

## Article

# Competency-Industry Relatedness (C-IR) Framework for Sustained Business Growth in Startups during and Beyond Pandemic: Myths and Lessons from Publicly Funded Innovative Startups

Varun Gupta <sup>1,2,3,\*</sup>  and Luis Rubalcaba <sup>1</sup>

<sup>1</sup> Department of Economics and Business Administration, University of Alcalá, Plaza de la Victoria 2, Alcalá de Henares (Madrid), 28802 Madrid, Spain; luis.rubalcaba@uah.es

<sup>2</sup> School of Business, University of Applied Sciences and Arts Northwestern Switzerland, 4600 Olten, Switzerland

<sup>3</sup> Instytut Zarządzania, Uniwersytet Szczeciński, ul. 71-004 Szczecin, Poland

\* Correspondence: varun.gupta@usz.edu.pl



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**Abstract:** Context: The coronavirus disease 2019 (COVID-19) pandemic led to a turbulent business environment, resulting in market uncertainties, frustrations, and rumors. Wrongly held beliefs—or myths—can hinder startups from turning new market opportunities into their favor (for example, by failing at diversification decisions) or undertaking wrong business decisions, e.g., diversifying in industries that have products of no real market value). Objectives: The objective of the paper is to identify the beliefs that drive the business decisions of startups in a pandemic and to isolate those beliefs that are merely myths. Further, this paper proposes strategic guidelines in the form of a framework to help startups make sound decisions that can lead to market success. Method: The two-step research method involved multiple case studies with five startups based in India, France, Italy, and Switzerland, to identify perceptual beliefs that drove strategic business decisions, followed by a case study of 36 COVID-19-solution focused startups, funded by the European Union (EU). The findings were validated through a survey that involved 102 entrepreneurs. The comparative analysis of two multiple case studies helped identify beliefs that were merely “myths”; myths that drove irrational strategic decisions, resulting in business failures. Results: The results indicate that startups make decisions in pandemic situations that are driven by seven myths, pertaining to human, intellectual, and financial resources. The decision on whether to diversify or continue in the same business operation can be divided into four strategic options of the Competency-Industry Relatedness (C-IR) framework: ignore, delay, phase-in, and diversify. Diversification in the same (or different industry) is less risky for startups if they have the skills, as needed, to diversify in related industries. Diversification in related industries helps startups leverage their experiences and learning curves (those associated with existing product lines) to adapt their existing products in new markets, or utilize their technologies to solve new problems via new products. The desired outcome for these startups should be sustainable business growth—to meet sustainability goals by contributing to the society and the economy. Conclusion: The C-IR framework is a strategic guide for startups to make business decisions based on internal factors, rather than myths. Accurately assessing skill diversity and the nature of new industries (or markets) will help startups leverage their existing resources optimally, without the need for (pricey) external funding. This will foster sustained business growth resulting in a nation economic development. Knowledge transfer from the Innovation ecosystem will further strengthen the C-IR framework effectiveness.

**Keywords:** startups; coronavirus; COVID-19; European Union; entrepreneurship; strategic decisions; economic development; sustainable business growth; Competency-Industry Relatedness (C-IR) Framework

## 1. Introduction

Startups is one of many initiatives that the European Union (EU) (<https://europa.eu/> accessed on 30 March 2021) is focusing on. The EU has been trying to streamline the administrative procedures associated with starting a new business in order to encourage more people to become entrepreneurs [1]. This focus is grounded in strong economic impacts of startups, as they enhance economic activity, leading to the improvement of economic performance indicators, for example gross domestic product (GDP), employment rates, production facilities, regional developments, etc. Support is provided to startups in the form of findings, knowledge exchange, financial benefits (e.g., tax benefits), residence permits to entrepreneurs, etc. For instance, during the coronavirus 2019 (COVID-19) pandemic, the EU awarded funds to small- and medium-sized enterprises (SMEs) via the European Innovation Council (EIC) Accelerator Pilot to work on projects that would tackle the coronavirus pandemic [2]. Startups can contribute to the growth of a country's economy by their innovative products or services, which result in garnering the attention of government officials.

Startups, defined as temporary organizations searching for scalable and repeatable business models [3], aim to gain success in their respective markets, and evolve into big companies. This objective is not easy because startups deliver innovative products in the market, which signifies that there may not be a well-established market for the product, thereby limiting the market understanding of the startup team. To gain success by releasing the product, and meeting customer needs, a customer development model that uses lean management is proposed in the literature. The basic idea is to interact continuously with the customers by using prototypes, face-to-face, and at the same physical space (for instance, minimal viable products), to capture their feedback, leading to products driven by actual needs, rather than grounded on startup team market hypotheses.

The coronavirus pandemic led to a turbulent business market. Only a few sectors (e.g., health and sanitization) experienced increased demand, while other sectors (e.g., tourism) experienced a low demand. This impacted startups in two different ways: (a) it made it difficult to interact with customers face-to-face due to lockdowns and other social distancing measures. (b) Startups that needed customers to scale quickly found it hard to sustain, especially startups in industries with low demand as a result of the pandemic, these startups either had to shut down their businesses or search for new industries (i.e., change their business ideas).

However, startups found it difficult to make strategic decisions in the middle of a pandemic; their focus was on formulating survival plans, growth, and diversification strategies in existing (or in new) markets. The success of strategic decisions depends on how much these startups are aligned with real market facts, rather than driven by rumors or intuitive reasoning. Rumors and intuitive reasoning could give rise to beliefs that are merely myths, which, unfortunately, also drive the decision-making process, leading to a final business outcome that is probabilistic and catalyzed by myths only.

For instance, HOOP, a UK-based startup founded in 2016, was a leisure and entertainment application that allowed parents to book activities for their kids in nearby locations [4]. COVID-19 had badly affected leisure and entertainment activities due to lockdown restrictions. The startup added a new feature, offering online activities for children, but this did not result in any sales, and the startup announced their exit. What went wrong here? The startup likely believed a myth that online is the key to succeed in the COVID-19 era.

Let us look at a successful example, this time involving the Swedish company Spotify, which is a global leader in music streaming [5]. The Spotify business model generates revenue from advertisements that the users' hear before listening to music. Because of COVID-19, advertisers cut their budgets, and this impacted the company's revenue. Rather than being guided by myths, the company accurately pivoted by offering podcasts to users. These two examples signify that the pandemic provided opportunities equally to all startups as well as big companies, but success depended on the rational decision-makings of entrepreneurs.

Due to the lack of research on startups operating in a pandemic [6], the startup community failed to identify the best practices executed by their peers during a pandemic—practices that may have high applicability in a working context. There may be numerous myths, but identifying the most common myths can help maximize startup agility. The literature lacks the studies that identify the myths among the startups that makes it hard for them to make strategic decisions in pandemic situations.

The two-step research method involved case study with five startups based in India, France, Italy and Switzerland to identify their perceptual beliefs that drove their strategic business decisions, followed by case study of 36 COVID-19 solution focused startups funded by the European Union (EU). The case study findings brought by five startups were validated through a survey with 102 Entrepreneurs. The comparative analysis of two multiple case studies helped to identify the beliefs that merely “myths”; myths that drive the irrational strategic decisions resulting in business failures.

