





# “Factors and circumstances affecting the business performance of firms based on new technologies”

<b>AUTHORS</b>	Štefan Slavik   Veronika Bednarova 
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Štefan Slávik, Ph.D., Professor,  
Department of Management, Faculty  
of Business Management, University  
of Economics in Bratislava, Slovakia.  
(Corresponding author)

Veronika Bednárová, Doctoral Student,  
Department of Management, Faculty  
of Business Management, University of  
Economics in Bratislava, Slovakia.



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Štefan Slávik (Slovakia), Veronika Bednárová (Slovakia)

# FACTORS AND CIRCUMSTANCES AFFECTING THE BUSINESS PERFORMANCE OF FIRMS BASED ON NEW TECHNOLOGIES

## Abstract

New technology-based firms (NTBFs) invent, develop, and commercialize original technologies whose research, development, and commercial success is highly uncertain and risky. Their growth is lengthy and often insufficient, but investors' growth expectations are high. The study aims to determine factors and circumstances that affect the growth of new technology-based firms. The source of knowledge is a personal experience from a guided interview with the founder, which is recorded in the questionnaire. The research sample includes 67 NTBFs doing business in Slovakia. The respondents' statements were analyzed using critical discourse analysis (CDA) with the support of artificial intelligence. The results are the factors that influence the business performance of the investigated companies. The performance of companies that show a long-term loss is affected by very limited access to financial resources, restrictive regulations, and a lack of qualified employees. The performance of companies that show a long-term profit is influenced by favorable access to external capital, effective management of human resources, optimization of internal processes, and improvement of marketing. The order of the identified factors expresses their importance in the thematic group. The secondary results are the accompanying circumstances of the growth of the investigated companies, namely the reasons for the establishment of NTBF and entry into business, commercialization of new technology, and cooperation with investors and banks. The combination of limited access to finance and a lack of qualified human resources creates a complex set of obstacles to the business performance of NTBFs.

## Keywords

NTBF, qualitative analysis, CDA, circumstances of growth, factors of growth

## JEL Classification

L26, M13, O30, O32

## INTRODUCTION

In recent decades, the proliferation of new technology-based firms (NTBFs) has become an important part of advanced national economies worldwide. These companies have a powerful innovation capability, which is based on cutting-edge technologies, and therefore have a significant impact (Rydehell et al., 2019) on long-term economic development, are considered a source of economic growth and innovation, support job creation, and promote transformational changes across industries. NTBFs help (Zapata Huamaní et al., 2017) convert innovative ideas into business opportunities, stimulate competition, and increase productivity. Their share in the internationalization of business, even in accelerating the internationalization of business, is not negligible (Cahen et al., 2017). However, very few technology companies experienced high growth during their first years of existence (Rannikko et al., 2019).

The consulting firm Arthur D. Little Group (1997) defined NTBF back in 1977 as follows: age under 25; a business based on invention; above-average technological risk; practical use of an invention or technologi-

cal innovation; independence, which means that the company is owned by individuals and is not a branch of an established company. Technologies play a decisive role in both the main and secondary processes of these enterprises (Lutz, 2003). Cunha et al. (2013) claim that NTBFs are independent enterprises that are less than ten years old and base their business on the development, production, and commercialization of technology. Fudickar and Hottenrott (2019) consider NTBFs as independently owned companies that have existed for less than twenty-five years and operate in high-tech or knowledge-intensive industries.

However, despite advances in understanding the growth trajectories of NTBFs, critical knowledge gaps remain that prevent a comprehensive understanding of their evolutionary pathways. In particular, the prevailing reliance on quantitative methodologies often addressed pre-defined factors assumed to be growth determinants. The traditional internal determinants of growth are usually the founder of the company (Camisión-Habaa et al., 2019; Farnoodi et al., 2020), the business team (Zellmer-Bruhn et al., 2021; García-Cabrera et al., 2021), business model (Rydehell & Issakson, 2016; Isaksson et al., 2021), interest in business internationalization (Baier-Fuentes et al., 2021), and enough investments at the beginning of the business (Mauer et al., 2024). Traditional external determinants of growth are public institutions supporting the innovation performance of NTBFs (Fudickar & Hottenrott, 2019), business networks (Löfsten et al., 2023), partnerships (Combs et al., 2023), and incubators (Santisteban et al., 2021).

Studies have shown that faster development and growth of NTBFs in the early stages are associated with a greater likelihood of long-term success (Mauer et al., 2024), and few NTBFs can be considered high-growth companies (Rannikko et al., 2019). Understanding the determinants of growth is important for policymakers, practitioners, and scholars as it has implications for the long-term viability and sustainability of NTBFs in an ever-evolving business environment.

Technologies that are new, original, and with high business potential bring tangible results with a significant time gap from their creation. Existing studies on NTBFs attempt to quantify the relationships between predefined factors and business growth. Qualitative studies on this topic are rare, but they could contribute to the emergence of new knowledge/factors that positively or negatively affect the business performance of NTBFs because they are not burdened by prejudices, thought stereotypes, and explicit hypotheses.

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## 1. LITERATURE REVIEW

Starting a business is not easy, and running it is even harder. Although an entrepreneur has a good idea, situational and psychological reasons can attract or discourage him/her (Burns, 2014). The situational reasons are the need for a regular income, different opinions on the content and performance of work in the current employment relationship, personal disagreements at the workplace, and loss of employment. Psychological reasons are the desire for independence, recognition, personal development, but also wealth. As a rule, they are derived from character and temperament traits (Stevenson & Jarillo, 1990); e.g., the need for independence has been identified as a fundamental trait of entrepreneurs (Mazzarol & Reboud, 2020). Jafari-

Sadeghi (2020) sees motives for self-employment similarly, dividing them into motivations driven by necessity, motivations driven by opportunity, and mixed motivations. The propensity for independent entrepreneurship can also come from education. Su et al. (2021) identified the crucial role of universities in creating entrepreneurial spirit in students. Business success depends not only on motivation but also on appropriate business skills. Research on serial entrepreneurs highlights the ability to develop strong entrepreneurial teams and networks (Dabić et al., 2023). The ability to create social networks and the leadership of the founder is considered by Zhihao (2022) to be a serious prerequisite for starting a business. Last but not least, business success is also determined by the entrepreneur's cognitive abilities (Morales-Alonso et al., 2024).

