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Towards a Review of Key Success Factors in Technology Entrepreneurship

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Abstract:

Research Question: Through a systematic review of the relevant literature, this paper identifies and analyses key success factors in technology entrepreneurship and provides a novel classification and systematization of the factors. Also, it provides a prioritization of the selected factors by tech entrepreneurs. **Motivation:** The conditions of uncertainty and the dynamic environment in which one technological venture operates cause that only a small number of them succeed (Baron, 2000; Changsok et al., 2012; Tomy & Pardede, 2018; Chen et al., 2019). Comprehensive systematization of success factors is lacking in the professional literature. This paper contributes to the literature in this field by systematizing and prioritizing the key success factors in technological entrepreneurship, as a usable basis for further research and decision making. **Idea:** The core idea of this paper was to provide an overview of existing knowledge and a systematized basis for further research, but also for work in the practice of technological entrepreneurship, giving guidance to all stakeholders and decision makers, entrepreneurs, investors and policymakers. **Data:** The review was conducted using online repositories of scientific publications on technology entrepreneurship success factors published in the period from 1980 to 2021. In total, 661 articles were identified, while 45 articles met the selection criteria and represent the basis for further research of this paper. In order to determine the prioritization of the identified factors, empirical research was conducted among decision makers of technological entrepreneurial ventures. **Tools:** The research and review of the literature were conducted by structured keyword search of the *Web of Science* database, while the process of article selection was performed using the identified selection algorithm, based on two phases, which both included the selection criteria. For the purposes of empirical research, the *Google* form questionnaire was used for collecting the data on the prioritization of the factors by technology entrepreneurs. **Findings:** The factors that are key to the success of technology ventures are often complex in nature. 151 originally identified success factors from different authors were classed into 31 groups. Based on the identified groups, five large groups of factors were used for classification: "characteristics of the founder/founding team", "environment", "technology and innovation", "organization" and "strategy". As a result of empirical research, the factor “motivation” emerges as the most influential factor on a venture’s success, while the “size of the founding team” is identified as the least influential. **Contribution**: This paper extends the existing literature providing the systematization of key technology entrepreneurship success factors with the systematization of scientific publications as a basis for further research.

Keywords: Technology entrepreneurship, business success, factors.

JEL Classification: L26, O32, Q55, M13

1. Introduction

An extremely fast development of technology and short innovation cycles lead to the trend of increasingly frequent launches of technological ventures on a global level. Technological entrepreneurial ventures are one of the basic sources of change in the way we live and work at the local and national levels. From innovative solutions to job creation, they are seen as the drivers of positive changes in societies. However, the conditions of uncertainty and the dynamic environment in which one technological venture operates, affect the fact that only a small number of them succeed. More than 90% of all launched technology startups fail in the market for many different reasons. Factors that are necessary for business success, or whose lack leads to business failure, are defined as key success factors (Santisteban & Mauricio, 2017). In other words,

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factors that are decisive for the success of a company are most commonly referred to as critical or key success factors (Freund, 1988). These factors are understood as a small number of key business areas where things must go well, for business to grow and management goals to be achieved.

In order to determine the success factors, it is necessary to first understand the notion of success itself. Business success can be defined in different ways according to who interprets it, and what interests it has in relation to the venture. An entrepreneur, investor or even a customer may perceive the success of the same venture in different ways (Kim et al., 2018). What is more, a review of the literature has shown that different perceptions of success are not only present among market participants but can also be seen in the literature. Colombo and Grilli (2012) define that the venture is successful if it has been acquired by another company or if it goes public (Colombo & Grilli, 2012). A review (Santisteban & Mauricio, 2017) provides insight into different business success measures in the literature: the number of jobs the company has generated, creating something that really impacts people's lives, good financial performance and company indicators, achieving the goals set by the company, size of the company's market share, growth of sales and profitability. It is concluded that the concept of success is extensive and complex, and can also refer to the domain of finance, supply chain, positive impact on the community, users and employees and many other business segments. According to the authors (Santisteban & Mauricio, 2021), a successful technology venture is a venture that meets the needs and requirements of the customers, has a higher profit than the industry average or has been acquired by another company for a price higher than its value.

For the past two decades, the research interest in the field of key success factors in technology entrepreneurship has grown significantly since the success rate is very low. According to the most recent Startup Genome report (Startup Genome, 2021), only 1 in 12 tech-startups succeeds. Various reasons lead to the success or failure of technology ventures. Some authors focus on the internal factors, while others focus on external ones. Furthermore, some of the authors analyse the influence of a single factor or a single group of factors, while others research the importance of a number of factors different in nature. From the technology itself (Tomy & Pardede, 2018; Bailetti, 2012; Kim et al., 2018; Chorev & Anderson, 2006; Santisteban & Mauricio 2017), market characteristics (Santisteban & Mauricio, 2017; Cooper, 1993; Durmusoglu, 2018), availability of financial resources (Song, 2008; Durmusoglu, 2018; Kim et al., 2018; Lash et al., 2007; Cooper et al., 1994; Santisteban et al., 2021), to the founder (Baron, 2000; Lans et al., 2014; Cooper, 1994; Cope 2011; Naffziger, 1994) and many more, researchers focus on different business aspects when analysing success factors of a technology venture. Throughout an extensive literature review that included articles published between 1980 and 2021, covering the field of technology entrepreneurship, it was concluded that a unified identification of the key success factors in technological entrepreneurship is missing in the professional literature. On the other hand, what entrepreneurs, their advisors and investors need is a better understanding of the factors and drivers associated with successful business practice (Cooper et al., 1994). Understanding the importance of technology entrepreneurship, this paper aims to fill this gap, offering a systematization and classification of key success factors in technology entrepreneurship, found in the analysed literature. Therefore, this article seeks to identify what the individual factors and group of factors that are crucial for technological entrepreneurial success are, as well as to conclude, based on performed empirical study, which factor and group of factors emerge as the most significant, and which as the least significant in terms of entrepreneurial success, on a given sample.

