impact

With regards to BMI breadth and Covid-19 impact bands, the first two are skewed towards the right, 78% in the first one and 70% in the second band have changed more than 7 dimensions. More than half (62 %) of the companies that hadn't perceived impact

from Covid-19 have changed less than half of the dimensions of the business model. Contrary to the positive impact band the vast majority stated that they had innovated all elements of the business model (43%).

Value dimensions

In the following paragraphs, we will analyze how the companies have innovated the different dimensions of the Business Model.

Value proposition

The distribution in the various value proposition bands is more concentrated in the low innovation band 30% of the respondents declared that they have not changed their value proposition. Most of the companies that had been impacted by the Covid-19 either "strongly negative" or "only negative", have drastically changed their value proposition, in both cases around 40% of the bands. A common trend can be noted between the moderately negative and zero impact bands firms within these segments did not change their value proposition: almost 80% in both bands are concentrated in the first two scores.

Value Delivery

Considering the Value Delivery innovation, 15% of the sample did not change dimension. Most companies had made minor changes. In contrast, few respondents had made drastic changes to their value delivery, with only 20% reporting a score of 4 or 5. Companies that have been "strongly negative impacted" and "negatively impacted", have changed their value delivery, just 10% of the first one and 2% of the second one did not modify it. On the other hand in the "moderately negative impact" and "no impact" bands just a few companies had innovated consistently (score 4 or 5): 9% in the first one and 5% in the latter one.

Value Creation

Companies that have not modified the dimension represents 26% of the sample. Bands in scores 1 and 2 have an equal percentage (21%), similar to the bands of 3 and 4, with a percentage of 15% and 11% respectively. Lastly, the drastic innovation bands are represented by few companies (4%). With regards to the "strongly negative impact" segment, companies are concentrated on the intermediate value creation scores, more than

50% of the belonging firms. On the other hand, companies that have been moderately negatively impacted, have reported a lower innovation in the dimension, 70% is concentrated on lower innovation score (0 or 1). Is different from the situation regarding non-impacted companies, the vast majority has not changed the dimension (60%).

Value Capture

Regarding this dimension, results show that companies have mostly innovated very little (around 45%), just 6.7%, declared to have innovated drastically. The distribution of companies on the other innovation score is similar (15% to 20%). Considering the "strongly negative impact" and the "negative impact" few companies have not changed their value capture dimension, 5% in the first one, 8% in the second one. It's relevant how in the moderately impact and no impact bands there are 0 companies, in both cases, that have drastically changed the dimension, even in the positively impacted companies the major part has not changed the dimension.

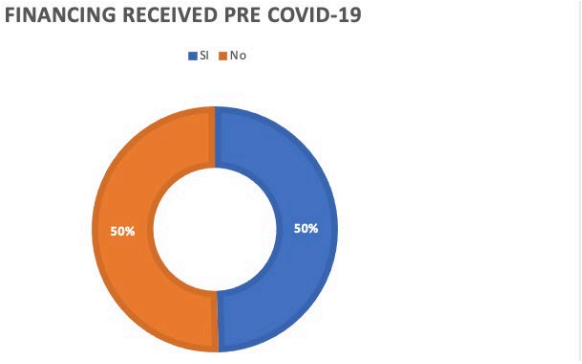
Financing in Startups

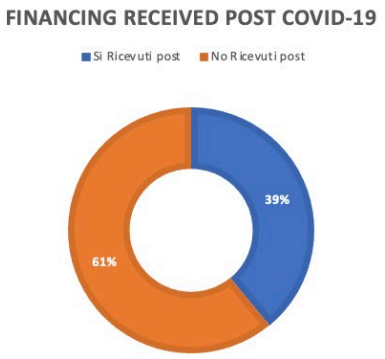
To analyze the financing landscape we subdivided the companies according to the binary variables of seeking funding, the binary variable of receiving funding, and the eventual impact of external investors. All these measures are considered before the Covid-19 pandemic and from the start of it.

Figure 18: Financing research graphs

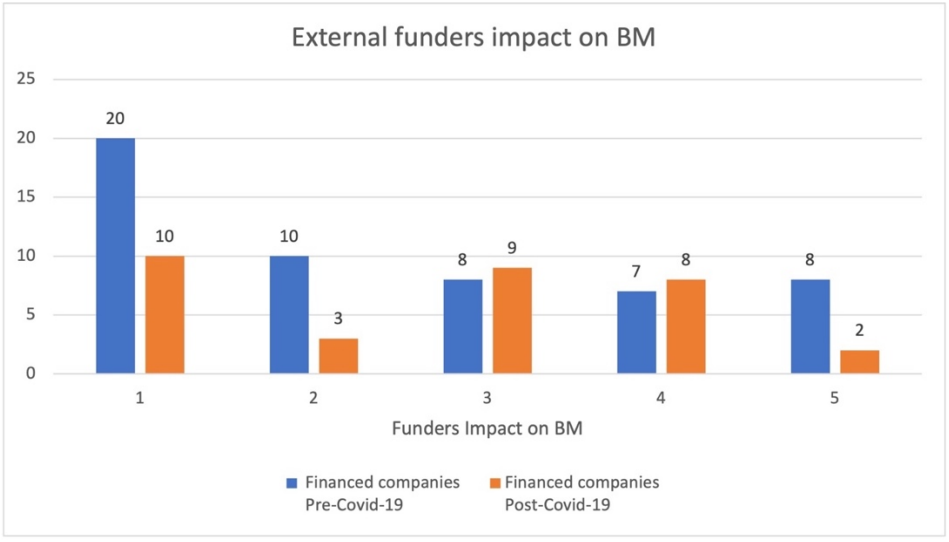
Out of the total sample, the majority have never sought equity finance (58%). In contrast, 42% have sought funding since the start of their business. Since the start of the pandemic, 32% of companies have sought funding, and 68% have not sought funding. Companies

that have not applied for finance have increased by 17. On the other hand, the number of companies that applied for financing decreased by 23%.





Concerning the 107 companies that sought funding, 53 did not receive investments and 53 received it. . In contrast, the 82 companies that sought funding after the arrival of the pandemic, are distributed differently with 61% not receiving funding and 39% receiving funding.



Of the 53 companies that received funding before the start of the pandemic, 37%, the majority, stated that their BM was influenced very little by external funders. The remaining 63% were evenly distributed across all ranges of influence on the BM from funders. Considering instead the companies that have received funding since February 2020, the band with the highest representation of influence on the BM is still the one corresponding to a very slight influence (31%), only a few companies declared to have received consistent help from investors.

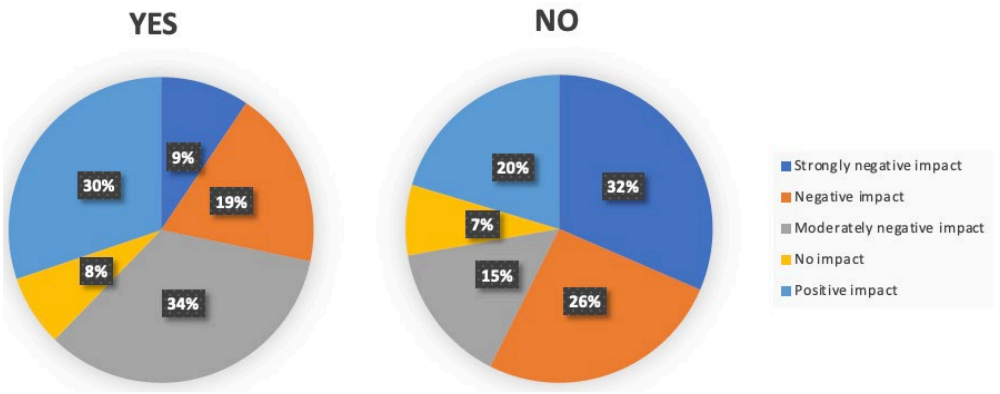


Figure 21: Financing received (Yes/No) before Covid ~ Covid-19 impact

Considering companies that have received financing before Covid-19, the majority stated that they were moderately negatively impacted (34%). 30% of these companies were positively affected by Covid-19. On the contrary, the companies that have not received investments reported a strong negative impact in the majority of cases more than 50% had a critical impact during the crisis.

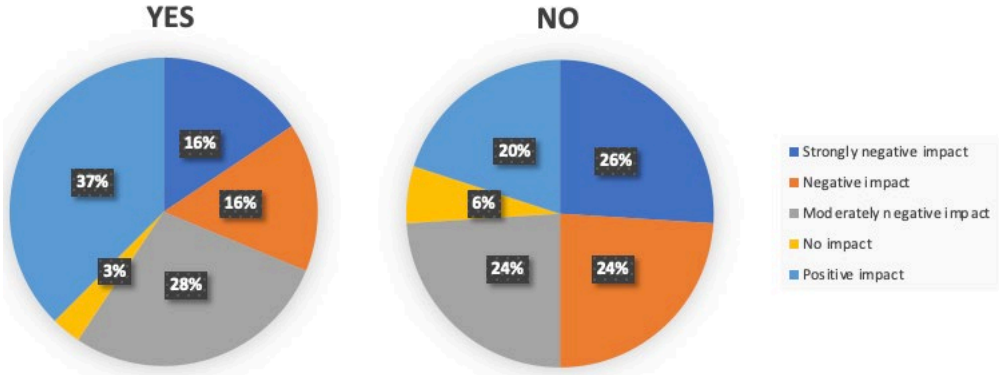


Figure 22: Financing received (Yes/No) during Covid ~ Covid-19 impact

Looking at the companies that have sought and received funding since February 2020, 37% of these have had a positive impact on business due to the pandemic. In contrast, 32% declared that they had been negatively or strongly negatively impacted. The situation is different for firms that have sought, but not received, external funding: bands are between 20% and 26%, except per the "no impact" band (6%).

Sector divisions

Considering the 4 sectors of the sample: Communication services, Manufacturing activities, Professional activities, and others, the BMI depth is similar in all of them. In particular, the companies that have innovated very little are always in the majority (from 35% to 40%) and the companies that have innovated radically are always in the minority (from 6% to 15%). The distribution of BMI breadth is opposite to the previous one with the companies that have innovated more than 7 elements that are always more than 50%, but there is still no substantial difference between sectors.

DISCUSSION

As introduced in the Methodology chapter, we clustered the company to analyze if the shock has prompted the Innovation on business models between the companies.

In this chapter, we will firstly present a general overview of the BMI measure and then discuss each of the impact of the Covid-19 band by describing them according to all the characterizing variables previously introduced in the Methodology chapter, to provide a comprehensive picture of the different clusters of firms in terms of the Business model innovation components**.**

BMI General Summary

We analyzed the more general measure of BMI Depth and breadth then we will go more in deep analyzing the 4 dimensions of the BMI.

- Depth: Companies have not carried out major innovations, but have simply made adaptations, to comply with restrictive regulations imposed by the government because of the virus
- *Breadth:* The trend is opposite to the depth one, the peak is on the highest Breadth Innovation band (9 elements of BM modified). (Fig. 8)

Looking at the Depth and Breadth innovation graphs together and comparing them, is noticeable how most companies have adapted their Business Model more than drastically innovate it. Companies are more likely to engage in Business Model Adaptation the more the external threat is severe (Foss and Saebi, 2017).

- *Value proposition:* value proposition has undergone adjustments in response to the external shock. A large part of the sample has limited itself to keeping the value proposition unchanged, in line with the threat rigidity theory companies have not changed the value proposition as it is a dimension that requires more effort and has a higher uncertainty of success (Chattopadhyay et al., 2001; Staw et al., 1981).
- *Value delivery:* companies due to Covid-19 have changed mainly their sales channels rather than their target segment. Again in line with threat-rigidity,

companies have modified elements on which they exert more control (Chattopadhyay et al., 2001).

- *Value Creation:* few companies varied this dimension, since companies that have activities, resources and partnerships that work, in a moment of crisis rely on well-learned response behaviors (Dutton & Jackson, 1987).

- *Value capture:* In response to the first impact with an external factor such as Covid-19, companies try as a first step to act on costs, reducing variable waste and unnecessary expenses. The threat-rigidity theory thus finds that firms confronted with external threats are more likely to respond with caution and more controllable elements (Staw et al., 1981).

Covid-19 Impacts Clustering

We clustered the participants according to their answers in the survey relative to the question about the impact they have suffered because of the Covid-19 crisis.

Strongly Negative Impact

Companies in this segment, since their survival is threatened, have adapted their business model by resigning and allocating progressively fewer resources (Lehner, 2000; March & Shapira, 1987). These companies reacted with a risk-seeking behavior in response to threats as opposed to opportunities (Dutton, Jackson, 1987) companies in this segment have an average of innovation that tends to score of innovation around 3 or 4.

This type of reaction from the companies that declared they have been impacted in a strongly negative way is in line with the prospect theory, which suggests that in the face of external threats, managers are more inclined towards risky behavior.

Negative Impact and Moderately negative impact

These two segments present similar behaviors of innovation, interpreting Covid-19 as a threat. In fact, because of restriction in information, constriction in control, and conservation of resources," the organizations "exhibit rigidity, or inability to act and/or do something new in the face of economic adversity" (Shimizu, 2007), these companies mostly adapt their Business model without making massive innovations. Companies responded with caution, exhibit an inward-looking tendency, and fall back on known and

routinized patterns of actions (Chattopadhyay et al., 2001; Shimizu, 2007) trying to align their businesses with the restrictions imposed by the government.

No Impact

Companies in this band have just adjusted their business model. Firms "not being affected" by the crisis were significantly less likely to adapt their business models because their perception of an opportunity is not significantly related to business model adaptation. This is in line with prospect theory, predicting that firms facing favorable conditions are more risk-averse as they have more to lose than to gain (Foss and Saebi 2017). Business model adaptation, in this case, is perceived as a risky operation because uncertainty is too much higher compared to the obtainable gain.

Positive Impact

In this segment, companies do not present a common behavior. In a period of crisis, events can both be perceived as an opportunity or a threat, the propensity to recognize an event as one or the other can enable business model adaptation (Foss and Saebi, 2017). Depending on the orientation of the companies they might have perceived Covid-19 as a threat or an opportunity. Some studies predicted that business model adaptation is likely to happen under conditions of an external threat (e.g. De Reuver et al., 2009; Voelpel et al., 2004), others pointed towards the importance of perceived opportunities as a catalyst for business model adaptation (e.g., Pateli and Giaglis, 2005; Sabatier et al., 2012). In this brand, we recognize both of these two behaviors.

Financing Before and During Covid-19

We considered how the different companies that did or did not seek funding and then whether they received it spread out before and after the onset of the crisis due to Covid-19. The number of financing researched is increased by 10% but on the other hand, the investments received decreased. Access to financing became more difficult for companies, in line with the findings of OECD in 2009, which analyzed the global crisis impact on financing.

Researchers suggest that some SME owners or managers may choose not to use equity as a source of financing to avoid any undesirable changes in the ownership of their firm (Reid, 1996). This can explain part of the companies that have not sought any financing.

The vast majority of companies that received funding from February 2020 onwards stated that they were positively impacted by Covid-19, advanced by reducing cash outflow to the minimum and having long-term financing in the form of interest and using it as a quality signal (Ou & Haynes, 2006). Lenders are more likely to decide to invest money in a company that is already doing well.

Work sectors, BMI Depth and Breadth Innovation

Looking at the categories of Depth innovation divided by business areas, we can roughly observe how much a sector has been more prone to a certain type of innovation. The type of business, in this case, is relevant because it can determine decisively the survival of a startup or SME to the restrictions created to cope with the pandemic. Considering Depth innovation in detail, there are no particular sectoral trends or imbalances, the percentages of Depth innovation are approximately the same for each sector.

Even the sectors, displayed according to the categorization of depth innovation, do not show great peculiarities. More or less the percentage with which the level of innovation is distributed within each cluster is the same for each occupational sector.

CONCLUSION

Main Findings

One of the main findings of our research is the analysis of the startups in terms of BMI. We defined a framework to measures the BMI in the startups through the use of a survey and integrating data from other datasets, based on a comprehensive literature review of the main building dimensions identified and presented by several influential academics in their research and studies on the business model concept over the years.

We defined Covid-19 as a hybrid shock, capable of incorporating the peculiarities of exogenous shocks and the economic repercussions of endogenous shocks. This definition was made after the analysis of definitions concerning exogenous and endogenous shock.

Based on the data collected from the 255 startups that participated in the survey, we were able to create a segmentation using the impact that Covid-19 had on the companies' innovation process as a discriminant variable. We analyzed how companies have reacted to the crisis brought by Covid-19 according to the literature review made, with a focus on the rigidity and prospect theory. In so doing, this study proposes that both the threat rigidity thesis and prospect theory are valid in organizational settings.

Research Limitations

The clustering we made based on the impact of Covid-19 is subjective since it depends on the respondents' interpretation of the question.

We identified these limitations regarding our research:

- All questions related to the innovation of the Business Model are subjective and can be influenced by the starting point of the company and the interpretation of innovation itself.
- The questionnaire was presented to companies starting in February 2021 one year after the beginning of the crisis, but while the crisis was still ongoing, without a clear indication of when the end is. This does not allow for a clear vision of the crisis and there is the possibility that the full effects have not yet been perceived.
- Our sample is limited to only one particular type of company (startups and SMEs) and is also focused on a small number of industries.

- The research lacks links to business-related economic performance variables and financial data related to the year 2020.

Future research directions

Considering the limitations that we have previously exposed, we considered these possible future research directions.

It will be essential to integrate the financial and economic variables, when available within the database to analyze comparison between the period of normality before Covid-19 and since the beginning of the crisis and have a clear comprehension of the impact on the performance not only on BMI.

Besides, to avoid that the measures concerning innovation suffer too much a subjectivity bias, it would be interesting to introduce a measure of entrepreneurial orientation.

When the crisis brought by Covid-19 will be over, it will be possible to have a more comprehensive view of the shock, analyzing its impact in a more precise way, with fewer biases regarding the moment of crisis that not only the economy is experiencing, but also the people themselves.

Contributions

Our main results are primarily aimed at all investors, managers, and operators of start-ups or SMEs, being able to draw information on how companies respond to a critical event of this magnitude. Besides, professionals can identify themselves in one of the segments identified through the impact generated by Covid-19, to understand how similar companies have reacted to the crisis.

Our research can be useful to researchers, who will be able to take advantage of our database and our empirical results to develop their studies to produce different models and analyses.

We analyzed two of the most important theories regarding the reaction of companies in a period of crises: prospect theory and threat-rigidity finding match for both. These two theories do not seem to be mutually exclusive.

Finally, with the definition of Hybrid Shock, we tried to provide a new definition of shock that could be useful in the future to define events of similar magnitude, or it could be a useful yardstick to develop further reasoning on the subject.

INTRODUCTION

In this section, we will go through a comprehensive introduction of the main topics of the thesis, in order to show their relevance and finally present the purpose of the research and its specific objectives. In particular, we will start with a brief overview of startups and SMEs at a national level, followed by a focus on Covid-19, and then consider some data on financing in Italy. We will also expose where our research wants to fit in the current literatures. To conclude an overview of the research structure.

Italian Startups: General Overview

The aim of this study is to analyze how the Italian entrepreneurial ecosystem has reacted to the Covid-19 crisis, focusing on startups considered innovative and technological.

Since the introduction of the *Decreto Crescita 2.0* in 2012, the Italian startup ecosystem has performed a constant growth. In particular, the national startup ecosystem has achieved good results in terms of aggregate number of ventures, investment raised, and employment. The status of innovative startup can be obtained by corporations established for less than five years, with annual turnover less than five million euros, unlisted, and in possession of certain indicators relating to technological innovation provided for by the national legislation.

In particular, at the time we are writing our research we can consider that: the number of innovative startups registered in the special section of the Register of Companies is 10,882, an increase compared to the previous year. The total share capital subscribed by the startups is growing, now standing at 583.2 million euros and also the workforce has increased compared to previous periods and the total number of partners and employees involved in the startups reaches 61,820. (Ministero Dello Sviluppo Economico, 2020)

In the Italian market (2019), investments in hi-tech startups amount to 694 million euros, still far from the values of other European countries (Report 2019 Dealroom-Atomic, speaks of the United Kingdom over $ 11 billion, 5.8 billion Germany, France 4.7 billion, Spain 1.3 billion, Switzerland 1.7 billion), but with a growing trend.

Investments from formal actors are 215 million in 2019. Remain investments from informal actors are the first source of funding (36%).

Therefore, in a situation of development, we want to analyze how this type of company has reacted in terms of innovation to a shock like the one brought by the Covid-19 virus.

Covid-19 In Italy

The first case of Covid-19 in Italy was recorded on February 20, 2020, from the following month the situation in the Italian state began to worsen, in particular the first restrictions have begun until resulting in a nationwide lockdown on March 9, 2020.

At an economic level these were the main steps caused by the crisis in Italy:

- In the first half of 2020, GDP fell by -12% compared to the same period in 2019;
- According to ISTAT, the turnover of industries in 2020 ended with a decline of -11.5% compared to 2019, the worst result since 2009;
- By April 2020, industrial production was down more than -40% from the beginning of the year;

In such a period of environmental turbulence we think is necessary to understand what is the economic impact that the companies considered has suffered and how they had tried to react.

The Aim of The Thesis

Relevance and importance

Our research is positioned in the field of studies concerning the Business Model, in particular Business Model innovation in relation to an external shock that causes environmental turbulence. Trying to enrich a concept, such the one of business model innovation, which to date is not well defined and clear.

Many studies have analyzed in this historical period how Covid-19 has impacted the economic system. Our research focuses more on startups and SMEs that are the type of companies usually most affected by these types of crisis.

Our research aims to make a targeted analysis of the type of shock that companies are facing, starting from the basis of this and going to compare it with past shocks, trying to identify specific characteristics.

Then we will create a structured database with data taken directly from the startups involved, trying to create a starting point that can be useful for any future research on the topic of shocks and in particular on Covid-19. We have to consider that since our research started and ended during the crisis period, we have the possibility to collect specific data different from those that will be collected in the future.

Our research focuses specifically on Italian innovative start-ups and SMEs. We decided not to consider other (i.e. incumbent) or similar working realities outside the national scene, because of the difference the government impact has on these kind of companies during this situation.

The research focuses on 2020, during the time of the pandemic, when government restrictions were in place throughout Italy, and the virus created a huge shock that had repercussions throughout the country not only on an economic level.

In particular, we focused on asking startup managers and founders how they had innovated their business model as a response to that shock.

We also decided to analyze the funding landscape of Italian startups, considering two different periods from the birth to February 2020 and afterwards, asking founders and managers if they had sought and received funding.

Analyzing the literature, we decided to approach the topic with two main purposes:

Analyze how the Business model of the Italian Startups changed because of Covid-19 impact and how the companies have tried to face such an environmental turbulence. In this economic setting, we also tried to study the possible changes in the financing landscape for small and medium-sized enterprises and startups. Through our empirical analysis we discovered interesting insights about the type of innovation companies achieved and how companies that have sought and received financing reacted to the crisis

In order to answer these questions, we have sent a questionnaire directly to the companies involved. After defining the structure of the business model, identifying all the dimensions that characterize it, we tried to understand through the use of a that questionnaire how many changes had been made to it and how radical these changes were.

Another very important objective is to gather information to understand whether certain variables, such as geographic distribution, professional sector and availability of funding, can significantly influence the levels of innovation brought to the business model.

Structure Overview

In this section we will briefly show how our research is structured:

Literature review: a literature review regarding business model, business model innovation, the relationship between SMEs and startups with shocks and finally funding in startups and SMEs.

Methodology: We have defined the empirical settings in which our research is based. Given a definition of the shock created by Covid-19. We will show how we collected the contacts to send the questionnaire and how the measures that will be used for the empirical analysis are structured.

Empirical results: Overview of what are the results obtained from data collected through the survey, crossing innovation data with data of crisis impact, showing the graphs and considering the distributions and trends.

Discussion: In this chapter we will present the assumptions and hypotheses we have made about the empirical results, dividing the companies by crisis impact bands in order to

analyze how they have innovated in response to the crisis. We will also analyze the main changes in the financing landscape.

Conclusion: in the last paragraph we will show our main findings, how we contributed to the literature, limitations and possible directions for future research.

LITERATURE REVIEW

In order to make an accurate analysis of the literature concerning business model innovation, it is essential to start from the beginning of this topic, the business model itself.

The business model is considered fundamental by both academics and companies, new and established ones. The term is often used as a buzzword, it is important to briefly analyze the evolution of the concept through the years.

Scholar had identified the internet spread and the dot.com bubble as the period in which the business model gathered importance turning into one of the most used buzzwords (Magretta, 2002). Zott, Amit & Massa (2011) stated that:" The business model concept became prevalent with the advent of the Internet in the mid-1990s, and it has been gathering momentum since then". This is mainly because companies had to reconceptualize and adapt their companies to the moment (Zott et al., 2011; Massa and Tucci, 2013; Casadesus- Masanell and Ricart, 2010). As Teece (2010, p. 172) notes "whenever a business enterprise is established, it either explicitly or implicitly employs a particular business model". Business model represent the core and distinctive aspect of companies.