The mission of NTBFs is not only to develop new technology and apply it to new products but also to manufacture and deliver them to the market. This process can be called commercialization, which contains (Mazzarol et al., 2022) seven elements with the attribute new: products, processes, inventions or reconfiguration of technology, markets, intellectual property rights, knowledge transfer, and management of new product development. Commercialized technologies represent a combination of high market and technological uncertainty (Haessler et al., 2023). The process of commercializing an emerging technology through a new venture is characterized by uncertainty (Bonnín Roca et al., 2017). Customers often do not know how to take advantage of the new value proposition, and new companies have no history (Myers & Albats, 2024). Many technological projects fail due to incorrect knowledge of industrial partners' needs and expectations, as well as legal and formal requirements (Malec et al., 2020). Universities play a key role in initiating innovation, but the paths of innovation from universities to commercialization are a serious problem. Many top research universities have established technology transfer offices, and others outsource this function. Their main task is to conclude contracts for the use of these technologies. Contracts usually take three forms (Carrick, 2023): entry into the equity, joint venture, or licensing. Min et al. (2020) consider an effective partnership between public technologies and private enterprises to be a key factor in successfully commercializing transferred technologies, regardless of the market situation. Connecting stakeholders in the technology commercialization process can take the form of a model (R&D-C Bridge) that removes the unclear division of tasks and the biased commercialization process (Budi & Aldianto, 2020). Unmanaged commercialization of R&D results increases the risk of company closure, especially for smaller companies, due to a significant slowdown in sales growth (Yoo & Jung, 2024).

Standard sources of financing bank loans and public issues of shares are unavailable for NTBFs due to lack of history and high-risk future. NTBFs face limited funding sources. The hope of success in the first round of financing increases the favorable evaluation of five signals: founders' education and work experience, ownership rights, alliances,

and size (Passavanti et al., 2024), which bring insight into the complex dynamics between NTBFs and investors. The main source of finance for technology start-ups is venture capital. It has obvious positive effects on company growth, whereas private, independent venture capitals have the greatest effects (Pantea & Tkacik, 2024). Leitão et al. (2022) also noted the beneficial effect of venture capital. The mobilization of financial resources of NTBFs is influenced (Rannikko et al., 2022) by a business plan and a trustworthy environment (incubator), but the initial experience with entrepreneurship is irrelevant. The state is also involved in the financing of innovative companies, especially indirectly, when it offers various financial reliefs (Ferrucci et al., 2021).

The central figure and key internal factor in a small and starting technological company is the entrepreneur (Zapata Huamaní et al., 2017) with his/her personal (age, education, and others) and professional characteristics (skills, experience, and others). Entrepreneurial experience is complemented by growth orientation (Rydehell et al., 2019). It is expected (Camisón-Habaa et al., 2019) that the managerial capabilities of the entrepreneur (knowledge, experience, education, power, and position) have an impact on company growth. There are strong correlations between growth rates, on the one hand, and founder- and firm-specific factors (Almus & Nerlinger, 1999).

Löfsten et al. (2024) compared stable and high-growth NTBFs and found that early business model choices predetermine long-term growth paths and that high growth is associated with greater early access to resources. Observing technology start-ups points to their limited growth because, according to Taupin et al. (2021), the business model in the scaling phase is merely replicated without changing most of the activities. García-Cabrera et al. (2021) suggest that NTBFs achieve better results if they invest in the development of the founding team's human capital, especially in science and technology training (specific human capital) and in seeking external sources of knowledge. The study warns that some decisions with a favorable effect at the start of the company may later have adverse effects, e.g., the use of explicit knowledge sources and larger founding teams.

Interest in the internationalization of business is also a significant growth factor. According to Baier-Fuentes et al. (2021), internationalization is an early path to the growth of NTBFs; Cahen et al. (2017) even recommend accelerating the internationalization of NTBFs.

Public institutions that support the innovative performance of NTBFs play a favorable role in the growth of new technological companies (Fudickar & Hottenrott, 2019). Government agencies, universities, and industry provide specialized knowledge and resources (Baier-Fuentes et al., 2021). NTBFs that are geographically close to professional and consulting networks experience positive growth effects already in the early stages after their nascence (Löfsten et al., 2023). Entrepreneurial networks (external factor, informal networks) and growth orientation (internal factor, growth attitude) also influence the novelty-oriented value proposition (Rydehell et al., 2018). Incubators play a relatively important role (Santisteban et al., 2021), as they are part of support networks and provide the missing resources and means for NTBF development and growth acceleration. The quality of new technology is also supported by open innovation, as companies combine external and internal ideas as a primary means of accelerating internal innovation or market access (Tchouwo et al., 2021).

The literature does not provide concrete reasons for entrepreneurs to start establishing NTBF. However, it can be assumed that these will be more psychological than situational reasons and will be triggered more by opportunity than by necessity. Commercialization of new technology or the transfer of new knowledge to the business sphere is a topic in the literature that deals with the connection of R&D results with production or business implementation of new technology. It can be assumed that in NTBF this transfer is not separated; it takes place smoothly in one company, but this does not exclude the emergence of various operational problems that need to be investigated. The literature is mainly devoted to the structure of financial resources for nascent technological enterprises; significantly less is written about the availability of financial resources, or about the relations between investors and NTBFs and their different motives and interests. Knowledge from the literature on growth factors of NTBFs is divided

into internal factors (founder/entrepreneur, business model, team, growth motivations (internationalization)) and external factors (public institutions, networks, incubators, and open innovations). It can be assumed that qualitative research will bring new knowledge about the circumstances affecting the performance of NTBF, which will complement the factors known so far from quantitative research.

Therefore, the aim of the study is to identify specific factors through qualitative analysis that explicitly influence the business performance of NTBFs and circumstances that implicitly influence the business performance of NTBFs.

## 2. METHODOLOGY

The analysis was conducted between February and November 2023 in 67 small and medium-sized technological enterprises in the territory of the Slovak Republic (Appendix A). The original list contained approximately 120 NTBFs, which is the upper limit of the number of enterprises of this type in the country. However, it was reduced due to the willingness to participate in research and the innovativeness of the technology being developed. This type of enterprise is only a fraction of the total number of enterprises in the Slovak Republic, but their innovativeness, which is based on the results of their own basic and applied research, is an extraordinary phenomenon in the economic life of the country. However, they have problems with business growth, which is often at odds with the quality of the new technology, and therefore, academic research is required to reveal the reasons for the frequent occurrence of poor business performance. The condition for selecting a company for the research sample was independent research and development of a new, usually patented, technology, three to ten years old, and subsequent commercialization of the new technology. Formal industry affiliation was not required, although it is noted. The investigation was conducted in the form of a structured interview based on a questionnaire (Appendix B) in direct contact between the researcher and the respondent, who was usually the founder of the company or an executive manager. Additional insights, information, and data were obtained from the company's web-

site, publicly available databases, and trade journals that published interviews with founders and reports on technology companies.