The paper is organized as follows. Section 2 provides the overview of the theoretical background and available literature on the key success factors in technology entrepreneurship, section 3 explains the research methodology according to which the selection of articles and systematization of factors was performed, while the following section, section 4, provides the explanation and classification of 31 identified key success factors into 5 large groups: "characteristics of the founder/founding team", "environment", "technology and innovation", "organization" and "strategy". This section also discusses the results of performed empirical research aimed at providing the evaluation and prioritization of 31 identified success factors. The final section provides the conclusion, where the contribution, limitations of this paper, as well as suggestions for future research on this topic, are presented.

2. Theoretical Background

An extremely fast development of technologies and emerging innovations lead to the trend of increasingly frequent launches of technology ventures. New technologies, only combined with clear market opportunity, can provide real business and social value. Technological innovations in most cases occur within technological ventures which also appear in the literature under the following names: technology startups, high-technology ventures, high-technology startups, or new technology-based firms. Technological

entrepreneurship combines the field of entrepreneurship and technological innovation (Beckman et al., 2012). It is characterized by the creation of products and/or services that are based on the application of technology and advanced technological knowledge.

The development of technological endeavours opens new challenges that entrepreneurs face: from raising funds, finding talented and interested employees to facing bureaucratic procedures and extremely high uncertainty of the environment (Isenberg, 2014). While these are the endeavors that are extremely innovative with the solutions they provide, unlike large companies, they are facing a high risk of failure, due to the limited amount of resources at their disposal (Li, 2001). Compared to other types of entrepreneurship, technological entrepreneurship is characterized by an extremely difficult path to success, but if it occurs, the benefits for the venture and its environment can be exceptional (Chen et al., 2019). Technological entrepreneurship is the driver of social and economic development, through the opening of new business positions and growth of the industry through new and innovative technologies. Economic research around the world increasingly links technological entrepreneurship with job creation, increasing competitiveness through the introduction of radical technological innovation in the industry, GDP growth and long-term productivity (Isenberg, 2011). Technological entrepreneurship is essential for growth, development and competitive advantage at the regional and national levels, and it is seen as a tool that promotes the prosperity of individuals, companies, regions and nations (Bailetti, 2012).

All the social and economic benefits of technological entrepreneurship come with the condition of its success. However, according to research, most high-tech ventures do not reach the growth stage, due to a large number of factors that must be met in order to survive in conditions of high uncertainty and a dynamic environment.

2.1. Success measures in technology entrepreneurship

The business environment in which a company operates is characterized by specific constraints, requirements, opportunities and threats, to which the company adapts its strategy, skills and resources in order to achieve business success (Grunert & Ellegaard, 1992). The combination of internal and external factors of a certain endeavour will influence its success or failure. Factors that are necessary for business success, or whose lack leads to business failure, are defined as key success factors (Santisteban & Mauricio, 2017). In other words, factors that are decisive for the success of a company are most commonly referred to as critical or key success factors (Freund, 1988). According to Bullen and Rockart (1981), critical success factors represent a limited number of fields in which satisfactory results will ensure a successful and competitive performance of a company. These factors are understood as a small number of key business areas where things must go well, for business to grow and for management goals to be achieved. Grunert and Ellegaard (1992) define key success factors as a skill or resource in which a company can invest, which, in the market in which it operates, leads to success. They can be characterized as internal or external, as well as the extent to which management has control over them (Grunert & Ellegaard, 1992). Leidecker and Bruno (1984) define key success factors as those characteristics, conditions, or variables that, when properly maintained and managed, have a significant impact on the success of a firm operating within a particular industry. Once identified, key success factors become the basis of a company's management information system and enable the creation of performance measurement standards. Identification of key success factors is the basis of the management information system, business strategy, strategic planning, as well as consideration of threats and opportunities from the environment, and internal strengths and weaknesses (Leidecker & Bruno, 1984).

Knowing the challenges, to survive and thrive in a contemporary business environment, it is very important to identify the key factors responsible for the success of technological endeavours. A successful endeavour is considered to be the one that offers products and/or services that are accepted in the market, that meet or even create the needs of end users, create new jobs and have financial performance above average in the industry in which they operate (Wing-ki et al., 2005; Santisteban et al., 2021).

From technology, market, stage of development, the team and entrepreneur itself, there is a broad spectrum of variables that influence the state and development of a technology venture. Therefore, the research interest among different authors focuses on different success factors. It is important to mention that key success factors in the literature also appear under some of the following names: performance drivers (Efrat & Shoham, 2012), success factors (Zaheer et al., 2018; Skawinska & Zalewski, 2020), critical success factors (Kim et al., 2018; Santisteban & Mauricio, 2017; Metzemaekers, 2000), factors of internal and external uncertainty (Tomy & Pardede, 2018).

Some authors focus on researching the impact of a single factor, while most authors investigate the significance and impact of several factors, different in nature, on the success of a technology venture (Kim et al., 2018). Certain authors have addressed the question of why some entrepreneurs are more successful than others, and what are the characteristics of an individual that can predict whether a person will embark on the entrepreneurial journey. Back in 1994, Naffziger and co-authors (1994) focused their research on the factors of entrepreneurial motivation and those that predict entrepreneurial potential, whereas Montiel-Campos and Palma-Chorres (2016) investigate the impact of entrepreneurial passion on the creative process of entrepreneurship itself, with results indicating a positive impact of passion on creativity. Besides factors related to the entrepreneurial characteristics, Xiao and North (2017) explore the impact of technology business incubators and their technical, professional, entrepreneurial, and financial support services on successful technology commercialization. Sonta-Draczkowska et al. (2019) research the role of project management in the process of new product development within new technology-based firms.