In the following years, academics dealing with the topic have tried to describe the business model considering its components, building elements and the relations between them, giving an interpretation of the concept as a combination of multiple and intertwined elements. This multidimensional approach is the most adopted by the scholars (Morris et al. 2005; Osterwalder et al. 2005; Zott et al. 2011), they attempt to categorize business models along with typical and generic instances, that could be ultimately applied to different firms (Cortimiglia et al. 2016). Despite the vast number of studies that have been conducted on the business model, there is no homogeneity in the literature, since proposed definitions and descriptions of the concept usually turn out to be strongly connected and influenced by authors fields of work (Linder and Cantrell, 2000). At a general level, the business model has been referred to as *a statement* (Stewart & Zhao, 2000), *a description* (Applegate, 2000; Weill & Vitale, 2001), *a representation* (Morris, Schindehutte, & Allen, 2005; Shafer, Smith, & Linder, 2005), *an architecture* (Dubosson-Torbay,

Osterwalder, & Pigneur, 2002; Timmers, 1998), *a conceptual tool or model* (George & Bock, 2009; Osterwalder, 2004; Osterwalder, Pigneur, & Tucci, 2005), *a structural template* (Amit & Zott, 2001), a *method* (Afuah & Tucci, 2001), *a framework* (Afuah, 2004), *a pattern* (Brousseau & Penard, 2006), *and a set* (Seelos & Mair, 2007). (Zott, Amit & Massa, 2011).

In the next section of this chapter, we will present definitions of the business model to clarify the concept and see how it has evolved during the years. It is important that we make such a discussion to better understand further on our study the related concept of Business model innovation.

Business Model: Concept and Definitions

Researchers have given different definitions of business models over the years:

Timmers (1998) define the business model as: "an architecture for the product, service and information flows, including a description of the various business actors and their roles; a description of the potential benefits for the various business actors; and a description of the sources of revenues".

Magretta (2002) analyzing the considerations made by Peter Drucker, says that the business model are: "at heart, stories – stories that explain how enterprises work. A good business model answers Peter Drucker's age-old questions: Who is the customer? And what does the customer value? It also answers the fundamental questions every manager must ask: How do we make money in this business? What is the underlying economic logic that explains how we can deliver value to customers at an appropriate cost?".

Morris et al. (2005) provided a definition of business model as a "concise representation of how an interrelated set of decision variables in the areas of venture strategy, architecture, and economics are addressed to create sustainable competitive advantage in defined markets"

Casadesus-Masanell and Ricart (2010) in their literature review, define the business model as: "the particular set of choices an organization makes about policies, assets and governance – and their associated consequences – are the organization's business model,

because they determine the logic of the firm, the way it operates and how it creates value for its stakeholders".

Osterwalder and Pigneur (2010) created the famous Business model Canvas, defining the business model as: "blueprint for a strategy to be implemented through organization structures, processes and systems".

A more recent definition of the term is the one proposed by Cortimiglia, Ghezzi and Frank (2016): "a business model is a unit of analysis that explains, from a system-level perspective, how activities conducted by a firm and external stakeholder create, deliver, and appropriate value".

Even without homogeneity there are some general considerations that are widespread and accepted by the academics:

- Business model is a combination of different design dimension and building blocks, not a model for revenue and cost (Osterwalder, 2004; Morris et al., 2005; Ballon, 2007; Johnson et al., 2008; Amit and Zott, 2009);
- Value, considered as what companies have to deliver to customers, is at the core of the business model and value capture is the second core concept of the business model, companies need to make profit out of their customers;
- Business model and Company strategy are related: the business model is a useful tool to translate the directions given by business strategy in guidelines for the execution of it.

Main Dimension and Components

It is important, having set out the most important definitions of business models in the literature, to consider which components of the BM are most used by academics in their frameworks and how they have interpreted the business model concept. Many authors over the years have tried to develop a classification of the business model based on the different elements that constitute it (Morris et al. 2005; Osterwalder et al. 2005; Zott et al. 2011), referring to the concept of the business model as a combination of different design dimensions and building blocks. (Yu, 2001; Hedman and Calling, 2003; Osterwalder, 2004; Morris et al., 2005; Ballon, 2007; Johnson et al., 2008; Amit and Zott, 2009).

There are some common dimensions of the business model that emerge from the literature. By crossing studies and research of different authors and by taking into account a reasonable number of publications, including articles, books, and book chapters in the business press and scientific journals, we will provide a classification of the most diffuse and adopted building components of the various business model frameworks of the literature. (i.e. Timmers, 1998; Afuah & Tucci, 2001; Chesbrough & Rosenbloom, 2002; Osterwalder, 2005; Shafer, 2005; Clauss, 2017; Johnson, 2008; Osterwalder & Pigneur, 2010; Afuah, 2014;). We identified four main dimension that repeats through the literature: *Value Proposition, Value Creation, Value Capture, Value Delivery.*

Value Proposition

The value proposition dimension contains a portfolio of solutions for customers (Morris et al., 2005; Johnson et al., 2008). Value proposition is one of the most widely used building blocks shared by all academics defined as: "an overall view of a company's bundle of products and services". (Osterwalder 2005). It appears in the definition of many important academics, for example: Chesbrough and Rosenbloom (2002), Moingeon and Lehmann-Ortega (2010), Osterwalder and Pigneur (2010), Teece (2010), and Yunus et al. (2010).

Value Creation

The value creation domain defines how and by what means firms create value along the value chain using the resources and capabilities of intra and interorganizational processes (Achtenhagen et al., 2013). According to Matzler et al. (2013) "here the key question is about core competencies and the value creation that can be achieved along the process". Value creation is seen as the ability to create value for the customers through the processes, the network and the resources of the company. Quoting Zott (2011) the value is created "in concert by a firm and a plethora of partners, for multiple users", so we can state that the appropriate unit of analysis for scholars must go beyond firms' and industries' boundaries. (Amit and Zott, 2001).

Value Capture

Value capture defines how value propositions are converted into revenues. It defines how firms gain revenues that cover cost and achieve profits that ensure sustainable performance (Johnson et al., 2008; Teece, 2010; Baden-Fuller and Haefliger, 2013).

The value capture includes often the financial part of the business: the revenue sources and the cost structures, considered as a unique element or separated. Academics refer to the two dimensions as: Pricing and revenue model (Linder and Cantrell 2000; Petrovic et al. 2001), Revenue streams (Osterwalder and Pigneur 2010), Value capture (Shafer et al. 2005; Richardson 2008; Teece 2010) and Cost structure (Afuah and Tucci, 2001; Osterwalder and Pigneur 2010).

Value Delivery

A fourth dimension that includes the elements that are often considered along with the value proposition. These elements are those that concern the customer interface such as: channels, target markets, relationships. Presented by many authors in their the business model frameworks (i.e. Johnson, 2008; Osterwalder and Pigneur, 2010; Shafer, 2005; Teece, 2010).

Some publications include in the business model even the *external factors* (i.e technology, economics, legal issues, environmental turbulence) (Voelpel et al., 2004). Other studies include *strategy* into the conceptualization of the business model (i.e. Chesbrough, 2010; Afuah, 2014). The largest part of the recent studies consider strategy and the business model as two distinct dimensions and should be considered separately (Zott and Amit, 2008; Casadesus-Masanell and Ricart, 2010; DaSilva and Trkman, 2013).

Business model innovation

Currently, there is a growing awareness that BMs can also be the object of innovation themselves (Chesbrough, 2010; Demil and Lecocq, 2010) and the concept of Business model innovation, has gathered importance in recent years (Spieth, Schneckenberg, & Ricart 2014; Zott, Amit & Massa, 2011). The BMI literature is a recent outgrowth of the BM literature. Although the notion that BMs can be innovated dates back to at least Mitchell and Coles (2003), it is only relatively recently that this insight has become more than an afterthought (Zott et al., 2011). Despite much practitioner and scholarly interest in BMI, the literature exhibits many of the characteristics of an emerging research stream, notably a lack of construct clarity (Suddaby, 2010).

Studies on the topic revolve around two main themes: BM design (entrepreneurs creating new BMs from scratch) and BM development (managers improving existing BMs) (Zott and Amit, 2010; Schneider and Spieth, 2013; Ghezzi et al., 2014).

BMI that results in the design of new BMs is related to both technology management literature dealing with innovation commercialization (Chesbrough and Rosenbloom, 2002) and entrepreneurship literature (Zott and Amit, 2007; Doganova and Eyquem-Renault, 2009; Trimi and Berbegal-Mirabent, 2012).

BMI to improve existing BMs tends to be related to strategic management literature (Schneider and Spieth, 2013; Ghezzi et al., 2014).

As it is highly dependent on environmental factors, a BM has to be constantly revisited, and if necessary innovated in order to keep it viable, competitive, and hard to imitate (Samavi et al., 2009; Chesbrough, 2010; Teece, 2010).

We report in table 1 the most important definitions of Business model innovation.

Business Model Innovation main definitions		
Author(s)	**Year**	**Definition**
Mitchell and Coles	2004	"By business model innovation, we mean business model replacements that provide product or service offerings to customers and end users that were not previously available. We also refer to the process of developing these novel replacements as business model innovation."
Markides	2006	"Business model innovation is the discovery of a fundamentally different business model in an existing business."
Santos et al.	2009	"Business model innovation is a reconfiguration of activities in the existing business model of a firm that is new to the product service market in which the firm competes."
Aspara et al.	2010	"Initiatives to create novel value by challenging existing industry- specific business models, roles and relations in certain geographical market areas."
Gambardella and McGahan	2010	"Business-model innovation occurs when a firm adopts a novel approach to commercializing its underlying assets."

Business Model Innovation main definitions		
Author(s)	**Year**	**Definition**
Yunus et al.	2010	"Business model innovation is about generating new sources of profit by finding novel value proposition/value constellation combinations."
Sorescu et al.	2011	"As a change beyond current practice in one or more elements of a retailing business model (i.e., retailing format, activities, and governance) and their interdependencies, thereby modifying the retailer's organizing logic for value creation and appropriation."
Amit and Zott	2012	Innovate business model by redefining (a) content (adding new activities), (b) structure (linking activities differently), and (c) governance (changing parties that do the activities).
Bucherer et al.	2012	We define business model innovation as a process that deliberately changes the core elements of a firm and its business logic
Abdelkafi et al.	2013	"A business model innovation happens when the company modifies or improves at least one of the value dimensions."
Aspara et al.	2013	Corporate business model transformation is defined as "a change in the perceived logic of how value is

Business Model Innovation main definitions		
Author(s)	**Year**	**Definition**
		created by the corporation, when it comes to the value-creating links among the corporation's portfolio of businesses, from one point of time to another."
Berglund and Sandström	2013	"A BMI can thus be thought of as the introduction of a new business model aimed to create commercial value."
Casadesus-Masanell and Zhu	2013	"At root, business model innovation refers to the search for new logics of the firm and new ways to create and capture value for its stakeholders; it focuses primarily on finding new ways to generate revenues and define value propositions for customers, suppliers, and partners."
Khanagha et al.	2014	"Business model innovation activities can range from incremental changes in individual components of business models, extension of the existing business model, introduction of parallel business models, right through to disruption of the business model, which may potentially entail replacing the existing model with a fundamentally different one."

Business Model Innovation main definitions		
Author(s)	**Year**	**Definition**
Foss and Saebi	2015	business model innovation may be defined as a realignment of activities, relations, routines, and contracts which results in a new configuration of how the firm creates and captures value that is the new to the product/service market in which the firm competes
Bouwman et al.	2016	“a change in company's BM that is new to the firm and results in observable changes in the firm's practices towards its customers and partners”
Heikkilä & Heikkilä	2017	“notable changes in the logic how an organization creates, delivers, and captures value”

Table 1: Business Model Innovation main definitions

Business Model Innovation: Research streams

The two main themes of business model innovation, BM design and BM development, have been analyzed by researcher more in detail and led to the identification of four research streams, whom are listed below:

1. ***Conceptualizing Business model innovation***: The first stream highlights the phenomenon itself, offering definitions and conceptualizations of BMI (e.g., Amit & Zott, 2012; Santos, Spector, & Van der Heyden, 2009; Teece, 2010). Thus, it focuses on such issues as the minimum meaningful definition of "business model innovation" and the dimensions along which companies can innovate the BM (e.g., Amit & Zott, 2012; Santos et al., 2009; Sorescua, Frambach, Singh, Rangaswamy, & Bridges, 2011). The main objective of the stream is to develop a framework in order to measure the level of innovativeness of the business model calculated *ex-post* the processes of innovation, or alternatively use it as a possible start for companies to plan their BMI in a simple and intuitive way, similar to what has been done with the by many authors for the Business model. Since there is not a common definition of both BM and BMI is difficult to create a framework with dimensions accepted by academics. Researchers usually start from a model and then modify it to better fit their work, based on their own needs.
2. ***BMI as an Organizational Change Process***: This stream emphasizes the capabilities, leadership, and learning mechanisms that are needed for successful BMI (Foss and Saebi, 2016). Academics following this stream try to highlight the different stages of the BMI process (e.g., de Reuver, Bouwman, & Haaker, 2013; Frankenberger, Weiblen, Csik, & Gassmann, 2013; Girotra & Netessine, 2013,; Pynnonen, Hallikas, & Ritala, 2012), identify the capabilities and resources needed for the process (e.g., Achtenhagen et al., 2013; Demil & Lecocq, 2010; Doz & Kosonen, 2010; Dunford, Palmer, & Benviste, 2010), emphasize the importance of both experimentation and learning (e.g., Andries & Debackere, 2013; Cavalcante, 2014; Eppler, Hoffmann, & Bresciani, 2011; Günzel & Holm, 2013; Moingeon & Lehmann-Ortega, 2010; Sosna, Trevinyo-Rodriguez & Velamuri, 2010), propose tools and framework to better plan and manage the BMI process (e.g., Deshler & Smith, 2011; Evans & Johnson, 2013).

This stream is more focused on developing a framework that can be helpful for companies to plan and follow the BMI process during its phases.

3. ***BMI as an outcome****:* This stream focuses on the outcome of the innovation processes, often addressing the emergence of new BMs in a particular industry, such as electric mobility (Abdelkafi, Makhotin, & Posselt, 2013), newspapers (Holm, Günzel, & Ulhøi, 2013; Karimi & Zhiping, 2016), tourism (Souto, 2015), and aviation (Schneider & Spieth, 2013). Other research in this stream examine particular Business model innovation that happened in particular economic environment or industry (i.e. low-income markets (Sánchez & Ricart; 2010), sustainable energy (Richter, 2013). The focus is more on describing Business model innovation processes that seems to be successful and replicable (Foss and Saebi, 2016).
4. ***Consequences of BMI***: The fourth stream addresses the organizational performance implications of BMI. In this stream there are researches that analyze the innovativeness and change given by a certain process carried by the company (e.g., Aspara, Hietanen, & Tikkanen, 2010; Bock et al., 2012), other works analyze the effects of different type of BMs on firm performance (e.g., Huang, Lai, Lin, & Chen, 2013; Wei, Yang, Sun, & Gu, 2014; Zott & Amit, 2007, 2008).

Two different lines of thought emerge from the streams: the second stream have a dynamic view of BMI that is seen as a process that require the company to have specific capabilities. The third and fourth streams have a more static view of the BMI that is seen as new types of innovative venture that can impact the company performance. Considering the BMI literature as a whole it does not exhibit the characteristics of a well-defined cumulative research stream (Foss and Saebi, 2016). This fact is clearly visible in the missed connection between the first and the third stream, the latter, in a cumulative research stream, should be built on the findings and conceptualization made in the first one.

In these streams, moreover, it is evident that there is a lack of analysis and emphasis on the environment in which the company is embedded and which can act as a lever for business model innovation. Particularly with regard to turbulent environments, caused by endogenous and exogenous shocks, such as the one that was created by Covid-19 or the

2008 financial crisis, in which companies have to innovate or adapt in order to survive or create competitive advantage.

BMI and Performance Relation

The measurement of firm performance is indeed one of the most critical aspects in strategic management research (e.g. Carton and Hofer, 2006; Combs et al., 2005; Richard et al., 2009), especially in relation to SMEs (Jarvis et al., 2000; Wood, 2006).

In general, business performance is defined as "the operational ability to satisfy the desires of the company's major shareholders" (Smith & Reece, 1999, p. 153) and it must be assessed to measure an organization's accomplishment.

SMEs are usually reluctant to publish their performance results in a public way, so the researchers had to resort to using subjective variables, such as Likert scale type variables to examine this feature.

There is an important relationship between performance and the business model related to the innovation of the latter, which has been analyzed in depth over the years by various scholars. In the next paragraph we will better analyze how it has been approached by the most important researchers and what have been their conclusions about it.

Scholars have acknowledged the significant role that business models play in firm performance and in generating competitive advantage (C. Zott, R. Amit, and L. Massa, 2011, H. Chesbrough, 2010). Example studies have shown that different types of BM changes can lead to improved Business performance (e.g. Giesen, 2007).

it is apparent that there is a large body of literature claiming that BM can be a source of competitive advantage (Markides and Charitou, 2004) and therefore affect firm performance (e.g. Afuah and Tucci, 2001; Aspara et al., 2010; Patzelt et al., 2008; Zott and Amit, 2007; Zott and Amit, 2008), we acknowledge that the contributions that combine the investigation of the BM as the basis for firm classification and how this affects enterprise performance, or, in other words, the influence that different types of BMs exert on firm performance, are few (e.g. DeYoung, 2005; Ordanini et al., 2004; Zott and Amit, 2008).

The relationship between BMI and business performance has been confirmed by several previous studies (i.e. Zott and Amit, 2007; Aspara, 2010; Cuculelli, 2015; Volberda, 2017).

Entrepreneurship scholars have recently stressed the importance of understanding how BM innovation interacts with other activities to affect firm performance (George and Bock 2011), in particular the dimensions of Business Model have been studied in relation with performance and innovation:

- *Value proposition innovation* helps firms to extend their product and service portfolios and address new market needs, which have been instrumental to firm performance (J. K. Han, N. Kim, and R. K. Srivastava 1998);
- *Value creation innovative* approaches provide alternative ways to strengthen firm performance since new configurations of activities/key processes and emerging new technologies/capabilities can both enable existing value propositions to produce greater economic results (i.e., more effective exploitation) and complement the new value propositions of firms (i.e., more effective exploration) (C. Heij, H. Volberda, and F. Van den Bosch 2014);
- *Value capture innovation* helps firms to realize new revenue streams, in addition to existing revenues, or to substitute the less profitable ones (C. Zott and R. Amit 2009), thus enhancing the prospect of future returns.

A recent literature review revealed 'an increasing consensus that business model innovation is key to firm performance' (Zott et al. 2011: 1033). Studies have confirmed that novelty centred BM design positively affects the performance of entrepreneurial firms (Zott and Amit 2007).

In general, besides the popular managerial literature on business model innovation strategies which claims that such strategies yield superior performance (e.g. Hamel, 1998; Kim & Mauborgne, 1999a, 2005b), there are some empirical studies which indeed report high performance returns for firms that exhibit proactive innovation orientation in their strategies (Gatignon & Xuereb, 1997; Green, Barclay, & Ryans, 1995; Wirtz et al., 2007). Such proactiveness is often characterized by strategic orientation toward exploiting emerging opportunities, experimenting with change, and mobilizing first-mover actions

(Dess, Lumpkin, & Covin, 1997; Lynn, Morone, & Paulson, 1996; Morgan & Strong, 2003). Thus, although the relationship between innovation and performance has been explored with mixed results, a majority of studies have concluded that a positive significant relationship exists between the two, with stronger evidence for the causal direction from innovation on performance (Bowen, Rostami, & Steel, 2010; Aspara et al., 2010). But due to the lack of a well-defined construct of BMI, the past literature has obtained inconsistent empirical findings regarding its effect on firm performance (George & Bock, 2011; Pedersen et al., 2018).

Considering the literature described above, it is noticeable that there is a lack of analysis in relation to conditions that are not only related to competitiveness and to markets. In these markets, the need to innovate the business model and improve companies' performances is dictated by competitors' moves or to obtain an advantage over them. There is a lack of analysis on environments that are uncertain due to exogenous or external shocks, such as the one we are experiencing today due to the Covid-19 pandemic, that force companies to innovate in order to avoid losses.

Business Model Innovation in Startups and SMEs in Response to Crises

Even though SMEs are the driving force behind the economy and de facto employ the most people (EASME, 2015), few studies have thus far focused specifically on innovation of BM at SMEs. Scopus search for "SME" and "business model innovation" produce only 90 results against the 1656 produced searching for just "business model innovation" (at the time the search was made).

Research is much more focused on established companies rather than on SMEs. And studies are mostly conducted on various industries and mostly in European countries (e.g. Bouwman et al., 2016; Marolt, 2016; Heikkilä & Heikkilä, 2017; Clauss, 2020, Myroshnychenko, 2020).

Clauss et al. (2020) argue that to have superior performance in BMI, SMEs need to configure three components of the business model: Value creation, Value proposition, and Value capture. A problem related to SMEs and startups is that are not aware that they are engaged in Business Model Innovation because they will not label themselves in this way; only a minority of SMEs are familiar with BM ontologies and with tooling (Bouwman, 2016).

A lot of past studies also argue that external factors have big impact on BMI in SMEs (Hidayat and Pangaribuan, 2020). In addition, other academic documented that disruptive changes, such as in case of exogenous shocks, interrupt equilibria making it possible for novel organizational mutations, intentional or random, to take hold (Corbo et al., 2018). By the way, considering the innovation in the whole economy, crises seem to have a negative effect on the overall innovation activity in established companies (Filippetti & Archibugi, 2011), but on the other hand Startups' activities seems to be less affected by the crises (Archibugi et al. 2013a, 2013b). In general, start-ups have been considered the key to rapid innovation in crises (Bessant et al., 2012, 2015).

Researchers that have tackled the topic agree on the fact that environmental turbulence and crises are enablers for BMI in startups and can help these companies to face problems during recession period, we will further analyze environmental turbulence in next paragraph.

Hausman & Johnston (2014) state that "innovation can significantly contribute to firm recovery from the effects of crises".

Devece (2016) define innovation activity as: "an essential driver of success throughout a recession".

Heikkilä & Heikkilä (2017) define BMI not only as a way to react to crises but also to identify possible opportunities and then react. BMI highlights reinventing a business model to exploit opportunities, it fits with opportunity recognition and can be encouraged by opportunity recognition (Chesbrough, 2010).

Opportunity recognition has a profound impact on SME performance (e.g., Gielnik et al., 2012; Tang et al., 2012). BMI contributes to SME performance in that BMI aids in SMEs taking advantage of new opportunities and coping with environmental changes (e.g., Demil and Lecocq, 2010).

However, SMEs often fail to accomplish the performance implications of opportunity recognition (Ireland et al., 2003) because opportunity recognition does not automatically lead to superior SME performance. Indeed, to achieve better performance, SMEs need to take appropriate actions to exploit recognized opportunities (Ketchen et al., 2007).

Due to the situation of Covid-19 that is currently shaking the whole world, it is important to further analyze the concept of Business model adaptation in SMEs and startups. Companies and their employee had to adapt themselves to the situation that the virus has brought (i.e. using masks, social distancing, stay at home, …) with the consequently adaptation of the business model, that has been both forced and not. In the literature most of the studies are qualitative and centered on few companies in a particular industry or market, it is important to make a more generalized analysis.

Business model adaptation is defined as how business models change in response to an external trigger (Corbo et al., 2018).

Foss and Saebi (2017) define business model adaptation as: "the process by which management actively aligns the firm's business model to a changing environment, for example, changes in the preferences of customers, supplier bargaining power, technological changes, competition, etc.".

Environmental dynamism and turbulence affect most industries today, prompting BMI through adaptation.

With respect to business model adaptation in response to external stimuli, previous research has analyzed how business models adapt to changes in the competitive environment and changes brought by new technologies (De Reuver, Bouwman and Maclnnes, 2009; Wirtz, Schilke and Ullrich, 2010).

The relationship between BMA and External shock has only been partially analyzed, usually with case-based research (i.e. Corbo et al., 2018). Still the shock considered are more related to competitors that shakes the market with a strategic move or are related to new entrants.

In period of crises events can both be perceived as an opportunity or a threat, the propensity to recognize an event as one or the other can enable business model adaptation (Foss and Saebi, 2017).

There are two conflicting theories that attempt to explain the approach of managers to opportunities and threats facing external environment turbulence: *threat-rigidity theory* and *prospect theory*.