Formal industry incorporation of researched NTBFs is according to SK NACE (Nomenclature statistique des économies économiques dans la Communauté européenne): C – Industrial production: 10; E – Water supply; Sewerage, waste management, and remediation activities: 1; F – Other building completion and finishing work: 2; G – Wholesale and retail trade: 3; J – Information and communication: 19; L – Real estate activities: 1; M – Professional, scientific, and technical activities: 27; N – Administrative and support service activities: 2; P – Education: 1; Q – Human health and social work activities: 1. The investigated companies deal with five main types of technologies (areas of R&D), which are ranked according to the weight in the research sample (result of informal qualitative analysis): 1. Ecological and sustainable materials. 2. Medicine. 3. Robotics and autonomous systems. 4. Data analysis and artificial intelligence (AI). 5. Gaming industry.

Field research was used to collect qualitative data that describe the reasons for entering the business; accompanying problems of commercialization of new technology related to production capacity, after-sales service, suppliers, and financing; internal and external factors that affect the growth of NTBFs. Respondents answered explicitly asked questions: “Reasons for starting a business. Brief description of the new technology and the customer value proposition. Problems with production capacity, accompanying service, suppliers, and financing. Reasons for the lengthy commercialization of a new technology. Motives, ideas, and claims of investors and cooperation with banks. External and internal factors affecting the growth of the company. Sales and profit curves.” Qualitative data take the form of verbal statements and textual records about the attributes and quality of the phenomenon under investigation. Answers were handwritten on the spot and then formally edited without changing the content. During the interview, the respondents were provided clarification on request if the questions were not fully understood. Qualitative research gives the respondent an appropriate degree of freedom in formulating answers that may bring unexpected

new knowledge/grounded research (Makri & Neely, 2021). Qualitative research on technology companies is rare; analogous research was carried out only by Mauer et al. (2024) on causal brakes and effectual pedals, but research on the circumstances and growth factors of NTBFs is based on a much larger sample.

Qualitative data on accompanying commercialization problems and internal and external factors affecting business growth took the role of causes, factors (quasi-independent variables) affecting business performance, and graphs of profit curves took the role of consequences (quasi-dependent variables) showing business performance. The profit curves of companies in the research sample, usually for a period of five years, are taken from the publicly accessible Finstat database.

To analyze the causes of the business performance of NTBFs, companies that were characterized by a low level of business activity or showed significant volatility in business performance were excluded from the research sample. The reason for the selection was that some companies were too idiosyncratic and would, therefore, make it impossible to identify generalizable factors affecting the business performance of NTBFs. The companies were divided into two groups. The first group contained 20 companies that had long-term losses, and the second group contained 17 companies that had long-term profits. When examining these two groups, no significant relation was identified between business performance and a specific industry or subject of business, indicating that the determining factors of business performance are multidimensional and transcendent to this categorization.

Qualitative statements were analyzed through critical discourse analysis (CDA) to identify factors influencing the business performance of NTBFs. CDA (van Dijk, 2015; Qian et al., 2018; Liu & Guo, 2016) is an effective tool for analyzing language and communication in a business context and allows for a deeper insight into the essence of factors affecting business performance. The choice of CDA as an analytical tool is conditioned by its proven effectiveness in identifying the opaque relationships that underlie complex social relationships (Fairclough, 1995; Wodak & Meyer, 2009).

Critical discourse analysis can have a different number of steps. Mullet (2018) establishes seven steps, Luo (2023) suggests four steps, and Cingerová and Motyková (2017) recommend seven basic steps according to the Duisburg school. Qualitative data analysis software (Maxqda) offers CDA in four steps. CDA in this study consists of four steps:

1. Reading and recording first impressions: Initial reading of texts results in recording first impressions, questions, and assumptions about content and structure.
2. Text coding: Using open coding with manual highlighting and subsequent re-coding using ChatGPT-4 artificial intelligence, key concepts, ideas, and themes in the responses were identified and marked.
3. Thematic analysis: Similar codes were collected into broader themes or categories. The subject of observation was how these themes overlap, repeat, or contrast in different texts or parts of the text.
4. Identifying patterns: The themes isolated in the previous step were analyzed for their distribution in the text, and then any recurring patterns or structures that indicated important aspects of the discourse were identified.

The identified patterns are divided into four groups, namely

1. A. Reasons for entering the business,
2. B. Problems with production capacity, accompanying service, suppliers, financing,
3. C. Motives, ideas, and demands of investors, cooperation with banks, and
4. D. Factors affecting the business performance of the investigated companies.

The order of the identified patterns expresses their importance/weight within the thematic group.

The ChatGPT-4 language model developed at OpenAI is an advanced text and image analysis

tool that uses deep learning to understand and interpret human speech. This model was used to identify patterns, verify analysis results, and perceive profit curves.

### 3. RESULTS

#### 3.1. A. Reasons for entering a business

The reasons for entering a business are diverse and are often related to personal values, professional interests, and the ability to perceive market opportunities. Solving a specific problem or bringing an innovation to market is a powerful incentive to action for many entrepreneurs. Establishing a company is considered to be an effective and often the only way to realize ideas, desires, and dreams and, at the same time, ensure the material existence of the founder. Based on the discursive analysis, they can be classified according to importance/weight into the following categories:

1. The desire for independence (the desire to do something of one's own). Many entrepreneurs need and desire to start their own companies and bring new solutions or products to the market.
2. Spotting a market gap. Some entrepreneurs have noticed a gap or unmet need in the market that their product or service can satisfy or solve.
3. Utilization (completion, application, commercialization) of academic research results. In some cases, the idea for a business arose during research that was carried out at a university or scientific research institution but under unfavorable conditions.
4. Bad ecological situation. The reason for the nascence of some companies was to improve the ecological situation or improve the sustainability of natural resources through suitable products or services.
5. Use of personal experience and skills. Entering a business is an opportunity to use the experi-

ence, knowledge, and skills of a budding entrepreneur acquired in previous jobs to create something of value.

6. Opportunity for innovation. Starting a business is an opportunity to fulfill the desire to bring innovative solutions or new technologies to the market.
7. Improving the quality of life or health. Development of products or services that have the potential to improve people's quality of life or health.

### 3.2. B. Problems with production capacity, accompanying service, suppliers, and financing

Technology entrepreneurs have identified the following challenges, which are ranked based on discursive analysis according to importance/weight into the following categories:

1. Financing. Companies highlight the difficulties in obtaining the necessary financing for their projects. Their source is private investments and European funds. Sufficient funding is lacking especially in the development of new technology and the increase of production capacity.
2. Production capacity and suppliers. Companies face their own limited production capacity and an inflexible supply chain with long lead times and limited availability of special materials and components. Some companies are dependent on foreign suppliers, which is why the implementation of their technological solutions is prolonged.
3. Qualified workforce. Companies have a shortage of employees with highly specialized skills necessary for the development and implementation of technologies. The sustainability of such highly qualified employees is also a problem.
4. Legislative and bureaucratic obstacles. Administratively demanding availability of European funds, conservative attitudes of officials, and complicated public procurement

processes are obstacles that hinder business development and project implementation.