In addition to identifying and researching into the impact of individual factors, a review of the literature showed that most authors have researched the impact of a number of factors, different in nature, on the success of the endeavour (Chorev & Anderson, 2006; Zaheer et al., 2018; Van de Ven et al., 1984; Lash et al., 2007; Durmusoglu, 2018; Efrat & Shoham, 2012; Kirchberger & Pohl, 2016; Park et al., 2016; Kim et al., 2018; Tomy & Pardede, 2018; Chen et al., 2019; Kakati et al., 2003; Skawinska & Zalewski, 2020; Santisteban & Mauricio, 2017; Santisteban & Mauricio, 2021; Song 2008). Such research supports the view that it is impossible to identify just one factor, or just one group of factors, such as psychological, strategic or industrial, that are responsible for the success of an endeavour, but that there is a range of different factors that lead to the success of a venture (Roure & Keeley, 1990). In this case, however, it can be noticed that many studies of this character are contradictory, meaning that in some articles the most significant are the factors that in other studies appear to be the least significant ones. This can be due to the differences in the research samples that different studies used. As an example, in 2018, Kim and co-authors (2018) investigate critical success factors of design startups on a sample of 24 ventures. The results of the study suggest that the commercialization of an idea is the most important factor of success, while entrepreneurial characteristics (such as goal orientation and competencies) emerged as important success factors as well (Kim et al., 2018). The same year, Zaheer and co-authors investigated the success factors that founders of 12 Australian digital startups considered to have influenced their success. The results of the study identify relationships in the founding team; mission, vision, and values as the most important factors, while environmental factors and factors considering the wider ecosystem have not been considered as significant by the founders at all (Zaheer et al., 2018). On the other hand, in their study, Lash and co-authors (2007) focus on the factors that led to the success of 220 ICT startups, concluding that human capital and previous work and entrepreneurial experience do not have a significant impact on the success of new ventures (Lash et al., 2007). Similar results emerged in the study of Durmusoglu (2018), whose research was based on the identification of factors that influence the governmental selection process for funding the techno-entrepreneurship projects. The results of the study showed that individual factors, such as gender, education and experience do not significantly affect the choice of the project, while the market, budget, location and employees are listed as the most important factors when selecting the techno-entrepreneurship project that will be incentivised.

3. Research Methodology

Through a systematic review of the relevant literature, this paper identifies and analyses key success factors in technology entrepreneurship and provides a novel classification and systematization of the factors. Also, it provides a prioritization of the selected factors by tech entrepreneurs. Thus, the research has two main phases: systematization and prioritization of critical success factors in technology entrepreneurship (see Figure 1).

The research and review of the literature were conducted in the period from January to June 2021, through a structured keyword search of the *Web of Scienc*e database, covering the articles published in the period between 1980 and 2021. This search resulted in 661 identified articles. Afterwards, the process of article selection was performed in two phases. The first phase included the article selection based on title and abstract, on the basis of which 490 papers were excluded from the future research. In the second phase, articles were further filtered based on 5 inclusion criteria, following the example of the author's model (Dziallas & Blind, 2019): peer-reviewed articles published in journals; articles in English; articles that comprise one of the keywords: "*success factor*", "*success indicator*" or "*success determinant*" in the title, abstract or full text; articles published between 1980 and 2021, and finally, articles covering the field of technology entrepreneurship. After the second phase, another 126 articles were eliminated. In total, 45 articles met the selection criteria, and they represent the basis of this paper for further systematization, classification and evaluation of key success factors in technology entrepreneurship.

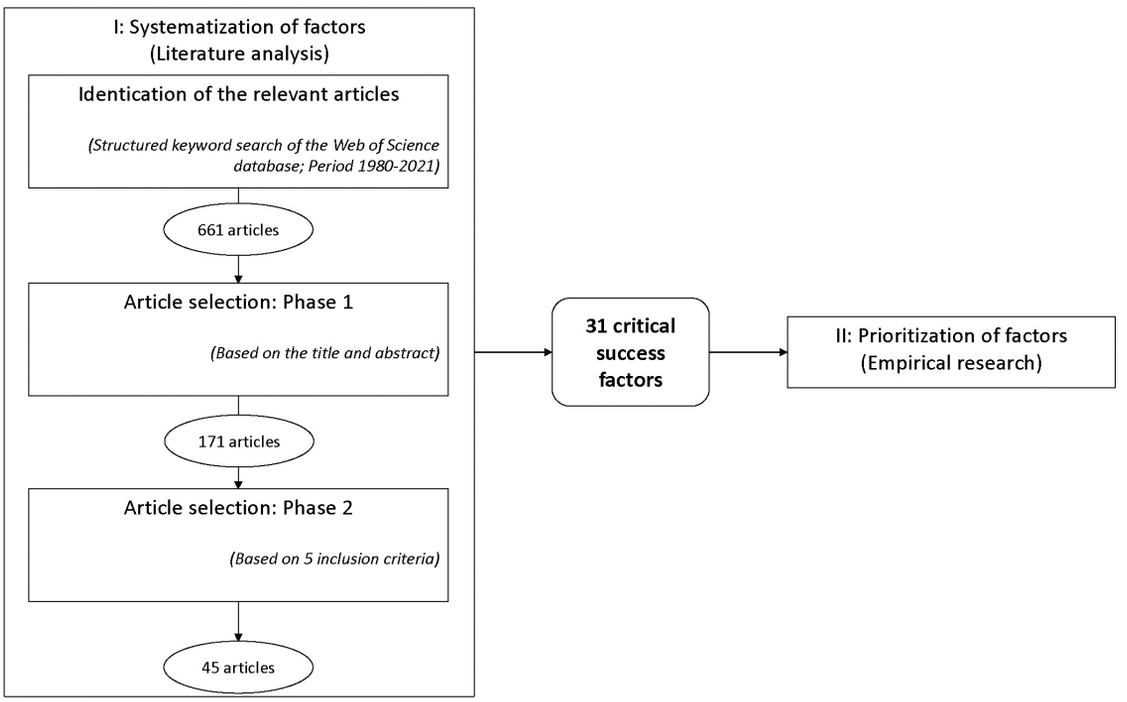

Figure 1: Flow of the research

The covered literature is rich in various factors different in nature, that the authors have identified as drivers of entrepreneurial success in their research. From the detailed screening of selected articles, 151 success factors were identified. In order to further classify factors by similar characteristics, and to facilitate their management, it was necessary to identify groups of factors and further classify the aforementioned factors by given groups. For the purposes of identifying groups of factors, the methodologies of the authors listed below were used.

