

Organizational Resilience Factors of Startups: An Exploratory Case Study

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Abstract: In an increasingly competitive environment subject to uncontrollable risks, the continuity of organizations can be severely threatened, and the decision-making process takes place under circumstances of great uncertainty. Therefore, it is necessary to develop strategies and competencies that allow the business to thrive. Startups, particularly technology-based ones, are an essential source of innovation. However, several studies indicate that approximately 60% of Startups fail in the first five years of business. To succeed, startups need to develop skills that allow them to rapidly evaluate their decisions and options, and to identify what is vital for the survival of their business. Thus, organizational resilience becomes of paramount importance to those companies. The term resilience is used in different areas of knowledge, but all the definitions share common ground regarding the concept: it describes the ability of an element to return to its normal state after a period of stress and crisis. The main objective of this exploratory research developed in Portugal is to identify the resilience factors of technological Startups. It is also intended to contribute to the design and development of instruments which promote organizational resilience in technological ecosystems. The current research follows the case study methodology based on a sample of 10 technological startups collected from the Startup Leiria ecosystem (Portugal). The Startup Leiria is an incubator of startup ventures which makes it a prime source of data and knowledge. The main findings point out the necessity to develop agility skills in Startup ecosystems. It was concluded that resilient organizations are characterized by having the ability to anticipate, respond, adapt, and recover from a disruptive event. The uniqueness of this study concerns its contribution to stimulate data-driven discussions regarding the necessity to implement programs for the reskilling of Startups in the context of their ecosystems.

Keywords: Resilience, Technological Startups, Skills, Adaptation, Entrepreneurship

1. Introduction

Organizational resilience is a topic of growing interest in a global context marked by increasing uncertainty and adversity (Gibson & Tarrant, 2010; Bhamra et al., 2011; Carlson et al., 2012). In dynamic contexts, with high levels of competition between organizations and the growing importance of innovation for the survival of companies, resilience becomes important for learning and organizational flexibility. In this context, resilience refers to the organization's ability and capacity to tackle changes and adapt to environmental risks. A resilient organization should be able to effectively align its strategy, operations, management, and decision-making systems to adjust to the continuous environmental changes (Starr et al., 2003). Thus, the resilience dimension is associated with an increasing ability to react to crises and overcome current and future challenges.

Startups, particularly technological ones, face huge challenges in terms of survival and sustainability (Bøllingtoft, 2012; Giardino et al., 2014; Kee et al., 2019). According to Giardino et al. (2014), approximately 60% of startup companies fail in the first five years of business. Many startups fail to identify business process challenges and obstacles which makes them unable to achieve successful results (Yusuf, 2013). To achieve success, startups need to carefully evaluate their decisions and options to identify the critical factors for the survival of their business. Therefore, organizational resilience becomes even more relevant in startup companies.

The relevance of the "resilience" and "startups" topics, has never been more evident than it is today. In this context, this exploratory research identifies the organizational resilience factors of technological startups by answering the question: what are the organizational resilience factors of technological startups in Portugal? The clarification and operationalization of the research question presuppose the answer to the following sub-

questions: (i) what are the characteristics of resilient organizations? (ii) how can organizational resilience be measured?

2. Literature review

The literature supporting this article was collected using several databases, namely, B-On-Online Knowledge Library, Scopus, and Web of Science. To refine the search, we have set limits on the publication dates of articles to include solely articles published from 2010 onwards. Furthermore, the search was limited to the following areas of study: engineering, computer science, business and management, economics, and finance. The main selection criterion was the existence of the words: "Startups", "resilience" and "organizational resilience" in the title. As the title can be misleading, we have selected the most relevant articles by analyzing the abstract. The main results of the literature review are presented below.