- **Threat-rigidity theory**: emphasizes the constraining role of past behaviour (past experience and rules) which is believed to determine largely actions taken in the present. “Because of restriction in information, constriction in control, and conservation of resources,” the organization and its top management “exhibit rigidity, or inability to act and/or do something new in the face of economic adversity” (Shimizu, 2007). Research drawing on threat-rigidity theory thus finds that firms confronted with external threats are more likely to respond with caution, exhibit an inward-looking tendency, and to fall back on known and routinized patterns of actions (Chattopadhyay et al., 2001; Shimizu, 2007). In contrast, opportunities are associated with higher levels of control and are “more likely to make salient the potential gains rather than the risks involved” which can lead managers to “initiate actions that might otherwise be perceived as too risky” (Chattopadhyay et al., 2001).

- **Prospect theory**: it relies on the assumptions of "reference dependency," "loss aversion," and "diminishing sensitivity" (Tversky and Kahneman, 1992). The basic idea is that managers are more sensitive to losses than to gains of the same magnitude. As a result, managers are more inclined towards risk-aversion when facing gains and more towards risk-taking when facing losses (Barberis, 2013; Jegers, 1991; Shimizu, 2007). Drawing on prospect theory, scholars have shown that firms performing poorly are more likely to exhibit risk-taking rather than risk-averse behaviour. Following the logic of prospect theory, we can assume that firms facing unfavorable conditions are more prompt to innovate or adapt their business model.

The core problem is whether managers are more apt to engage in change in order to escape from, adapt to, or even thrive on disruptive opportunities embedded in crises. Alternatively, they stick with the old solutions, products, routines, and business models. Avoiding change and trying to ignore crisis in the hope of a return to prior stability. The management literature is far from consensus on this issue (Sarkar and Osiyevskyy, 2017). Some researchers argue for increased likelihood of innovative actions and organizational change (e.g., Bowman, 1982; Bromiley and Wiseman, 1989; Gooding et al., 1996; Miller and Chen, 2004), while others suggest rigidity and risk-aversion (e.g., Staw et al., 1981; Schendel et al., 1976; Laughhunn et al., 1980; Iyer and Miller, 2008; Shimizu, 2007).

Foss and Saebi (2017) through their analysis they stated that: "a perception of an opportunity is not significantly related to business model adaptation and that firms reporting "not being affected" or "positively affected" by the recession were significantly less likely to adapt their business models". On the other hand, we can conclude that companies that are affected by the crisis adapt their business model.

Foss and Saebi (2017) studied the reaction of the companies in response of the financial crisis of 2008, considered as an economic shock. Their analysis is peculiar and very much linked to the 2008 crisis; it has not been extended and generalized to other situations of environmental turbulence, caused by shocks, disruptive technologies or others. There is the possibility to reanalyze the concept facing a different crisis such the one that the

pandemic has brought nowadays and look for possible congruencies and dissociations and generalize the study.

Academics usually analyze the business model innovation and adaptation defining the external opportunity as a possible technology to exploit in order to create competitive advantage. On the other side a threat is usually perceived as a competitor gathering market share or introducing a new product/process or technology that can impact on the performance of the company (e.g. De Reuver et al., 2009; Voelpel et al., 2004; Pateli and Giaglis, 2005; Sabatier et al., 2012). There is a missing focus on exogenous or endogenous shocks, such as Covid-19, that disrupt the economy by changing the whole external environment forcing companies to adapt and innovate to survive or create competitive advantage.

Financing in Startups and SMEs

Venture capital is a form of private equity and a type of financing that investors provide to startup companies and small businesses that are believed to have long-term growth potential. This is the type of alternative finance that start-ups and companies turn to, which by their nature have a high failure rate, but when they are successful they guarantee their investors exits that pay them back handsomely.

While business angels invest their own personal financial resources in start-ups, Venture Capital funds, when they are set up, must in turn raise capital, turning mainly to so-called institutional funds, such as social security institutions, local public bodies, insurance companies and banks.

Receiving funding is not only the same as receiving an amount of cash to use in investments or innovative activities, but it means being able to integrate knowledge and exploit the know-how of the investors. The startups obtain two types of resources from VC: financial and intangible resources, including experience, knowledge, and networks (Pisano, 1994; Teece, 1992) The accumulated knowledge and experience of VC firms play an important role in helping startups understand the market and commercialize their ideas (Carter, 1990; Shan W., 1994; Stuart, 1994; Stuart, 2000).

There are many studies carried out that look for the correlation between Venture Capital investments on startups and the impact on their growth and performance: This type of investment does not always have an amplifying effect on the performance of startups, in fact it has been shown how different variables can modify the effect of these in positive or negative terms.

In fact, it has been demonstrated that with regard to digital startups, the growth of the amount invested makes the startup grow at an early stage and then reverses the trend once the optimal level of $300,000 is exceeded. In essence, the correlation between venture capital investment and startup growth takes the shape of an inverted “U” (Cavallo et al., 2019).

Among the possible causes of this effect, several possibilities have been mentioned, such as overconfidence and over-optimism, which can be positive at the beginning (Simon and Shrader, 2012) but can become detrimental in a short time; in fact receiving a significant

amount of capital can let this overconfidence arise in the management and that can result in a prolonged waste of financial resources, which can compromise the survival of the company (Hayward et al., 2006; Tyebjee and Bruno, 1984).

Researchers suggest that some SMEs owner–managers may choose not to use equity as a source of financing in order to avoid any undesirable changes in the ownership of their firm (Reid, 1996). Other entrepreneurs, nevertheless, may choose to source funding from external equity in order to share the risk with less risk-averse investors. However, the valid judgement of the importance of the external equity for SMEs should be based on the eventual success of firms that receives it, not on the quantity that the firm utilizes (Berger & Udell, 1998).

The advantages of equity financing in this regard are twofold (Ou & Haynes, 2006). First, unlike debt, equity offers long-term financing with minimum cash outflow in the form of interest. The Second important aspect is that receiving VC investment in the initial stage plays a significant role as a quality signal, showing that the startup has high value, which also helps it to attract more investment (Heeley, 2007; Hsu,2013); in fact, new ventures backed by VC may benefit from a higher credibility and visibility, enhancing their chances to search for partners, attract customers and human capital (Stuart et al., 1999).

In the early stage, start-ups rely predominantly on internal funds provided by informal outside sources including financial assistance from family and friends (Abouzeedan, 2003), trade credit, venture capital and angel financiers (He & baker, 2007). Moreover, studies revealed that the positive effect of VC to the growth of new ventures is especially evident in the first part of the life cycle and in hi-tech new ventures (e.g.Bertoni et al., 2011; Colombo and Grilli, 2005; Stuart et al., 1999).

As they company's objective becomes to expand business the need for external funds arises through formal external sources and financial intermediaries, such as banks, financial institutions and securities markets are needed (Chittenden, Hall, & Hutchinson, 1996). Still at this point are unsuitable for debt financing due to their activities commonly associated with high risk and uncertainty.

The positive effects of receiving an investment from a company are various and recognized. All the studies analyzed do not consider the market and the external

environment as a factor influencing the possibility for startups and small businesses to receive investment.

In the current literature researchers are more focused on analyzing the impact of the 2008 financial crisis, considered as an exogenous shock, and the changes triggered by the sovereign debt crisis with the epicenter of the Southern European countries (Portugal, Italy, and Spain) considering the financing SMEs receive (i.e. OECD, 2009).

The covid-19 has frozen the business environment in a radical way, and this may have changed the way firms invest and the propensity to invest. It is important to analyze such an impact that is different from the one that has been studied in the previous literature.

Environmental Turbulence: Definition and Characteristics

Ansoff and McDonnell (1990), define environmental turbulence as the combined measurement of the changeability, instability, and predictability which is reflected in the complexity and novelty of change in the environment.

Clauss (2019) stated that environmental turbulence is associated with the magnitude and unpredictability of changes in market trends. In addition, turbulence can be best described as "unpredictable uncertainty for strategic planning purposes" (Ramirez, 2016). Environmental uncertainty is believed to arise when managers are not 'confident that they understand the major changes and events in their industries' (Vecchiato, 2016). Such an environment has also been regarded by some scholars as 'hypercompetitive' and it was taken to refer to 'an environment of fierce competition leading to unsustainable advantage or the decline in the sustainability of advantage'. (Tsitsi Mufudza, 2018)

Theory suggests that environmental turbulence should impel more innovation (O'Cass and Weerawardena, 2010) and it is characterized by rapid changes in customer preferences and technological developments (Clauss, 2019).

Clauss (2019) studying SMEs in the German manufacturing industry, show that environmental turbulence is an important contingency factor in the context of BMI, arguing that "firms in such environments operate under constant pressure to not only respond quickly to changing market conditions but also learn to proactively anticipate and adapt".

Turbulent environments exist by nature, a few market sectors are inherently more turbulent and uncertain than others, but unique phenomena such as "shocks" can create severe turbulence on a market suddenly and this turbulence can quickly spread across all markets because of their natural connectedness.

Exogenous and Endogenous Shock

Economists invariably divide shocks into two types: endogenous and exogenous. Endogenous shocks arise from within the economic system, while exogenous shocks are natural catastrophe events that are not easily predictable and very often have disastrous consequences. (Atlantis council, 2020)

Shocks are unique, random, and unpredictable phenomena that have a large impact on the economy and are caused primarily by factors that cannot be controlled or predicted by market participants.

In traditional theoretical approach of such authors as Krugman, Dornbusch, etc. economic shocks have been variously defined as unexpected and big changes in exogenous economic variables that affect and influence endogenous variables. (Karpavicius, 2012).

From a statistical point of view, a shock represents an event that according to the parameters of the normal distribution is virtually impossible yet occurs much more often than predicted by normal distribution. In an economic sense shocks are often associated with fluctuations of economic growth, structural shifts in importance of various industries as well as volatility relating to the path of economic development. (Karpavicius, 2012)

Many studies have considered exogenous shocks impacting directly and indirectly, several endogenous economic variables. "... exogenous shocks have both direct and indirect economic effects… A direct impact is usually through damage to the stocks of physical and human capital and in some cases to output, while the direct impact of terms-of-trade shocks is on income of both the private and public sectors. Shocks also have indirect effects that reverberate throughout the economy and can affect output, investment, macroeconomic balances, debt and poverty" (Geithner, 2003, p. 9).

Numerous examples of exogenous shocks have been cited in the past, such as wars, epidemics, natural disasters, and high-impact socio-political events; these events are generally followed by crises of different types, but they all have in common the negative impact on the economy of the markets. Nevertheless, a shock such the Covid- 19 has never been experienced before, is important to further analyze it to create a general view on the phenomena.

Covid-19 Shock

In the first half of 2020, the world was hit by a pandemic. The virus was identified as a new coronavirus called COVID-19 (Qiu et al., 2020). COVID-19 originated in the city of Wuhan (China) and spread rapidly around the world, causing human tragedy and enormous economic damage. By mid-June 2020, there had been over 8 million cases of COVID-19 globally, with over 436,000 deaths. (Abel Brodeur, David Gray, Anik Islam Suraiya, Jabeen Bhuiyan; 2020)

Ferguson et al. (2020) from the Imperial College London COVID-19 Response Team claim that COVID-19 is the most serious episode since the 1918 Spanish Influenza pandemic.

Exogenous shocks cause major disruptions to economic systems (Hudecheck et al., 2020) and the COVID-19 pandemic, for instance, has generated disconnected supply chains, logistics challenges, shortage or unavailability of key resources, extreme price distortions, government restrictions on the functioning of many industries and markets and the need to redesign the working processes for many industries (Todd Morgan, Sergey Anokhin, Laurel Ofstein, Wesley Friske, 2020).

To analyze the impact of Covid-19 on the economy, it is necessary to consider the various channels of economic transmission through which Covid-19, or other exogenous shocks, can negatively affect the health of markets.

Analysing studies on Covid-19 (Carlsson-Szlezak, Philipp, Reeves, M., & Swartz, 2020a; Carlsson-Szlezak et al. 2020b), we identified 3 main channels of economic transmission:

- ***First is direct impact***: is linked to the reduction of consumption and spending by the population which, in addition to an excessive prolongation of restrictive government regulations, risks losing more and more confidence in the market, gaining a negative stance towards long-term economic prospects.
- ***Second is the indirect impact***: it arises from the repercussions of shocks on the financial market and therefore on the performance of the real economy. In fact, the average wealth of families decreases, while their savings increase, and all this has a negative impact on family consumption, which decreases further.

- ***The third channel***: is identified in the negative effects on the supply curve, which inevitably undergoes a downturn due to blocked production, which has repercussions on a reduced supply of products and services on the part of companies, with a consequent reduction in the supply of labor and employment. Furthermore, a prolonged period of the shock can give rise to mass layoffs, heavily damaging average employment. (Abel Brodeur et al., 2020).

Atlantic Council (2020) offers a very interesting comparison, placing the economic impact of Covid-19 side by side with that of the Lehman Brothers crisis in 2008. Their analysis highlights a variety of technical data to make the case that Covid-19 is not exogenous but **endogenous to the economy**, a shock co-created by humanity's economic relationships with the biosphere. Afterwards, the common points of the COVID-19 with the crisis of 2008 will be analyzed, in order to provide our personal thought.

METHODOLOGY

In this chapter, we will explain in detail the main steps of the research process we went through in order to reach the goal set by the thesis: to provide an empirical analysis of the innovation brought by startups on the Business Model to combat the crisis brought by Covid-19 and to analyze how funding in Italy was modified.

We will define the boundaries of the empirical setting, in particular focusing on the concept of shock related to Covid-19, we will introduce our own interpretation and definition.

Finally, we will show how we collected contacts through different tools additional information regarding the survey respondents from an external database (AIDA).

SMEs and Startup: The Italian Enterpreneurial Ecosystem

As reported by the Italian ministry of economic development: "The innovative startup is a young, high-technology enterprise with strong growth potential and therefore represents one of the key points of Italian industrial policy".

In 2012, a decree law of the Italian government (D.L. 179/2012) introduced several measures to support innovative start-ups and sustain them throughout their life cycle. These measures were taken to develop a dynamic and competitive innovation ecosystem, to create new opportunities and create jobs, promoting a sustainable growth strategy.

Companies that meet the following requirements can register as innovative startups:

- It is a new company, or one established no more than 5 years ago;
- It is resident in Italy or in another European Economic Area country but has its production site or branch in Italy;
- Has an annual turnover of less than 5 million €;
- It is not listed on a regulated market or on a multilateral trading platform.
- Does not and has not distributed profits;
- Has as its exclusive or main corporate purpose the development, production and marketing of a product or service with high technological value;
- Is not the result of a merger, demerger or sale of a business unit;

Finally, a startup is innovative if it meets at least 1 of the following 3 subjective requirements:

- It incurs expenses in R&D and innovation equal to at least 15% of the higher value between turnover and cost of production.
- It employs highly qualified personnel (at least 1/3 PhD, PhD students or researchers, or at least 2/3 with a master's degree);
- Is the owner, depositary or licensee of at least one patent or holder of a registered software.

Since May 2020, thanks to another a decree law (n. 34 cd. Decreto "Rilancio") Start-ups registered as innovative have advantages (i.e., lower taxation, possibility of receiving capital through equity crowdfunding, soft loans, etc.) that allow the company to develop faster and more efficiently.

Innovative start-ups can enjoy the benefits within 5 years of their establishment; after this period, they have the possibility to transform into innovative SMEs, without losing the available benefits.

The world of startups in Italy has been assuming an ever-increasing importance in the market for years.The total number of startups at the beginning of 2020, net of new entrants and exits from the market, has been steadily increasing; in fact, there are almost 11,000 innovative startups registered in the business register.

As of 1st January 2020, the number of innovative startups registered in the special section of the Companies Register reached 10,882, an increase of 272 units compared to the previous quarter (FASI, 2021).

Regarding the different work sectors of startups, 73.7% of innovative startups provide services to businesses (software production and IT consulting, R&D and information services activities). 17.6% work in manufacturing (manufacture of machinery, manufacture of computers and electronic and optical products), while 3.4% work in commerce. (FASI, 2021).

The total workforce involved in innovative startups and SMEs now numbers more than 85,000, a sign of the emergence of a real asset to be protected and continued to guide in its path of birth, growth and consolidation (Corcom, 2020).

The geographical distribution of startups in Italy is very unbalanced. In fact, Lombardy remains the region where the largest number of innovative startups is located, with almost 26.9% of the national totals. This is followed by Lazio and Emilia Romagna in central Italy with 11.3% and 8.6%, a further clear sign of the disparity between north and south in Italy.

Covid-19 Shock Definition

Within the literature review we have proposed different definitions of shocks, highlighting how there are different opinions about the impacts on the socioeconomic fabric for each shock or crisis occurred in the past. Doubt comes when the shock is extremely peculiar, as in the case of Covid-19. The current situation is of a totally different magnitude than the others, also due to the unpredictability of the virus and above all its extremely fast spread.

Economists invariably divide shocks into two types: endogenous and exogenous. Endogenous shocks arise from within the economic system, while exogenous shocks are natural catastrophe events that are not easily predictable and very often have disastrous consequences.

Covid-19 shock is not exogenous but endogenous to the economy, a shock co-created by humanity and the biosphere, due to the strict relationship.

Beyond the health and human tragedy of COVID 19, it is now widely recognized that the pandemic triggered the most serious economic crisis since World War II. All economic sectors are affected by disrupted global supply chains, weaker demand for imported goods and services, a drop in international tourism (OECD, 2020), a decline in business travel, and most often a combination of these. Measures to contain the virus' spread have hit SMEs and entrepreneurs particularly hard (OECD, 2020)

Thus, the covid-19 can be considered as a **Hybrid Shock** and has some characteristics of both types of shocks (exogenous and endogenous).

In terms of similarity with endogenous shocks, we can compare Covid-19 to the 2008 crisis. We noticed these common characteristics:

1) Uncertainty:

Uncertainty can be defined as a non-quantifiable risk. It is a risk that is not easily tracked, so its probability of occurrence and impact are difficult to predict. This is true for both the new coronavirus and the subprime mortgage case. (Frank Knight, 1921)

The COVID-19 crisis froze a large chunk of business and employment activity halfway around the world.

The World Pandemic Uncertainty Index, constructed by the International Monetary Fund (IMF), and the Global Economic Policy Uncertainty Index (GEPU, calculated at PPP exchange rates) (figure 1) are now at their highest levels. (Atlantic council 2020)

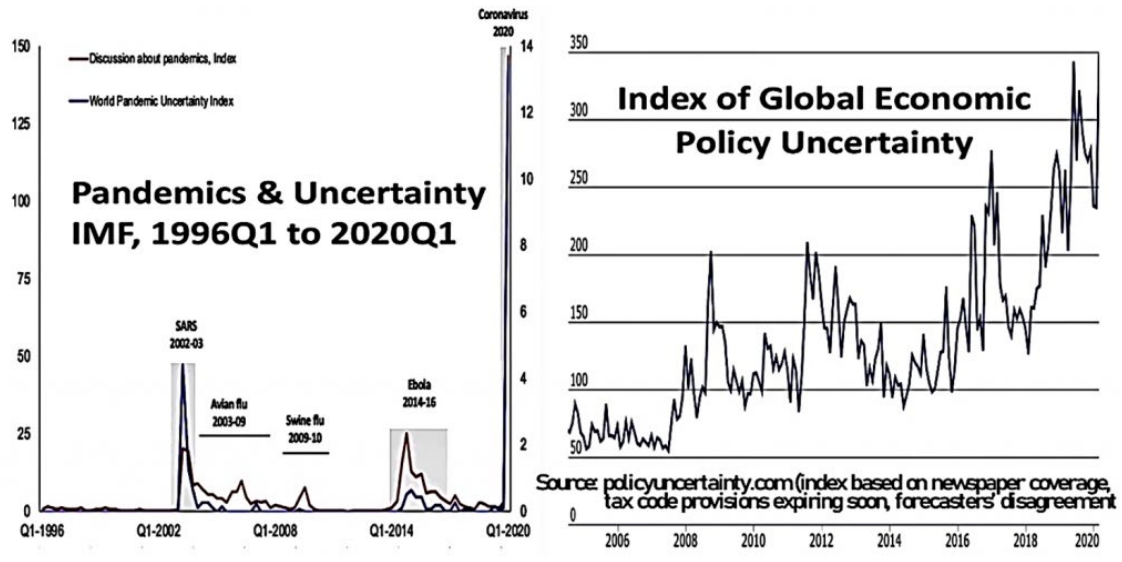


Figure 1: *Global Economic Policy Uncertainty Index*

2) Collapse:

The initial declines in the stock markets of major countries (up to a quarter of their valuation) were similar between the two recessions.

And both global recessions were later qualified as the largest since the Great Depression.

In the second picture, the S&P 500 Index from 2008 to 2020 is shown. It also provides a focus, first, on the six months following the Lehman Brother's bankruptcy, September 2018, and then, on the 2.5 months so far observed after the historical peak on February 19, 2020.

In both cases, the index was considered overvalued. In mid-September 2008, the previous peak had already been partially corrected; on February 19, 2020, the index made an all-time high well after COVID-19 had reached the United States. (Atlantic Council 2020)

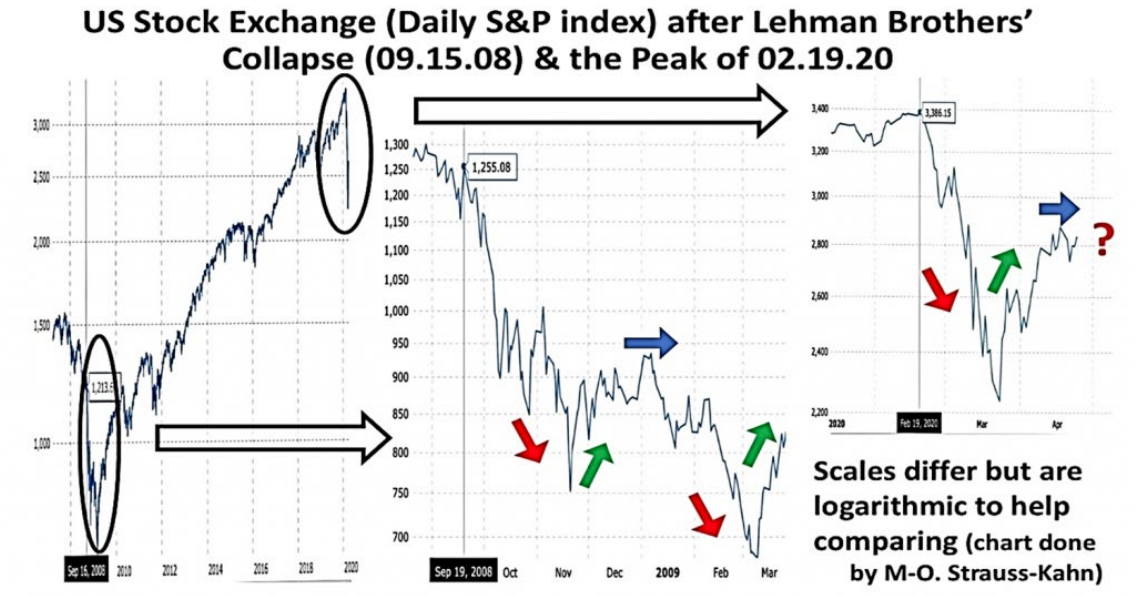


Figure 2: US stock exchange after Lehman Brothers' Collpase

We can idealize that these types of reactions are common for crises of this magnitude.

3) Reactions:

To limit such shocks, monetary and fiscal policies provided massive support in both cases. In fact, many governments announced large investment recovery packages – already much larger than those adopted in 2008 – focusing on public investment. These investment recovery packages prioritize three areas: strengthening health systems; (ii) digitalization; (iii) accelerating the transition to a carbon neutral economy (OECD, 2020).

However, the virus is by nature an exogenous factor, not controllable and predictable. The total unpredictability given by the exogenous nature of the factor is evident, in fact the absence of short-term medical responses to the virus (either as vaccines or treatments) has necessitated the use of lockdowns and social distancing restrictions as government tools to reduce the transmission of the virus across the population. (Ferran Giones, Alexander Bremab, Jeffrey M.Pollackc, Timothy L.Michaelisd, KimKlyveref, Jan Brinckmanng, 2020).

The COVID-19 pandemic was a largely unforeseen event that was not considered in ventures' business planning processes or outcomes, regardless of how formal or informal those efforts were. Even for those founders and investors focusing on scenario planning, such a specific event or similar scenarios were typically not considered. In their risk-modeling, more frequently occurring (and more likely) scenarios were considered such as delays in product or service development, delays in the sales processes, or core customer churn. By and large, the COVID-19 economic crisis was an unknown (Loch et al 2008) which appeared rapidly and that poses an existential threat to many ventures. (Ferran Giones, Alexander Bremab, Jeffrey M.Pollackc, Timothy L.Michaelisd, Kim Klyveref, Jan Brinckmanng, 2020)

Considering the discussion made above, we decided to consider Covid-19 as an hybrid shock, exogenous in its nature and endogenous in its consequences and impact on economic system.