Kakati (2003) identifies groups that describe characteristics of the entrepreneur, market characteristics, characteristics of the product, financial characteristics and competitive strategy and performance measures. Nassir and Sahibuddin (2011) in their paper divide success factors into 3 major groups: factors related to human resources, factors related to organizational processes, and factors related to technology. Authors Santisteban and Mauricio (2017) identify the following 3 categories of success factors: organizational factors, which represent a group of factors that describe the organizational characteristics of startups; human capital factors - a group of factors concerning the characteristics of the entrepreneur and the characteristics of the founding team, as well as environmental factors, which are factors that describe the external environment of the enterprise. The authors (Boyoung, Hyojin & Youngok, 2018) identify key success factors for design startups and classify them into 4 major groups by the following names: Entrepreneurship, Innovation, Technology, and Economics and Finance.

4. Research Results and Discussion

This section presents and discusses the findings from the literature review on success factors. 151 originally identified success factors from different authors were synthesized into 31, due to overlapping of the same factors that were repeated by different authors. Based on the identified factor groups, and for the purposes of systematization and classification of success factors in this paper, five large groups of factors were identified: "characteristics of the founder/founding team", "environment", "technology and innovation", "organization" and "strategy". All 31 success factors were further classified in the above-mentioned groups of factors, where a vast majority of factors (nine) fell under the group "characteristics of the founder/founding team", six fell into the group "environment", five in the group "technology and organization" and finally six in the group "organization", as well as in the group "strategy".

The following table (Table 1) provides assigned names of the factors, their definition, the authors of the papers in which these factors were mentioned and names under which these factors were previously mentioned by authors.

Table 1: Systematization and classification of key success factors in technology entrepreneurship

FACTOR	FACTOR DEFINITION	AUTHORS
CHARACTERISTICS OF THE FOUNDER/FOUNDING TEAM		
Level of education	The level of formal education that the founder/founding team possesses.	Van de Ven (1984), Colombo & Grilli (2005); Durmusoglu (2018); Santisteban & Mauricio (2017); Cooper et al. (1994)
Previous working (entrepreneurial/management) experience	Previous working experience in the same/similar industry. Founder/Members of the founding team have already participated in entrepreneurial ventures or grew up in an entrepreneurial family. Previous experience in a management position within an organization.	Colombo & Grilli (2005); Santisteban & Mauricio (2017); Song (2008); Mitchelmore et al. (2009); Cooper et al. (1994); Efrat & Shoham (2012); Naffziger et al. (1994); Van de Ven (1984); Durmusoglu (2018)
Risk orientation and internal locus of control	Understanding and accepting uncertainty and ability to manage risk	Van de Ven (1984); Naffziger et al. (1994); Kim et al. (2018); Sonta-Draczkowska et al. (2019)
Motivation	High level of commitment to the idea and venture- motivation and goal-orientation. Willingness to make a personal investment in the form of time and money; clear vision about the business success and desire for achievement	Van de Ven (1984); Cooper et al. (1994); Naffziger et al. (1994); Kim et al. (2018); Santisteban & Mauricio (2017)
Founding team	Founding team based on long-term personal relations, previous joint working experience (not less than six months), complementary technical skills and business expertise.	Chorev & Anderson (2006); Zaheer et al. (2018); Roure & Keeley (1990); Durmusoglu (2018); Santisteban et al. (2021)
Size of the founding team	The number of people who participated in starting the venture.	Song (2008); Santisteban & Mauricio (2017)
Social competence and leadership skills	Interpersonal skills of the founder/members of the founding team: ability to communicate effectively, negotiation skills, precision in assessing others, ability to leave a positive impression on others.	Baron (2000); Mitchelmore et al. (2009); Chorev & Anderson (2006); Santisteban & Mauricio (2017)
Functional competencies and abilities	Knowledge and expertise in the field of HR, marketing and IR. Previous engagement in HR, marketing, IR activities/positions.	Mitchelmore et al. (2009); Efrat & Shohan (2012); Santisteban & Mauricio (2017); Song (2008); Kim et al. (2018); Chen et al. (2019)
ENVIRONMENT		
Competition	Strength and intensity of the competition within the industry.	Roure & Keeley (1990); Tomy & Pardede (2018); Chen et al. (2019) Santisteban & Mauricio (2017); Song (2008); Durmusoglu (2018)
Customer concentration and market growth	The existence of an unmet need in the market and size of the target market; Expected growth and size of the target market.	Roure & Keeley (1990); Lash et al. (2007); Tomy & Pardede (2018); Durmusoglu (2018); Chen et al. (2019) Song (2008); Efrat & Shoham (2012)
Level of technological changes	Speed and frequency of technological changes within the industry.	Li (2001); Efrat & Shoham (2018); Tomy & Pardede (2018); Santisteban & Mauricio (2017); Song (2008)