2.1 Startups Concept

The idea of startup dates to the end of World War II as it first became popular in the context of the attempt to boost technology-focused companies, often in support of the production of weapons or aircrafts. Currently, a startup is synonymous of novelty but continues to be associated with technology and creativity. Sharifi & Hossein (2015) defined a startup company as a young company at the beginning of its activity with growth potential to become a large company. Pickernell et al. (2013) defined startups as young companies and companies that have been in existence for a maximum of four years. A connected idea is developed by Kee et al. (2019) who defined a company's initial success as its ability to survive or stay in business based on its financial and non-financial performance over the last five years (Lussier & Pfeifer, 2001; Yaacob et al., 2014; Durda & Krajčák, 2016). The European Commission defines startups as follows: "Startups, often technological in nature, generally combine rapid growth, high dependence on product, process and funding innovation, maximum attention to new technological developments and extensive use of business models, innovative businesses and often collaborative platforms" (Kopera et al., 2018, p.2). Furthermore, the role of human capital has been recently discussed for these firms and the team's characteristics are seen as crucial for the ventures' success (Campino et al., 2021).

In sum, a startup is a company, but also a differentiating vision, that seeks to explore a business opportunity in an innovative or underused area. Instead of being supported by a fixed model, it has a fluid concept, allowing adaptation to the opportunities that arise. Therefore, a startup can be characterized by having a new market concept, which is unstable in nature and adapts to opportunities. The risk of failure is high and not always easy to assess at the outset. Startups are usually technology intensive with an enormous growth potential.

Startups can promote economic growth as they are important vehicles for offering employment opportunities, and creating innovation (Bøllingtoft, 2012; Giardino et al., 2014; Kee et al., 2019). Despite their essential role in economic and social growth, startups face difficulties to sustain themselves and survive (Kee et al., 2019). According to Giardino et al. (2014), approximately 60% of startup companies fail in the first five years of business. Therefore, the first five years are the most vulnerable period for this type of companies. Identifying and measuring the success of startups is extremely difficult, as it is a relative measure. Initial success can be measured in several ways, such as financial, non-financial or hybrid methods (Lussier & Pfeifer, 2001; Yaacob et al., 2014; Durda & Krajčák, 2016; Kee et al., 2019).

2.2 Resilience Concept

With origins in Latin, the word *resilio* designates the return to a previous state (Barlach et al., 2008). The term resilience is applied in several areas of knowledge: ecology, sociology, economics, individual and organizational psychology, supply chain management, strategic management, risk management, physical security engineering management, engineering, and information systems (Erol et al., 2010; Bhamra et al., 2011). The literature in entrepreneurship has understood the concept of resilience as a response to a difficult or even extreme context (Danes et al., 2009). It has also been understood as a personality trait, quality, or capability of the entrepreneur (Hayward et al., 2009). Therefore, resilience is considered an asset to face difficulties and not a capacity strong enough to be considered the catalyst to start the entrepreneurial process itself (Bernard & Barbosa, 2016). Thus, business resilience can be defined as a company's ability to anticipate, prepare, respond, and adapt to incremental changes and sudden disruptions to survive and thrive (BSI, 2017).

Erol et al. (2010) compile several definitions of resilience from different authors, of which the main characteristics of resilience stand out: (i) the ability of the system to adaptively respond to a disruptive event to

avoid losses; (ii) the ability to recover quickly within a period and at acceptable costs; (iii) allows the system to achieve its objectives, maintaining control over its functioning and structure, which translates into a capacity for self-organization, learning and adaptation.

2.3 Organizational Resilience

According to Hillmann & Guenther (2020), organizational resilience can be defined as a capability, competence, characteristic, result, process, behavior, strategy or type of performance or a combination of these. Furthermore, the authors state that organizations will only be able to increase their resilience if there is clarity in the concept and the variables that determine it to evaluate, develop and improve them continuously over time. According to The British Standards Institution (2018), organizational resilience is defined as "an organization's ability to anticipate, prepare, respond and adapt to incremental changes and sudden disruptions to survive and thrive". The idea of thriving introduced by this concept is of tremendous importance. Organizational resilience goes beyond survival towards a more holistic view of business health and success. A resilient organization is Darwinian in the sense that it adapts to a changing environment to remain fit for its purpose (Kerr, 2015). Another definition presents organizational resilience as an ongoing benchmarking, improvement, and reassessment process. It is an organization's ability to anticipate, prepare, respond, and adapt to incremental changes and sudden disruptions to survive and thrive (The British Standards Institution, 2018). Kahn et al. (2018a) base their definition on Sutcliffe & Vogus (2003) and state that organizational resilience can also be defined as the organization's ability to absorb tension and preserve or improve its functioning, despite the presence of adversity.