Based on the findings, the Competency-Industry Relatedness (C-IR) framework is proposed, which could drive strategic decision-makings amongst the startups, in view of emerging market opportunities in a pandemic. The results indicate that the startups take decisions in pandemic situations driven by seven myths, which pertain to human, intellectual, and financial resources. The decision on whether to diversify or continue in the same business operation is separated into four strategic options of the Competency-Industry Relatedness (C-IR) framework: ignore, delay, phase-in, and diversify. The startups need to access their internal factors to make business decisions rather based on analysis of dynamic market information during pandemic, which could lead to false positives (business outcomes which are faulty in reality but seem to be promising (positive) based on market trends during pandemic) The reason for false positives on business outcomes stems from the contamination of business information with rumors (for instance, subjective judgments about businesses, fake news and much more).

The results in this article will help startup communities in making rational business decisions based on facts. This will help prevent startups from wasting economic resources as a result of exploring wrong markets, diversifying in wrong industry sectors based on myths (or diversifying into new markets), or being fascinated by a temporary increase in demand across the sectors. The startups can then achieve sustainable goals by contributing to the society and the economy during a pandemic.

Achieving sustainability goals is felicitated by achieving sustained business growth, with the “right” innovative products and services for the “right” market. Diversifying in the correct market with an innovative product can help prevent startups from wasting their financial resources—resources provided by governments to support their survival (for instance, tax holidays or social security for employees), during a pandemic.

A pandemic offers threats, as well as opportunities, for entrepreneurial activities, but decisions made in a hurry could be destructive for entrepreneurs [3,7]. Of course, strategies to survive, grow, or diversify in a pandemic will depend on the availability of the resources, particularly skills and finances. The ability of firms to tackle a pandemic, by adopting proactive and adaptive responses when offering products to a market with changing needs, depends on the availability of the strategic resources inside the firm [8].

This paper is structured as follows: Section 2 provides a theoretical background on startup practices during a pandemic, as well as government support for the startup community. Section 3 highlights the research methodology, focusing on a case study of startups, EU funded startups, and surveys with entrepreneurs. Section 4 highlights the dataset, an analysis of which forms the basis of identification of real market facts (Section 6) by comparing commonly held beliefs among startups in a pandemic (Section 5). Implications for managers are reviewed in Section 7; limitations are presented in Section 8; and the conclusion and directions for future research is presented in Section 9.

## 2. Theoretical Background

### 2.1. Startups Success Rate during the Pandemic

Quantitative values representing startup success rates during a pandemic era was not a strong target for investigation, as evident from the negligible studies reported in the literature. Recently, Wilbur Lab (<https://www.wilburlabs.com/> accessed on 30 March 2021), a San Francisco-based startup studio, reported that, based on a survey of 150 entrepreneurs, 77% of them faced business failures because of the pandemic [9]. Another interesting study finding [9] is that 30% of surveyed entrepreneurs recommended market research prior to launch, 22% recommended formulating stronger business plans, and 13.5% good financing as the way to prevent failures. These findings suggest the role of communicating with customers to identify effective business models driven by market facts and, thus, have good probability of attracting funding. The strategic decisions driven by hypotheses should be avoided to prevent failures.

Startup Genome (<https://startupgenome.com/> accessed on 30 March 2021), a U.S.-based innovation policy advisory and research firm, released a Global Startup Ecosystem Report, which reports that 4 out of every 10 startups are on the verge of being closed due to capital requirements; they just have capital left for the next three months [10]. Furthermore, 72% of startups witnessed a decline in their revenues since the beginning of the pandemic; on average, they are experiencing a decline of 32% [10]. Around 71% of startups reduced their expenses and 60% either laid off employees or reduced their salaries [10]. The overall impact is that these startups will survive on the financial support received by their federal governments (because of their fiscal and monetary policies). In absence of financial support, and due to declining demand, these startups may not survive. Moreover, cost reduction, declining demand, and need for capital during a pandemic will negatively impact the economy and place pressure on government revenues.

### 2.2. Startups during a Pandemic

The authors in [3] reported that, based on interviews with German entrepreneurial ecosystem actors, startups are threatened by their liquidity and long-term survival aspects due to reduced sales and fixed business operation costs. Funding is scarce, there is pressure to adapt to the environmental needs, and innovation ecosystem cooperation is weak. Entrepreneurs adopted the bricolage crisis response in regards to making diversification decisions, by delivering new products or services, and solving new customer problems. Government funding support reached all startup community members due to different eligibility criteria.

Authors in [11] reported that, based on a survey of 162 Indian Agricultural startups, they faced issues, such as liquidity, funding, and a decline in product demand. This triggered them to undertake product tailoring, technology modification, and long-term growth potential investments.

Authors in [12], based on the analysis of Crunchbase data pertaining to the entrepreneurial finance investments in China during COVID-19, reported that the availability of financing to foster entrepreneurial activities, was negatively affected. The declining support for funds impacted entrepreneurial activities.

Authors in [13], based on the comparative analysis of North American and European innovative startups, reported that habitual entrepreneurs are mostly associated with entrepreneurial activities, leading to the establishment of new startups, as opposed to those founded by entrepreneurial teams. The results could provide another perspective that entrepreneurs—with experience in establishing startups prior to the pandemic—may find themselves in a better position to start new entrepreneurial activities during a pandemic.

Authors in [14], based on interviews with entrepreneurs from 15 startups in Iran, reported the various challenges faced by startups during a pandemic. The challenges include human resource management, the market, finances, innovation ecosystem support, crisis management skills, challenges in meeting current obligations towards customers, and the need to adapt business models.

Literature focusing on the response of startups during a pandemic is limited. Themes that emerged from the studies [3,11–14] are presented in Table 1.

**Table 1.** Summary of related work.

Reference	Threats/Findings	Response to Pandemic (Marketing View)
[3]	Liquidity, long-term survival, declining demand, funding, limited support from innovation ecosystems.	New products or services solving new customer problems.
[11]	Liquidity, funding, and declined product demand.	Product tailoring, technology modification, and long-term growth potential investments.
[12]	Limited financing for fostering entrepreneurial activities.	-
[13]	Habitual entrepreneurs dominate entrepreneurial team establishments.	-
[14]	Human resource management, market related, finance related, support from innovation ecosystem, crisis management skills, challenges in meeting current obligations towards customers, and the need to adapt business models	-

### 3. Research Methodology

The research was conducted in two steps. The first step involved a case study with the startups, to identify perceptual beliefs that impacted their strategic decisions. The second step was to collect the real facts pertaining to the 36 COVID-19 solution focused startups, which were funded by the EU on 8 June, 2020 [2,15]. The objective was to use these facts as the basis to identify the beliefs that were merely “myths”. These “myths” formed the basis of the irrational strategic decisions in the startup context that finally resulted in market failure. The case study guidelines, as proposed in [16], were utilized to conduct the case studies.

#### 3.1. Case Study with Five Startups

Five startups based in Italy, India, France, and Switzerland were interviewed through online interviews during September 2020 (the time period representing the second wave of COVID-19), to identify the rationale behind their strategic decisions in the pandemic. Brief details about the five software startups (named A, B, C, D, and E to keep their real identities anonymous) are presented in Table 2.

**Table 2.** Startups details.

S. No.	Startup Name	Country	Market Growth	Number of Employees (Team Size)	Management People Interviewed	Industry Served	Change in Business (During COVID-19)
1.	A	Italy	About to turn into company	8	4	Social sector	No.
2.	B	India		7	3	Financial	No.
3.	C	France	Initial Growth	12	4	Education	No.
4.	D	India		09	2	Education	No.
5.	E	Switzerland		10	3	Medical	No.