Startups and SMEs Facing Covid-19 In Italy

Startups are more affected by external shocks due to their not-yet-established organization, natural uncertainty due to competition, and the size of the company, which, not being large, cannot perform the same response maneuvers as a large company. Given the more flexible nature of these types of companies, it is possible that the work restrictions generated by the presence of the virus have modified the strategy and classic working methods, making these actors more sensitive to the search for new growth and market opportunities. The objective of our thesis is to analyze that the impact of a "hybrid" shock such as Covid-19 changed the level of BMI of startups and SMEs on the national territory, which were able to seize new technological and market opportunities, or had to adapt to external threats in order to survive.

Foss and Saebi (2017) studying the two theories related to the perception of the company of the environment as a threat or an opportunity, threat rigidity and prospect theory. Find support their model they find support for the prospect theory which suggests that in the face of external threats, managers are more inclined towards risky behaviour, such as adapting the firm's business model. Their analysis was mainly based on shocks caused by competitors and new technologies, we want to enlarge this vision to a different type of shock such the one caused by the Covid-19 pandemic.

Essentially, we suppose that startups and SMEs tend to innovate their Business Model during periods of environmental turbulence caused by exogenous and endogenous shock.

In particular, we suppose companies to have changed their dimensions of the business model (Value proposition, Value creation, Value capture, Value delivery) in response to how they have been impacted by the shock and due to the government measure to prevent the spread of the virus.

Financing in Period of Crises

SMEs in European countries have gone through a period of high instability in the last decades that was initially due to the global financial crisis (2008–2009) and even more stressful changes triggered by the sovereign debt crisis with the epicenter of the Southern European countries (Portugal, Italy, and Spain).

It is believed that during a financial crisis, SMEs' access to finance tends to be reduced (Korab & Pomenkowa, 2015). It is also revealed that after a crisis, SMEs' access to finance has not improved. It had been caused by cutting cash flows of companies. Bremus and Neugebauer (2018) show that SMEs' access to finance was exacerbated by reduced cross-border loan inflows, and obviously, it led to an increase in credit prices.

As reported in Europe Central Bank in one of their Economic Bulletin (Issue 4/2020): The tightening of financial conditions as a result of the Global Financial Crisis (GFC) and the subsequent sovereign debt crisis in the euro area led to severe difficulties for small and medium-sized enterprises (SMEs) in accessing finance. In response, Europe has sought to facilitate access to finance through monetary policies. Europe help has greatly improved the situation in recent years for SMEs and startups in finding external funding, but many problems and challenges still remain even before the start of the pandemic situation. Considering SAFE (Survey on the access to finance of enterprises) results indicate that there is a financing gap: a difference between financial needs and the availability of external funding. In particular it exists considering specific financing instruments such the market-based ones. Diversification across alternative financing instruments can make an important contribution to resilience against adverse financial and real shocks.

As reported by Korab & Pomenkowa (2015) in their analysis of financing for SMEs in the Czech Republic, during crises these types of companies are more financially constrained due to problems with both cash flow and cash holdings. By financial constraints we mean frictions which prevent a fi rm to realize all desired investments not only due to credit constraints but also due to the inability to issue equity or due to problems to issue new bonds (as suggested by Lamont et al., 2001).

Past studies that try to analyze how external funding for start-ups changes in times of crisis are mainly related to the 2008 financial crisis. However, we know that even in the case of other shocks such as the one caused by the coronavirus, which lead to negative structural change, startups and SMEs are always the most affected and damaged.

In particular, we decided to align the research with the strand that in the last two years since the start of the pandemic has been trying to analyze the impact that Covid-19 is having on SMEs and startups. Our intention is to compare how and if these types of companies were seeking external equity funding before the pandemic and since the pandemic began.

Specifically, given the severe crisis that the Covid has brought and the need that startups have had to vary and adapt their business model to the situation, we assume that the funding landscape in Italy has been changed by the hybrid shock caused by the Covid-19 virus.

Sample and Data Collection

Initial database

Given the empirical nature of the research, we had to create a sample of Italian startups' and SMEs, the objective was to create a sample large enough to provide a picture of these type of companies in the Italian ecosystem, to make considerations about it. In particular we want to analyze and find common pattern on how companies reacted to exogenous shock through Business model innovation and adaptation.

The initial database reported these variables:

- ***Company name***
- ***CF_IVA****:* The Company Register Number, is the registration number assigned by the Company Register of the Chamber of Commerce, is the tax code of the company.
- ***Incorporation year****:*
- ***NUTS3***: translated from Italian: Nomenclature of Statistical Territorial Units of Italy, which is divided in three codes: (I) Groups of regions (e.g., North, North-West, South, etc.); (II) Regions of Italy (e.g., Piemonte, Lombardia, Liguria); (III) Provincial areas (e.g., Milan, Rome, Turin). On the database we have the last one, this gives us the possibility to go back to the first two.
- ***Type***: where the company has been founded (i.e. database Alba, Control, Pitchbook) and if it is an *Innovative startup* (yes/no), meaning it is recognized by the government as an innovative startup.
- ***Tel***: telephone n address of the company's website
- ***Email***
- ***Website***

Contact gathering

Given the initial database our objective was to gather the highest number possible of emails or other contacts of the company in order to send the survey to them.

We had different approaches to find the contacts (described in the chronological order in which they were used):

- ***Pitchbook*:** Pitchbook is a company that provides data, research and technology covering private capital markets, including venture capital, private equity and M&A. In particular we used to make extraction of data regarding startups and SMEs of Italy in the high-tech sector. This platform was fundamental to firstly enlarge the database.

  We followed the sequent procedure: We made three extractions of companies (due to the monthly limit of 1000), using as filters: *location* Europe → South Europe → Italy; Number of employees max 100; year of foundation from 01/01/2000 to 31/12/2013 (divided in three time span). We extracted 1115 companies. we cross-referenced the extractions with the initial database by company name to find how many matches there were between the two, looking for specific contacts of founders or managers of the companies. We found 279 contacts for a total of 340 contacts adding the already existing one.

- ***Website searching and contacting:*** using the website address of the initial database, we looked for generic contact (i.e. *info@, administration@, support@*) in order to send a preset email asking for contacts of the founders or managers of the company. The email text (translated from Italian) was:

  "*Good morning, I am writing on behalf of Politecnico di Milano. I wanted to ask if it is possible to have an email contact of your managers or founders, to send a survey to be filled in*."

  We decided to go through this method with half of the database since it was time consuming and not very effective (9% responses), we received 372 contacts for a total of 712.

- ***AIDA***: is a financial and personal analysis database, with information on shareholdings and management relating to approximately 1,300,000 Italian capital companies. Using AIDA, we were able to find the names of managers,

CEO's or founders of companies. We extracted from AIDA using the CF_iva as a key to cross-reference the two databases. Through this method we had the possibility to extract the names of founders or CEOs of the companies we were looking for then we extracted 5552 names. We used the names to trace their Linkedin contacts and contact them via the site, we found 2355 Linkedin profiles (42%). Unfortunately, we were not aware of the problem with the site's InMail messages. To overcome the problem, we decided to use the company's website, which is in the database, to search for a generic contact to contact and specifically ask for the questionnaire to be redirected to the CEO or manager. Out of 2355 lines we succeed to contact 1245 companies, with a rate of 53%. The ones we didn't contact were either because they no longer had a functioning website or they didn't provide any contact person to whom the email request could be delivered. As we were not satisfied with the amount of companies and contacts we found to send the survey to, we decided to widen our search. As we had the names of CEOs and managers not associated with a LinkedIn contact, we sent an email to all available generic contacts specifically asking them to forward the survey to that person. We searched for generic contacts from the remaining 3197 available companies, from which we were able to extract 1013 contacts, with a rate of 32%. We expected this rate to be lower as we had not previously found any kind of link between the name of the possible CEO or manager and the company itself.

The total number of companies we have found and subsequently contacted is 2670, in the next table we have summarized the collection of contacts in a more schematic way.

Method	Number of Contacts	Cumulative number
Already existing in the database	61	61
Pitchbook	279	340
Website searching and direct contact	372	712
AIDA LinkedIn	1145	1857
AIDA no LinkedIn	813	2670

Table 2: Contacts extraction

We had a last instrument to use, that was: *Registro imprese – Startup e PMI innovative (Innovative start-ups and SMEs - Company Register)*.

Before starting we decided to analyze in deep the database, since looking for contacts from database such this one is really time consuming.

We decide to extract a significant sample from the database using the formula of Wayne W. (1999)

$$Sample\ size = \frac{\frac{z^2\ x\ p(1-p)}{e^2}}{1 + \frac{z^2\ x\ p(1-p)}{e^2 N}}$$

Where:

- ***p*** = is the probability that the company searched is present in the startups and SMEs database;
- ***1-p*** = is the probability that the company searched is **not** present in the startups and SMEs database;

  In our case we don't know the probability p of a company appearing in the list of innovative startups and SMEs, so we decided to consider p = 0,5, with such a solution the *sample size* is maximized;
- ***z*** = z-score indicates how many standard deviations a given proportion is from the mean. In our case considering we have chosen a *confidence interval* of 99%, the z-score is a fixed number: 2,58;
- ***N*** = entire population size; we considered 6915 companies from the initial database we excluded the ones that were in liquidation;
- ***e*** = margin error, we decided for a margin error of 5%

Considering the formula and the variables chosen, we had these results:

Probability Yes/No	50%
Startup/SME (no liquid)	6915
Confidence interval	99%
Error margin	5%
Sample size	**608**

Table 3: Significant sample calculation

We analyze 608 companies randomly chosen from the “Registro delle imprese” database and this was the result:

%	EXISTENCE	REGISTRO IMPRESE
Yes	78%	34%
No	17%	66%
Not Found	5%	0%

CONTACTS R.I.	#	%
Not found	82	39%
Generic contact	120	58%
Specific contact	6	3%

Table 4: Existence analysis on Registro Imprese

Table 5: Sample of Contacts gathering with Registro Imprese

We considered the results unsatisfactory and so we decided to not go further with the “Registro delle imprese” database, since it requires too much time effort.

Measures

In order to realize an accurate analysis that focuses on the concept of Business Model Innovation and how the companies had reacted, in terms of innovation, to the Covid-19 pandemic, it is fundamental to select a reference business model framework.

Based on the literature review carried previously and in line with the line of thought that conceptualize the Business Model as value architecture of the firm (Osterwalder and Pigneur, 2010; Teece, 2010; Cortimiglia, Ghezzi and Frank, 2016; Casadesus-Masanell and Ricart, 2010; Magretta, 2002) we decided to adopt the Business Model Canvas, conceptualized by Osterwalder and Pigneur (2010) (fig 6) as the starting point to create a construct to measure the Business model innovation of each company.

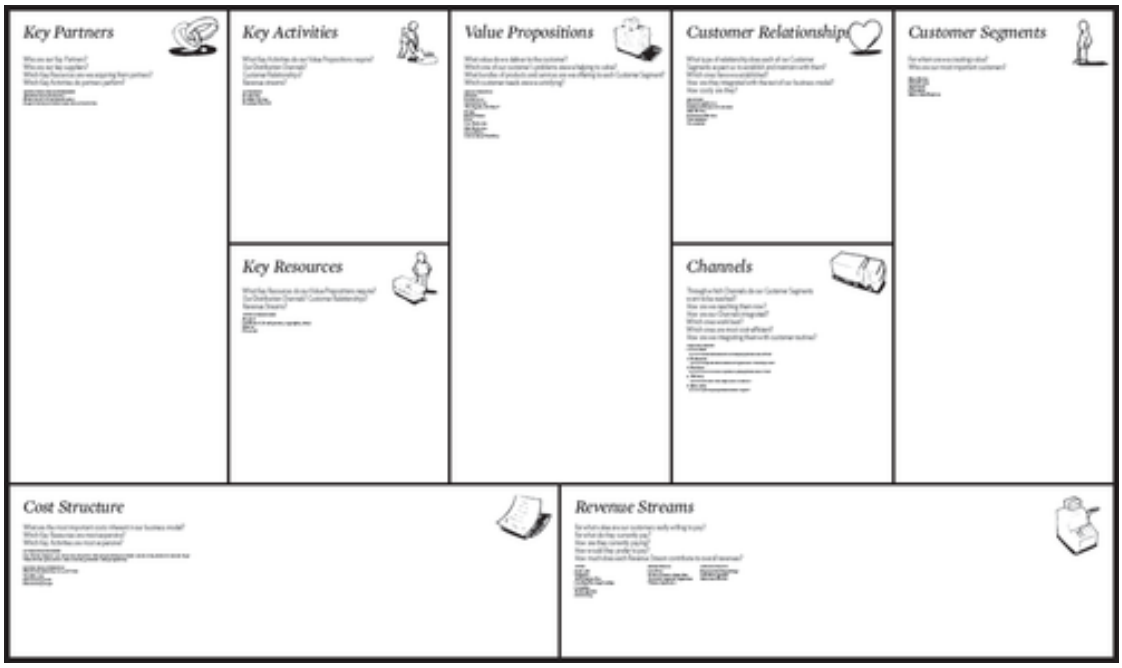


Figure 3: Business Model Canvas (Osterwalder and Pigneur, 2010)

Business Model Innovation Measures

In order to measure the Business model innovativeness of each company we had to build a construct based on the business model dimensions. Through the survey we presented to the respondents the definitions of each single business model unit, without presenting them the different aggregation that we further consider.

We asked with the survey how much each element has changed due to the Covid-19 pandemic shock on a scale of 0 to 5, in which they had to respond 0 if none of the element has changed and 5 if in their opinion has changed drastically.

To better understand business model innovation of the company we decided to develop a three based layer construct, based on different aggregate variables (*Fig. 7*). Such construct is useful to analyze how much, generally speaking, companies has innovated their BM to respond to the Covid-19 crises, but it even permits us to analyze in detail which blocks have been changed the most and to what extent.

BUSINESS MODEL INNOVATION MEASURE		
1st Layer	**2nd Layer**	**3rd Layer**
Business Model Innovation Breadth	Value proposition	
	Value creation	Key Partners
		Key Activities
		Key Resources
Business Model Innovation Depth	Value delivery	Customer Relationships
		Customer Segments
		Channels
	Value capture	Cost Structure
		Revenue Streams

Table 6: Business Model Innovation Measures

Business model Innovation breadth

We define the Business Model Innovation Breadth as the number of elements that has been changed by the companies, the range goes from zero elements to nine (all of them). It is important for our research to have such a variable, since it permits to distinguish between firms that engage at a lower breadth (i.e. changing few dimensions), will try to survive to the shock and improve their Business Model locally with few minor adaptation or companies that have been affected by the pandemic only to a small extent. On the other hand firms with higher breadth (i.e. changing many dimensions) move away from their usual Business Model and radically change how they capture, deliver, create their value and what they propose to the customers. These latter kind of companies are the ones that have been the main focuses of the research on the BM change breadth has been focused on defining how many dimensions has to be changed in order to be considered as a change. Some scholars argue that BMR can be manifested in the change of a single element of a firm's business model, others suggest that two or more elements must change before we can meaningfully talk about BMR having taken place (Foss and Saebi, 2018).

This measure alone can be deceiving, as we might have a company that has changed everything but very marginally, this would result in a maximum score when the change has not been so important. For this reason, it is important to add a second variable to this variable, which avoids this problem.

Business Model Innovation depth

Through this variable it is possible to understand what is the extent of the change made by the company due to the Covid-19, not considering how many dimensions have been changed, but focusing on how much they have been changed.

Business model dimensions

In order to analyze BMI, we had to subdivide the business model in four different dimensions. We report the definitions of the single blocks that compose the Business Model, as are reported in the survey (see appendix). As we had written above all the single blocks, have been measured through a one-item five-point Likert scale variable, asking how the company has changed the element due to Covid-19 situation.

- **Value proposition**: the set of products, services and solutions offered to the market that create value for customers by solving a problem or satisfying a need.
- **Value delivery**: it describes the how the firm's activities are articulated in order to deliver the value proposition to the customer. In particular, it includes:
  - ***Customer relationships***: how the company interacts with its customers. For example, only with digital and online tools or also through a physical contact point and/or through the creation of communities.
  - ***Customer segments****:* how the company interacts with its customers. For example, only with digital and online tools or also through a physical contact point and/or through the creation of communities.
  - ***Channels*****:** a company can distribute its value proposition to customers through different channels, physical or virtual.

- **Value creation**: it relates to how the firm organizes itself to create value for its target customers in terms of internal and external activities, processes and resources needed:
  - *Key activities*: the key activities that lead the enterprise to create its value proposition (product/services) and distribute it to the market.
  - *Key partners*: the set of players outside the company (suppliers, partners, universities, research centers) with whom relations of various kinds are cultivated (traditional customer-supplier relations, partnerships, strategic alliances).
  - *Key resources*: the resources needed to create value for customers, and which are considered assets to sustain and support the business. These resources may be human, financial, physical or intellectual.
- **Value capture**: how the firm monetizes the value created and then delivered to its customers, and how eventually it generates profit:
  - *Revenue stream*: the way a company generates revenues from different customer segments to make its business model financially sustainable.
  - *Cost structure*: the nature and type of costs to ensure the functioning of the business model. In particular, reference is made to the relationship between fixed and variable costs.

Survey Data: Covid Impact and Financing

In order to measure the impact of Covid-19, we asked to the respondents how much the pandemic has impacted their business, relating the response to what they generally consider to be normal market conditions. We presented the possible answers on a scale from 1 to 5, where 1 was positively influenced and 5 was strongly and severely negatively influenced (Likert scale variable with 5 point).

Through this variable we can define how the different companies had perceived the external turbulence. We define threat as the perception of a negative effect, while opportunity refers to being positively affected.

The responses allowed us to create a Likert variable and analyze the impact companies felt from the shock.

Equity Financing

In order to accurately analyze how the financing from external financial investors has changed during this period of crisis, we decided to divide the analysis of this factor in two different periods: from the founding of the company to the start of the pandemic, which we have tentatively identified as February 2020. The following period, on the other hand, was considered from the start of the pandemic (February 2020) to the day the respondent completes the survey.

With this breakdown, we can analyze whether the number of investments that companies sought and received increased or decreased during the period of environmental turbulence due to Covid-19 compared to before. In addition, we can analyze whether companies have been helped by funding and to what extent, in both periods before and after Covid-19.

Financing before Covid-19

- *Capital seeking (before Covid-19)*: The first question was directed to the companies asking if whether they have sought some form of external financing, a capital injection additional to that provided by the founders at the inception of the venture capital company. The possible responses were yes or no, giving us a binary variable and gives us an overview of the number of companies that sought external funding prior to Covid-19;

- *Capital received (before Covid-19)*: The question concerning this variable was asked to the respondents only if they answered yes to the first question. Regarding the answer, there was the possibility to ask whether they actually received any financing (yes) or not (no). This variable can help us to make a rate between the number of companies that have sought funding and companies that have actually received funding.
- *Financing impact (before Covid-19)*: We asked to the respondents how much their company's business model has been influenced by the support and involvement of external funders, prior to Covid-19. In particular we proposed 6 possible answers in a scale from 0 to 5, in which: 0 if the company business model is not have been influenced by the support of investors; 1 if the company business model has been little influenced by support from external investors; 5 if the company business model has been greatly influenced by the support given by external investors.

Financing after Covid-19

We presented the same questions as listed above referring to the period going from the start of the pandemic (February 2020) until the day of the response.

- *Capital seeking (after Covid-19)*
- *Capital received (after Covid-19)*
- *Financing impact (after Covid-19)*

In the following figure we will show how in more detail how the questions related to the financing work.

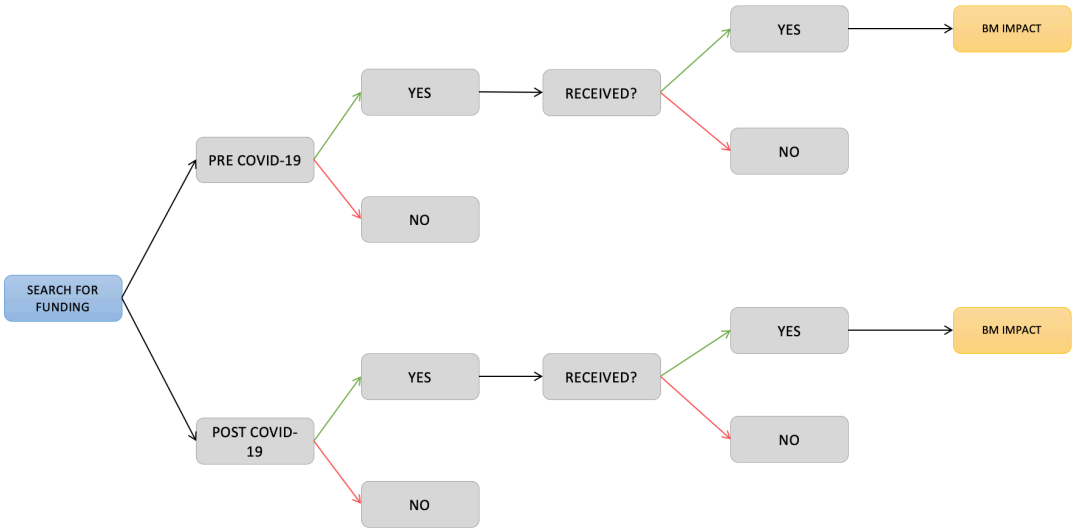


Figure 4: Financing questions schema

Data Extracted From AIDA

In order to find the variables needed for our analysis, we asked the respondents to enter the IVA number of their company. Thanks to this information we were able to cross-reference the database of survey responses with AIDA, a tool we also used previously to find contacts.

Using AIDA, we were able to extract:

Firm age: we decided to control for the age of the firm as older firms are found to be less innovative (e.g., Gopalakrishnan & Bierly, 2006). This variable also gives us the possibility to control how older, or younger, companies responded to the shock caused by Covid-19.

Firm size: we measured the size as the number of employees, since size can influence innovation. Studies report a positive effect of firm size on innovation (Damanpour, 1991; Greve, 2003), although the theoretical debate about the effect of firm size has not been conclusively resolved.

***Italy's Area/Region/Provinc*e**: we decided to use as a categorical variable the three different possible labels that we have in the NUTS code (see above). Is important to divide the companies into three different possible groups in order from least (Italy's area) to most stringent (Province). It is important to further analyze how the companies in the different part of Italy had reacted to the Covid-19 crisis.

Industry: We decided to insert a dummy variable related to the industry, to have to have a general mapping of which industries have innovated more or less because of Covid-19 and to understand which industries have been most affected by the crisis.

Revenue's growth: We decided to look at revenue growth for companies, as companies that had higher growth than others prior to the pandemic may have more capacity to innovate.

Survey Responses

We started submitting the survey from 18 February 2021, using the Opinio website as a platform. From that moment we decided to wait about two weeks for people to respond. On 3 March 2021 we collected the data that was available: specifically, 444 people opened the survey, of this number of people 179 completed the survey with all the data.

We decided to do a second wave in order to increase the scope of the responses received and have as much data as possible. After sending out the survey for the second time we had a total of 255 responses, out of 680 who opened and received the survey, for those who had already received the survey in the first wave it was not possible to redo the survey or access it.

If we consider the total number of companies we contacted, 2670, 9,55% of the companies answered the survey completely, while it was opened by 25,5% of the contacted. It is necessary to consider the fact that the contacts we found came from all kinds of industries: mechanical, agricultural, digital, pet, sport…

Taking this into account, it is understandable that many companies are not interested in the topic of the survey or are not aware of what a Business Model is and therefore are not attracted by our requests and the result of the research. As stated by Bouwman (2016) a problem related to SMEs and startups is that they are not aware that they are engaged in

Business Model Innovation because they will not label themselves in this way; only a minority of SMEs are familiar with BM ontologies and with tooling.

From the survey it was possible to find all variables concerning Business model Innovation and pre and post Covid-19 pandemic start funding (see variables paragraph above).

Data Analysys

The database has been created and populated with all the different types of data. In this section, we will present the methodologies followed in order to move from the raw data collected to a consistent set of business model characterizing variables, and moreover, to the actual values that those variables can assume.

BMI Depth Variable Creation

In order to investigate how deeply companies have innovated their business model we decided to focus the depth measure on the average of the innovation scores declared by companies for each element of the business model. In this way we have the possibility to understand how much companies have actually innovated, we can interpret this variable as a measure of how vertical the innovation of the business model has been.

We then divided the scores into four innovation bands, using the equal width method. Considering the scores from 0 to 5, all bands have a width of 1.25. Below is a description of the bands:

- ***The company has innovated very little***: we consider all those companies whose average depth is between 0 (i.e. they have not changed anything) and 1.25.
- ***The company has innovated moderately***: in this band are considered those companies whose average depth is between 1.25 and 2.5;
- ***The company has innovated significantly***: in this range are considered those companies that have a depth score between 2.5 and 3.75;
- ***The company has innovated in a radical way***: in the last band are included those companies that have implemented radical innovations to their business model, innovating most of the elements in a strong way. The score ranges from 3.75 to 5 which represents the maximum;

BMI Breadth Variable Creation

This type of measure was implemented to make an analysis of how many dimensions of the business model were changed by the companies, in particular considering how many dimensions had a score different than 0. Also, for this measure we decided to make a discretization of the variables, in particular we chose to create a value for the companies

that changed the whole business model. This measure is complementary to the previous one since it is a horizontal measure of business model innovation.