Level of the entrepreneurial ecosystem development	A set of private and public institutions and individuals that support innovation and entrepreneurship. Development of the entrepreneurial ecosystem within the area in which the venture operates and the presence of support institutions, such as technology business incubators and their technical, financial, entrepreneurial, and professional support services.	Xiao & North (2017); Koohi & Feizbakhish (2017); Santisteban et al. (2021); Santisteban & Mauricio (2017)
Legal regulations and procedures	Government support for technological entrepreneurship in the form of financial incentives and initiatives to support the development of entrepreneurial activities; current laws in the field of entrepreneurship, innovation, science, and technology development.	Tomy & Pardede (2018); Santisteban & Mauricio (2017)
Resource availability	Availability of institutions and external sources of funding (such as venture capital funds); availability of qualified and educated workforce.	Tomy & Pardede (2018); Santisteban & Mauricio (2017); Kim et al. (2018); Bertoni et al. (2011)
TECHNOLOGY AND INNOVATION		
Uniqueness and superior product/ technology performance	Unique and differentiated product that meets/ exceeds customer needs and offers superior value.	Roure & Keeley (1990); Li (2001); Chen et al. (2019); Santisteban et al. (2021); Santisteban & Mauricio (2017); Chorev & Andreson (2006); Moroni et al. (2015); Kim et al. (2018)
Time to market	The period from the initial development of the product to its commercialization.	Tomy & Pardede (2018); Chen et al. (2019)
Creative and proactive use of technology	Active acceptance and recognition of new and emerging technologies; organized and continuous process of obtaining external information about the progress in the field of technology and science, analysis of obtained data and process of turning that knowledge into a tool for the decision-making process.	Kim et al. (2018); Santisteban et al. (2021)
Pivoting	Development of product/technology in iterations to achieve the right product-market fit.	Jocquet et al. (2015)
Protection of intellectual property	Secure protection of property from potential copying, protection of products or technological processes	Song (2008); Kim et al. (2018)
ORGANIZATION		
Stage of development	Number of years the venture is active (stage of development in which venture is currently in)	Song (2008); Santisteban & Mauricio (2017)
Location	The geographical location of the venture and the applicability of the business idea to the location within which the venture is being developed	Santisteban & Mauricio (2017); Durmusoglu (2018)
Financial resources	The level of financial resources available to the enterprise and the development of appropriate financing instruments throughout the lifecycle of the enterprise	Song (2008); Durmusoglu (2018); Kim et al. (2018); Lash et al. (2007); Cooper et al. (1994); Santisteban et al. (2021)
Market-oriented organizational culture and flexibility	Organizational culture characterized by the ability to quickly adapt to market conditions, and which focuses on timely market entry and the delivery of products and services valued by customers.	Chorev & Anderson (2006); Zaheer et al. (2018); Sonta-Draczkowska et al. (2019); Santisteban et al. (2021); Kim et al. (2018)

Innovative and entrepreneurial organizational culture	Organizational culture that is innovation-driven and that enhances the generation of original ideas, experimentation and learning from failure. Ability to quickly overcome failure and solve challenging situations, as well as effectively cope with crisis.	Kim et al. (2018); Santisteban et al. (2021); Skawinska & Zalewski (2020); Metzemaekers (2000); Cope (2011); Duchek (2012)
Partnerships and networks	Established partnerships and presence of a professional network of people available to the founder/ founding team.	Song (2008); Santisteban & Mauricio (2017); Skawinska & Zalewski (2020); Durmusoglu (2018); Spiegel et al. (2015)
STRATEGY		
R&D investments	Quantity of investments in internal research and development activities.	Song (2008)
Marketing strategy	Comprehensive knowledge of the market, with development and clear marketing plan.	Chorev & Anderson (2006)
Business plan	Vision of a clear business idea that is applicable to the given market and meets market needs. Existence of clearly defined business plan, that provides detailed analysis of unmet market need and that gathers necessary knowledge and information through frequent market analysis and continuous adjustments to change.	Van de Ven (1984); Naffziger et al. (1994); Chorev & Anderson (2006); Zaheer et al. (2018); Kim et al. (2018)
Focus and incremental expansion	Focus is on a specific customer segment/product, while the expansion of business scope is based on previously achieved success and is incremental.	Van de Ven (1984); Zaheer et al. (2018)
Value management and sustainable development	Social responsibility of the venture and its activities, where the focus is on value creation for venture's stakeholders and further management and maintenance of created value.	Skawinska & Zalewski (2020)
Technology globalization	The extent to which the technology is marketed and scaled to foreign markets	Kim et al. (2018); Song (2008)

Source: Authors

In recognizing the success factors, many authors emphasize the importance of education, and previous experiences of the entrepreneur (in establishing new businesses and others), communication and social connections with customers, suppliers, distributors, and investors. Their personal characteristics, motivation, goal orientation, readiness to take risks and learn from failure, and openness for personal development of management and other skills, as well as complementarity of these skills within the founding team, are also found as relevant. These factors are systemized in the first group.

The second group of factors focuses on the role of the environment in endeavours' success. It is widely known that technology-based ventures are operating in market conditions of high uncertainty and frequent changes. Therefore, it is important to consider the intensity of competition in a given market, customer concentration and market growth, as well as the level of technological changes that are present in the market. Some authors consider the presence of a developed entrepreneurial ecosystem, strong legal regulations and procedures that promote entrepreneurship and innovation, as well as resource availability as equally important when it comes to the external environment of the venture.

The success of a technology venture can also be linked to the factors that form the group "technology and innovation". Those are the factors that determine the technology itself, characterizing its uniqueness and superiority, its creative and proactive use, as well as iterative development. The mechanism for protection of intellectual property as well as the period from the initial development of the product to its commercialization can play a significant role in succeeding in an ever-changing and developing environment. Many authors write about the importance of organization-related factors. The practice of continuous identification of new opportunities, encouragement of experimentation and learning from failure, flexibility, and responsiveness as well as creativity and innovation (encouragement of experimentation and generation

of ideas in the process of product/service development) can play a key role in a venture's business achievements and are deeply connected to the organizational culture. Location, stage of development, partnerships and networks and availability of financial resources are seen as equally important and altogether belong to the third group of factors.

Closely related to organizational factors, the next and the last group identifies factors falling under the "strategy" group. When creating a strategy that is sustainable in the context of technology entrepreneurship, the focus should be on the presence of a clearly defined business plan. Marketing strategy, technology globalization, the number of internal R&D investments as well as the focus on value creation and sustainable development are all factors to be considered when shaping the long-term plan for the venture.

4.1. Empirical research results

To provide the prioritization of 31 identified success factors, empirical research was performed. The research was conducted from 3rd to 11th September 2021, on a test sample of 33 decision makers of technological entrepreneurial ventures from the database of ICT hub based in Belgrade and technological ventures created within the Belgrade-based PlusPlusNT company. Out of 82, 33 entrepreneurs completed the questionnaire correctly, resulting in the response rate of 43.42%. For the research purposes, a Google form questionnaire was created and distributed in the mentioned period. The survey involved determining the significance of each of the identified factors, based on a scale from one to five, with respondents rating a factor that has no influence with number one and a factor that is very influential in the terms of venture's success with number five. The average of collected ratings was applied to determine the priority of each factor, while the formula for standard deviation was used to determine experts' agreement on the given priority of each factor.