The interviews were conducted with the startup management representatives involving startup founder, chief technology officer, chief executive officer, director (research), etc. The designations varied across the studied startups, but the officials who took part in the strategic decisions were involved in the case study. The meeting reports were also analyzed in order to explore the information obtained in the interviews. The five startups

were selected because they represented a mixed array of businesses across the market growth scale (considering growth as a continuous scale of the market share). Three startups were about to turn into companies (on the higher end of the growth scale), and for two startups, there was growing demand for their products (they were just at the beginning of the growth scale). Further, these startups already participated in three previous case studies conducted by the authors [17–19], which strengthened the knowledge sharing due to familiarity of research and the startup environment.

### 3.2. Validation of Case Study Findings through Survey

The findings were validated by a survey conducted with 102 entrepreneurs from 100 startups. The survey objective was to identify the prevalence levels of the identified beliefs amongst the surveyed startups—beliefs that impacted the strategic business decisions of these startups. Startups have different working contexts, different challenges to face, and different resources, so they may have different bases for making strategic decisions. However, the survey outcome will help validate the identified beliefs prevalent in diverse startup populations. Findings of case studies are never generalizable, and this survey is one way to justify efforts in targeting these beliefs, which could help startups make rational decisions in a pandemic.

The survey questionnaire, presented in Table A1 (Appendix A), was shared with 140 entrepreneurs who had active relations with many universities through incubators, accelerators, spin-offs, partnerships, etc. The 102 entrepreneurs responded to the questionnaire (73% response rate). Table 3 displays demographic information on the survey participants.

**Table 3.** Survey Participants Demographics.

Parameter	Number	Percentage (%)	
<b>Age</b>	21–25	20	19.61
	26–30	40	39.22
	31–35	30	29.41
	35+	12	11.76
<b>Continent</b>	Europe	30	29.41
	Asia	25	24.51
	America	20	19.61
	Africa	17	16.67
	Australia	10	9.80
<b>Gender</b>	Male	60	58.82
	Female	42	41.18
	Prefer not to say	Nil	0.00
<b>Domain</b>	Engineering	21	20.59
	Medical	20	19.61
	Business Management	19	18.63
	Interdisciplinary	40	39.22
	Other	02	1.96

Survey participants were diverse, in terms of their age, continents to which they belonged, gender, and domain expertise. This diversity included global perspectives from young and experienced entrepreneurs. Few countries have a strong startup ecosystem and, thus, involving entrepreneurs from across the world overcomes the possibility of a few countries dominating the outcome.

Table 4 provides the statistical outcomes of the participants' responses to the questions asked in the questionnaire. The measurement scale of 1 to 5 was used; with strongly agree = 5, agree = 4, neither agree nor disagree = 3, disagree = 2, strongly disagree = 1. The responses collected were aggregated and averaged for each question across an individual

measurement scale. High mean values represent the level of agreement among the surveyed participants, which either supported or contradicted the case study findings, depending on which measurement scale category received the majority of responses. For example, a mean value of 4.9 was too high; it showed a high level of agreement among participants. The case findings (as represented by the questionnaire questions) are in agreement with the survey findings if the majority of survey responses are associated with the “strongly agree” or “agree” category. Table 4 presents the outcome of the survey.

Table 4 shows that, overall, 56.6% of entrepreneurs strongly agreed, 25.6% agreed, 3.9% had no perspectives, 2.1% disagreed, and 2.1% strongly disagreed with the case study findings, with a 4.03 average agreement (out of 5) among survey participants. The agreement supports the case study findings (82.2% agreed to the findings of the case study).

### 3.3. Case Study of 36 EU-Funded Startups

The EU granted Euro 166 million to 36 startups under the European Innovation Council (EIC) Accelerator Pilot to tackle the coronavirus pandemic [2]. The data collection on the 36 EU-funded startups involved the analysis of websites, LinkedIn profiles, and Crunchbase. The information to be searched was scoped by the factors, implicitly or explicitly represented by the identified beliefs (through the case study with the five startups). The initial details of the 36 startups were collected from the official website of the EU on 12 February 2021 [15].

The information extracted included (a) startup name, (b) project name, (c) website link, (d) city, and (e) country. The website link was used to access the individual startup details. The information available on the official website does not give complete information as looked at by the authors. For instance, in a few cases, the team details were not completely mentioned, except for those at corporate management levels. The details are elaborated by accessing the LinkedIn profiles of these startups. In case multiple information about the same variables were available on the official website and the LinkedIn profile (for instance, team details), the following conflict resolution strategy was adopted:

- (a) Official website information is detailed, with useful insight: information on official websites was considered more accurate than that available on LinkedIn. The dataset was populated with the information from the official website only.
- (b) Official website information is too limited to bring any useful insight: LinkedIn information was considered more accurate than the official website information. The dataset was populated with the information from the LinkedIn profile only.

Thus, the dataset was populated by collecting data from the official websites and LinkedIn profiles of the startups. In one startup case, the information was accessed through the Crunchbase database. LinkedIn profiles were only searched if the official website did not provide enough information or lacked information. The dataset considered both startups and small- and medium-sized enterprises (SMEs) equivalent in this article.

These startups were selected due to their potential to provide effective solutions to the COVID-19 pandemic. The rigorous evaluation resulted in the selection of 36 startups among 1400 applications submitted to the EIC Accelerator pilot in March 2020. Studying the context of these startups will provide rich lessons to startup communities in pandemic situations.

The data collection, analysis of the data, and preparation of the Excel file was conducted by V.G. (first author) and reviewed by L.R. (second author). Conflicts (10%) were resolved by consensus meetings. The compiled dataset is hosted at Harvard Dataverse [20] and can be accessed at <https://doi.org/10.7910/DVN/L88OOB> (accessed on 20 March 2021).

Table 4. Survey Results.

Variable Measured	Statement/Question	Strongly Agree (%)	Agree (%)	Neither Agree nor Disagree (%)	Disagree (%)	Strongly Disagree (%)	Mean	Overall Mean
Myth 1: large team size helps startups grow in the market.	Have you conducted business expansion (scaling) decision based on your team size?	52.2	26.5	6.2	3.5	1.8	3.95	3.92
	To make internationalization decisions, or diversification decisions, do you consider your team size as one of the internal competencies?	51.3	25.7	5.3	6.2	1.8	3.89	
Myth 2: it is a good idea to diversify into markets with increased demand during a pandemic.	Do you get motivated to launch a new product in an industry that shows increasing demand trends?	69.0	20.4	0.0	0.0	0.9	4.27	4.18
	Is customer demand being the main basis when it comes to making strategic decisions?	63.7	18.6	2.7	2.7	2.7	4.09	
Myth 3: pivoting is in the startup DNA and this will be a catalyst for turning COVID-19 into an opportunity.	Do you feel pivots are a safe option to tackle fluctuating demand during the COVID-19 pandemic?	57.5	23.0	2.7	3.5	3.5	3.98	3.94
	Do you feel comfortable to make frequent pivots to improve business conditions during the COVID-19 pandemic?	53.1	23.9	5.3	4.4	3.5	3.89	
Myth 4: funding is scarce during a pandemic. It is impossible to attract good funding.	Do you reduce your efforts to attract new funding because of the pandemic?	55.8	31.0	3.5	0.0	0.0	4.13	4.12
	Are your business decisions affected because you feel that funding is hard to receive during a pandemic?	55.8	30.1	2.7	0.9	0.9	4.10	
Myth 5: alignment of the startup founder's background with the new industry expertise requirements (industry where the startup identified business opportunities), fosters strategic decision success in highly uncertain circumstances, especially during a pandemic.	Do you prefer to launch products in the industry that matches your domain expertise?	61.9	19.5	2.7	0.0	6.2	4.02	4.09
	Do you avoid diversifying into "unrelated" industries (different from your background)?	61.1	24.8	3.5	0.9	0.0	4.17	

Table 4. Cont.