Below is the division into bands:

- Companies have *innovated from 0 to maximum 2 dimensions*: these companies have innovated only a very small part of the dimensions
- Companies that *have innovated from 3 to 4 dimensions*
- Companies that *have innovated from 5 to 6 dimensions*, in this case we consider companies that have innovated more than half of the BM
- Companies that have *innovated from 7 to 8 dimensions*, we can consider in this range the companies that have changed most of their BM
- Companies that *have innovated all dimensions of the BM*, all 9 elements.

Value Dimensions: Variable Creation

Value proposition: As far as the value proposition is concerned, it was not necessary to make any division into bands or transformations as the data was presented in the survey by itself. The variable is useful to distinguish how the companies have innovated their product or service proposition to fight the crisis bring by Covid-19

Value delivery: we considered the value delivery to distinguish how companies have changed the way they engage with customers and their target customers. We calculated the average score of the elements of the business model that belong to this dimension: Customer Relationships, Customer Segments and Channels.

We then used the scores to divide the companies into bands, using the equal width method, rounding down or up if the score was respectively above or below 0.5 for each score. In this way we kept the bands present in the survey, where:

- 0 means that no items belonging to the dimension were changed;
- 1 if the company has only slightly modified the elements of the dimension,
- 5 if the company has changed the elements of the dimension in a very important way

Value creation: it is important to monitor through this variable whether companies due to covid 19 have changed their way of performing core activities, have tightened or cut partnerships or have had to vary their core resources. This dimension is calculated using

the average of the elements of the BM belonging to this dimension (same procedure as before). The elements that make up value creation are: Key Activities, Key Partnerships, Key Resources. The bands are as follows:

- 0 means that no items belonging to the dimension were changed;
- 1 if the company has only slightly modified the elements of the dimension,
- 5 if the company has changed the elements of the dimension in a very important way

Value Capture: Regarding the fourth and last component of the business model framework adopted, dealing with the firm's different revenues sources and cost structure we adopted the same procedure as before calculating the mean and dividing by bands. Again, we keep the bands that were presented in the survey:

- 0 means that no items belonging to the dimension were changed;
- 1 if the company has only slightly modified the elements of the dimension,
- 5 if the company has changed the elements of the dimension in a very important way

Financing Impact Variables Creation

In order to map companies' requests for funding and also analyse which companies actually received funding, we created binary variables based on the responses received. The same procedure was done for the questions concerning financing before and after the start of the pandemic.

We created a dummy variable for the first question concerning the actual seeking of funding by outsiders. The second dummy variable depends on the answer given in the first question. In particular, if respondents stated that they had sought funding, they had to answer whether they had actually received funding.

If the answer to the second question was also positive, a final variable was created concerning the impact of external financiers on the company's business model. A diagram is provided below to help understand the structure of these three variables.

Variables Creation from AIDA Extraction

The following variables were extracted from AIDA, using as a key the Iva code asked in the survey.

- Sales revenue in 2019
- Sales revenue in 2018
- Province
- Number of employees in 2019
- Foundation year
- ATECO code

The data from 2019 were the latest available on the database.

Zone variable

In order to have a better mapping of how the different responses were distributed around Italy, we decided to divide the various regions into 4 macro-areas: North-West, North-East, Centre and south. The following table shows all the assignments used, only the province from which we had responses are present in the table 7.

Zone	Region	Province
Center	Toscana	Firenze
		Livorno
		Lucca
		Pisa
	Umbria	Perugia
	Marche	Ancona
		Pesaro-Urbino
		Ascoli-Piceno
		Fermo
		Macerata
	Lazio	Frosinone
		Roma
		Viterbo
	Sardegna	Cagliari
		Sassari
North-East	Trentino Alto Adige	Bolzano
		Trento
	Verona	Padova
		Vicenza
		Rovigo
		Treviso
		Venezia
		Verona
	Friuli Venezia Giulia	Pordenone
		Trieste
		Udine
		Bologna
		Ferrara

Zone	Region	Province
North-east	Emilia Romagna	Forlì-Cesena
		Modena
		Parma
		Piacenza
	Emilia Romagna	Ravenna
		Reggio nell'Emilia
		Rimini
North-West	Piemonte	Alessandria
		Cuneo
		Torino
	Liguria	Genova
		Imperia
		Savona
	Lombardia	Bergamo
		Brescia
		Como
		Lodi
		Milano
	Lombardia	Monza
		Novara
		Pavia
		Sondrio
		Varese
	Valle d'Aosta	Aosta

Zone	Region	Province
South	Campania	Caserta
		Napoli
		Salerno
	Puglia	Bari
		Foggia
		Lecce
		Taranto
	Basilicata	Matera
	Calabria	Cosenza
	Sicilia	Palermo
		Catania
		Siracusa

Table 7: Zone division according to region

Industry

We decided to have this variable because the industry can certainly be significant considering both the impact of covid on companies and innovation. Through the ATECO code (an alphanumeric combination that identifies an economic activity), we divided the responding companies according to the industry they belong to, in particular the subdivision is shown in the following table.

Industry	#Responses
Manufacturing activities	51
Information and communication services	75
Professional, scientific and technical activities	95
Other	28

Table 8: industry responses

Considering the answers received, there are three industries that are much more present than the others:

Manufacturing activities: physical or chemical transformation of materials, substances or components into new products. The processed materials, substances or components are raw materials that come from agriculture, forestry, fishing, mining or are the product of other manufacturing activities.

Information and communication services*:* This section covers specialized professional, scientific and technical activities. These activities require a high level of preparation and provide users with specialized knowledge and skills.

Professional, scientific and technical activities: This section includes the production and distribution of information and cultural products, the management of the media for the transmission and distribution of these products, as well as activities related to the transmission of data and communications, activities related to information technology and activities of other information services.

We decided to combine all the industries excluded from these three into other category, otherwise we would have had a lot of industries to consider in the model with very low representation.

In the Other category are included the following industries:

- Agriculture, forestry and fisheries
- Construction
- Wholesale and retail trade; repair of motor vehicles and motorbikes
- Financial and insurance activities
- Real estate activities
- Rental, travel agencies, business support services
- Education
- Health and social work
- Artistic, sporting, entertainment and recreational activities

***Age*:** From the foundation year we extracted the age of the company, Subtracting the year the company was founded from 2020.

***Revenue's growth*:** We have calculated the percentage revenue growth considering the two years preceding the pandemic, i.e. 2018 and 2019.

***Firm size*:** Taking in consideration the classification provided by the European Union, we have decided to divide the companies into three different categories according to the number of employees present, as follows:

Type	Size	Number of companies
Medium-sized enterprise	<250	4
Small enterprise	<50	34
Micro enterprise	<10	217

Table 9: Division of Companies by size (EU classification)

We can see that the breakdown by enterprise size is totally skewed towards micro enterprises. We have therefore decided not to analyze this data.

EMPIRICAL RESULTS

In this chapter we will report the empirical results of the research process. As a first step, we will describe the composition of our sample, showing the nature of our data and providing a description that will be able to provide a representation as accurate as possible of the landscape of start-ups and SMEs in Italy.

Next, we will empirically analyze how our sample reacted in response to Covid-19 by modifying their business model. By analyzing the variables described in the methodology, we will empirically report which areas of the business model have undergone the most changes in this period of turbulence, which sectors have been most prone to change, which firms have declared to have reacted to the external shock, and which aspects these responses have in common.

We also decided to consider the impact of external financing that the interviewed companies may or may not have received, before and after the arrival of Covid-19.

Sample of Reference

The sample of companies representing the starting point of our study on the impact of covid on business model innovation consists of 255 Italian innovative startups.

Analyzing the distribution of the companies participating in the survey in detail, we can see that most of them belong to the northwest zone (37%), due to the fact that this zone includes Lombardy, which is home to most of the Italian startups. The most represented after the north-west area is the north-east area (29%).

These two figures are in line with the actual distribution of innovative startups in Italy. The last two areas considered, the center and the south, represent 34% of the sample, with a percentage of 20% and 14% respectively.

The fact that startups are unevenly distributed throughout Italy is not a problem, as it reflects the real distribution of this type of company in the country.

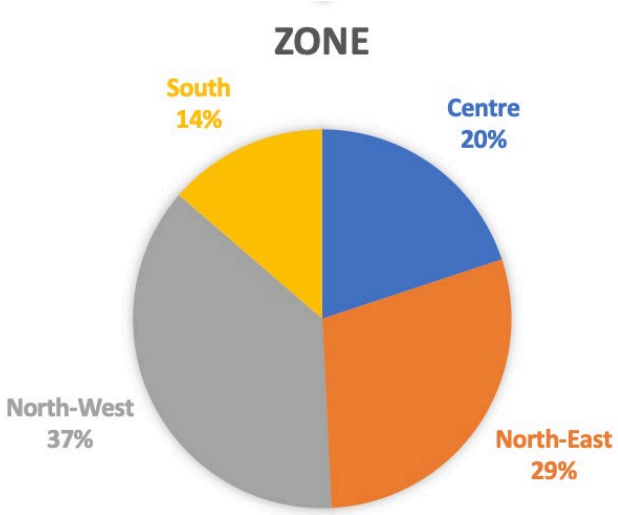


Figure 5: Zone sample distribution

Results from The Survey

In this section we will show the results of the survey sent to the sample companies investigating how much they have innovated in business model innovation, the research and the impact of funding when it was received. All 255 variables in the sample responded to the questions posed.

The results will be presented considering first the more general variables of business model innovation depth and breadth.

Then we will go into more detail considering the four dimensions, identified in the methodology, concerning the business model: value proposition, value creation, value delivery and value capture.

All the previous variables have been considered in relation to the impact of the covid that has been declared by the respondents.

We then subdivided the companies according to the binary variables of seeking funding, again all 255 companies are considered. Going to represent instead the actual receipt of funding the number of responding companies varies, due to the dependence of this

variable on the previous one. The same reasoning is applied for the variable representing the impact of external financiers on the company's business model.

This will allow us to analyze on the Italian startup and SME landscape how covid has impacted business model innovation and the search for and receipt of funding.

Finally, we will analyze how companies have innovated in different sectors by cross-referencing the data extracted from Aida concerning the sectors in which companies operate and the data on business model innovation from the survey.

BMI Depth results

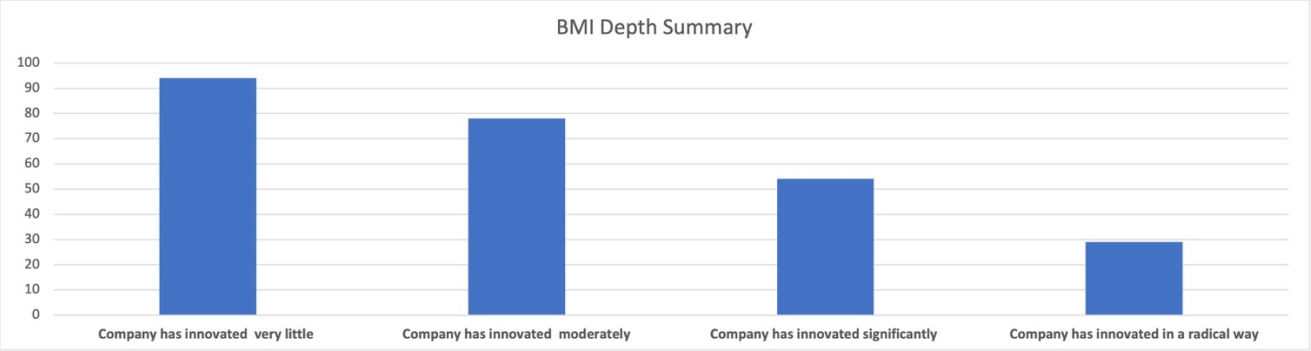


Figure 6: BMI Depth summary

The graph (Fig. 6) shows the total number of companies by Business Model Innovation Depth. The first two bands together account for 68% of the sample and at a significant level include all companies that reported low or no innovation.

The remaining 32% of the sample is divided over the two bands identifying a medium and high level of innovation, with 21% of the sample on band 3 and the remaining 11% on band 4.

At first glance, one can see a thinning in terms of the population of the bands that is directly proportional to the increase in the level of innovation declared.

We decided to display the number of companies present in each band of the business model innovation depth, segmenting them by the level of Covid-19 impact they declared. (Fig. 7)

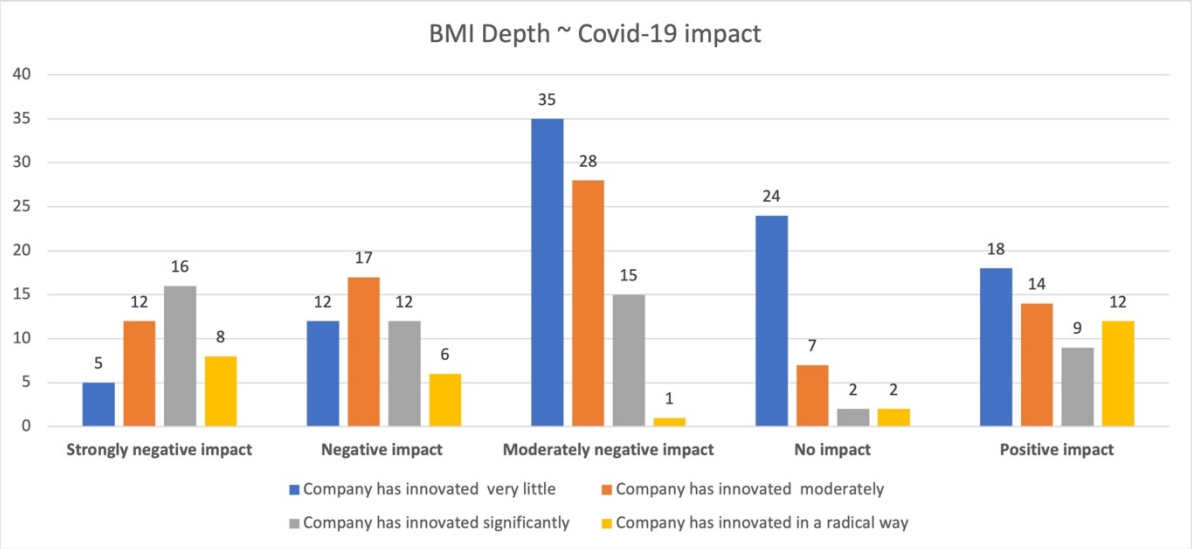


Figure 7: BMI Depth ~ Covid-19 Impact

Considering this segment of strongly negative impact, the number of companies that have innovated very little in their business model is small (12%). For the most part, the sample consists of companies that have innovated at least moderately (69%). The remaining 19% belong to the higher innovation segment.

Analyzing the segment of companies that stated that they only had a negative impact the distribution within the segment remains homogeneous and there are no relevant peaks. In the low and medium innovation bands there are 50% of the companies, equally distributed, which declared to have been negatively impacted by Covid-19. The remaining part of the sample was mainly in the moderate innovation band (36%). Only 12.7% declared to have innovated substantially.

Considering the companies that declared to have been moderately negatively impacted by the crisis, there is an evident peak in the low innovation band (44%) followed by the moderate innovation band (36%). Considering the highest innovation bands, there is practically no representation in the radical innovation band (1%), while the substantial innovation band represents 19% of the segment. The distribution is decidedly skewed to the right, i.e. towards the highest innovation band.

Companies that stated that they were not impacted by the crisis caused by Covid-19 mostly fall in the low innovation band, more than 50%.

In the moderate innovation bracket, 20% of the companies are in the low innovation bracket. The remaining 11 % are equally divided between the remaining two bands (5.5 % for both).

On the other hand, companies that reported receiving a positive boost from the Covid-19 do not show any particular imbalance in innovation. 34% of the companies are in the low innovation range, 26% in the moderate innovation range. Finally, 60% of the companies that were positively impacted by covid stated that they had carried out low or moderate innovation on the business model. The remaining companies were divided into the high innovation bands, with a difference of 6% between the two categories; respectively 16% for the substantial innovation band and 22.5% for the radical innovation band.

BMI Breadth results

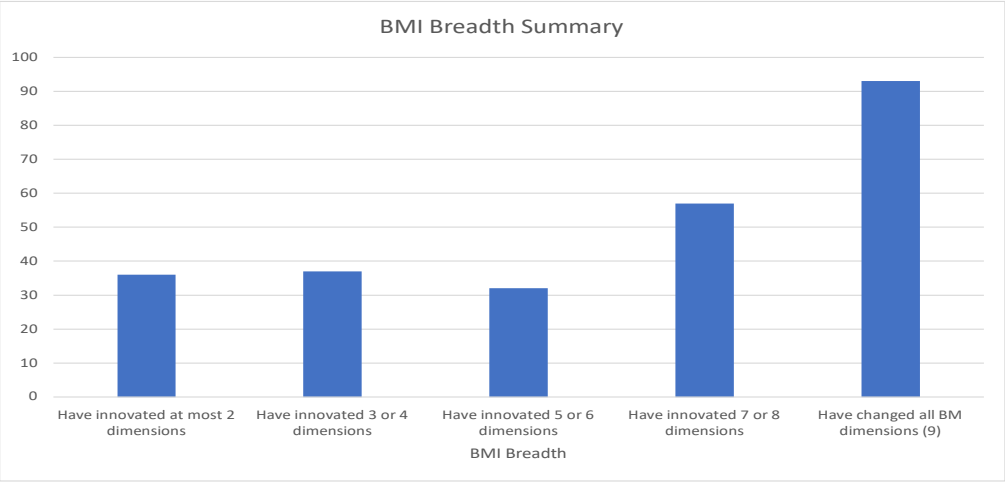


Figure 8: BMI Breadth summary

The graph (fig. 8) shows the total number of the respondents divided by breadth bands. Observing the distribution on the bands divided by the number of dimensions modified, it is interesting how the majority of the companies that participated in the survey declared to have modified all nine dimensions of the business model, for this reason the distribution is skewed towards the right. In particular 36% fall into the higher band. The second most populated band is the one in which companies declared to have changed from seven to eight dimensions (22%). Adding the companies that changed five or six dimensions (13%) to the previous two groups, we can see that 71% of companies have changed more than half of the business model dimensions indicated in the survey. The remaining

companies in the survey are very similar, with 14% having changed a maximum of two elements and 15% having changed three to four blocks of the business model.

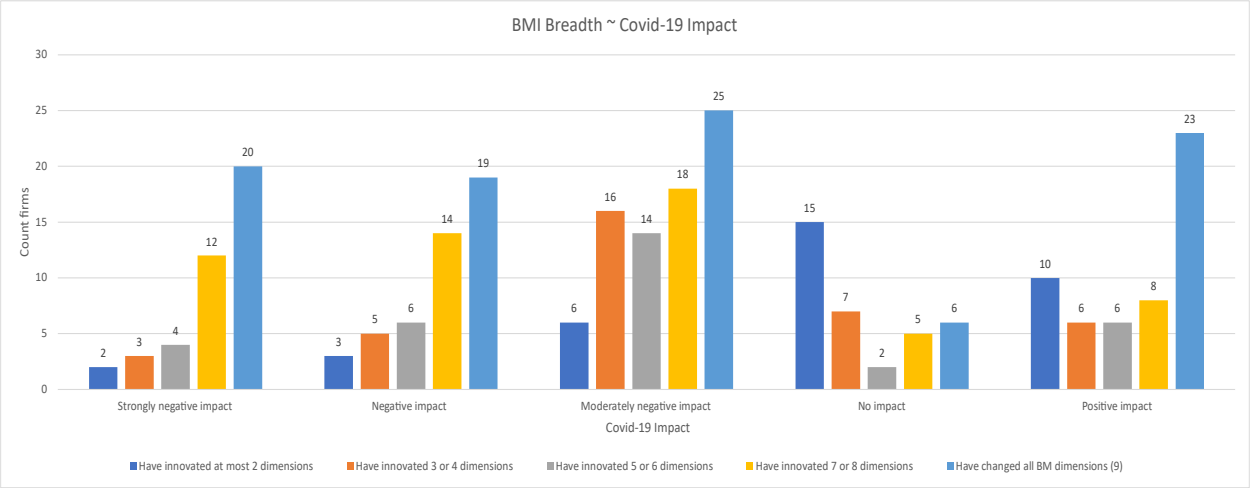


Figure 9: BMI Breadth ~ Covid-19 impact

Next, we decided to cross-reference data on business model breadth with data on the impact of covid declared by companies. (Fig. 9)

It can be seen that the category of companies that have renewed their business model in all its aspects is numerous on all covid impact bands except for zero impact. In the null covid impact band, most of the observations fall on absent innovation or situational adjustment. When analyzing the distribution of the sample on the various covid impact scores we must always take in consideration that most respondents (36%) stated that they had changed their entire business model.

Analyzing the Covid-19 impact bands specifically we can see that the companies that declared to have been impacted in a strongly negative way and in a negative way have a similar distribution among them, skewed towards the right. In particular, 78% of the companies in the most negative covid impact band stated that they had changed all 9 dimensions of their business model, while the other three bands were similar.

The same reasoning can be applied to the second band where 70% changed more than 7 dimensions and the other BMI breadth bands add up to about 30%. Also, in this case, the distribution is very skwed to the right.

The slightly negative impact band is the most populous. As far as the intermediate bands are concerned, the distribution is quite homogeneous, in fact we can notice that the companies that have innovated 3 or 4 dimensions represent 20%, the companies that have innovated 5 or 6 dimensions represent 17% and the band in which the companies have innovated 7 or 8 dimensions represents 22%. In contrast, the borderline bands are completely unbalanced in the percentages. Companies that have changed the entire business model have the highest percentage with 32%, while companies that have changed between 0 and 2 dimensions are only 7% of the distribution.

It is interesting to observe how the companies that declared not to have been impacted by the covid are distributed, as they show a very different distribution from the other covid impact bands.

We can see that the vast majority of these companies are found to have changed between 0 and 2 dimensions, as much as 42%. Adding together the percentage represented by these companies with the percentage of companies that have changed between 3 and 4 elements of the business model (20%) we can see that more than 50% of the companies have changed less than half of the dimensions of the business model. The remaining 40% is represented mostly by companies that have changed all dimensions of the BM (17%). On the other hand, companies with between 5 and 8 dimensions (i.e. two bands) account for 20%.

Considering the companies positively impacted by Covid, however, the vast majority stated that they had innovated all elements of the business model (43%), we can see a notable peak in this bracket. In the intermediate bands the distribution is more homogeneous, in fact both bands of companies that have innovated 3 or 4 elements and 5 or 6 elements have a percentage of 11%. The companies that have innovated 7 or 8 dimensions have a slightly higher percentage (15%). In the other borderline band, made up of the companies that innovated between 0 and 2 dimensions, we find 20% of the companies that declared they were not impacted by covid.

Value Dimension Empirical Analysis

In the following paragraphs we will analyze how the companies have innovated the different dimensions of the Business Model, then we will cluster the companies according to the impact of Covid-19 and compare the different Dimensions innovation.

Value Proposition Empirical Analysis

In this section we will analyze the relation of the value proposition with the impact of the crisis declared by the companies.

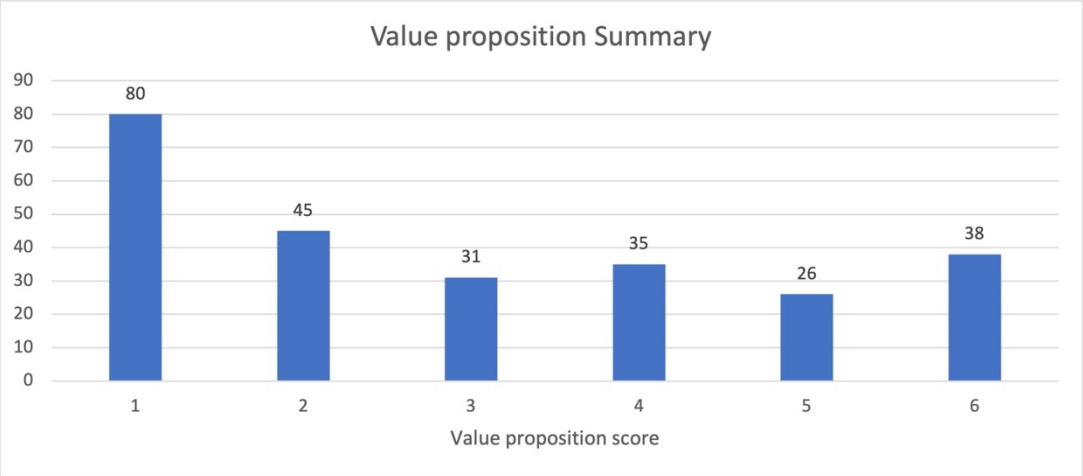


Figure 10: Value proposition summary

The distribution in the various value proposition bands is shifted to the left, in particular 30% of the respondents declared that they have not changed their value proposition, this means that they have not changed their offer, in terms of services and products to customers.