The following table (Table 2) provides results of the empirical research, where for each of the identified factors the average rating, standard deviation, as well as overall priority can be assessed.

Table 2: Evaluation of key success factors in technology entrepreneurship

Factor	Average rating	Standard deviation	Priority
Level of education	3.636	0.994	28
Previous working experience	3.758	0.830	24
Risk orientation and internal locus of control	4.545	0.711	6
Motivation	**4.939**	**0.242**	**1**
Founding team	4.394	0.788	9
Size of the founding team	2.909	1.071	31
Social competence and leadership skills	4.788	0.415	3
Functional competencies and abilities	3.818	0.769	23
Competition	3.667	0.957	27
Customer concentration and market growth	4.030	0.728	19
Level of technological changes	4.182	0.846	16
Level of entrepreneurial ecosystem development	4.091	0.765	17
Legal regulations and procedures	3.758	0.969	25
Resource availability	4.303	0.810	12
Uniqueness and superior product/ technology performance	4.697	0.728	5
Time to market	4.091	0.765	18
Creative and proactive use of technology	4.242	0.792	15
Pivoting	4.303	0.637	10
Protection of intellectual property	4.000	0.829	21
Stage of development	3.121	1.053	30
Location	3.576	1.200	29
Financial resources	4.303	0.810	13
Market-oriented organizational culture and flexibility	4.515	0.870	8
Innovative and entrepreneurial organizational culture	4.727	0.517	4
Partnerships and networks	4.303	0.728	11
R&D investments	3.909	0.631	22
Marketing strategy	4.515	0.667	7
Business plan	4.789	0.600	2
Focus and incremental expansion	4.000	0.612	20
Value management and sustainable development	4.273	1.008	14
Technology globalization	3.697	1.045	26

Based on the results of the research, it can be concluded that experts see motivation that falls under the group "characteristics of the founder/founding team", as the most significant factor for a venture's success with an average rating of 4.939, while also being the factor around which experts were the most in agreement, with a standard deviation 2.422. This result confirms the research results of some of the previously analysed studies (Chorev & Anderson, 2006; Van de Ven, 1984). Among the most important success factors based on experts' opinion these can also be found: "social competence and leadership skills" belonging to the group "characteristics of the founder/founding team", "business plan" from the "strategy" group, "innovative and entrepreneurial organizational culture" from the group "organization", as well as "uniqueness and superior product/ technology performance" that falls under the group "technology and innovation". There were no average ratings below this result. Factors "location", "competition", "legal regulations and procedures" as well as the "level of education" are all factors considered to be on a low level of influence for the success of the venture. As the least significant factor the "size of the founding team" belonging to the group "characteristics of the founder/founding team", was identified, with an average rating of 2.909. The experts were the least in agreement while assessing the importance of the factor "location" which belongs to the group "organization" and whose standard deviation is 1.200.

Conclusion

To encourage the development of technology entrepreneurship and enable all the benefits it brings, there has to be an understanding of its importance and the nature of its success. Furthermore, it is necessary to consider and identify all aspects of this type of endeavour – from the very definition to each factor that makes it either success or a failure. This process is complex and demanding, and often undermanaged, considering that business success can be perceived in different ways, while factors that can affect it are numerous. Both in literature and economy, there is no uniform and standardized process for factor identification and comparison, which is much needed, considering that the success rate of startups in technology entrepreneurship is lower than 10%. Contributing to the simplification of this process, this study was performed in order to determine, systemize and classify key success factors in technology entrepreneurship. Extensive literature review was performed and from 661 articles initially identified, 45 met the selection criteria, out of which 151 success factors were extracted and later synthesized into 31 factors, based on the carefully performed analysis. These factors where then classified into five categories, according to their nature and similarities: "characteristics of the founder/founding team", "environment", "technology and innovation", "organization" and "strategy", providing a clear and understandable overview. Furthermore, in order to compare factors with each other and prioritize them, the empirical study was performed. Results of the empirical research indicated that the experts who participated consider the most important success factor to be the factor "motivation", which refers to the commitment of the founder in the terms of financial resources and time, but also to the existence of a desire for success. Common to all of the factors that emerged with highest ratings, such as "social competence and leadership skills", "business plan" and "innovative and entrepreneurial organizational culture", is that they are all internal in nature and in the power of the endeavour itself to manage them, but still belong to different groups, leading to a conclusion that when speaking of success, factors are interrelated and only when combined, lead to positive results. This empirical research was performed on a test sample, and it is proposed that future studies should include a larger sample of experts from various industries. Considering that certain factors within the performed study have a high level of standard deviation within the answers of experts, more detailed research of their significance is proposed. Also, it is necessary to keep in mind that the results of research on the significance of key success factors in technological entrepreneurship may vary depending on the sample selected for evaluation of the factors, given that the factors are complex in nature and can be differently evaluated depending on the lenses through which they are observed. Still, the contribution of this paper is relevant both from the perspective of academicians and that of practitioners. From the academic perspective, it represents a valuable base for further research, enriching the literature on key success factors in technology entrepreneurship, and providing a new perspective on its classification. From the business perspective, this paper provides an extensive list of factors that can be used as a support, for both entrepreneurs and investors, as well as for all interested parties, in the process of identification and tracking of success factors necessary for the growth and development of technology ventures themselves.