Variable Measured	Statement/Question	Strongly Agree (%)	Agree (%)	Neither Agree nor Disagree (%)	Disagree (%)	Strongly Disagree (%)	Mean	Overall Mean
Myth 6: availability of a large team of diverse skills is the only prerequisite to survive or grow in the market during a pandemic.	Do you feel that your business will survive turbulent market fluctuations if you have a big team with diverse expertise?	45.1	34.5	7.1	1.8	1.8	3.90	3.95
	Do you think that team size and diverse skills are the main criteria for strategic business decisions?	52.2	29.2	5.3	1.8	1.8	3.99	
Myth 7: the growing startups usually have a single product in the market and diversification (offering more products in the product line) is the reason for failure.	Do you feel that startups should concentrate solely on a single product?	52.2	26.5	6.2	3.5	1.8	3.95	3.92
	Do you feel that, as a startup, you avoid launching another product, when you are already scaling up?	51.3	25.7	5.3	6.2	1.8	3.89	

#### 4. Dataset

This dataset comprises the details of the 36 startups that were funded by the European Union (EU) under the European Innovation Council (EIC) Accelerator Pilot to tackle the coronavirus pandemic. The details include:

- (a) Startup establishment year.
- (b) Startup founder's background.
- (c) Primary industry served before COVID-19.
- (d) Team size and competencies.
- (e) Product line and nature of COVID-19 related products launched.

The dataset file was composed of 16 columns, signifying meaningful information about the background, organizational, product, and "In House Vs outsource" decisions (referred to as development/manufacturing location, hereafter), as shown in Table A2 (Appendix B). These variables helped analyze the strategic decisions of the startups, which can be adapted by competitors to avoid making irrational business decisions during a pandemic. The data types and meanings of the dataset columns are provided in Table A3 (Appendix C). Authors should discuss the results (and the interpretations) from the perspective of previous studies and of the working hypotheses. The findings and their implications should be discussed in the broadest context possible. Future research directions may also be highlighted.

#### 5. Seven Commonly Held Beliefs Amongst Startups

Representatives from the five startups were asked how they perceived the business environment during a pandemic and what factors (pertaining to the startup context) influenced their strategic decisions. Table 2 highlights that, although these startups did not change their ongoing businesses by diversification or pivoting during the COVID-19 pandemic, yet, at some point, the corporate board analyzed the environment and conducted evaluations of the different business alternatives. As the study was conducted in September 2020 (the time period representing the second wave of COVID-19), the authors had access to the strategic decisions made from March to the beginning of September. The analysis of the insights (shared by the startups) and analysis of their meeting records highlight the following seven beliefs, which were the basis of their strategic decisions made during the first COVID-19 wave.

Myth 1: a large team size helps the startup grow in the market.

Justification: it is possible to capture opportunities, especially in pandemic situations, only if startups have a large team size. This helps startups optimally distribute the work related to existing products and new products (to be released during a pandemic) amongst available teams. As per the founder of startup C, *"We considered to launch a new product in the education area again, helping universities to take advantage of resources of competitor universities, but we voted against this idea because we have limited team"*.

Myth 2: it is a good idea to diversify into markets with increased demand during a pandemic.

Justification: during a pandemic, industries witness different trends in customer demand and buying habits. For instance, during COVID-19, the travel industry experienced a down time, while the health sector experienced opposite trends. It may be hard for a new startup to survive in a pandemic; pivoting seems to be a better option. As per the founder of startup D, *"One of the options that was discussed frequently in our board meetings was the launch of a new product in the medical domain as well. The product we thought to launch was alcohol gel sanitizer in partnership with a local manufacturer because the demand for this product increased rapidly during the lockdown. The competitor products were very expensive, and we have good relations with the distribution channels to bring a great value to the customers"*.

Myth 3: pivoting is in a startup's DNA; this will be a catalyst for turning COVID-19 into an opportunity.

Justification: the pandemic brings sudden and unexpected fluctuations in the market. This required startups to make quick decisions and experiment with new ideas. Lean

startups have a rich experience with continuous experimentations, which could help them find suitable ideas that work in the market during a pandemic. As per the founder of startup A, *“Our startup has a good experience with uncertainties and reacting quickly to changed market situations is our strategic asset. We love challenges & failures, but we marry success”*.

Myth 4: funding is too scarce during a pandemic. It is impossible to attract good funding.

Justification: the pandemic brings fluctuations in the business environment and reduced demand. Investors also avoid or reduce investing in startups that de-align with the temporary market trend changes.

Myth 5: alignment of a startup founder’s background with new industry expertise requirements (where startups identify business opportunities) fosters strategic decision success in highly uncertain circumstances, especially during a pandemic.

Justification: the rich background in the area that aligns closely with the new industry, which attracts a steady rise in demand, helps startups make informed decisions. As per the chief technology officer of startup B, *“We discussed many options to conquer amid COVID. The founders’ rich background in the financial and pharmaceutical domain helped us avoid exploring the markets of health & wellness. As per his advice, the trends are temporary and most of these products will become commodity products in the future”*.

Myth 6: availability of a large team of diverse skills is the only prerequisite to survive or grow in the market during a pandemic.

Justification: the availability of diverse team skills can help startups make strategic decisions to survive in the market. For instance, startups with rich skills in the technical and biotechnology domains can only grow in the market as they can find innovative ways to diversify existing products.

Myth 7: growing startups usually have a single product in the market and diversification (offering more products in product lines) is the reason for failure.

Justification: startups have limited resources and work under high uncertainties. Finding a scalable and repeatable business model is the hardest part and most startups fails in this process only. Efforts to launch a new product, when startups are struggling with a main product, will be a “knee-jerk” decision.

The seven myths are the beliefs of the studied startups that forced them to remain in their primary business rather than experiment with new industries that experienced sudden growth of demand.

## 6. Real Facts

Analysis of the 36 EU-funded startups provides strong evidence that negates the seven myths that confront many startups, especially during COVID-19 pandemic. The facts suggest that the seven myths should not be considered limiting factors for startups during the COVID-19 pandemic, as these startups take measures to survive in the existing market and fulfil their responsibility towards society. The results of the analysis are provided individually, against each one of the seven myths.

Myth 1: a large team size helps the startup grow in the market.

Fact: the team size of the startups ranged from a minimum of 3 to a maximum 55, and an average of 18 (considering the team size of AW Technologies was 10). The startups had single-to-multiple products on the market. This is a good indication that a large team should not always be considered a criterion for growth in the market, especially during a pandemic.

Lesson learned: the startups should make strategic business decisions, but not solely based on their existing team sizes. A small team could work together through strong coordination and communication to drive business growth.

Myth 2: it is a good idea to diversify into markets with increased demand during a pandemic.