5. External production and technological obstacles. Some companies cite specific production and technological barriers, such as the limited production capacities of component suppliers and product certification, which makes production more expensive and limits the choice of subcontractors.

### 3.3. C. Motives, notions, and demands of investors, cooperation with banks

Based on the analysis of entrepreneurs' responses, it is clear that entrepreneurs and companies have various expectations from investors and banks that reflect their unique needs, market positions, and long-term goals. Investors are looking for projects with great business potential and an evident benefit, while the banks' attitude depends on the specific financial needs and strategies of each company.

Investors' motives and requirements for companies in which they would like to invest can be categorized into four groups:

1. Finding high growth potential. Investors choose projects with high growth and innovation potential, which can bring a high rate of return on investment.
2. Interest in innovative technologies. Investors are looking for unique technological solutions that solve specific problems, bring new market opportunities, or satisfy completely new needs.
3. Long-term return on investment. Some investors are patient and willing to wait for a longer period for the return on investment, especially in industries where research, development, and commercialization of new technologies are lengthy.
4. Benefit for society or the environment. Some investors prefer projects that have a positive social or environmental impact.

Entrepreneurs' attitudes toward cooperation with banks can be divided into three categories:



1. Limited use of banking services. Some companies report that they only use standard banking services because they are financed by non-bank sources or government grants. As a rule, these companies do not meet the criteria for granting a bank loan.
2. Financing and loans. If companies use banking services, they are looking for operational financing, loans, or other banking products to support their development and growth. As a rule, these companies meet the criteria for granting a bank loan.
3. Strategic partnerships. Companies are looking for opportunities for strategic partnerships with banks or financial institutions for joint projects or to gain access to a wider range of financial services.

### 3.4. D. Factors influencing the business performance of the investigated companies

Companies that showed low economic activity, an economic imbalance, or demonstrated significant volatility of performance indicators were excluded from the factor analysis. The reason for this selection was that such companies represented too idiosyncratic cases, which would make it impossible to identify any generalizable phenomena in a comparative study. The analysis continued with the selection of companies that were divided into two categories, namely 20 companies that showed long-term losses and 17 companies that made long-term profits. When examining these two groups of companies, it was not possible to identify any significant relation between business performance and a specific industry or type of business. This suggests that the determining factors of business performance are multidimensional and transcendent to this categorization.

#### 3.4.1. D.1. Companies that report a long-term loss

Companies that have been at a loss for a long time have slowed down development and growth, which is caused by several factors. The first factor is significantly limited access to financial resources. This problem manifests itself in various forms. Companies cannot obtain external financing from

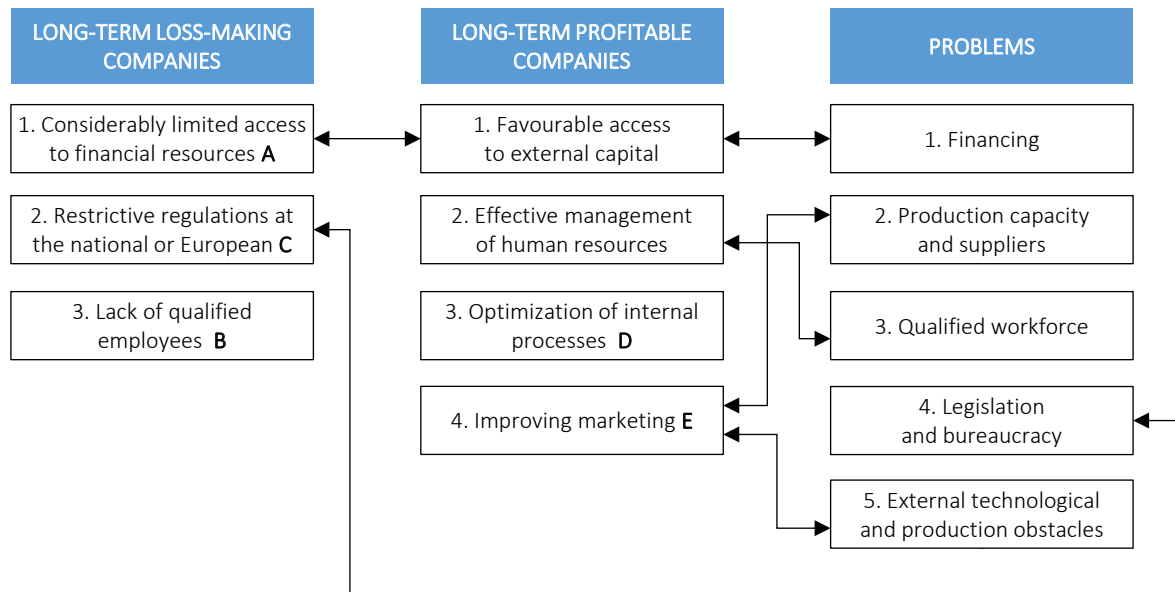
banks and venture capitalists, or the offer of venture capitalists is insufficient, while they generate few resources for self-financing and development from their own operations. Limited access to capital has a direct negative impact on investing in innovation, expanding business activities, or even maintaining routine operations.

The second factor that complicates the path to prosperity is restrictive regulations at the national or European level. These regulations can include strict environmental standards, extensive licensing requirements, complex tax laws, and other legislative hurdles that require companies to spend significant administrative effort and financial resources to comply. An excessive regulatory burden not only reduces the operational flexibility of companies but also increases their costs and often prevents further innovation.

In addition to the above external obstacles, companies that have been losing for a long time face a third factor, a critical internal problem, and that is the lack of qualified employees. The labor force deficit is conditioned in two ways. On the one hand, there is a lack of available professionals with the necessary qualifications and skills necessary for the development of companies in the labor market. On the other hand, the lack of funds weakens the position of companies in the competition for talented employees because they do not offer attractive remuneration or invest in improving their current employees' expertise. The lack of highly qualified experts weakens the effective implementation of innovation projects, productivity increases, and adaptation to changing market conditions, thereby reducing competitiveness and increasing the likelihood of long-term losses.