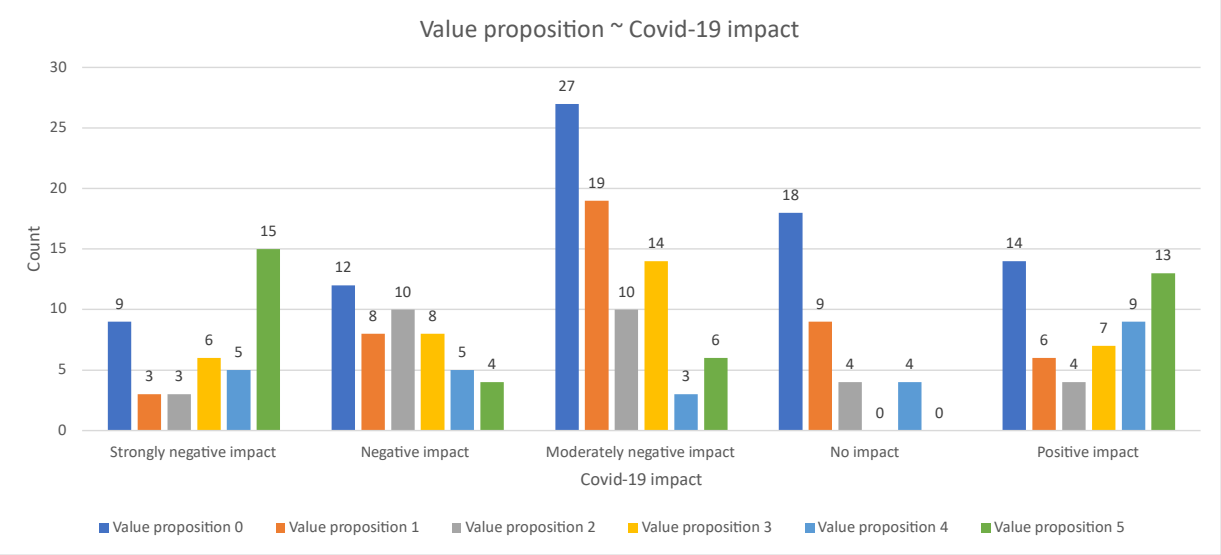


Figure 11: Value proposition ~ Covid-19 impact

As far as the other scores are concerned, there is no particular predominance, which could indicate that changing the value proposition is a factor dependent on the sector in which the companies operate. We can quickly see that in the range of companies that had been impacted by the covid-19 either strongly negative or only negative, there is an imbalance in terms of percentages of companies that have drastically changed their value proposition: 36.5% of the companies that reported being severely impacted by Covid-19 have a value proposition score of 5, this drastic change may be because they have tried to survive the impact of the exogenous shock on their business. On the contrary, there is a relevant part of the sample that, in response to the severe crisis, did not change its commercial proposition to customers.

A common trend can be noted between the moderately negative and zero impact bands in fact firms within these segments did not change their value proposition. Cases of relevant innovation are present with an insignificant percentage.

The segment of companies positively impacted presents a similar trend to the first one. There are many companies that have renewed their value proposition. At the same time a substantial number of companies left their value proposition unchanged, despite changes and external restrictions.

Value Delivery Empirical Analysis

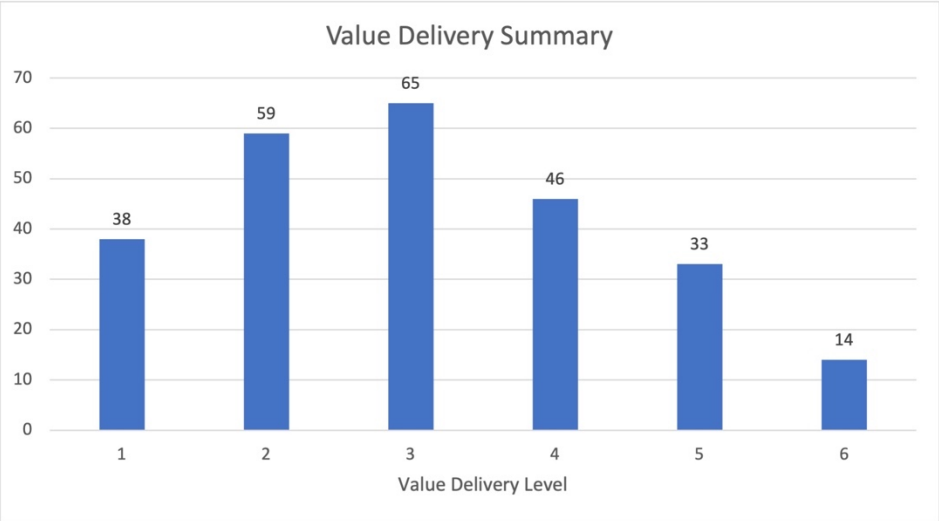


Figure 12: Value Delivery summary

15% of the sample did not change their value delivery. Most said they had made minor changes. In contrast, few companies had made drastic changes to their value delivery, with only 20% falling into the latter two bands.

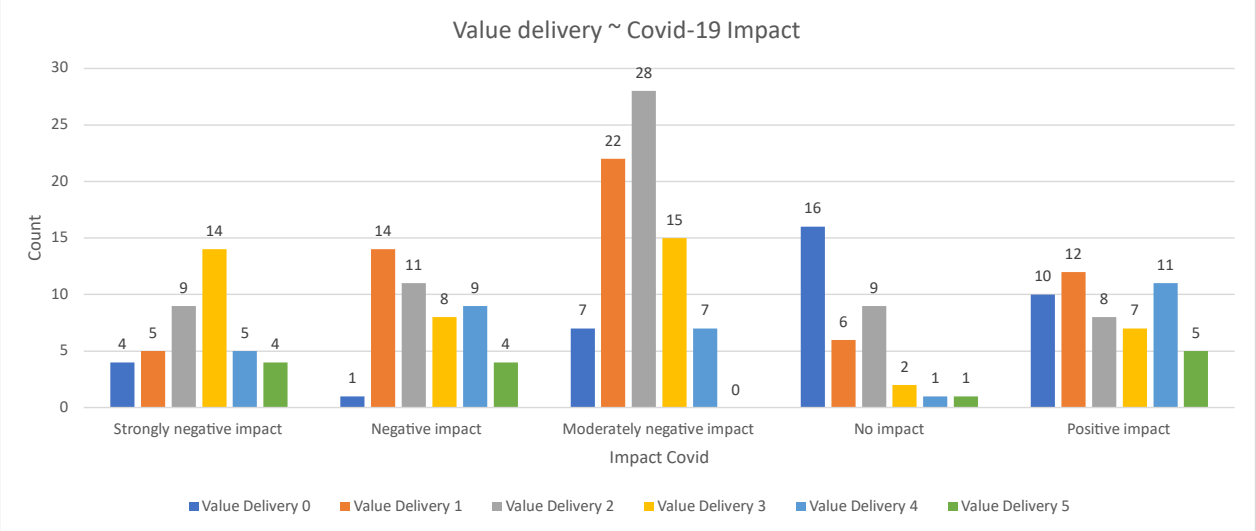


Figure 13: Value Delivery ~ Covid-19 impact

The majority of the companies that reported a strong negative impact from Covid-19 are evenly distributed across the innovation bands, with a peak in Value Delivery band 3 representing an average value of innovation.

None of the companies in the negative impact band changed their value delivery, in fact looking at the graph in detail, we can see that there is more concentration of companies in the first two innovation bands. Those who declared to have suffered a moderately negative impact are the most numerous and are placed, with a very high peak, in the bands of minimum innovation. However, as far as the most critical innovation bands are concerned, there is not much evidence to represent them. Looking at the category of those not impacted by Covid-19, we can see that the majority of companies stated that they did not innovate in value delivery remaining anchored to their previous model; those that stated that they changed the elements of the business model from 3 to 5 are only 10%. The 53 companies that reported a positive effect are evenly distributed across the 5 innovation bands, with all percentages ranging from 10% to 22%. The distribution does not show particularly significant peaks.

Value Creation Empirical Analysis

Considering the value creation of the companies that participated in the survey, we decided to analyze how they innovated in response to Covid. First of all, we will analyze in general the distribution of the six bands presented in the methodology and then we decided to cross the value creation innovation data with the covid-19 impact data.

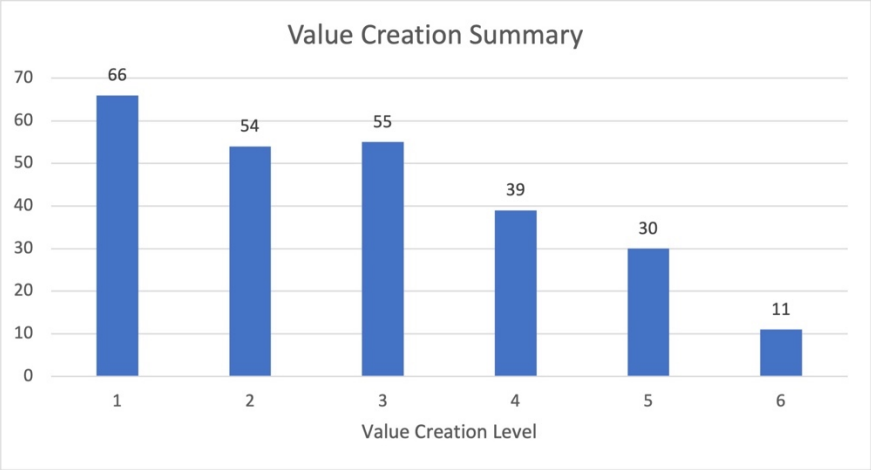


Figure 14: Value creation summary

Looking at the barplot of the distribution of companies based on the extent to which they have changed their value creation is squashed to the left.

In particular, looking at it we can see that the 0 band, that is the companies that have not modified the elements belonging to the dimension, is the most populated and represents 26% of the sample. Then the bands in which value creation has a score of 1 and 2 have an equal percentage (21%). The percentages then fall for the bands with a score of 3 and 4, with a percentage of 15% and 11% respectively. The most extreme band indicating that the company has changed size a lot is the least populated with a percentage of only 4%.

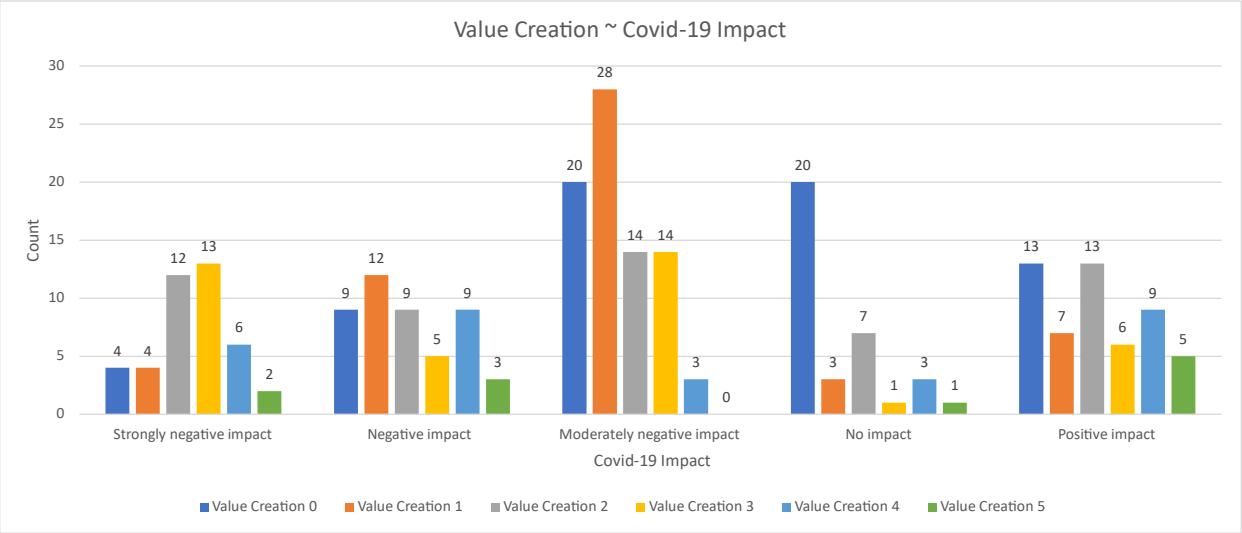


Figure 15: Value creation ~ Covid-19 impact

Looking at the distribution of companies that said they were critically impacted by covid 19 we see that the distribution is concentrated on the intermediate value creation scores of 2 (29%) and 3 (32%), more than 50% of the sample. The lowest innovation bands 0 and 1 have an equal percentage representation (10%). The remaining companies are unevenly distributed over the higher innovation bands. The band representing a value creation score of 4 represents 15% of the strongly negatively impacted companies. The respondents who instead declared to have innovated drastically in size represent only 5% of this Covid-19 impact category.

Considering the respondents who stated that they were negatively impacted by Covid, the distribution shows no regular trends and no peaks.

There are 3 score bands for value creation which have the same percentage. In fact score bands 0, 2 and 4 all have a representation percentage of 19%. The value creation innovation band in the case of the negative Covid-19 impact is the one corresponding to

score 1 (25%). Considering how the remaining companies are distributed, we can see that maximum innovation is represented by only 6% of the companies. The last band to be considered is related to the value creation score 3 with a percentage of 10.5%.

Looking at the graph of companies that declared to have been moderately negatively impacted, we can immediately see that there is a peak corresponding to a value creation innovation score of 1 (35%). Then, the highest percentage is represented by companies that did not innovate in the dimension considered (25%). The score bands 2 and 3 of change in value creation correspond to two equal percentages, in fact both are 18%. It is possible to note that the highest value creation innovation bands are the least representative, in particular in the highest band there are no companies and in the penultimate band only 4%.

We can see that the band corresponding to no impact presents a very particular distribution. In fact, we can see that there is a peak in the number of companies that have not innovated in value creation, which represents about 60% of companies. The remaining companies are more or less evenly distributed over the remaining bands, with the exception of the band with score 2 which represents 20% of the distribution.

The last distribution to be analyzed concerns firms that have been positively impacted by the crisis brought on by the pandemic. In this case there is no well-defined distribution. Companies that have not changed value creation and those with a score of 2 have the highest percentage of representation 25% both. Highest innovation bands share 26% of the responding companies, in particular the band with a score of 5 corresponds to 9% and the band with a score of 4 corresponds to 17%. The two remaining bands, value creation 1 and 3, have a very similar percentage around 12%.

Value Capture Empirical Analysis

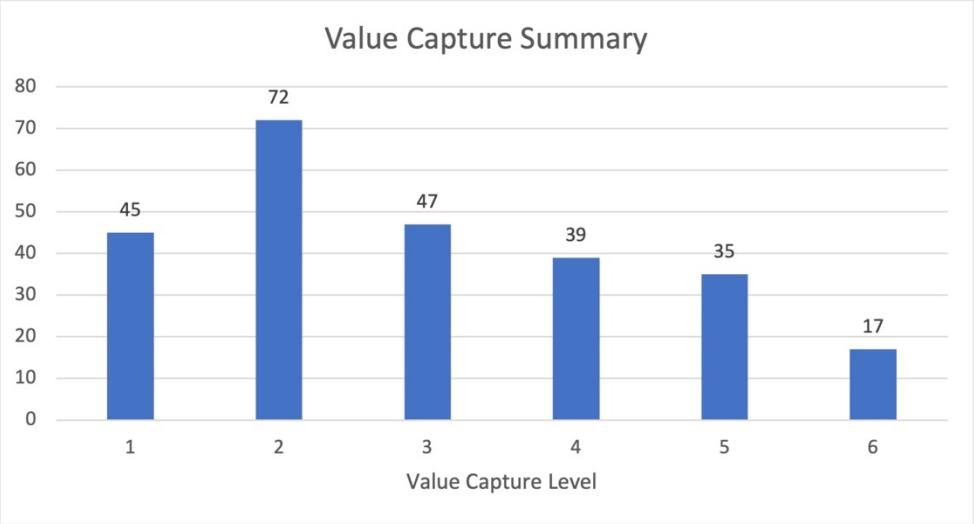


Figure 16: Value Capture summary

The following paragraph will present how the companies have innovated their value capture divided by the impact of the Covid-19

Considering how the companies, based on value capture, were divided up we can see that there is a peak of companies that have innovated very little in their value capture (around 45%). The distribution over the various bands is partly squeezed to the left, with 18% of companies that have not changed their value capture and 18% that have changed it slightly. The remaining percentage of companies is distributed in a decreasing way on the remaining bands, where there is more representation in the band of companies that declared to have innovated on average (3) and then decrease until 6.7%, who declared to have innovated drastically.

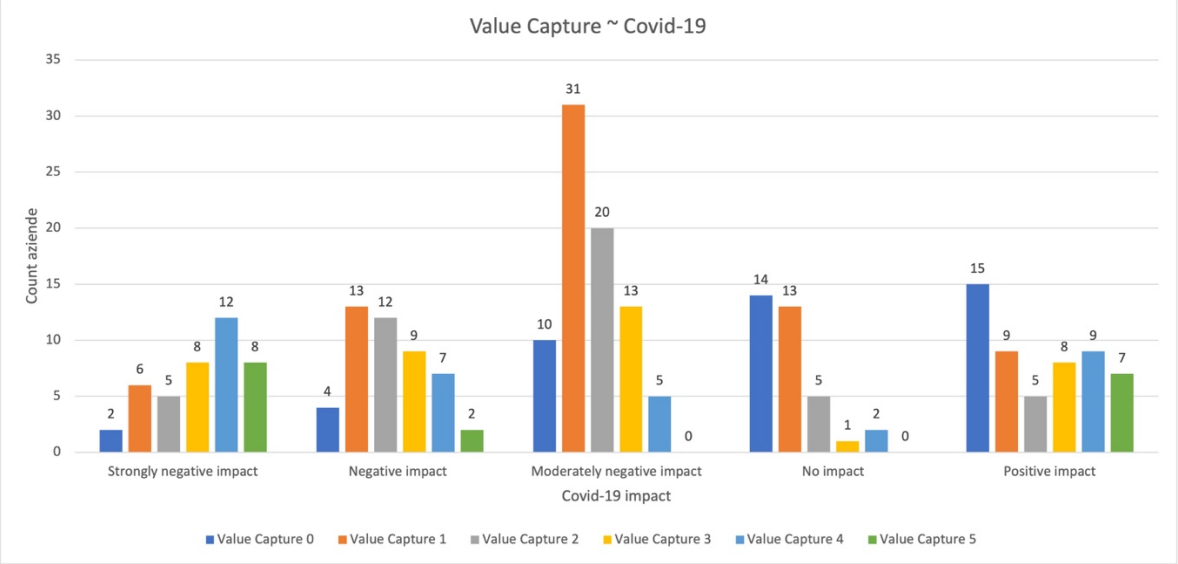


Figure 17: Value capture ~ Covid-19 impact

Looking instead at barplots that relate dimension innovation to covid impact, we can notice that, compared to the other covid impact bands, the strongly negative impact band has a higher number of companies (even at an absolute level) that have implemented substantial changes in value capture, representing 19.5% of the companies in this band. The same percentage belongs to the value capture band with a score of 3. We can note a peak in the value capture innovation band of 4 (29%). Only a few firms have not innovated in value capture, 5%. The two remaining bands, value capture innovation 1 and 2 have a very similar percentage, 15% and 12% respectively.

Considering the negative impact, the distribution shows a notable spike in low level change value captures, with 55% of companies falling into the mild innovation bracket. The companies that declared that they did not change the value capture are 7.9%. It is remarkable that there are no companies that declared radical changes. The value capture innovation 2 band represents 25%. Next, the size innovation score band 3 contains 16% of the companies. The last band to be considered, value capture innovation with score 4, represents 6%.

The distribution of companies that were not impacted by Covid is very peculiar. The companies that declared not to have innovated are 40%, while 37% declared to have innovated only slightly in size. No company declared to have radically changed size, while the remaining percentage is divided on the innovation bands with low percentages.

In particular, 14% belonged to score band 2, only 3% to score band 3 and 6% were in the value capture innovation band of 4.

Looking at the companies that have been positively impacted by Covid: most companies have not innovated the dimension of the business model (28%), while on the other bands the distribution is more even. Regarding the sample as a whole, in this band the number of companies that have innovated drastically is higher than in the other bands. Regarding the sample in general, in this band the number of companies that have innovated drastically is higher than in the other bands, with a percentage of 13%. The bands with a score of 1 and 4 have the same percentage (17%). The value capture 3 innovation band is also very similar (15%). The last band to consider is the band with an innovation score of 2 which represents 9%.

Financing Before and During Covid-19 Crisis

In this session we will look at how the companies participating in the survey requested external funding in two different time frames: before the beginning of the Covid-19 pandemic (February 2020) and after the beginning of the pandemic until the time the survey was sent out. We will then conduct a more in-depth analysis of the companies that have sought funding by comparing whether they have received or not received funding in the same periods, and if so, what impact external funders have had on the company's business model.

Figure 18: Financing research graphs

Looking at the graphs on seeking finance before the pandemic began and since the pandemic began. Out of the total sample, the majority of respondents have never sought equity finance (58%). In contrast, the remaining 42% have sought funding since the start of the business.

Since the start of the pandemic, i.e. in the last year, 32% of companies have sought funding, compared to 68% who have not sought funding. Comparing the two periods, although of different lengths, we note that the number of companies that have not applied for finance has increased by 17%, from a total of 148 to 173. On the other hand, the number of companies that applied for financing decreased by 23%

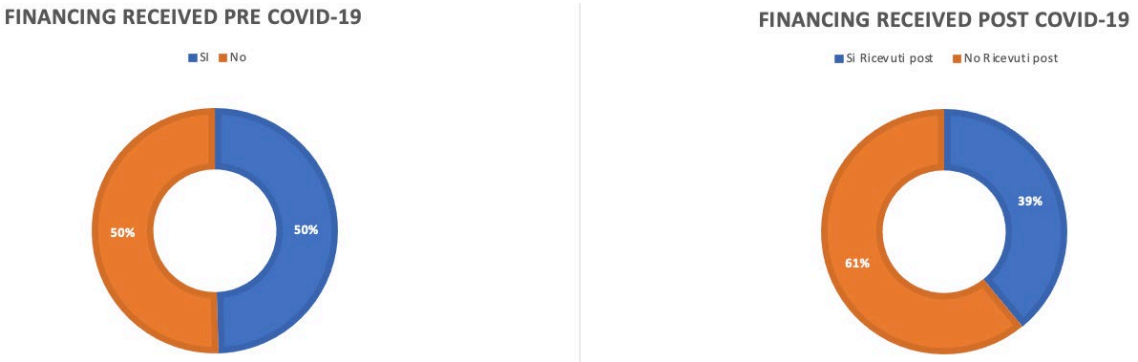


Figure 19: Financing received graphs

In this section we analyze how companies received funding before and after the onset of the crisis. In this division, the sample considered is that of all companies that responded positively to seeking funding both before the pandemic and after the pandemic.

Specifically, before the pandemic, the 107 companies that sought funding were split down the middle in terms of who actually received funding and who did not, 53 and 53 respectively. In contrast, the 82 companies that sought funding after the start of the pandemic are distributed differently, with 61% not receiving funding and 39% receiving funding. The ratios of those received before and after Covid-19 varied.

Another consideration we decided to make regarding the funding received by start-ups before and during the crisis concerns the impact external financiers had on the business model and how supportive and involved they have been.

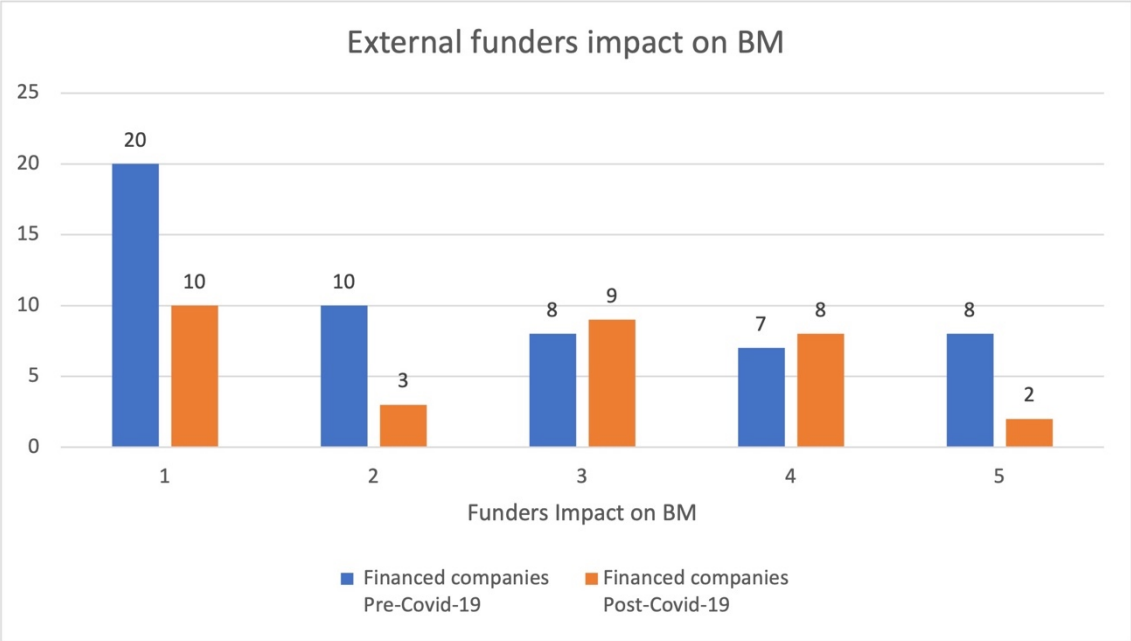


Figure 20: External funders impact on BM

Of the 53 companies that received funding prior to the start of the pandemic, 37%, the majority, stated that their BM was influenced very little by external funders. The remaining 63% were evenly distributed across all ranges of influence on the BM from funders. In particular bands 3 and 5 have an equal percentage (15%), while there are small differences in the business model impact score of 2 (19%) and the score of 4 (13%).