Ponomarov & Holcomb (2009) identified three areas of classification of the organizational resilience concept: (i) readiness and preparedness; (ii) response and adaptation; (iii) recovery and adjustment. Moreover, Erol et al. (2010) cite Hollnagel et al. (2006), to define resilience as "the ability of a system to predict, recognize, anticipate and defend against changing risk configurations before adverse consequences manifest". From this perspective, resilience is the ability to anticipate risks, before the consequences occur, even if their characteristics change. Starr et al. (2003) defines a resilient organization as one that aligns strategy, operations and management systems and structures with decision-making support to anticipate and adjust to continuous risk changes, withstand business disruptions, and gain an advantage over less adaptive competitors.

For this study, we understand organizational resilience as an organization's ability to anticipate, respond, adapt, and recover from a disruptive event. It is an organizational competence, manifested by a set of routines and processes, which depends on the quantity and availability of the organization's resources, allowing it to overcome vulnerabilities, learn, create new opportunities, and overcome the initial stage verified before the disruptive event, to create competitive advantage.

2.3.1 Dimensions of Organizational Resilience

A complete and more immediate qualitative view of organizational resilience needs the definition of a series of direct measures on the level of organizational resilience. Previous work in the literature has extensively discussed the issue of dimensions of resilience. For example, Bruneau & Reinhorn (2007) presented four resilience properties, on which four dimensions depend, namely, robustness, redundancy, resourcefulness, and speed. Furthermore, the authors identified four different dimensions that characterize resilience: technical, social, economic, and organizational. This model was expanded by Kahn et al. (2018b) who included vulnerability and susceptibility aspects to assess the degree of resilience of a system. Specifically, susceptibility refers to the frequency of adverse events combined with the exposure of systems to these events. Therefore, based on the analysis of previous contributions, seven different areas of resilience assessment can be identified:

1. Adaptability: refers to the adaptive ability of a system in response to changes in its environment.
2. Reliability: refers to the probability that a system will perform its function reasonably in a specific time interval and under certain operating conditions.
3. Agility: refers to the ability of a system to respond and react to changes in uncertain and ever-changing environments.
4. Effectiveness: refers to the quality of being successful in achieving what you want and the ability to produce the intended results.
5. Flexibility: refers to the extent and pace at which organizations adapt to sudden and radical changes and is based on the ability to quickly change elements to perform different tasks without having to reorganize all the processes of the organizational system.

6. Level of recovery: refers to the difference between the initial state of the system before the disturbance and the point of restoration, or even compared to a desired level of recovery to assess the performance of specific actions taken.
7. Recovery time: refers to the time required for the system and the organization to restore its normal state.

Table 1: Summary of the resilience Definitions

CONCEPT	AUTHORS/YEAR	DEFINITION
Dynamic organizational resilience	(Annarelli & Nonino, 2016)	Based on dynamic capabilities that allow organizations to manage unexpected threats and risks
Static organizational resilience	(Annarelli & Nonino, 2016; Jia, 2018)	It deals with strategic resilience initiatives based on the management of internal and external resources.
Reactive organizational resilience	(Somers, 2009)	The organization's ability to return to its normal state without incurring serious damage or loss.
Proactive organizational resilience	(Lovins & Lovins, 1982; Jia, 2018)	Deliberate efforts that increase the ability to deal with potential threats.
Individual organizational resilience	(Horne, 1997; Mallak, 1998; Coutu, 2002; Lengnick-Hall et al., 2011; Shin et al., 2012)	It is the combination of individual capabilities and actions that the organization can only be as resilient as its individuals are.
Collective organizational resilience	(Lengnick-Hall et al., 2011)	"It results from a set of capabilities, routines, practices, and specific organizational processes by which a company is conceptually oriented, acts to advance and creates an environment of diversity and adjustable integration."