Fact: The startups did not change their primary markets. To illustrate this point, consider the following few instances:

- Content Flow GmbH (established in 2015) did not diversify into new markets, but rather found applicability for its live streaming platform as a solution for COVID-19 challenges.
- Avy B.V. (established in 2016) proposed the applicability of its unmanned aerial vehicle (UAV) “drone” to provide urgent medical deliveries using drones.
- COVID-19 Telemedicine ApS (founded in 2020) launched a “remote patient monitoring system”, which seemed to have high applicability during the COVID-19 pandemic (and will have high applicability in future epidemics). The objective was to screen and monitor patients through online tools. This startup was born during the COVID-19 pandemic period by providing an effective solution.
- NanoScent Ltd. (Established in 2017) diversified into a new product, which can detect COVID-19 in just 30 s. Their diversification was possible as they utilize scent technology as their strategic asset.

To provide COVID-19-related solutions, the startups: (a) adapted their products to provide solutions to COVID-19; (b) found applicability of their technologies for COVID-19 issues (and thus diversified); (c) created entirely new solutions. This also signifies that disruptive ideas (with no previous history of similar products in the markets) could result in business success, but this direction should be chosen carefully.

Lesson learned: the startups should avoid diversification in relatively unknown industries with completely new products and new technologies. The sudden increase in demand in one industry may be merely for a short time. The strategic decision to enter a new industry should not be made based on rumors or short-term market trends. It is advisable to find interdisciplinary applications of existing technologies or applicability of existing products to solve new problems in the markets (for instance, pandemic problems). This helps startups use their experiences and learning curves in new industries. Diversification in completely unknown markets should be avoided (no matter how promising it appears to be).

Myth 3: pivoting is in the startup’s DNA and this will be a catalyst for turning COVID-19 into an opportunity.

Fact: none of the startups made a pivot. They strongly focused on their existing products and managed to identify opportunities using their existing technologies or products.

Lesson learned: success in the market during a pandemic requires focusing on existing efforts rather than rapidly changing directions. Changing directions driven by market rumors or temporary trends could be detrimental for startups.

Myth 4: funding is too scarce during a pandemic. It is impossible to attract good funding.

Fact: the EU awarded Euro 166 million to 36 startups. Funding opportunities are not scarce, but they require innovative ideas.

Lesson learned: startups should try to get funding from leading funding agencies and should focus on funding from other investors (even if limited during a pandemic). They should focus on improving their business solutions rather than being misguided by this misconception.

Myth 5: alignment of the startup founder’s background with new industry expertise requirements (an industry where the startup identified business opportunities) fosters strategic decision success in highly uncertain circumstances, especially during a pandemic.

Fact: the startups did not change their primary industries in pandemic situations. In other words, they found solutions for COVID-19 problems with their existing solutions or technologies. There is no instance where any of the startups moved from one industry to a completely unrelated industry (e.g., transportation to the pharmaceutical industry). One startup actually proposed the application of their transportation solutions to medical solutions (for instance).

There are many startups where the founder has a different background than the industry served by their products. Yet, the startups are successful and innovative enough to create value in society. For instance:

- moveUP.care (established in 2015) serves the medical industry. The founder has experience in engineering and management.

- Virogates AS (established in 2001) serves the medical industry. The founder has a rich background in management.

Lesson learned: success in the market, especially during a pandemic, depends on the availability of the different types of expertise scattered across the stakeholders of startups. For instance, startup founders, chief technology officers, chief executive officers, chief finance managers, etc., have to work unitedly to uniquely combine their best practices to a strategy that works for the startup. Success is not dependent on expertise of a single person, but on availability of different types of expertise in the startup environment.

Myth 6: availability of a large team of diverse skills is the only prerequisite to survive or grow in the market during a pandemic.

Facts: diverse team competencies are required for being successful in the market. However, larger skill sets (quantitatively) (the same skills processed by larger groups of people) is not a prerequisite for success.

All of the studied startups have diverse skills, including strong management skills, expertise in engineering/technology (software engineers), expertise in application domain and strong business, as well as functional management. However, many startups have small teams (with an average team size of 18), which signifies that diverse skills are required, but not quantitatively (diversely) large.

For instance, COVID-19 Telemedicine ApS (established in 2020) started with a team with skills in management, software engineering, clinical practice, business, and functional management.

Lesson learned: startups should focus on obtaining a team with diverse experience on board. The diverse expertise could be a source of creative ideas that have potential to work in pandemic situations for startups.

Myth 7: growing startups usually have a single product on the market, and diversification (offering more products in product lines) is the reason for failure.

Facts: the studied startups had products that ranged from single products to multiple products in their product lines. For instance, HPNOW APS (established in 2015) had four products in their product lines although the startup is continuously growing in the market. NanoScent Ltd. (established in 2017) had four products in the market based on their scent technology.

Lesson learned: diversification is not always a reason for failure. If a startup has technology, then diversification based on this strategic resource is a path that could be pursued. However, diversification using existing resources (for instance, experience with existing products) could also result in successful diversification. For instance, Kahun Medical Ltd. (established in 2018) came up with the coronavirus knowledge graph to help doctors diagnose COVID-19 and artificial intelligence (AI) tools to provide doctors with real-time COVID-19 data.

## 7. Implications for Managers

Business decisions during a pandemic, and overcoming myths, should be based on resources (human, financial, and intellectual) that companies possess by virtue of their ongoing business operations. Human resources signify employees by their skills, and intellectual resources signify the possession of resources, such as patented technology. If the company has the competency (human resources), then it should consider if it is diversifying into a related industry. An unrelated industry will inhibit the company from leveraging their existing human and intellectual resources. Diversifying into a related industry can help them reuse their existing technology into a new market, leveraging their prior experience and learning curves with existing technology and products.

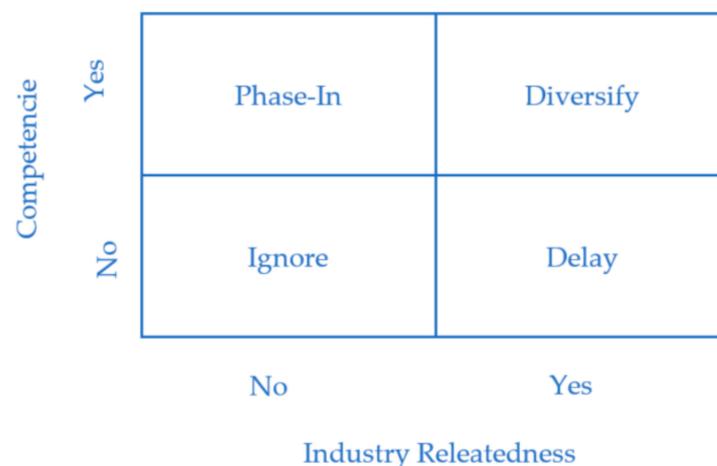
Financial resources should also be considered when making business decisions, but it should not be a limiting factor. This is because if a company diversifies into a related industry that has increased demand, and the company already has the skill sets, technology, experience, and learning curves (because of their existing product offerings) then such a decision is less risky to undertake.

The key checklist that could guide strategic decisions in a pandemic environment is provided in Table 5.