#### 3.4.2. D.2. Companies that report long-term profit

In contrast to companies that have been at a loss for a long time, there is a group of companies whose economic situation is stable, and they regularly generate profit. These companies see the factors that are obstacles for other companies as the root causes of their thriving businesses. Despite the overall financial constraints that all companies face, these companies have much better access to external capital. Sources of external capital are venture capital, investment funds, crowdfund-



**Figure 1.** Factors affecting the performance of NTBFs and problems with production capacity, accompanying services, suppliers, and financing

ing, and bank loans. The availability and variability of financial resources make it possible to cover not only routine operating expenses but also to invest in research and development, expansion, and the acquisition of strategic partners.

Profitable companies manage human resources effectively and are, therefore, able to attract and retain talented employees. They have developed sophisticated talent management systems that include attractive compensation, career growth opportunities, training programs, and a stimulating work environment. They are not primarily limited by a lack of skilled labor and can, therefore, focus on other aspects of their development.

At an advanced stage of development, when the basic needs of capital and labor are satisfied, companies focus more on optimizing internal processes. Optimization includes the streamlining of operational processes, the implementation of lean management, and the use of the latest technologies for process automation and digitization. The goal is to achieve higher labor productivity, reduce operating costs and improve overall business efficiency.

In parallel with internal optimization, companies devote significant efforts to improving marketing. They realize the importance of building a strong brand, developing the assortment in accordance

with customers' needs and preferences, and using modern marketing tools to achieve maximum response in the target customer group, promote uniqueness, and support long-term relationships with customers.

The mentioned factors allow profitable enterprises to maintain and develop competitiveness. The combination of multiple sources of external financing, effective human resources management, continuous optimization of internal processes, and purposeful marketing generate sustainable growth and profitability.

Figure 1 shows a summary of factors influencing the performance of NTBFs and problems with production capacity, accompanying services, suppliers, and financing. Access to capital, or the availability of capital that solves financing problems is the most weighted performance determinant (A) for both profitable and loss-making companies, and it is also the most serious operational problem. The joint cross-sectional determinant of performance and problem concerning the relationships in Figure 1 is human resources (B). Other relationships are not cross-sectional. Regulations, legislation, and bureaucracy (C) only limit loss-making companies. Profitable companies, on the other hand, experience problems with internal processes, production capacity, and external resources to

replace internal operating and capacity deficits (D). Marketing (E) is given purposeful attention only by profitable companies and is otherwise not considered an operational issue.

## 4. DISCUSSION

The dominant reasons for establishing an NTBF and entering the business are psychological reasons and opportunity-driven motivations. Personal reasons (internal motivation) include the desire for independence, the use of academic research results, and the use of personal experience and skills. External reasons (external motivations) are market gap, ecological situation, innovation opportunity, and improvement of quality of life are intertwined. More interest in innovations comes to the fore, the content, and especially the novelty, which can be interpreted variously, but new technologies, their research, development, and commercialization are in their background. Entrepreneurs with new technologies want to bring something new and better to the market, but for this, they need independent action. Going into business will allow them to act freely and implement technological progress. The knowledge gained complements the previous knowledge about independence (Mazzarol & Reboud, 2020), motivations (Burns, 2014; Jafari-Sadeghi, 2020), and cognitive abilities of the entrepreneur (Morales-Alonso et al., 2024) establishing a company with the specifics of establishing an NTBF and entering a technological business. The founders of NTBFs are generally distinguished scientific personalities with a strongly developed sense of social responsibility, and the establishment of a company has a transcendent meaning for them, which is a strong motivation for the growth of their company.

Obstacles to the commercialization of new technologies are the lack of money, own and external production capacities, qualified labor, and external bureaucracy and legislation. Identified problems foreshadow subsequently identified business performance factors, although not completely. The missing resources in NTBFs are a concretization of general knowledge about uncertainty in technological entrepreneurship (Haessler et al., 2023; Bonnín Roca et al., 2017). The identified problems are the primary problems of small companies with very limited resources and capacities of all kinds, which are multiplied by

high and special demands on the quality and technical level of resources. Protracted procurement of special resources and lengthy adaptation to external bureaucratic and legislative rules and procedures due to the absence of employees with appropriate qualifications are factors that lead to human resource frustration and weaken company growth. Malec et al. (2020) also reported the failure of technological projects due to non-fulfillment of legal and formal requirements, but overall this topic is on the fringes of research interest.

Investors look for growth, progress, revenue, and a little bit of social responsibility in technology companies. The acquired knowledge about investor motives (criteria) and requirements complements the set of favorable signals for investors from Passavanti et al. (2024). While the signals are dominated by the quality of the founders and their networks, which represents a resource prerequisite for achieving performance, the results are clearly dominated by growth and performance based on an advanced (novel, original) technological solution and, to a lesser extent, on a socially responsible solution. The performance criterion is somewhat consistent with the mobilizing effect of the business plan on obtaining financial resources for NTBF (Rannikko et al., 2022). Investors apparently demand that the founders demonstrate at least the hypothetical growth of the NTBF, which will bring the expected return, and the new technological solution, in this case, is analogous to bank collateral.

Banks are looking for solvent customers with collateral. Technology companies need banks to provide them with basic banking services (all banks), advanced banking services (only some banks), and loans (only some banks and to a limited extent). The bargaining power of small and young, albeit technological, companies is negligible, and so is the interest of banks in lending to them. The results of research and development of new technology are uncertain and, therefore, not a reliable guarantee for a loan. Technology companies are generally small firms with a short history and little or no assets that are insufficient to guarantee a loan, and therefore loans are generally unavailable to them. Banks do not need such customers. The hope of NTBF to obtain a loan increases with the growing age and assets of the company and its establishment in the market (Kedzior et al., 2020).

Companies that show a long-term loss have a lack of financial resources, which results in the unavailability of qualified employees and difficult adaptation to regulations at the national and European level, which are considered restrictive. As a rule, research studies are not devoted to the causes of business failure; research interest is much more oriented to the causes of success. The reasons for the failure of NTBFs are technology, market, financing, and management skills, although these reasons vary according to the stage of company development (Pinkwart et al., 2015). The reason for the failure of start-ups that are relatively close to NTBFs is primarily the exhaustion of capital, e.g., 38% of the research sample (Cbinsights, 2021) and 47% of the research sample (Statista, 2022). Financial poverty breeds other poor and low-quality resources. The unavailability of qualified employees can be solved by participating in incubators (Santisteban et al., 2021) and professional and consulting networks (Löfsten et al., 2023), which are not a full-fledged replacement for one's own experts, but make sense as an auxiliary or temporary solution. This possibility did not appear in this research study, probably also because the founders are mostly experienced and self-confident academics who highly value their own independence and professional prestige.