2.4 The startup ecosystem in Portugal

Portugal has gained international notoriety with the holding of international events in technology and innovation, such as the Web Summit, which is associated with a growing awareness of the Portuguese population itself for the technological and scientific evolution worldwide and, consequently, its greater openness for the introduction of technologies and the greater demand for these solutions.

According to a study carried out within the scope of the Startup Europe Partnership (SEP) 50 initiative, Portugal has 67 scale-ups (companies that obtained funding of more than one million dollars), which raised a total of 310 million euros between 2014 and 2019, with Portugal being among the most favorable European ecosystems for scale-ups, growing twice the European average.

However, 88% are small scale-ups that obtained funding between 1 and 10 million dollars, representing 0.2% of Portuguese GDP (ANI- Agência Nacional de Inovação, 2019). According to the study "The State of European technology" carried out by Atomico, an international investment company, in 2018, the growth of investment in Portuguese technology caused the technological sector to grow five times more in Portugal than in other European economies (Atomico, 2022). According to the study's results, the technology sector in Portugal is driving job creation, with the workforce growing by 6.4% /year, which is clearly above the European average of 1.1%. In this indicator, Portugal is only behind France, which obtained 7.3% (Barbosa, 2018). The Portuguese ecosystem gained international visibility and managed to attract new investors to Portuguese startups, as well as large technological competence centers of multinationals such as Google, Zalando, CGI, Cisco, Altran, Natixis, Fujitsu, VW, Vestas or Mercedes (Ministério da Economia, 2018).

3. Methodology

The current research follows the case study methodology based on the application of a questionnaire to the leaders of a sample of 42 technological startups present in the Startup Leiria ecosystem. Only ten startups answered the questionnaire. Nine of the ten startups under analysis allowed the researcher to disclose their identity. The tenth company will be identified as Startup 10. Thus, the startups under analysis are: 1. Make it Special; 2. ByteRev; 3. REATIA; 4. Delft Digital Learning; 5. Datah artificial intelligence; 6. Medfolio, Lda.; 7. Digital Manager Guru; 8. Alcotester; 9. Sound Particles; 10. Startup 10. The case study is supported by the content analysis of the questionnaire. The questionnaire was drawn up from the literature and consists of questions

graded on a Linkert scale and open-response questions. The questionnaire was applied from July 22, 2021, to September 17, 2021.

3.1 Startup Leiria Presentation

Startup Leiria is a non-profit association founded in July 2004 that currently has 42 associated startups. Its mission is to promote and support companies and entrepreneurs in creating value and growth in an agile and sustainable way (Startup Leiria, 2021). Startup Leiria presents four models to support companies or future companies: (i) acceleration of ideas: consulting programs to design and validate new products, services or business models; (ii) acceleration of startups: consulting programs to accelerate the entry of new products or services in the market and the first sales; (iii) business acceleration: programs to generate innovation within existing structures; (iv) accelerated scale-ups: top management programs to leverage the company's rapid growth and access to key partners. Additionally, it provides the "Creative Laboratory", which offers communication services: strategy and content creation, design of various communication materials, customer acquisition or brand awareness campaigns and design services for prototyping new products and services (Startup Leiria, 2021).

3.2 Description of Startups Participating in the Case Study

Table 2 presents the Startups of the case study.