REFERENCES

[1] Bailetti, T., Bot, S., Duxbury, T., Hudson, D., McPhee, C., Muegge, S., et al. (2012). An Overview of Four Issues on Technology Entrepreneurship in the TIM Review. *Technology Innovation Management Review*, *2*(2), 28-34. DOI: 10.22215/timreview/557

[2] Baron, R. A. (2000). Psychological Perspectives on Entrepreneurship: Cognitive and Social Factors in Entrepreneur's Success. *Current Directions in Psychological Sciences, 9*(1), 15-18. DOI: 10.1111/1467-8721.00050

[3] Beckman, C., Eisenhardt, K., Kotha, S., Meyer, A., & Rajagopalan, N. (2012). Technology Entrepreneurship. *Strategic Entrepreneurship Journal*, *6*(2), 89-93. DOI: 10.1002/sej.1134

[4] Bertoni, F., Colombo, M. G., & Grilli, L. (2011). Venture capital financing and the growth of high-tech start-ups: Disentangling treatment from selection effects. *Research Policy, 40*(7), 1028–1043. DOI: 10.1016/j.respol.2011.03.008
[5] Bloodgood, J.M., Sapienza, H.J., & Almeida, J.G. (1996). The Internationalization of New High-Potential U.S. Ventures: Antecedents and Outcomes. *Entrepreneurship Theory and Practice 20*(4), 61–76. DOI: 10.1177/104225879602000405
[6] Bullen, C. V., & Rockart, J. F. (1981). A primer on critical success factors. *Massachusetts Institute of Technology, Sloan School of Management, Massachusetts, USA*.
[7] Cantamessa, M., Gatteschi, V., Perboli, G., & Rosano, M. (2018). Startups' Roads to Failure. *Sustainability, 10*(7), 2346. DOI: 10.3390/su10072346
[8] Chamanski, A., & Waago, S. (2001). The Organizational Success of New, Technology-Based Firms. *Working paper, Norwegian University of Science and Technology, Trondheim, Norway.* DOI: 10.1080/14632440110105062
[9] Changsok, Y., Dongwoo, Y., Huykang, K., & Eunnyeong, H. (2012). Key Value Drivers of Startup Companies in the New Media Industry—The Case of Online Games in Korea. *Journal of Media Economics, 25(*4), 244–260. DOI: 10.1080/08997764.2012.729546
[10] Chen, Y., Tsai, C., & Liu, H. (2019). Applying the AHP Model to Explore Key Success Factors for High-Tech Startups Entering International Markets. *International Journal of E-Adoption*, *11*(1), 45–63. DOI: 10.4018/IJEA.2019010104
[11] Chorev, S., Anderson, A. R. (2006). Success in Israeli high-tech start-ups; Critical factors and process.*Technovation , 26*(2), 162–174. DOI: 10.1016/j.technovation.2005.06.014
[12]Colombo, M. G., & Grilli, L. (2005). Founders' human capital and the growth of new technology-based firms: A competence-based view. *Research Policy*, *34*(6), 795–816. DOI: 10.1016/j.respol.2005.03.010
[13] Cooper, A. C. (1993). Challenges in predicting new firm performance. *Journal of Business Venturing*, *8*(3), 241-253. DOI: 10.1016/0883-9026(93)90030-9
[14] Cooper, A. C., Gimeno-Gascon, F. J., & Woo, C. Y. (1994). Initial human and financial capital as predictors of new venture performance. *Journal of Business Venturing, 9*(5), 371–395. DOI: 10.1016/0883-9026(94)90013-2
[15] Cooper, R. G. (1981). An empirically derived new product project selection model. *IEEE Transactions on Engineering Management, EM-28*(3), 54–61. DOI: 10.1109/TEM.1981.6448587
[16] Cope, J. (2011). Entrepreneurial learning from failure: An interpretative phenomenological analysis. *Journal of Business Venturing*, *26*(6), 604–623. DOI: 10.1016/j.jbusvent.2010.06.002
[17] Duchek, S. (2017). Entrepreneurial resilience: a biographical analysis of successful entrepreneurs. *International Entrepreneurship and Management Journal, 14*(2), 429 –455. DOI: 10.1007/s11365-017-0467-2
[18] Durmusoglu, Z.D.U. (2018). Assessment of techno-entrepreneurship projects by using Analytical Hierarchy Process (AHP). *Technology in Society*, 41-46. DOI: 10.1016/j.techsoc.2018.02.001
[19] Dziallas, M., & Blind, K. (2019). Innovation indicators throughout the innovation process: An extensive literature analysis. *Technovation*, *29*(3), 80-81. DOI: 10.1016/j.technovation.2018.05.005
[20] Efrat, K., & Shoham, A. (2012). Born global firms: The differences between their short- and long-term performance drivers. *Journal of World Business*, *47*(4), 675–685. DOI: 10.1016/j.jwb.2012.01.015
[21] Freund, Y.P. (1988). Critical success factors. *Planning Review, 16*(4), 20-23. DOI: 10.1108/eb054225
[22] George, G., Zahra, S.A., Wheatley, K.K., & Khan, R. (2001). The Effects of Alliance Portfolio Characteristics and Absorptive Capacity On Performance: A Study of Biotechnology Firms. *Journal of High Technology Management Research, 12*(2), 205–226. DOI: 10.1016/S1047-8310(01)00037-2
[23] Grunert, K. G., & Ellegaard, C. (1992). The concept of Key Success Factors: Theory and Method. *MAPP, 4*, 505-524.
[24] Isenberg, D. (2014, May). What an Entrepreneurship Ecosystem Actually Is. *Harvard Business Review*. Retrieved February 10, 2021, from https://hbr.org/2014/05/what-an-entrepreneurial-ecosystem-actually-is
[25] Jocquet, V., De Cleyn, S. H., Maene, F., & Braet, J. (2015). Product Iterations in Venture Capital Funded Technology-Based Start-Ups: Pivoting as Critical Success Factor?. *The Journal of Private Equity, 19(*1), 53–62. DOI: 10.3905/jpe.2015.19.1.053
[26] Kakati, M. (2003). Success criteria in high-tech new ventures. *Technovation, 23*(5), 447–457. DOI: 10.1016/S0166-4972(02)00014-7
[27] Kim, B., Kim, H., & Jeon, Y. (2018). Critical Success Factors of a Design Startup Business. *Sustainability*, *10*(9), 2981. DOI: 10.3390/su10092981
[28] Koohi, S., & Feizbakhish, M. (2017). A study on the effects of systemic elements of entrepreneurial ecosystem on startup success within the discovery stage. *International Transaction Journal of Engineering, Management, & Applied Sciences & Technologies*, *9(*6), 567-577. DOI: 10.14456/ITJEMAST.2018.52