Considering instead the companies that have received funding since February 2020 at the time they answered the questionnaire, in total 32 companies the distribution is different. There is no particular peak, but the band with the highest representation of influence on the BM is still the one corresponding to a very slight influence (31%). The other companies belonging to this category are unevenly distributed. In particular, bands 3 and 4 have a percentage close to the highest, 28% and 24% respectively. The remaining bands corresponding to the highest influence and a score of 2 have the lowest percentage of representation, 9.5% and 6.5% respectively.

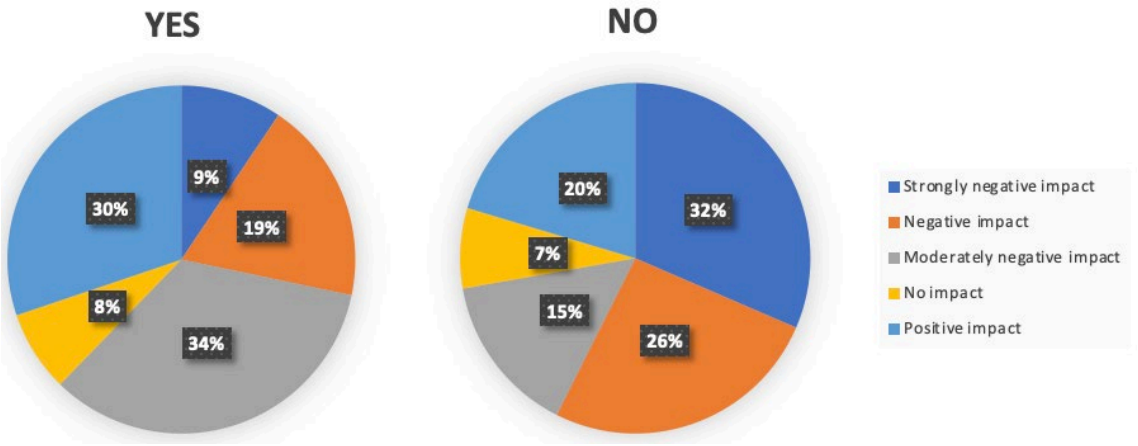


Figure 21: Financing received (Yes/No) before Covid ~ Covid-19 impact

Looking at the pie chart of companies that received funding before the start of the pandemic, we can see that the majority of companies stated that they were moderately negatively impacted (34%) during the situation brought about by the exogenous shock. It is striking that the second band with the most representation is that of companies that were positively impacted by Covid-19 (30%). The next most populous band is that corresponding to a negative impact (19%). The least populated bands have a very similar percentage and are those of strongly negative impact (9%) and no impact (8%).

On the other hand, looking at the graph of companies that sought but did not receive external funding before the crisis caused by Covid-19. The distribution is different from before, with the vast majority of companies reporting a strongly negative impact due to the pandemic (32%). Considering the fact that the negative impact band represents 26% of this segment of companies, we can see that more than 50% had a critical impact during the crisis. 20% of the respondents in this segment answered the survey stating that they were positively impacted by the crisis. 15% had a moderately negative impact and the remaining 7% had no impact at all from the crisis.

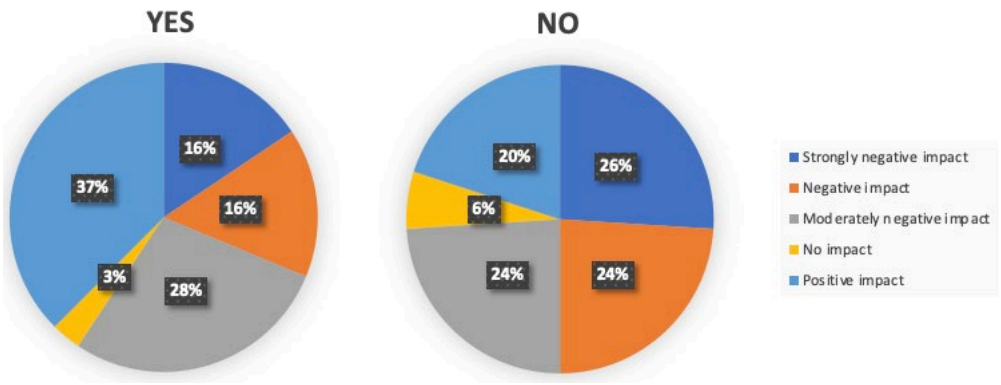


Figure 22: Financing received (Yes/No) during Covid ~ Covid-19 impact

Looking at the companies that have sought and received funding since February 2020 at the time they responded to the questionnaire, we can see that the pie chart shows that 37% of these have had a positive impact on business due to the pandemic. In contrast, 32% said they had been negatively or strongly negatively impacted, with both ranges having a 16% share. 28% were moderately negatively impacted. We note that only 3% of funded companies claim to have had no impact due to the covid.

The situation is different for firms that have sought, but not received, external funding. The bands are all in a very narrow range, with the exception of those firms that have not perceived any impact, which account for only 6%. All other bands are between 20% and 26%. Looking at the individual segments, we can see that 26% responded that they were strongly negatively impacted by Covid-19. This was followed by both the negative impact and moderately negative impact segments with 24%. In contrast, 20% of companies were positively impacted.

Aida and Survey Cross Data Results

In this section we will analyze how the declared impact and innovation variables of the business model (BMI Breadth and Depth) differ according to the Sectors identified through the ATECO Code.

BMI Depth by Sector

In this section we look at how the different sectors have innovated in terms of depth (Fig. 23).

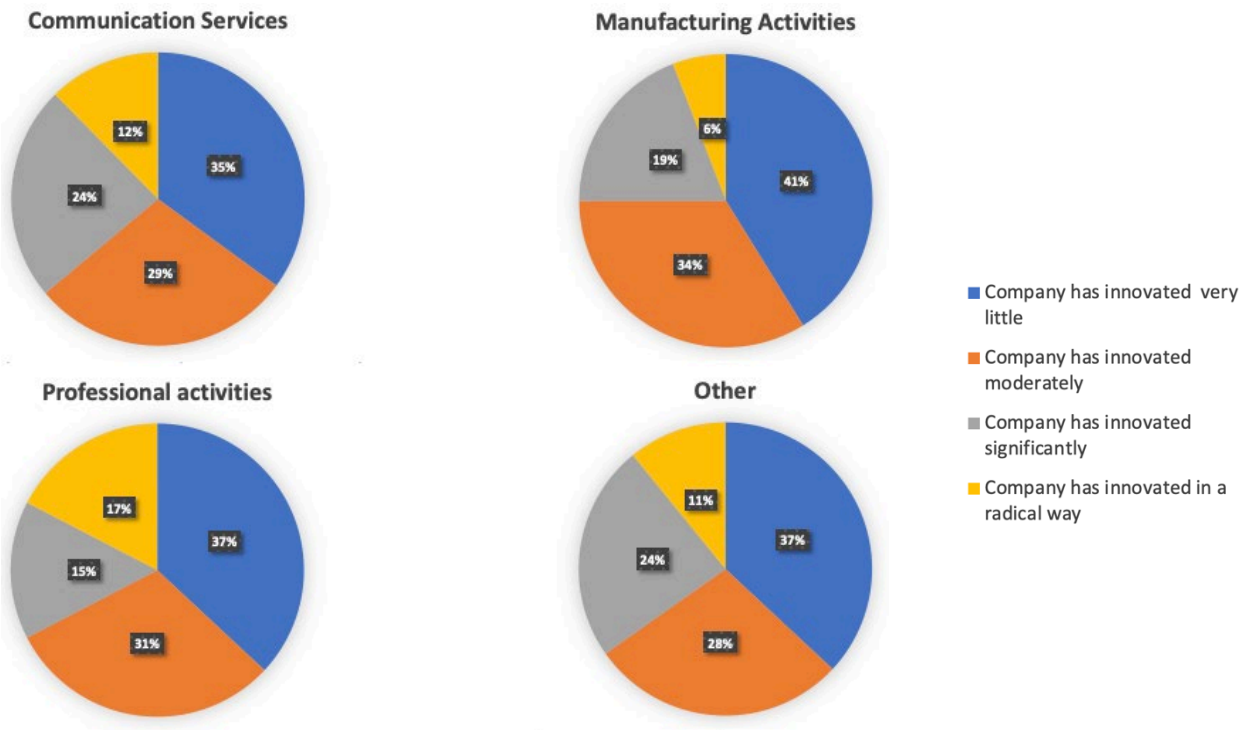


Figure 23: Industries ~ BMI Depth

With regard to communication services, the majority of survey participants have innovated very little in their business model (35%). Companies that have innovated moderately represent 29% of the sample. The remaining two highest bands for innovation are respectively one behind the other in percentage. The companies that have innovated radically are 12% of the companies belonging to the communication services. The remaining 24% belong to the band that has significantly innovated.

In the Professional Activities sector, the majority of companies innovated very little (41%). 34% of the segment stated that they had innovated moderately little and the remaining 25% were distributed over the two highest innovation brackets, with only 6% having innovated radically.

Companies belonging to the manufacturing sector have mostly innovated very little, with 37% falling into this category. 31% have innovated moderately little. We can therefore consider that 68% of manufacturing companies have been restricted in their innovations. The remaining 32% are almost equally divided between companies that have innovated a lot (17%) and companies that have innovated moderately (15%).

The companies that do not belong to the three sectors that mainly make up the sample are distributed as follows: 37% fall into the lowest innovation band, 28% make up the second innovation band. The remainder of the companies fall mainly into the moderate innovation band (24%), while the high innovation band is less represented (11%).

BMI Breadth by Sector

In this section we look at how the different sectors have innovated in terms of breadth.

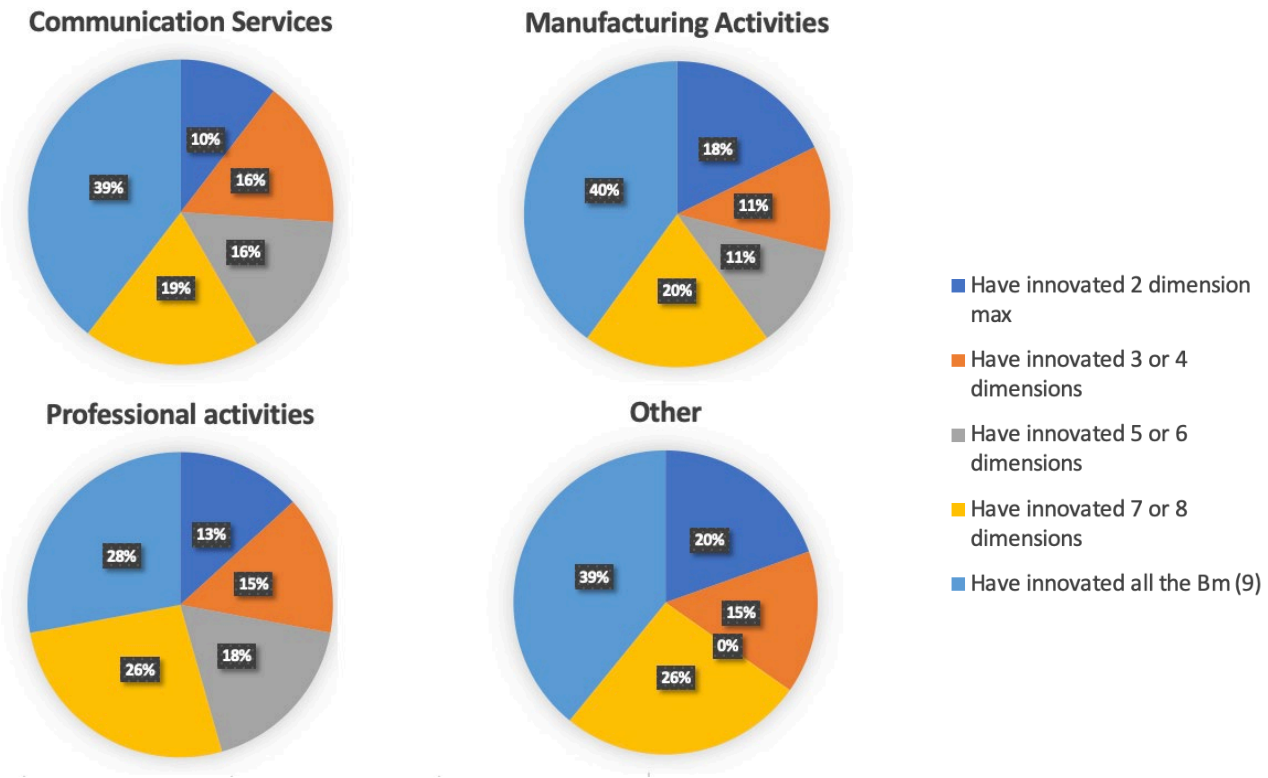


Figure 24: Industries ~ BMI Breadth

Companies belonging to the communication services sector have for the most part changed their entire BM (39%). Only 10% innovated at most two dimensions. The remainder of the sample breaks down with similar percentages. 16% have innovated 5 or 6 dimensions, the same percentage belongs to companies that have innovated 3 to 4 dimensions. The companies that have innovated 7 or 8 dimensions are 19% of the sample belonging to this sector.

For manufacturing companies, the vast majority innovated 7 or more dimensions, with 40% innovating the entire business model and 20% 7 or 8 dimensions.

The two bands ranging from 3 to 6 dimensions accounted for 22% of the segment, both with 11%. Finally, 18% said they had changed at most 2 dimensions of the business model.

In the professional activities sector, 28% changed their entire business model. A similar percentage (26%) changed 7 to 8 dimensions. We can see that more than 50% have changed a large portion of the BM. As for the remaining percentages: 18% said they innovated between 5 and 6 dimensions, 15% between 3 and 4, the remaining 13% changed a maximum of 2 dimensions.

The companies that do not belong to the 3 most represented sectors break down as follows: more than 50% declared to have changed many dimensions of their business model: 39% changed all dimensions, while 26% innovated 7 or 8 dimensions. We can see that no company declared to have changed between 5 and 6 dimensions. We can say that there is a separation in this data between those who innovated many dimensions and those who innovated few. in fact, 15% only changed between 3 and 4 dimensions. The remaining 20% innovated at most 2 dimensions.

DISCUSSION

Covid Impact, BMI Depth and Breadth

Based on the data collected on business model innovation and the impact of Covid-19 regarding the 255 companies that participated in the survey and the variables extracted from the AIDA database. We decided to analyze how much the companies belonging to the various Covid impact bands, presented during the methodology, have modified the most general variables of the Business Model: BMI Breadth and Depth. Subsequently we have analyzed more specifically how the innovations of the 4 dimensions of the business model identified in the methodology are distributed.

To do this as anticipated before, we have grouped the single blocks of the Business Model, as presented in the Business Model Canvas. This was the starting point to make then a more general and structured analysis of the dimensions. This allows us to have an overall dimension of the variables and to go to understand what are the dimensions that have changed most as a result of the crisis of Covid-19 in Italian startups and why these are varied considering the individual elements that make them up.

To make an analysis as structured as possible we first considered innovation in terms of breadth and depth individually without relating it to other measures taken during the survey or by aida, in this way it was possible for us to have an overview of the verticality and horizontality of innovation. With the same reasoning we have considered the 4 dimensions of innovation: *value proposition, value capture, value delivery and value creation.*

Then we decided to analyze the innovation measures by dividing the companies by how they declared to have been impacted by Covid-19. In this way we were able to analyze how the Covid has actually influenced the innovation brought by Italian Startups and SMEs. In particular, we have been able to look for trends and patterns within the impact bands, being able also to make an analysis of the perception that companies have had of Covid.

Then we analyzed how companies have sought funding and if received considering two different periods from the birth of the company to February 2020 (beginning of the crisis

due to the pandemic), and from February 2020 to the time they responded to the survey. With this data we were able to analyze how the funding landscape in Italy has changed before and after Covid. In addition, we decided to analyze how companies that received funding were impacted by Covid-19 by also comparing the two

We then broke down the 255 companies by their industries extracted from AIDA as explained in the methodology. We decided to analyze the measures of BMI Breadth and Depth to make an analysis of how innovation is distributed in different sectors and whether there are sectors that have innovated more than others.

BMI General Summary

In the following paragraph we will analyze the measures of Business model innovation of the companies that responded to the survey. Firstly, we will analyze the more general measure of BMI Depth and breadth then we will go more in deep analyzing the 4 dimensions of the BM.

It is possible to assume that most of the surveyed companies have not carried out major innovations, but have simply made adaptations probably to comply with restrictive regulations imposed by the government because of the virus. As the level of Depth innovation increases, the overall number of companies decreases, which may imply a behavioral trend that is less prone to specific innovation.

Depth

Companies have had to innovate to respond to the severe impact of Covid-19 with a risk-taking attitude. This was necessary to avoid bankruptcy and survive the crisis.

Breadth

The opposite is true for what can be observed on the different Breadth Innovation bands. The trend is opposite and the peak is on the highest Breadth Innovation band.

Looking at the Depth and Breadth innovation graphs together and comparing them, is noticeable how most of companies have adapted their Business Model more than drastically innovate it. In fact, companies are more likely to engage in Business Model Adaptation the more the external threat is severe (Foss and Saebi, 2017).

Value Proposition

The middle bands of value proposition innovation, which correspond to mild innovation, do not suggest any particular considerations in terms of changing the offering or strategy (*Figure 10: Value proposition summary*). Value proposition has undergone adjustments in response to the external shock. A large part of the sample has limited itself to keeping the value proposition unchanged, in line with the threat rigidity theory companies have not changed the value proposition as it is a dimension that requires more effort and has an higher uncertainty of success (Chattopadhyay et al., 2001; Staw et al., 1981).

Value Delivery

We can assume that companies concentrate mainly in bands 2 and 3 because considering how this dimension is constituted (customer relationship, customer segments, customer channels) (*Figure 12: Value Delivery summary).* Companies due to Covid-19 have changed mainly their sales channels rather than their target segment. Again in line with threat-rigidity, companies have modified elements on which they exert more control (Chattopadhyay et al., 2001).

Value Creation

In general, we note that very few people varied this dimension much between unimpacted and positively impacted. This may be due to the fact that companies opportunity threat perceptions impede such commitments and induce decision makers to rely on well-learned response behaviors (Dutton & Jackson, 1987)

Value Capture

The distribution of companies is more concentrated on the mild innovation segments *Figure 16: Value Capture summary).* This distribution could be due to the fact that in response to a first impact with an external factor such as Covid-19, companies try as a first step to act on costs, reducing variable waste and unnecessary expenses. Threat-rigidity theory thus finds that firms confronted with external threats are more likely to respond with caution and more controllable elements (Staw et al., 1981).

An initial explanation could derive from the fact that, modifying or acting on the cost structure, does not always produce a benefit in absolute terms, but may involve critical operational issues to be overcome; in this sense, maintaining the cost structure "AS-IS" in a situation of non-negative impact, could have been the choice of those companies that decided to focus on how to exploit the new opportunities, concentrating resources and time to open up new paths.

Covid-19 Impact: Clustering

In the following paragraphs we will further analyze the clusters identified by splitting the companies according to their answer in the survey relatively to the question about the impact they have suffered because of the Covid-19 crisis.

Strongly Negative Impact

Companies in this segment, since their survival is threatened, have adapted their business model by resigning and allocating progressively fewer resources (Lehner, 2000; March & Shapira, 1987). These companies reacted with a risk seeking behavior in response to threats as opposed to opportunities (Dutton, Jackson, 1987).

This type of reaction from the companies that declared they have been impacted in a strongly negative way is in line with the prospect theory, which suggests that in the face of external threats, managers are more inclined towards risky behavior.

Depth Innovation

Companies have had to innovate to respond to the severe impact of Covid-19 with a risk-taking attitude. This was necessary to avoid bankruptcy and survive the crisis, through the means of innovation. This behavior is in line with studies claiming that business model adaptation is likely to happen under conditions of external threat (e.g. De Reuver et al., 2009; Voelpel et al., 2004)

Breadth Innovation

Breadth innovation behavior is, in this case, driven towards change that encompasses many or almost all areas of the business model. The behavior of these companies has been 'defensive', i.e. that they have innovated to protect their business having been impacted in a strongly negative way. Comparing breadth innovation with depth, the overall level of innovation brought is mostly horizontal; in fact, at depth level there is no extremely specific innovation. Following this line, the innovations made have touched many areas of the business model but not in a critical way, a symptom of the fact that companies had to somehow modify their standard working methods, adapting them to the new external scenario. This is a clear scenario of business model adaptation that increase as the threat is perceived as more severe (Foss and Saebi, 2017).

Value Proposition

The 36.5% of the companies that declared to have been severely impacted by Covid have a score of 6 for value proposition innovation, this drastic change is because the companies in question tried to survive the impact of the exogenous shock, changing their offer to the customer or their revenue streams, again in line with past studies on the subject (i.e. De Reuver et al., 2009; Voelpel et al., 2004, Foss and Saebi, 2017, Chattopadhyay et al., 2001).

Since the arrival of Covid, there has been a strong rush to digitalization both in terms of work management and in terms of proposing the offer to the customer. For this reason companies in question have innovated their value proposition to adapt to the new requirements and respond to the crisis effect.

Value Delivery Innovation

The majority of the companies that reported a strong negative impact from Covid are evenly distributed across the Value Delivery innovation bands, with a peak in Value Delivery band 3 representing the average value of innovation. In response to the shock it these companies have mainly changed their Value Delivery dimension. Firms are unlikely to change their business model unless they have rather strong incentives to do so (Bohnsack et al., 2014; Cavalcante et al., 2011; Santos et al., 2015), this is one of the case in which they had to change it.

Value Creation Innovation

The trend of the Value Creation Innovation segment shows a similar behavior to that of Value Delivery. Companies in question have only slightly shifted partners and activities. In this situation of business shift following a drastic impact with the external shock, it is certainly necessary to adapt business model (Chattopadhyay et al., 2001). In this particular case the elements of value creation, are part of this reasoning.

Value Capture Innovation

The trend line for value capture remains similar to those identified in the previous dimensions, with a greater shift towards more specific innovation. Companies who have been very negatively impacted by the virus revisit their revenue streams and cost structure

in order to cope with the losses or work complexities generated by the impact. Cost structure is one of those BM block on which managers have more organizational control, considering this Prospect theory (Kahneman & Tversky, 1979) provides evidence that individuals in loss situations are risk seeking as long as they have a certain level of control over the situation.

Negative Impact

In the following paragraph, we will analyze how the companies that stated they were moderately negatively impacted innovated their business model dimensions, first with a broader view (BMI Breadth and Depth) and then we will analyze the individual dimensions that make up the business model.

In this sector startups mostly interpret the Covid-19 as a threat. These companies adapted their business model trying to align to the restriction imposed by the situation, reacting with a rigid behaviour because of restriction in information, constriction in control, and conservation of resources, inable to act and/or do something new in the face of economic adversity" (Shimizu, 2007).

Depth Innovation

Considering the depth of innovation, companies that were negatively impacted did not substantially innovate their business model. In particular, most of these companies have tried not to overturn their business model but to adapt it in order to survive the crisis caused by Covid-19 , focusing more on consolidating and returning on tracks of activity already known (Dutton & Jackson, 1987).

Breadth Innovation

We can see here how companies for the most part have innovated all dimensions of the business model. Considering this data in relation to depth, companies innovated in a more horizontal way than vertical.. This can be given by the fact that the business has been modified in order to be in line with the limitations that the pandemic crisis has brought. Government restrictions to curb the spread of the virus triggered a necessary business model adaptation mechanism. Threat-rigidity theory thus finds that firms confronted with external threats are more likely to respond with caution, exhibit an inward-looking tendency (Chattopadhyay et al., 2001; Shimizu, 2007).