Companies that show long-term profit have access to external capital that results in quality human resources, efficient internal processes, and persuasive marketing/promotion. Access to a sufficient amount of capital alone is not a sufficient condition for business success. The capital must be used and valued efficiently and economically. Financial wealth can give birth to other rich and quality resources. The results are in line with knowledge about the early availability of resources (Löfsten et al., 2024), investments in human capital (García-Cabrera et al., 2021), the quality of the founder (Camisón-Habaa et al., 2019), which in sufficient quantity and quality, are a significant source of growth. On the topic of growth, Pisano (2024) states that it is necessary to set the pace of growth, look for new demand, and gather the financial, human, and organizational resources necessary for growth. Knowledge about the investigated NTBFs confirms the need for the quantity and quality of resources for appropriate growth, but the new demand is probably replaced by the innovativeness

of the new technology and the pace of growth by the ambitions of the founder. The effective internal operation of the company and the building of a brand and reputation are not explicitly mentioned in other research on NTBFs or are overlooked. It is probably also a consequence of the prevailing quantitative analyses, which confirm or refute predefined causes of success, while this study is based on qualitative analysis, which does not explicitly formulate the causes of success.

Losing companies see the causes of poor performance in the external environment, and profitable companies see the causes of good performance inside the company. External causes objectively exist, but they are relative because their handling and overcoming are conditioned by the quality of the internal environment of an NTBF. Sufficient or insufficient capital is the obvious and first cause and the most serious determinant of business performance, as well as other identified factors in the order.

The lack of capital limits not only investment in research and development of new technologies but also the financing of basic operational processes that are necessary for the standard functioning of everyday business. Lack of funding also means that the surveyed companies are forced to cut back on marketing and sales activities, resulting in reduced market visibility and a disadvantage in the competition for customers. Without sufficient investments in marketing, it is impossible to build a strong brand and create long-term relationships with customers, which is a basic prerequisite for sustainable growth and profitability.

The lack of qualified human resources is the second significant barrier to growth and innovation. Companies that do not have access to talented and experienced experts are limited in the creation and implementation of new ideas, technologies, and procedures that could increase the originality of the developed technology and the efficiency of operations. The lack of qualified staff causes companies to be more susceptible to deficiencies and shortcomings in the development of new technology, and therefore, the so-called technological debt, lower customer satisfaction, and ultimately, a weakening of prestige and market position comes into existence.

The challenge for further research is to reveal and confirm the causes of the factors that positively and negatively affect the growth of NTBFs. What affects the availability of capital for a company that typically has only one rare asset, which is an emerging technology that requires further research, development, production, and commercialization? Investors claim that there is plenty of capital but a lack of viable ideas. What affects the availability of highly qualified specialists for a company that can offer attractive professional self-realization associated with considerable research and business risk? There are few top specialists, but there are plenty of risky and unproven ideas.

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## CONCLUSION

The purpose of the study was to identify and explain the factors that affect the business performance of NTBFs and the circumstances that accompany the growth. The combination of limited access to finance and a lack of qualified human resources creates a complex set of obstacles for NTBFs that significantly limit their ability to develop new technologies, respond to new opportunities, adapt to changing market conditions, and maintain competitiveness. In this situation, not only the research and development of new technologies, the introduction of innovations, and the improvement of products, but also the efficiency of internal processes, i.e., reducing costs and increasing productivity, become challenging. Access to capital and human resources is a critical factor that directly impacts a business's ability to achieve and sustain growth, profitability, and long-term success.

New knowledge can be used in business practice as control, warning, and preventive criteria in the establishment of NTBF, but also in other stages of NTBF development, which signal a potential slowdown in growth, or explain the actual slowdown in the growth of a technological enterprise. On the other hand, knowledge of growth factors and circumstances enables their conscious and rational improvement, thus making full use of the business potential of new technology.

The research limits lie in the size of the sample, the range of which cannot be increased too much because the number of firms with completely new technology in the country is relatively small. Field research carried out in a direct interview with the founder demands obtaining consent for a guided interview and for the work schedule of the researcher and the respondent. This is also the reason for the limited research sample. The research limit is also the limited time for the interview and the depth of penetration into the researched topic, which, however, can be partially compensated by the analysis of publicly accessible documents about the respective company.

## AUTHOR CONTRIBUTIONS

Conceptualization: Štefan Slávik, Veronika Bednárová.

Data curation: Štefan Slávik, Veronika Bednárová.

Formal analysis: Štefan Slávik, Veronika Bednárová.

Funding acquisition: Štefan Slávik, Veronika Bednárová.

Investigation: Štefan Slávik, Veronika Bednárová.

Methodology: Štefan Slávik, Veronika Bednárová.

Project administration: Štefan Slávik.

Resources: Štefan Slávik.

Software: Štefan Slávik.

Supervision: Štefan Slávik.

Validation: Štefan Slávik, Veronika Bednárová.

Visualization: Štefan Slávik, Veronika Bednárová.

Writing – original draft: Štefan Slávik.

Writing – review & editing: Štefan Slávik, Veronika Bednárová.