[29] Lans, T., Blok, V., & Wesselink, R. (2014). Learning apart and together: towards an integrated competence framework for sustainable entrepreneurship in higher education. *Journal of Cleaner Production, 62*, 37-47. DOI: 10.1016/j.jclepro.2013.03.036
[30] Lasch, F., Le Roy, F., & Yami, S. (2007). Critical growth factors of ICT start ups. *Management Decision*, *45(*1), 62-75. DOI: 10.1108/00251740710718962
[31] Leidecker, J. K., & Bruno, A. V. (1984). Identifying and using critical success factors*. Long Range Planning, 17*(1), 23–32. DOI: 10.1016/0024-6301(84)90163-8
[32] Li, H. (2001). How Does New Venture Strategy Matter in the Environment–Performance Relationship*? Journal of High Technology Management Research*, *12*(2), 183–204. DOI: 10.1016/S1047-8310(01)00036-0
[33] Marino, K.E., & De Noble, A.F. (1997). Growth and Early Returns in Technology-Based Manufacturing Ventures. *Journal of High Technology Management Research, 8*(2), 225–242. DOI: 10.1016/S1047-8310(97)90004-3
[34] McGrath, R.G., 1999. Falling forward: Real options reasoning and entrepreneurial failure. *Academy of Management Review, 24*(1), 13–30. DOI: 10.5465/amr.1999.1580438
[35] Metzemaekers, D.A.M.M. (2000). Critical success factors in technology management. *International Journal of Technology Management, 19*(6), 583–585. DOI: 10.1504/IJTM.2000.002836
[36] Montiel-Campos, H., & Palma-Chorres, Y. M. (2016). Technological Entrepreneurship: A Multilevel Study. *Journal of Technology Management & Innovation, 11*(3), *77–83.* DOI: 10.4067/S0718-27242016000300009
[37] Moroni, I., Arruda, A., & Araujo, K. (2015). The Design and Technological Innovation: How to Understand the Growth of Startups Companies in Competitive Business Environment*. Procedia Manufacturing, 3,* 2199–2204*.* DOI: 10.1016/j.promfg.2015.07.361
[38] Naffziger, D. W., Hornsby, J. S., & Kuratko, D. F. (1994). A Proposed Research Model of Entrepreneurial Motivation. *Entrepreneurship Theory and Practice, 18*(3), 29–42.
[39] Nasir, M. H. N., & Sahibuddin, S. (2011). Critical Success Factors for Software Projects: A Comparative Study. *Scientific Research and Essays*, *6*(10), 2174-2186. DOI: 10.5897/SRE10.1171
[40] Rakicevic, J., Levi Jaksic, M., & Ukropina, N. (2018), The Role of Support Organizations in Technology Entrepreneurship Ecosystem: Case of Serbia. *Symorg 2018*, 666-675.
[41] Robinson, K.C., & McDougall, P.P. (2001). Entry Barriers and New Venture Performance: A Comparison of Universal and Contingency Approaches*. Strategic Management Journal*, *22*(6–7), 659–685. DOI: 10.1002/smj.186
[42] Roure, J. B., & Keeley, R. H. (1990). Predictors of success in new technology based ventures. *Journal of business venturing, 5(*4), 201-220. DOI: 10.1016/0883-9026(90)90017-N
[43] Santisteban, H., & Mauricio, D. (2017). Systematic Literature Review of Critical Success Factors of Information Technology Startups*. Academy of Entrepreneurship Journal*, *23*(2), 1-23.
[44] Santisteban, H., Mauricio, D., & Cachay, O. (2021). Critical success factors for technology-based startups. *International Journal of Entrepreneurship and Small Business, 42*(4).
[45] Skawinska, E., & Zalewski, R.I. (2020). Success Factors of Startups in the EU—A Comparative Study. *Sustainability*, *12(*19*)*, 8200. DOI: 10.3390/su12198200
[46] Song, M., Podoynitsyna, K., Van Der Bij, H., & Halman, J. I. M. (2007). Success Factors in New Ventures: A Meta-analysis*. Journal of Product Innovation Management*, *25*(1), 7–27. DOI: 10.1111/j.1540-885.2007.00280.x
[47] Sonta-Draczkowska, E. & Mrozewski, M. (2019). Exploring the Role of Project Management in Product Development of New Technology-Based Firms*. Project Management Journal, 51*(3), 294-311. DOI: 10.1177%2F8756972819851939
[48] Spiegel, M., & Marxt, C. (2011). Defining Technology Entrepreneurship*. 2011 IEEE International Conference on Industrial Engineering and Engineering Management (1623-1627). IEEE.* DOI: 10.1109/IEEM.2011.6118191
[49] Startup Genome (2021). The Global Startup Ecosystem Report 2021 GSER2021. Available at: https://startupgenome.com/reports/gser2021
[50] Tomy, S., & Pardede, E. (2018). From Uncertainties to Successful Start Ups: A Data Analytic Approach to Predict Success in Technological Entrepreneurship*. Sustainability, 10(*3), 602. DOI: 10.3390/su10030602
[51] Van de Ven, A. H., Hudson, R., & Schroeder, D. M. (1984). Designing New Business Startups: Entrepreneurial, Organizational, and Ecological Considerations. *Journal of Management, 10(*1), 87–108. DOI: 10.1177/014920638401000108
[52] Wing-Ki, W., Hong-Man, C. & Venuvinod, P. (2005). Assessing the growth potential of high-technology startups: An exploratory study from Hong Kong. *Journal of Small Business and Entrepreneurship*, *18(*4), 453-470. DOI: 10.1080/08276331.2005.10593353

[53] Xiao, L., & North, D. (2017). The role of Technological Business Incubators in supporting business innovation in China: a case of regional adaptability?. *Entrepreneurship & Regional Development, 30*(1), 1–29. DOI: 10.1080/08985626.2017.1364789
[54] Zaheer, H., Breyer, Y., Dumay, J., & Enjeti, M. (2018). Straight from the horse's mouth: Founders' perspectives on achieving 'traction' in digital start-ups. *Computers in Human Behavior, 95*, 261-274. DOI: 10.1016/j.chb.2018.03.002

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