**Table 5.** Myths, success factors, and diversification decisions.

Myths	Success Factors	When to Diversify
Myth 1: large team size helps startups grow in the market.	Human resources	Your team has the right skill sets that are required to diversify in new markets.
Myth 2: it is a good idea to diversify into markets with increased demand during a pandemic.	Intellectual resources	Only if the industry is “related” to your existing industry where you operate, so that you can reuse your skill sets, experiences, and knowledge, and take advantage of your technologies.
Myth 3: pivoting is in a startup’s DNA and this will be a catalyst for turning COVID-19 into an opportunity.	Human, intellectual, and financial resources	Pivot only if the industry is related and the team has the right skills.
Myth 4: funding is scarce during a pandemic. It is impossible to attract good funding.	Financial resources	Not a criterium for diversification if the industry is related and the team has the right skills.
Myth 5: alignment of the startup founder’s background with the new industry expertise requirements (the industry where the startup identified business opportunities) fosters strategic decision success in highly uncertain circumstances, especially during a pandemic.	Human resources	Focus on your team’s existing competencies that best match those required by the industry where you are diversifying.
Myth 6: availability of a large team of diverse skills is the only prerequisite to survive (or grow) in the market during a pandemic.	Human resources	Do not judge diversity of skills based on quantity. Diversify if you have diverse skills possessed by even a small size team.
Myth 7: growing startups usually have a single product on the market and diversification (offering more products in product lines) is the reason for failure.	Human, intellectual, and financial resources	Diversify into related industries.

The Competency-Industry Relatedness (C-IR) framework helps startups take any of the four strategic options related to their diversification, represented by a  $2 \times 2$  matrix (Figure 1).



**Figure 1.** C-IR Framework.

The framework is organized across two criterion—competencies and industry relatedness. These two criteria have nothing to do with the established time frame of the company or the size of the company. A small company may possess competencies/skills and may analyze opportunities in related industries. These criteria are discussed as follows:

- Diverse team competencies: this element signifies that the startup should have diverse expertise at management, technical, and application domain levels (of the proposed product).
- Industry relatedness: this element signifies whether the startup is targeting the new industry that is closely related to its primary (existing) industry served by it, in terms of available technology and/or similar products in the product lines. Industry relatedness is composed of two elements:
  - Applicability of “owned” technology: this element signifies whether the startup has ownership of the technology, which has applicability in the new industry that is under consideration by the startup.
  - Applicability of existing products: this element signifies whether the startup already have products in its product lines that has applicability, directly or indirectly (through adaption), as a solution to the problem pertaining to the new industry under consideration.

The combination of these two possible outcomes generates four possible strategic options, as discussed below:

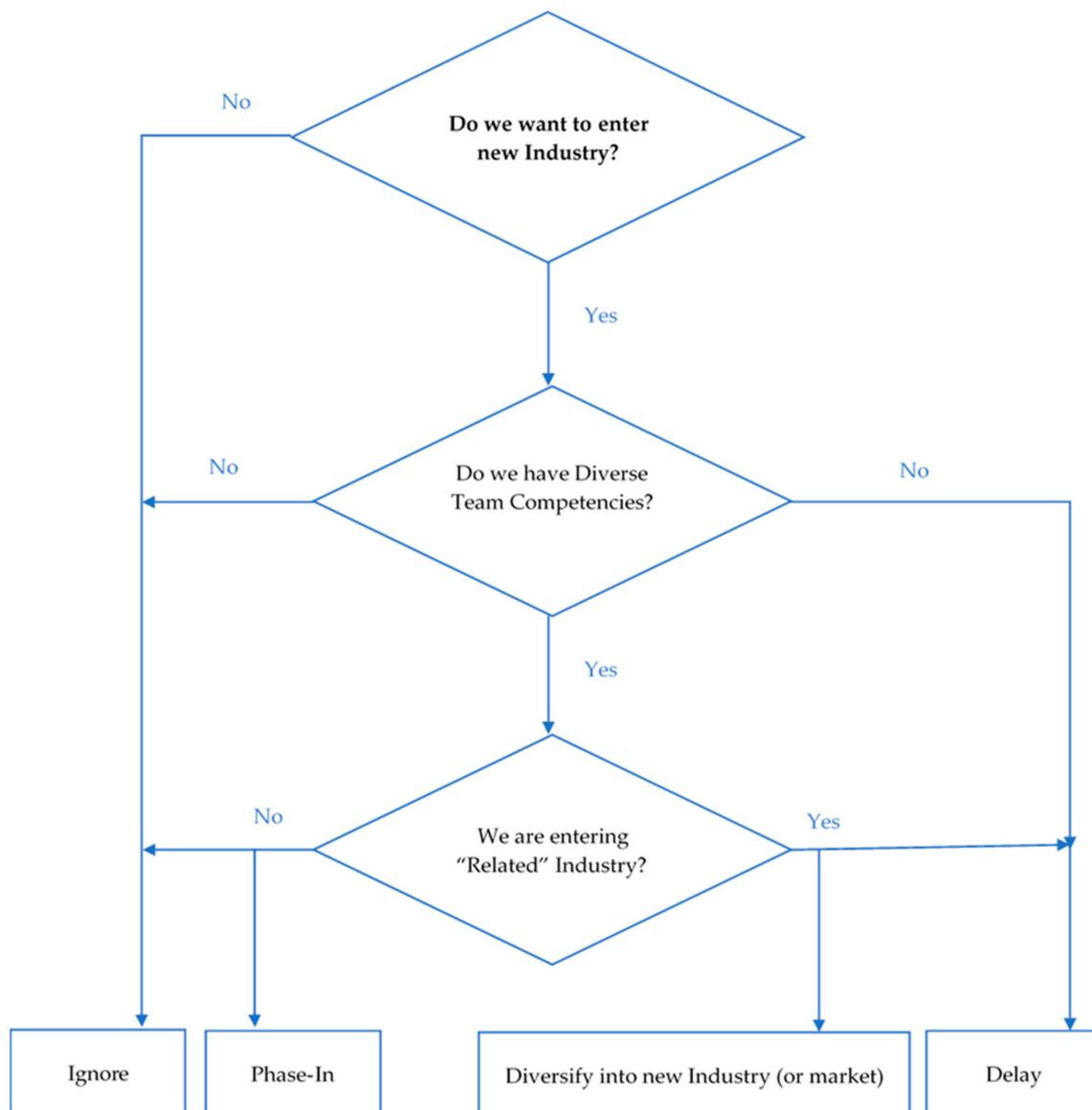
- Ignore: this option suggests ignoring diversification. However, if a company chooses diversification, low competencies, and low relatedness between industries will incur high risks and a need for a large amount of financing.
- Delay: this option suggests delaying the diversification-related decisions for the time being. However, if a company chooses to take diversification, low competencies, and high relatedness between industries, it can incur medium risks and a need for a large amount of financing. For instance, a company may lack competency, but may have a patented technology that could find application in a new industry. Costs will be high because they may need to hire a new team, but procession of intellectual property, or a new product (that could be adapted to new markets) absorb the diversification risks. Low competencies signify that the company is not offering a product in the growth or mature stage of the product’s life cycle.
- Phase-in: this option suggests taking diversification in small increments. This decision, because of high competencies, but low relatedness between industries, would incur medium risks and the need for a medium amount of financing.
- Diversify: this option suggests diversification decisions because the company has both competencies and “relatedness” between industries. This option is the least risky and requires less financing.

During a pandemic, startups can identify their competencies and industry relatedness to select suitable, strategic options. The startups with full competencies and relatedness could diversify comfortably rather than invest their efforts in analyzing market trends, which may be misleading during a pandemic. The financing and risks involved in the four strategic options are presented in Table 6.