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## REFERENCES

- Almus, M., & Nerlinger, E. A. (1999). Growth of new technology-based firms: Which factors matter? *Small Business Economics*, 13(2), 141-154. <https://doi.org/10.1023/A:1008138709724>
- Baier-Fuentes, H., Guerrero, M., & Amorós, J. E. (2021). Does triple helix collaboration matter for the early internationalization of technology-based firms in emerging economies? *Technological Forecasting & Social Change*, 163, Article 120439. <https://doi.org/10.1016/j.techfore.2020.120439>
- Bonnín Roca, J., Vaishnav, P., Morgan, M. G., Mendonça, J., & Fuchs, E. (2017). When risks cannot be seen: Regulating uncertainty in emerging technologies. *Research Policy*, 46(7), 1215-1233. <https://doi.org/10.1016/j.respol.2017.05.010>
- Budi, A. A., & Aldianto, L. (2020). Research and development – Commercialization bridge: A refined model. *The Asian Journal of Technology Management*, 13(1), 47-62. <https://doi.org/10.12695/ajtm.2020.13.1.4>
- Burns, P. (2014). *New venture creation. A framework for entrepreneurial start-ups*. Palgrave MacMillan.
- Cahen, F. R., Oliveira Jr., M. M., & Borini, F. M. (2017). The internationalization of new technology-based firms from emerging markets. *International Journal of Technology Management*, 74(1/4), 23-44. <https://doi.org/10.1504/IJTM.2017.10004282>
- Camisón-Habaa, S., Clemente-Almendros, J. A., & Gonzalez-Cruza, T. (2019). How do technology-based firms become also highly innovative firms? The role of knowledge, technological and managerial capabilities, and entrepreneurs' background. *Journal of Innovation & Knowledge*, 4(3), 162-170. <https://doi.org/10.1016/j.jik.2018.12.001>
- Carrick, J. (2023). Navigating the path from innovation to commercialization: A review of technology-based academic entrepreneurship. *Journal of Applied Business Research*, 39(1). Retrieved from <https://journals.klalliance.org/index.php/JABR/article/view/223>
- Cbinsights. (2021, August 3). *The top 12 reasons start-ups fail*. Retrieved from <https://www.cbinsights.com/research/report/startup-failure-reasons-top/>
- Cingerová, N., & Motyková, K. (2017). *Úvod do diskurznej analýzy [Introduction to discourse analysis]*. Comenius University in Bratislava. (In Slovak). Retrieved from [https://fphil.uniba.sk/fileadmin/fif/katedry\\_pracoviska/krvs/ZS\\_2018\\_2019/Uvod\\_do\\_diskurznej\\_analyzy.pdf](https://fphil.uniba.sk/fileadmin/fif/katedry_pracoviska/krvs/ZS_2018_2019/Uvod_do_diskurznej_analyzy.pdf)
- Combs, J. G., Ketchen, D. J. Jr, Terjesen, S. A., & Bergh, D. D. (2023). After the start-up: A collection to spur research about entrepreneurial growth. *Strategic Entrepreneurship Journal*, 17(3), 693-709. <https://doi.org/10.1002/sej.1476>
- Cunha, D., Silva, S., & Teixeira, A. A. C. (2013). Are academic spin-offs necessarily new technology-based firms? *FEP Working Papers*, 482. Retrieved from <https://ideas.repec.org/p/por/fepwps/482.html>
- Dabić, M., Vlačić, B., Kiessling, T., Caputo, A., & Pellegrini, M. (2023). Serial entrepreneurs: A review of literature and guidance for future research. *Journal of Small Business Management*, 61(3), 1107-1142. <https://doi.org/10.1080/00472778.2021.1969657>
- Fairclough, N. (1995). *Critical discourse analysis*. Longman.
- Farnoodi, S., Ghazinoory, S., Radfar, R., & Tabatabaian, S. H. (2020). Governmental origin: Why NTBFs grow in a transitional economy. *Economic Research-Ekonomska Istraživanja*, 33(1), 379-398. <https://doi.org/10.1080/1331677X.2019.1674173>
- Ferrucci, E., Guida, R., & Meliciani, V. (2021). Financial constraints and the growth and survival of innovative start-ups: An analysis of Italian firms. *European Financial Management*, 27(2), 364-386. <https://doi.org/10.1111/eufm.12277>
- Fudickar, R., & Hottenrott, H. (2019). Public research and the innovation performance of new technology-based firms. *The Journal of Technology Transfer*, 44(2), 326-358. <https://doi.org/10.1007/s10961-018-9695-z>
- García-Cabrera, A. M., García-Soto, M. G., & Nieves, J. (2021) Knowledge, innovation and NTBF short- and long-term performance. *International Entrepreneurship and Management Journal*, 17, 1067-1089. <https://doi.org/10.1007/s11365-020-00656-z>
- Haessler, P., Giones, F., & Brem, A. (2023). The who and how of commercializing emerging technologies: A technology-focused review. *Technovation*, 121, Article 102637. <https://doi.org/10.1016/j.technovation.2022.102637>
- Isaksson, A., Löfsten, H., & Rannikko, H. (2021). The influence of initial business models on early business performance: A study of 589 new high-tech firms. *International Journal of Innovation Management*, 25(05). <https://doi.org/10.1142/S1363919621500559>

21. Jafari-Sadeghi, V. (2020). The motivational factors of business venturing: Opportunity versus necessity? A gendered perspective on European countries. *Journal of Business Research*, 113, 279-289. <https://doi.org/10.1016/j.jbusres.2019.09.058>
22. Kedzior, M., Grabinska, B., Grabinski, K., & Kedzior, D. (2020). Capital structure choices in technology firms: Empirical results from Polish listed companies. *Journal of Risk and Financial Management*, 13(9), Article 221. <https://doi.org/10.3390/jrfm13090221>
23. Leitão, J., Ratten, V., & Braga, V. (2022). *Latin American and Iberian entrepreneurship. New perspectives on culture, traditions and heritage*. Springer Nature Switzerland. <https://doi.org/10.1007/978-3-030-97699-6>
24. Little, A. D. (1977). *New technology-based firms in the United Kingdom and the Federal Republic of Germany*. London: Wilton House.
25. Liu, K., & Guo, F. (2016). A review on critical discourse analysis. *Theory and Practice in Language Studies*, 6(5), 1076-1084. <http://dx.doi.org/10.17507/tpls.0605.23>
26. Löfsten, H., Isaksson, A., & Rannikko, H. (2023). Entrepreneurial networks, geographical proximity, and their relationship to firm growth: A study of 241 small high-tech firms. *The Journal of Technology Transfer*, 48, 2280-2306. <https://doi.org/10.1007/s10961-022-09988-0>
27. Löfsten, H., Isaksson, A., Rannikko, H., Tornikoski, E., & Buffart, M. (2024). Impact of the initial business model on the growth trajectory of new technology-based firms: A path dependency perspective. *The Journal of Technology Transfer*. <https://doi.org/10.1007/s10961-024-10086-6>
28. Luo, A. (2023, June 22). *Critical discourse analysis. Definition, guide & examples*. Scribbr. Retrieved from <https://www.scribbr.com/methodology/discourse-analysis/>
29. Lutz, A. (2003). Nuevos nichos de mercado para emprendedores tecnológicos. Experiencias prácticas en la Unión Europea [New paradigms and new opportunities: niche markets for technology entrepreneurs. Practical experiences in the European Union]. In K. Simón (Ed.), *La creación de empresas de base tecnológica: Una experiencia práctica* [The creation of technology-based companies: A practical experience] (pp. 43-50). Navarra: Asociación Española de Centros Europeos de Innovación Españoles. (In Spanish). Retrieved from <https://dialnet.unirioja.es/servlet/articulo?codigo=6513344>
30. Makri, C., & Neely, A. (2021). Grounded theory: A guide for exploratory studies in management research. *International Journal of Qualitative Methods*, 20. <https://doi.org/10.1177/16094069211013654>
31. Malec, M., Stańczak, L., & Ricketts, B. (2020). Integrated commercialization model of research and development project results. *Management Systems in Production Engineering*, 28(4), 228-239. <https://doi.org/10.2478/mspe-2020-0033>
32. Mauer, R., Nieschke, S., & Sarasvathy, S. D. (2024). Gestation in new technology ventures: Causal brakes and effectual pedals. *Journal of Small Business Management*, 62(1), 67-102. <https://doi.org/10.1080/00472778.2021.2002877>
33. Mazzarol, T., & Reboud, S. (2020). *Entrepreneurship and innovation. Theory, practice and context* (4<sup>th</sup> ed.). Springer Nature Singapore. <https://doi.org/10.1007/978-981-13-9412-6>
34. Mazzarol, T., Reboud, S., Clark, D., Moore, M., Malone, P., & Soutar, G. N. (2022). *Commercialisation and innovation strategy in small firms. Learning to manage uncertainty*. Springer Nature Singapore. <https://doi.org/10.1007/978-981-19-2651-8>
35. Min, J-W., Kim, Y. J., & Vonortas, N. S. (2020). Public technology transfer, commercialization, and business growth. *European Economic Review, Elsevier*, 124, Article 103407. <https://doi.org/10.1016/j.euroecorev.2020.103407>
36. Morales-Alonso, G., Blanco-Serrano, J.A., Núñez Guerrero, Y., Grijalvo, M., & Blanco Jimenez, F. J. (2024). Theory of planned behaviour and GEM framework – How can cognitive traits for entrepreneurship be used by incubators and accelerators? *European Journal of Innovation Management*, 27(3), 922-943. <https://doi.org/10.1108/EJIM-04-2022-0208>
37. Mullet, D. R. (2018). A general critical discourse analysis framework for educational research. *Journal of Advanced Academics*, 29(2), 116-142. <https://doi.org/10.1177/1932202X18758260>
38. Myers, A., & Albats, E. (2024). The challenges and strategic solutions of emerging technology entrepreneurship: A systematic literature review. *Proceedings of the 57th Hawaii International Conference on System Sciences*. <https://hdl.handle.net/10125/107038>
39. Pantea, S., & Tkacik, M. (2024). Venture capital and high-tech start-ups in Europe: A systematic review of the empirical evidence. *Venture Capital*. <https://doi.org/10.1080/13691066.2024.2315069>
40. Passavanti, C., Primario, S., & Rippa, P. (2024). A configurative analysis investigating how new technology-based firms gain the first financing round. *Journal of Economic Interaction and Coordination*, 19, 305-341. <https://doi.org/10.1007/s11403-023-00398-5>
41. Pinkwart, A., Proksch, D., Schefczyk, M., Fiegler, T., & Ernst, C. (2015). Reasons for the failure of new technology-based firms: A longitudinal empirical study for Germany. *Credit and Capital Markets-Kredit und Kapital*, 48(4), 597-627. <https://doi.org/10.3790/ccm.48.4.597>
42. Pisano, G. (2024). How fast does your company really grow? *Harvard Business Review*. Retrieved from <https://hbr.org/2024/03/how-fast-should-your-company-really-grow>
43. Qian, J., Wei, J., & Law, R. (2018). Review of critical discourse