Value Proposition Innovation

Considering the value proposition, the moderately negatively impacted companies for the most part have innovated a little on this dimension. To some respondent certain changes have become necessary, for example services that were not digitized, given the impossibility of having a physical interaction (i.e. professional and technical services). Companies have innovated in a non-radical but slightly, responding with caution and exhibiting rigidity in line with threat-rigidity.

Value Delivery Innovation

Survey respondents have decided to change their relationships with customers by trying to create a strong bond and avoid losing them during a period of crisis and environmental turbulence. In fact, it seems that the companies impacted in a moderately negative way have had a rigid attitude to value delivery, modifying only what was strictly necessary, a typical behavior exposed in threat-rigidity theory (Staw et al., 1981).

Value Creation

As far as value creation is concerned, the attitude has been more rigid than innovative, adapting organizational areas over which they think they can exert greater control (Staw et al., 1981), trying to maintain what they do and adapt it to the situation brought by Covid-19 without particular changes. From the analysis made in the paragraph of the empirical results, there is a good representation of companies with a score of value delivery innovation of 4 and this can be given from the fact that it has been necessary to modify in substantial way the activities or to digitalize some of the resources in order to manage them from remote.

Value Capture

Only a few companies reported that they had not changed their Value Capture (Cost structure, Revenue streams). The companies have tried in part to cut costs, fixed and variable in order to mitigate the impact of the covid and to be able to survive. This is one of the dimensions on which managers have direct control, without impact on other part of their business. Let's assume that these innovations are increasingly in response to a threat that has impacted the business rather than exploiting an opportunity (Staw et al., 1981).

Moderately Negative Impact

We will consider the companies that reported being moderately negatively impacted, specifically 79 companies. This represents the most populous impact segment.

Depth Innovation

For the majority of cases, companies that reported being negatively impacted by the exogenous shock, but in a mild and non-damaging way, this level of innovation could be determined by the adaptation of some areas of the business to the restrictions imposed due to Covid-19, in line with threat-rigidity theory (Staw et al., 1981). This shows a rigidity to innovate by companies in this Covid impact band. We can assume that innovation done in a mild manner was helpful in mitigating the impact that Covid had on the firms considered.

Breadth Innovation

With regard to the breadth of innovation, the situation is specular with respect to that seen in innovation depth. In fact, most companies claim to have innovated all dimensions of the Business Model. Considering that the depth, on the contrary, is low, it means that most of the dimensions have only been adapted. Companies had to innovate part of the dimensions to align with the restrictions imposed by the government, responding with caution and going back to known routines (Shimizu, 2007)

Value Proposition Innovation

The companies impacted in a moderately negative way have not innovated their value proposition for most of the cases, this is a symptom of rigidity on the part of this type of companies, which are impacted and do not react proactively, in line with threat-rigidity theory. These companies in a time of crisis, respondents decided not to change what underpins their business, i.e. products and services, but just make adaptation.

Value Delivery Innovation

Looking at the value delivery innovation for these companies we can see that, despite the fact that the sample is the largest compared to the other Covid-19 impact bands, there is no company that has radically innovated the three elements belonging to value delivery: Channels, Segments, Customer relationships. On the contrary most companies focus on

average innovation. Companies are not inclined to change the customer segment of reference and explore new markets in this moment of strong crisis even if they have been slightly impacted, we must consider how difficult it is to settle in a new market. The situation is different with regard to channels and customer relationships, as in some cases it has been necessary to modify distribution channels due to the impossibility of using traditional channels, such as stores. Companies innovate elements they have more control on (Chattopadhyay et al., 2001).

Value Creation Innovation

Companies have not innovated or have innovated only in a very slight way. The same reasoning made earlier can be applied to this dimension, the companies have reacted rigidly to the impact of covid and have not gone to change the components that we can consider founded in the business and source of advantage in the business process, such as activities, resources or partnerships. The activities of the companies have had to be transferred remotely and the resources managed differently. The starting point of different companies must also be taken in consideration.

Value Capture Innovation

There are companies that have not changed the size deciding to remain stable on what was present in the company before the advent of the Corona Virus, this reasoning is typical of companies that respect the threat-rigidity theory. The vast majority instead results to have modified only in a light way the dimension, this could be given from the following a more defensive and rigid reaction, more rapid and efficient to perceive of the changes from part of the startups and often that one to cut the superfluous costs where possible and to revise is the fixed costs that those variable ones, is not equally simple to modify the sources of gain.

No Impact

In the next section we will look at how the 35 companies that said they were not impacted by Covid innovated their Business Model.

Depth Innovation

These companies have not had their business negatively impacted by the situation imposed by Covid-19. Their way of doing business remained almost unchanged. Therefore, the level of BMI sought or achieved is in line with the growth expectations implemented at the strategic level prior to the arrival of the crisis or that the companies do not intend to innovate in a still uncertain period; this concept is consistent with prospect theory (Foss and Saebi, 2017). In this case we can see that the fact that the low depth level of innovation denotes a clear rigidity of innovation and the Covid-19 by these companies has not been seen as an opportunity from which to generate growth and new profits, but have rather preferred to stay on more established tracks without changing the business.

Breadth Innovation

Looking at horizontal Business Model innovation, most of reported changes are between 0 and 2 dimensions: these companies only made few adjustments to be aligned with government restrictions, but these were small. Notably, the non-impacted dimensions have exactly the opposite distribution from all other impact bands given by Covid-19. This denotes a rigidity on the part of companies that were not impacted, consistent with the considerations made regarding depth of innovation.

Value Proposition Innovation

The vast majority stated that they did not change the dimension, remaining anchored to the products and/or services they offer prior to Covid-19. Only a few have declared to have modified slightly to align with the conditions imposed by the Corona virus, such as digitizing the offer or the service, starting from a stable and solid base.

Value Delivery Innovation

As far as the Value Delivery dimension is concerned, also in this case the great majority of the companies have declared not to have modified the dimension in question, the same

reasoning of rigidity made before is applied in this case. Companies that have a score of 2 are more than the other dimensions. This is given by the individual elements that make up this dimension: Customer Relationships, Channels, Customer Segments. Respondents have in fact changed more the relationships they have with their customers in order to retain them, and channels rather than customer segments.

Value Creation Innovation

Value Creation also follows the trend of companies not being impacted by Covid-19, with most companies reporting that they did not innovate on the dimension considered, confirming that there is rigidity among companies rather than a propensity to innovate. The few companies that have innovated this dimension have changed activities or resources, due to the fact that it is more difficult to have formed new partnerships in this time of crisis.

Value Capture Innovation

The trend is in line with to all other dimensions. In particular, companies have not made any innovation or just few innovations. In conclusion there is a good match with the prospect theory also for what concern the value capture dimension.

Positive Impact

In the following paragraphs we will analyze how the companies that reported a positive impact from the crisis caused by exogenous shock have innovated their Business Model.

Depth Innovation

Looking at the empirical study above, the majority of the segment (which falls into the no or minimal innovation bands) did not need to innovate their business model in response to the positive boost brought by Covid-19. Ideas may be divided on this segment as it can be assumed that heavy innovative maneuvers were carried out to exploit new opportunities or alternatively to defend against an unpredictable change in the external scenario. According to prospect theory, individuals in favorable conditions are risk-averse because they feel they have more to lose than to gain. Conversely, individuals who are in unfavorable circumstances are risk- seeking, because they feel they have little to lose. Thus, executives facing threats may be expected to be risk-seeking, and executives facing opportunities may be expected to be risk-averse (Fiegenbaum & Thomas, 1988; Wiseman & Gomez-Mejia, 1998). Obviously, the answer depends on how a company perceives the external situation: whether it sees a prevalence of opportunity or risk.

Breadth Innovation

The number of companies that have innovated in all areas of the business model has a significant percentage on the cluster. In line with the hypotheses developed in the chapter on depth innovation, firms have innovated very heavily in order to exploit the new levers and positive channels that the impact of the external shock has generated. There is a possibility that covid simply enhanced or positively impacted the performance of some areas of the business, so as with depth innovation, a critical and consequently large level of innovation could have generated critical management issues in a turbulent period. This division on the queues within the cluster is also associated with the adoption or maintenance of a specific long-term strategic plan.

Value Proposition Innovation

The fact that Covid-19 positively impacted the level of business of these actors have led several companies to take the opportunity to concretely renew their customer offer, exploiting new channels and resources to enter new markets. At the same time, many

players had a boost in the performance of their core business, without the need or desire to change their offering. In addition, the positive impact of covid and the response in terms of changing the value proposition is be closely linked to the sector in which the companies operate and the product topology offered.

Value Delivery Innovation

Companies that reported having had a positive impact from Covid-19 have the highest number of responses of “not changing their value delivery”. However, these segments also include many companies that have made a radical change to value delivery. These hypotheses are in line with what has been said previously, regarding the reaction to the Covid-19.

Value Creation Innovation

The distribution trend within the band is similar to that of Value Delivery Innovation. Since there are no obvious peaks or strong imbalances in terms of innovation or non-innovation, the discriminator for this type of business model size is a further variable that directly impacts on the willingness to innovate or not. In the category of positively impacted, other discriminating variables gain relevance, such as the occupational sector or the availability of external financing. Value creation describes how the company generates more or less value from its business but does not identify the commercial strength of a product/service on the market; hence no strong assumptions about this dimension are made.

Value Capture Innovation

The behavior of companies on this band in also in line with what has already been discussed. Strong innovation in terms of revisiting cost structure and revenue streams occurred most in the queue band. However, there are numerous instances of non-innovation within the band. In line with the previous hypothesis, it is evident that there is an accumulation of 'resilient' companies that have decided to remain stable in a period of uncertainty, counterbalanced by a number of companies that are also highly innovative in these aspects.

Financing Before and During Covid-19

In the next paragraphs we will consider how the different companies that did or did not seek funding and then whether they actually received it spread out before and after the onset of the crisis due to Covid-19. Next, we will go on to analyze by segmenting companies by Covid-19 impact if there are any differences between companies that sought and/or received financing before and after the onset of the crisis.

Distribution and Funding Search

Considering the companies that have sought funding prior to Covid we can see that the distribution between Yes and No is skewed towards companies that have not sought funding, this means that for the most part companies start with internal funding or are still in a stage of development of their business and have not yet sought ways to expand their scope and markets. We can see that the distribution tends to change since the beginning of the pandemic, in fact the part related to the No's has increased. This may be dictated by the fact that companies in a period of crisis may not be inclined to ask for funding for fear of rejection. This is a typical attitude that was found in the analysis made by OECD in 2009, regarding the effect of the global crisis on startups.

If we consider instead the funding received before and after Covid, in the first case there was a perfect balance in the 107 companies that requested funding between received and not received. Also, in this case the distribution changes with the companies that have not received funding that increase, this is attributable to the period of crisis where startups and small and medium enterprises are the most damaged, in particular it is difficult to receive funding from outside in a period of crisis that is not focused on a single sector, but is expanded to the whole economy.

Analyzing how external financiers have impacted the business model of the companies considered, we can see that before Covid the vast majority has not been minimally impacted by the influence, this may mean that external funding was probably received at a time when the company's strategy was already defined and there was a need to broaden its horizons. On the other hand, as far as the other bands of influence are concerned, they are equally distributed, we can interpret this fact by observing that the influence also depends from company to company and also on the type of financing received. This is in

contrast with literature about financing, since it is considered that founders can help startups to grow with their ability and experiences.

If we observe the situation during Covid-19 we notice that the companies that have declared to have been influenced a lot are only 2.

Covid-19 Impact and Financing Relation

In this section we will consider how firms that received financing before and after the onset of the crisis were impacted by Covid-19.

Before Covid-19

If we look at the two situations: companies that received funding, companies that did not receive funding, in both cases before the onset of the pandemic crisis. We can see that Covid-19 impacted significantly differently. In fact, a good portion of the companies that received funding subsequently experienced a positive impact during the crisis brought on by the pandemic. In contrast, most companies that never received funding prior to Covid-19 mostly reported being impacted in a strongly negative way. One might think that this is given by the support that funders give to companies in terms of expertise and ability to innovate the business, but as we saw in the previous paragraph this is not the case. So the impact could be given by the economic support that you receive from the funding. The fact remains that more than half of the companies have stated that they have been negatively impacted, this may also depend on the amount of funding received during the pre-February 2020 period.

It is interesting to note that the percentage of companies that said they had been impacted in a strongly negative way increases greatly, but the percentage of those impacted positively varies by 10%.

After Covid-19

The vast majority of companies that received funding from February 2020 onwards stated that they were positively impacted by Covid-19, this is probably also given by the fact that one factor leads to another. lenders are more likely to decide to invest money in a company that is already doing well during the downturn trying to take advantage of the opportunity that has been created rather than investing in a company that has been impacted in a highly negative way and needs to be rescued. In spite of this we can see that there are still many companies that have been negatively impacted, in this case we can think of a bet that has not gone well or as we said before an attempt to save companies in which perhaps the lenders have already invested.

Considering instead the companies that have sought funding since the beginning of the pandemic, but have not received it, we have noticed that the percentage of companies that have had a positive impact has decreased, we could assume that these companies have decided to seek funding to take advantage of the opportunity that Covid has created, but then have not received it due to the economic difficulties of the moment that have plagued the whole world.

Both in this case for the companies that did receive funding, the portion of the sample that was not impacted by Covid-19 is small. The vast majority of companies that did not receive funding were negatively impacted, the reason for their research can likely be related to business survival.

Work Sectors, Depth and Breadth Innovation

Looking at the categories of Depth innovation divided by business areas, we can roughly observe how much a sector has been more prone to a certain type of innovation. The type of business in this case is relevant, because it can determine in a decisive way the survival of a startup or SME to the restrictions created to cope with the pandemic. Observing how companies in different sectors have ranked in terms of innovation depth and breadth can open up a number of hypotheses on the subject. In particular it seems that in this period of crisis there is no influence from the sector in terms of innovation

BMI Depth

Looking at Depth innovation in detail, there are no particular sectoral trends or imbalances. The percentages of Depth innovation are approximately the same for each sector. The only peculiarity can be seen in the low percentage of high and moderate innovation for the professional activities sector. It is possible that this type of sector is more rigid in terms of the possibility of vertical innovation due to the nature of professional activities included in this ATECO code. Innovation is much easier for companies operating in the technology and innovation sector, as opposed to more traditional activities, whose innovation is often "inherited" (e.g. a technology that allows a traditional process to be managed in an innovative and optimal way).

BMI Breadth

The different sectors, displayed according to the categorization of depth innovation, do not show great peculiarities. More or less the percentage with which the level of innovation is distributed within each cluster is the same for each occupational sector. It can be noted that for professional activities, the total percentage representing an overall innovation on 7 or more areas of the business model is about 10% lower than for all other sectors. However, the density of such clusters, subsequently subdivided by innovation levels, does not imply empirical statistical validity, which is why none of the possible hypotheses that can be extracted from this concept could make sense. The sector remains a relevant figure but we would need a larger number of respondents for each sector in order to formulate at least plausible hypotheses.

CONCLUSION

Before highlighting the main findings of the research, as well as its contributions to both academics and practitioners, limitations, and possible future developments, it is useful to summarize the research objectives earlier introduced in the Methodology chapter.

- To analyze how Italian start-ups have reacted to the crisis brought about by the Covid-19 virus in terms of Business Model Innovation, trying to identify recurrent attitudes among companies.
- Analyzing how the startup funding landscape has changed from before the start of the pandemic (February 2020) to the period during Covid-19

These main objectives guided our research throughout the systematic analysis of the 280 firms found belonging to the sample of reference, which ultimately represented a key element of the empirical research conducted.

Main Findings

One of the main findings of our research is the analysis of the startups in terms of BMI in particular in a general dimension considering BMI Depth and Breadth and then more in deep with the 4 dimensions: Value proposition, Value Delivery, Value Capture, Value Creation. We defined a framework to measures the BMI in the startups through the use of a survey and integrating data from other datasets, on the basis of a comprehensive literature review of the main building dimensions identified and presented by several influential academics in their research and studies on the business model concept over the years.

We looked specifically at the characteristics of the external shock in question. We noted that this presented typical characteristics of an exogenous shock, but at the same time its effects were similar to those caused by other economic crises, which by nature are endogenous events. Thanks to this parallelism carried out on the characteristics of the shocks, we defined Covid-19 as a hybrid shock, capable of incorporating the peculiarities of exogenous shocks and the economic repercussions of endogenous shocks.

Based on the data collected from the 255 startups that participated in the survey, we were able to create a segmentation using the impact that Covid-19 had on the companies'

innovation process as a discriminant variable. We analyzed how companies have reacted to the crisis brought by Covid-19 according to the literature review made, with a focus on the rigidity and prospect theory. In so doing, this study proposes that both the threat rigidity thesis and prospect theory are valid in organizational settings.

The same analysis was carried out on the funding sought and received by the startups, which allowed us to compare how the companies sought funding and if they received it, in a situation of economic turbulence and crisis compared to a situation of normality.

Contributions

Our main results are primarily aimed at all investors, managers and operators of start-ups or SMEs, being able to draw information on how companies respond to a critical event of this magnitude. Thanks to this analysis, professionals have the possibility to identify themselves in one of the segments identified through the impact generated by Covid-19, to understand how similar companies have reacted to the crisis.

Secondly, our research can be useful to researchers, who will be able to take advantage of our database, implementing and improving it in several aspects, using our empirical results to develop their studies in order to produce different models and analyses, in order to respond to the many future research opportunities still open.

We analyzed two of the most important theories regarding the reaction of companies in period of crises: prospect theory and threat-rigidity finding matches for both. These two theories do not seem to be mutually exclusive.

Finally, with the definition of Hybrid Shock, we tried to provide a new definition of shock that could be useful in the future in order to define events of similar magnitude, or alternatively it could be a useful yardstick to develop further reasoning on the subject.

Research Limitations

The analysis we have done has been guided above all by the division of the sample population into impact groups, but we must consider the fact that this subdivision is subjective, since it depends on the respondents' personal interpretation of the question. In addition, it is important to consider that all questions related to the innovation of the Business Model are subjective and can be influenced by the starting point of the company and the interpretation of innovation itself, although in the questionnaire are the definitions of the individual elements is important to consider how the score is open to interpretation. It is also fundamental to consider that the questionnaire was presented to companies starting in February 2021 one year after the beginning of the crisis, but while the crisis was still ongoing, without a clear indication of when the end is. This does not allow for a clear vision of the crisis and there is the possibility that the full effects have not yet been perceived.

It is also necessary to consider that the sample drawn and the study are focused only on a particular type of companies, namely startups and SMEs. This does not allow for an overall view of the impact of the crisis brought about by Covid-19 as incumbents are not considered.

As each firm was only surveyed regarding their main business model, we cannot account for the fact that firms might be pursuing more than one business model at the same time (Markides and Charitou, 2004). As recent theoretical research argues that firms might benefit from the coexistence of business models that base on different strategies (Markides, 2013) and therefore apply varying reconfigurations of the business model components at the same time.

Our research is limited only to Italian startups and does not consider companies from other countries, again this is a limitation to be considered since during the crisis due to the virus, aid from the state government can greatly influence the economic performance and survival of individual companies.

Our research lacks links to business-related economic performance variables and financial data related to the year 2020. Specifically, it was not possible to find these data due to the extended dates and deadlines for approving budgets. It was only possible for

us to take data prior to the crisis period and the related information instead was all found through the survey, with the risk of having a subjectivity bias.

Future Research Directions

Considering the limitations that we have previously exposed, we now introduce some future directions and related work that could be carried out in order to broaden and enrich the research and study about the topic.

It will be essential to integrate the financial and economic variables, when available within the database to make an analysis of comparison between the period of normality before Covid-19 and since the beginning of the crisis, in this way it will be possible to consider in an objective way the impact that the crisis has had on companies. In addition, to avoid that the measures concerning innovation suffer too much a subjectivity bias, it would be interesting to introduce a measure of entrepreneurial orientation.

Thanks to these variables it would be possible to make a definite statistical model that could test the hypotheses through multilinear regression models or logical regression, which could lead to more structured and proven findings.

In addition, the research could be expanded to other types of companies, not limited to Italian startups in certain sectors, but trying to investigate the entire landscape of European or global startups including more structured companies.

When the crisis brought by Covid-19 will be over, it will be possible to have a more comprehensive view of the shock, analyzing its impact in a more precise way. in this situation it will also be possible to consider how companies have recovered after the shock.

In conclusion, we think our study provides insight into how companies have been impacted by Covid-19 and how they have responded in terms of business model innovation, allowing us to shed light on innovation as a response to a crisis. In addition, we have been able to make an analysis of funding in Italian startups and how this has changed during the period of crisis. We believe that our study can pave the way for further investigation and research to consider a very important shock factor such as the one we

are experiencing at the moment of writing and to analyze how a fundamental part of the Italian economy, startups, have reacted to the crisis

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ANNEX: Survey

Research of Politecnico di MILANO - BMI Survey 2020

Business Model Innovation Survey 2020

This short questionnaire aims to collect information on how the business model of your company has been changed (or not) following the emergency due to Covid-19.

The questionnaire is part of a research project of Politecnico di Milano, coordinated and managed by professors: Prof Ghezzi, Prof Guerini and Prof Cavallo.

We guarantee the utmost confidentiality of the data that will be communicated through this questionnaire.

Please complete all questions in the questionnaire unless otherwise indicated. Below are two definitions relevant to a proper understanding of the concepts in the questionnaire:

BUSINESS MODEL: By business model we mean the way your company operates in order to create and market its product/service offerings to the market.

BUSINESS MODEL INNOVATION: A business model innovation occurs when you introduce a novelty or a significant change in the way your company operates in order to create and market its product/service offering to the market.

IVAAPPLICATION FORM

Enter the IVA number of the company concerned. The data will be used exclusively to catalog the results obtained according to different variables (Industry, company size, company name etc..)

IVA number:

1. Type of external impact determined by the Covid 19 emergency

1.1. How and to what extent has your company been affected by the Covid 19 emergency and subsequent economic recession? Please relate your answer to what you generally consider to be normal market conditions.

o Strongly and severely negatively affected

o Significantly negatively affected

o Moderately negatively affected

o Not affected

o Positively affected

2. Business Model Innovation

2.1 What elements of the business model have you changed in response to the Covid-19 contingency? For each element, indicate on a scale of 1-5 how much you have changed the elements of the business model.

1 = if your company only slightly modified the indicated BM element.

5 = if your company has very significantly modified the indicated BM element.

0 = if the element has not been modified.

Elements that make up the Business Model From 0 to 5

1. Value Proposition: the set of products, services and solutions offered to the market that create value for customers by solving a problem or satisfying a need.

2. Customer Relationship: how the company interacts with its customers. For example, only with digital and online tools or also through a physical point of contact and/or through the creation of communities.

3. Customer Segments: To build an effective business model, a firm must identify which customers it seeks to serve.

4. Channels: A firm can distribute its value proposition to customers through various channels, physical or virtual.

5. Key Activities: The key activities that lead the firm to create its value proposition (product/services) and distribute it to the market.

6. Key Partners: The set of players outside the company (such as suppliers, partners, universities, research centers) with whom relationships of various kinds are cultivated (traditional customer-supplier relationships, partnerships and strategic alliances, joint ventures).

7. Key Resources: The resources needed to create value for clients, and which are considered assets to sustain and support the business. These resources can be human, financial, physical or intellectual.

8. Revenue Stream: The way in which a firm generates revenue from different customer segments to make its business model financially sustainable.

9. Cost Structure: the nature and type of costs to ensure the operation of the business model. In particular, reference is made to the relationship between fixed and variable costs.

10. All elements of the Business Model listed above.

11. None of the elements listed above

3. Funding before the Covid-19 pandemic

3.1 Considering the entire period from the inception of the company to the start of the Covid-19 pandemic (February 2020), did you seek any form of external financing (i.e., additional capital to that provided by the founders at the inception of the company) in venture capital (equity)?

Yes or No or

3.2. If you answered yes to the previous question, did you then actually receive any form of external venture capital (equity) funding?

Yes or No

If you selected NO to 3.2 skip to section 4, otherwise continue to question 3.3.

3.3 Please indicate how much your firm's current business model has been influenced by the support and involvement of external funders on a scale of 1-5, specifically:

1 = if your firm's business model has been little influenced by the support given by external investors.

5 = whether your company's business model has been heavily influenced by the support of external investors. from 1 to 5

4. Funding after the Covid-19 pandemic

4.1 Considering the entire period from the onset of the Covid-19 pandemic (February 2020) to the present, have you sought any form of external financing (i.e., additional capital contributions beyond those provided by the founders at the inception of the company) in venture capital (equity)?

Yes o No o

4.2. If you answered yes to the previous question, did you then actually receive any form of external venture capital (equity) funding?

Yes or No or

If you selected NO to 4.2 the survey is complete, otherwise continue to question 4.3.

4.3 Please indicate how much your firm's current business model has been influenced by the support and involvement of external funders on a scale of 1-5, specifically:

1 = if your firm's business model has been little influenced by the support given by external investors.

5 = if the business model of your company has been influenced a lot by the support given by external investors.

from 1 to 5