**Table 6.** Risks and costs with strategic options.

Option	If Diversification Decision Is Made		Diversification Decision in Pandemic
	Cost	Risk	
Ignore	Too high	Too high	Ignore it completely.
Delay	High	Medium	Delay for time being.
Phase-In	Medium	Medium	Incremental entry.
Diversify	Less	Less	Rapid decision.

Diversification decisions based on the Competency-Industry Relatedness (C-IR) framework is represented using a flow chart (Figure 2).



**Figure 2.** Diversification decision-making through the C-IR framework.

Business environment fluctuations arising because of the pandemic are short-term trends, which incur great risks for the survival of businesses. Strategic decisions need to be undertaken, considering the strategic assets of the startup processes, and the amount of risk they can incur. The startup should avoid making strategic decisions based on their intuitive ideas, market rumors, or frustrations. These decisions must be driven by real market facts and best practices of peer startups. The IC framework provides guidance to startups, to rationally make business decisions in both normal and in pandemic situations. The Competency-Industry Relatedness (C-IR) framework will also be helpful to make decisions about diversification in different markets but within the same industry (industry relatedness will be evaluated to be true in this case as firm is diversifying with same industry). For example, a firm already delivering transportation services using drones could diversify to serve a new market during a pandemic by adapting its product to deliver medicines during a pandemic (Industry remains the same but market is changed).

## 8. Limitations of the Work

The business environment changes fast, forcing companies to adapt to changing circumstances. The fluctuating business environment may cause the organizational setting of companies to evolve (thirty six EU funded SMEs as well as five startups), which may impact the outcome of the study. The innovation potential of the study outcome (real impacts of the Competency-Industry Relatedness (C-IR) framework) will be hard to predict until it is implemented in real settings and may be best described in the future as a longitudinal study. However, the study outcome will be beneficial to firms (especially in the midst of a coronavirus pandemic, leading to business turbulences), thereby setting a stage for the “new” normal.

## 9. Conclusions and Future Work

The COVID-19 pandemic has led to a turbulent business environment, threatening the survival of many small-, medium-, and large-sized enterprises. However, the environment is a witness to many new businesses gaining traction in the market, as well as many existing businesses growing their market shares. The pandemic may have various impacts on businesses across different industries, yet the businesses in industries with temporarily lowered demand could make rational decisions on whether to diversify in new markets or not to diversify at all (continue operations in an existing industry, serving the same market), which could help them avoid business failures.

Firms typically make two types of mistakes in a turbulent environment. They will fail to turn a business opportunity into their favor (e.g., avoiding diversification decisions) or undertake wrong business decisions (for instance, diversify in an industry with a product with no real market need). These mistakes are grounded in the seven myths, identified by comparative analysis of the outcome of the case study involving startups and the 36 startups recently funded by the EU.

To avoid mistakes, especially during a pandemic, when even a small mistake could lead to business closure, the Competency-Industry Relatedness (C-IR) framework is a useful guide. Startups can adopt any of the four strategic options—ignore, delay, phase-in, and diversify, when making diversification decisions; with each option associated with different involved costs and risks. The analysis of the competencies and industry relatedness will help firms leverage their resources, in order to capture the opportunities in “related” industries. The overall rationale behind the framework is that firms could safely diversify into “related” industries by finding application of existing technology to solve new problems, or adapt existing products to serve new markets, if their skill levels, experiences, knowledge, and intellectual resources, are high. This will help them avoid making decisions driven by market myths and focus more on internal factors that could provide sustainable competitive advantages in new industries. The findings are applicable for any sized company, including large enterprises.

As society looks forward to a post-pandemic “return to normal” (currently gloomy prognostications), the framework has a real opportunity to be used by the business environment, to set the precedence for a “new normal”. The real innovation potential of the framework will be evaluated in time, when firms will have to make the right assessments of their internal factors, as well as accurate analysis of the rising opportunities in the environment. One important point to note here is that startups would also be able to diversify in related industries with disruptive technologies—even if they have small teams—as long as they have the core competencies.

The key to sustained business growth is right assessments of their internal factors, as well as accurate analysis of the rising opportunities in the environment. This task could be further from knowledge transfer from innovation ecosystem elements especially through partnerships with academia [21]; the area that could set directions for future work.

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**Informed Consent Statement:** Informed consent was obtained from participants of the multiple case study conducted with five startups and those who took part in the survey.

**Data Availability Statement:** The data supporting reported results are hosted at Harvard Dataverse and could be accessed at <https://doi.org/10.7910/DVN/L88OOB>.

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**Conflicts of Interest:** The authors declare no conflict of interest.

## Appendix A

**Table A1.** Survey Questionnaire.

Section I (Informed Consent)
The objective of this survey is to validate the findings about the commonly held beliefs amongst the startups during a pandemic that impacts their business decisions. The participation is voluntary; however, your perspectives will be very helpful to make real contributions for boosting startup success rates. The data provided by you will only be used as aggregated responses of the survey and individual details will never be disclosed.
Section II (Participant Data)
Please provide your brief details, which will help us to analyze differences in perspectives among the cohort.
What is your age?
<ul style="list-style-type: none"> <li>■ 21–25</li> <li>■ 26–30</li> <li>■ 31–35</li> <li>■ 35+</li> </ul>
In which continent is your startup located?
<ul style="list-style-type: none"> <li>■ Europe</li> <li>■ Asia</li> <li>■ America</li> <li>■ Africa</li> <li>■ Australia</li> </ul>
What is your gender?
<ul style="list-style-type: none"> <li>■ Male</li> <li>■ Female</li> <li>■ Prefer not to say</li> </ul>
Your domain expertise is:
<ul style="list-style-type: none"> <li>■ Engineering</li> <li>■ Medical</li> <li>■ Business Management</li> <li>■ Interdisciplinary</li> <li>■ Other</li> </ul>

Table A1. Cont.

<b>Section III</b>
<p>Myth 1: large team size helps the startups grow in the market. Remember strongly agree = 5, agree = 4, neither agree nor disagree = 3, disagree = 2, strongly disagree = 1.</p>
<p>Have you conducted business expansion (scaling) decision based on your team size?</p> <ul style="list-style-type: none"> <li>■ 1</li> <li>■ 2</li> <li>■ 3</li> <li>■ 4</li> <li>■ 5</li> </ul>
<p>To make internationalization decisions, or diversification decisions, do you consider your team size as one of the internal competencies?</p> <ul style="list-style-type: none"> <li>■ 1</li> <li>■ 2</li> <li>■ 3</li> <li>■ 4</li> <li>■ 5</li> </ul>
<b>Section IV</b>
<p>Myth 2: it is a good idea to diversify into markets with increased demand during a pandemic. Remember strongly agree = 5, agree = 4, neither agree nor disagree = 3, disagree = 2, strongly disagree = 1.</p>
<p>Do you get motivated to launch a new product in an industry that shows increasing demand trends?</p> <ul style="list-style-type: none"> <li>■ 1</li> <li>■ 2</li> <li>■ 3</li> <li>■ 4</li> <li>■ 5</li> </ul>
<p>Customer demand is the main basis when it comes to making strategic decisions:</p> <ul style="list-style-type: none"> <li>■ 1</li> <li>■ 2</li> <li>■ 3</li> <li>■ 4</li> <li>■ 5</li> </ul>
<b>Section V</b>
<p>Myth 3: pivoting is in the startup DNA and this will be a catalyst for turning COVID-19 into an opportunity. Remember strongly agree = 5, agree = 4, neither agree nor disagree = 3, disagree = 2, strongly disagree = 1.</p>
<p>Do you feel pivots are a safe option to tackle fluctuating demand during the COVID-19 pandemic?</p> <ul style="list-style-type: none"> <li>■ 1</li> <li>■ 2</li> <li>■ 3</li> <li>■ 4</li> <li>■ 5</li> </ul>
<p>Do you feel comfortable to make frequent pivots to improve business conditions during the COVID-19 pandemic?</p> <ul style="list-style-type: none"> <li>■ 1</li> <li>■ 2</li> <li>■ 3</li> <li>■ 4</li> <li>■ 5</li> </ul>

Table A1. Cont.