Table 2: Startups Participating in the Case Study

	DESCRIPTION
STARTUP 1	Make It Special specializes in the field of digital transformation through application development services and proprietary software development for SMEs. The company specializes in machine learning, business intelligence, nearshore service, software development, digital transformation, outsourcing, digital commerce, and SaaS services (Make it Special Group, 2021).
STARTUP 2	ByteRev is a company that develops mobile applications on Android and iOS, implemented on Google Play (ByteRev, 2021).
STARTUP 3	Reatia is a metasearch platform which indexes thousands of listings and properties every day, creating a complete and updated database containing hundreds of thousands of properties available to the professional or real estate agency, evaluating any property with a high degree of market certainty and, finally, provide complete reports for each property and the market (Reatia, 2021).
STARTUP 4	Delft Digital Learning provides consultancy support through the development of digital learning strategies for companies and educational institutions, support in training to accelerate the development of digital learning skills and in the production and design of courses, development and implementation of short modules, complete courses, and programs (Delft Digital Learning, 2021).
STARTUP 6	Data H Artificial Intelligence operates in the information technology and services sector. The business model is based on partnerships between the company and customers, which ensure the success of AI through the synergy between the engine (deep learning algorithms) and data (Data H Artificial Intelligence, 2021).
STARTUP 6	Medfolio is dedicated to developing digital tools designed to facilitate and revolutionize the path of the Internal Doctor. Its mission is to make the Doctor's Specialty Internship more organized and practical to focus on the essentials and have time to be a doctor (Medfolio, Lda., 2021).
STARTUP 7	Digital Manager Guru is a complete online sales platform through which companies with subscription products, software platforms, physical product sales websites, online courses, training and consulting can operationalize their business and generate their digital strategy with complete freedom to choose which services and tools I want to use (Digital Manager Guru, 2021).
STARTUP 8	Alcotester is dedicated to the placement, maintenance, and calibration of machines for measuring the alcohol content through the creation of rigorous and highly important equipment in the prevention of road accidents, enabling the measurement of BAC (Blood Alcohol Rate) in grams of alcohol per litre of blood (Alcotester, 2021).
STARTUP 9	Sound Particles is a startup that developed a disruptive 3D audio software, which uses computer graphics concepts applied to sound, allowing, among other things, to simulate thousands of sounds simultaneously, being used in all major Hollywood studios and in films such as "Cars 3", "Despicable Me", "Wonder Woman", "Guardians of the Galaxy 2", among many others (Sound Particles, 2021).
STARTUP 10	The startup operates in the technology sector, focusing its activity on software development, automation, and quality control.

4. Results Analysis

The founders of the startups that took part in the research are all male, in the average age group of 30 years and mainly with a higher education degree (most of them with a master's degree). More than half of our sample has

a degree in Computer Science or Computer Engineering. Most of the startups under analysis were founded in 2019 or 2020, so they are in the seed stage (defined market offer, first sales) or in the growth stage (strong sales and/or customer growth), with B2B (business-to-business) customers. The turnover varies between 10,000 euros/year and 350,000 euros/year. Respondents admitted that the decision to create their own company was based on the aspiration to manage their own operations. Most startup founders remain linked to the business or as a formal worker. These startups have between 6 and 11 workers. The recruitment task is difficult due to the high salary demand and the perceived risk of working in a young company. The percentage invested in R&D (Research and Development) showed very different results. It can only be concluded that the surveyed startups invested more in 2021 than in 2020. The Cloud and Analytics areas were considered the most interesting for the near future.

Regarding the financial aspect, 80% of respondents revealed that they founded their company with their individual capital. The entrepreneurs revealed that they preferred to finance their ventures using individual capital and recurring to VC (Venture Capital) firms. All respondents considered that the Covid-19 pandemic was the biggest challenge in the startup's history. The main consequences pointed out were the decrease in sales and reduction of liquidity, forcing the readjustment of the business model and redefinition of the offer. The attraction of new customers and the constant rapid changes in the market were also indicated as challenges in the development of the business. Most respondents identified revenue growth as their main objective/priority until they reached a stable profitable company stage. The Portuguese startup ecosystem was considered an environment with potential, which needs continuous improvement. Supporting government policies were indicated as the most relevant area when creating and developing a startup. Measures such as strengthening state support, financial incentives to support the normalization of the company's activity and tax reductions were voted the most relevant and necessary. The Startup Portugal Program and the Europe Startup Nations Alliance initiative were highly valued, with Incubation/Incubator vouchers being the most interesting source of funding in the respondents' opinion. According to the results obtained, the most relevant indicators for developing organizational resilience are people, product or service, leadership, and culture.