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<b>Section VI</b>	
Myth 4: funding is too scarce during a pandemic. It is impossible to attract good funding. Remember strongly agree = 5, agree = 4, neither agree nor disagree = 3, disagree = 2, strongly disagree = 1.	
Do you reduce your efforts to attract new funding because of the pandemic?	
<ul style="list-style-type: none"> <li>■ 1</li> <li>■ 2</li> <li>■ 3</li> <li>■ 4</li> <li>■ 5</li> </ul>	
Are your business decisions affected because you feel that funding is hard to receive in the pandemic?	
<ul style="list-style-type: none"> <li>■ 1</li> <li>■ 2</li> <li>■ 3</li> <li>■ 4</li> <li>■ 5</li> </ul>	
<b>Section VII</b>	
Myth 5: alignment of the startup founder background with the new industry expertise requirements (industry where startup identified business opportunities) fosters strategic decision success in highly uncertain circumstances, especially a pandemic. Remember strongly agree = 5, agree = 4, neither agree nor disagree = 3, disagree = 2, strongly disagree = 1.	
Do you prefer to launch products in the industry that matches your domain expertise?	
<ul style="list-style-type: none"> <li>■ 1</li> <li>■ 2</li> <li>■ 3</li> <li>■ 4</li> <li>■ 5</li> </ul>	
Do you avoid diversifying into “unrelated” industries (different from your background)?	
<ul style="list-style-type: none"> <li>■ 1</li> <li>■ 2</li> <li>■ 3</li> <li>■ 4</li> <li>■ 5</li> </ul>	
<b>Section VIII</b>	
Myth 6: availability of a large team of diverse skills is the only prerequisite to survive or grow in the markets during a pandemic. Remember strongly agree = 5, agree = 4, neither agree nor disagree = 3, disagree = 2, strongly disagree = 1.	
Do you feel that your business will survive turbulent market fluctuations if you have a big team with diverse expertise?	
<ul style="list-style-type: none"> <li>■ 1</li> <li>■ 2</li> <li>■ 3</li> <li>■ 4</li> <li>■ 5</li> </ul>	
Do you think that team size and diverse skills are the main criteria for strategic business decisions?	
<ul style="list-style-type: none"> <li>■ 1</li> <li>■ 2</li> <li>■ 3</li> <li>■ 4</li> <li>■ 5</li> </ul>	

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Table A1. Cont.

<b>Section IX</b>	
Myth 7: the growing startups usually have a single product in the market, and diversification (offering more products in product lines) is the reason for failure. Remember strongly agree = 5, agree = 4, neither agree nor disagree = 3, disagree = 2, strongly disagree = 1.	
Do you feel that startups should concentrate solely on a single product?	
■	1
■	2
■	3
■	4
■	5
Do you feel that, as a startup, you avoid launching another product when you are already scaling up?	
■	1
■	2
■	3
■	4
■	5

## Appendix B

Table A2. Dataset file columns and startup information.

Startup Information	Dataset Column Title	Usefulness
Establishment year	Year of Establishment	To understand if the startup is a new entry during COVID-19 or if it existed before. If it existed before, then how much experience did it have in the market?
Founder background	Founder Background (Except Entrepreneurship)	The founder has strong entrepreneurship experience. It helps to analyze the influence of the founder's background on the innovativeness of the startup. Innovativeness is evident from the startup's ability to gain EU funding, i.e., their solutions are perceived innovative enough to tackle the COVID-19 pandemic.
Primary industry served	Primary Industry (Before COVID-19)	To evaluate if a startup diversified into a different industry during COVID-19, relative to the one served by its product line before the pandemic.
Team size and competencies	(a) Team Size (b) Team Competencies a. Corporate Management b. Engineering/Technology (Software Engineers) c. Application Domain Engineers d. Business/Functional Management	To analyze if the team competencies were strategic assets for these startups. In other words, the possession of the management, engineering, and application domain competencies helped startups find business opportunities during a pandemic.
Product line and nature of COVID-19 related products launched	(a) Product or Service (b) COVID-19-related Product/Service Already Launched a. Existing Product Adapted; b. Diversification (New Product); c. New Product Launch; d. Pivot Made (During COVID-19), (c) Products/Services	This helps to analyze if startups launched a new product during COVID-19 or the launching is to be done in the future. In particular, if the startup diversified by launching a new product (compared to its original product line), adapted an existing product, launched a completely new product (new market entry of startup), or pivoted the business model. This is meaningful to analyze whether the startups have technology or existing solutions that have potential to form the basis for the pandemic solutions or just an excellent idea.
Development/manufacturing location	Software Development/Product Manufacturing Location (In-House of Third Parties)	To analyze if a startup preferred to have software development (for software products) or manufacturing (for hardware devices) in-house or through third parties. This helps to make an analysis if the possession of development/manufacturing experience helped the startups find COVID-19-related solutions feasible to be implemented.

## Appendix C

**Table A3.** Datatypes of Dataset variables and meaning.

Dataset Column Title	Data Types	Meaning
Year of Establishment	Number	Year the startup was founded.
Founder Background (Except Entrepreneurship)	Text	Academic background of the founder (except entrepreneurship)
Primary Industry (Before COVID-19)	Text	The primary industry served by startup product lines (before COVID-19).
Team Size	Number	Size of the team (except advisor boards, etc.)
Corporate Management	Boolean	Team responsible for making corporate strategies.
Engineering/Technology (Software Engineers)	Boolean	Team responsible for engineering the software. The rationale is that software is the main component of innovative systems these days.
Application Domain Engineers	Boolean	Team responsible for engineering the product (even if it is a non-software product).
Business/Functional Management	Boolean	Team responsible for making business and functional strategies.
Product or Service	Text	The startup deals with delivery of the product or service in the market.
Existing Product Adapted	Boolean	If the startup adapted existing products to provide solutions to COVID-19-related problems.
Diversification (New Product)	Boolean	If the startup launched a new product (apart from the existing products of its product lines) as a solution to the COVID-19 related problems.
New Product Launch	Boolean	The startup is a new entrant to the market during the pandemic, with a solution to COVID-19 related problems.
Pivot Made (During COVID-19)	Boolean	The startup modified its business model (especially value proposition) to tackle COVID-19 opportunities rather than one formulated to execute another business idea.
Products/services	Text	Existing products in the product lines or details of the services offered in the market.
Software Development/Product Manufacturing location In-house of third parties)	Text	If the software development of product manufacturing happens in-house or through third parties. This is a “make or buy” or “in-house or outsource” decision.

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