In summary, the organizational resilience factors identified are:

- Strong and resilient leadership: motivated, dedicated, focused, and qualified leader.
- Qualified and motivated workers.
- Capital resilience: adequate cash flow, with a solid financial strategy in the development process, keeping its capital leverage within a reasonable range.
- Organizational agility and flexibility be flexible and adjust the business model and redefine the offer when necessary.
- Take advantage of support areas and government policies.
- Government support that favors entrepreneurship.
- Resilient organizational culture (Top-Down Direction): strengthens the dedication and cohesion of all members of the organization.

5. Conclusions

Resilience is a concept often associated with different areas such as engineering and psychology. This study intends to understand if this is a concept consciously promoted in the organizations or, despite not being a conscious decision making, there are practices that promote resilience. The resilience concept integrates vulnerability management, adaptability, and organizational agility. Risk management, knowledge management, human resources and information systems also contribute to the development of organizational resilience.

Previous studies have found that organizational resilience is a multidimensional construct, and the results obtained in the present research validated this idea. Resilience is about ensuring that an organization can achieve its fundamental goals in the face of adversity (Dalziel & McManus, 2006; Olu-Daniels & Nwibere, 2014). As mentioned in the literature review and observed in the results analysis, resilience is not an abstract capability. Resilience needs to be interpreted as the specific and complex interactions between different levels of adopted behavior, including individuals, groups, and organizational units (Cho et al., 2007). To create a resilient organization, it is necessary to implement a focused strategy to build strategic resilience.

It is important for companies to have an ambitious vision and mission. A company's vision and mission play an important role in its strategy and objectives, and a common vision facilitates the company's growth and paves

the way for its future development. On the other hand, it is important that companies establish clear development objectives and form corresponding core competencies. An ambitious vision and objective business mission, help guide workers to focus on long-term development, while clear development goals help motivate the organization members and promote efficient synergies and mutual support within the organization. Workers are one of the company's most important resources and the main value-creating body. Therefore, cultivating the organizational loyalty of workers and retaining them helps the company increase the dedication and cohesion of the organization's members.

The main results indicate that the startups under analysis are organizations with resilient characteristics and behaviors in terms of organizational culture and strategic actions that are reflected in stable performance. These startups have learned from adversity as they seek to adapt to constant market changes and see change as an opportunity for improvement. Our results show convergence in the capacity of organizational resilience as a quality that can help organizations and groups survive and thrive in difficult or volatile environments.

Regarding the resilient characteristics, the results stand out concerning a focused, qualified, and motivated leadership as well as skilled workers, organizational agility, and flexibility. Furthermore, resilient characteristics concern the ability to remain focused on the company's everyday activities, including investment, even in times of crisis and a strategic vision that promotes the creation of opportunities in difficult times. The characteristics studied can be related to the work of Donnellan et al. (2006), where organizational resilience is considered an intelligent, reflective, flexible, and open to change organization.

Regarding resilient behaviors, the main behaviors and strategies pointed out by Whitehorn (2011) are present in the organizations studied, namely: (i) the organization's agility in anticipation, actions, changes, and responses; (ii) leadership that encourages and values the continuous development of individual and group skills; (iii) change is seen as an opportunity for growth, harmony between the external and internal environments; (iv) creation of market opportunities.

The startups surveyed trust the quality of their products, look for new technologies and innovation, retain qualified employees and identify opportunities for constant improvement. From the results obtained in the study, these organizations are aligned with the concept of organizational resilience. A culture of excellence needs to be implemented to build cultural resilience. A resilient organizational culture is conducive to the formation of a sense of community among the organization's members, which can help organizations survive crises.

Additionally, it is important to reinforce the relevance of government policies and support that favor entrepreneurship, facilitate, and promote the creation and development of young companies. To meet the research objectives, it can be concluded that in a time of financial, economic, and social crisis, the resilience of organizations can make the difference between the company's success and failure to adapt to new conditions.

The study's main limitations are the scarcity of studies focused on organizational resilience and the small sample size that does not allow extrapolation of results.

A practical implication of the present research is that building organizational resilience requires time and long-term strategic design, detailed planning, and effective measures. Thus, the resilient organization can sustain a competitive advantage over time, provide excellent performance and effectively innovate and adapt to rapid and turbulent changes in technologies and markets.

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