- analysis in tourism studies. *International Journal of Tourism Research*, 20(4), 526-537. <https://doi.org/10.1002/jtr.2202>
44. Rannikko, H., Buffart, M., Isaksson, A., Löfsten, H., & Tornikoski, E. T. (2022). Mobilising finance and achieving early growth in new technology-based firms: A legitimacy perspective. *International Journal of Entrepreneurial Behaviour & Research*, 28(6), 1532-1555. <https://doi.org/10.1108/IJEBR-09-2021-0687>
  45. Rannikko, H., Tornikoski, E. T., Isaksson, A., & Löfsten, H. (2019). Survival and growth patterns among new technology-based firms: Empirical study of cohort 2006 in Sweden. *Journal of Small Business Management*, 57(2), 640-657. <https://doi.org/10.1111/jsbm.12428>
  46. Rydehell, H., & Isaksson, A. (2016). Initial configurations and business models in new technology-based firms. *Journal of Business Models*, 4(1), 63-83. <https://doi.org/10.5278/ojs.jbm.v4i1.1241>
  47. Rydehell, H., Isaksson, A., & Löfsten, H. (2019). Effects of internal and external resource dimensions on the business performance of new technology-based firms. *International Journal of Innovation Management*, 23(1). <https://doi.org/10.1142/S1363919619500014>
  48. Rydehell, H., Löfsten, H., & Isaksson, A. (2018). Novelty-oriented value propositions for new technology-based firms: Impact of business networks and growth orientation. *The Journal of High Technology Management Research*, 29(2), 161-171. <https://doi.org/10.1016/j.hitech.2018.09.001>
  49. Santisteban, J., Mauricio, D., & Cachay, O. (2021). Critical success factors for technology-based start-ups. *International Journal of Entrepreneurship and Small Business*, 42(4), 397-421. <https://doi.org/10.1504/IJESB.2021.114266>
  50. Statista. (2022). *Main reasons for business failure among start-ups worldwide in 2022*. Retrieved from <https://www.statista.com/statistics/1271464/start-up-failure-reasons/>
  51. Stevenson, H. H., & Jarillo, J. C. (1990). A paradigm of entrepreneurship: entrepreneurial management. *Strategic Management Journal*, 11, 17-27. Retrieved from <http://www.jstor.org/stable/2486667>
  52. Su, Y., Zhu, Z., Chen, J., Jin, Y., Wang, T., Lin, C.-L., & Xu, D. (2021). Factors influencing the entrepreneurial intention of university students in China: Integrating the perceived university support and theory of planned behaviour. *Sustainability*, 13, Article 4519. <https://doi.org/10.3390/su13084519>
  53. Taupin, L., Le Masson, P., & Segrestin, B. (2021). Scale-up phase in deep-tech start-ups: Replication or massive learnings? *R&D Management Conference*. Retrieved from <https://minesparis-psl.hal.science/hal-03383828/document>
  54. Tchouwo, C. T., Poulin, D., & Veilleux, S. (2021). Understanding the specific characteristics and determinants of open innovation in small and medium-sized enterprises: A systematic literature review. *International Journal of Innovation Management*, 25(6). <https://doi.org/10.1142/S1363919621500638>
  55. van Dijk, T. A. (2015). Critical discourse analysis. In D. Tannen, H. E. Hamilton, & D. Schiffrin (Eds.), *The Handbook of Discourse Analysis* (2<sup>nd</sup> ed.). Wiley Blackwell. <https://doi.org/10.1002/9781118584194>
  56. Wodak, R., & Meyer, M. (2009). Critical discourse analysis: History, agenda, theory, and methodology. In R. Wodak & M. Meyer (Eds.). *Methods for critical discourse analysis*. Sage. Retrieved from [https://www.researchgate.net/publication/284725833\\_Critical\\_discourse\\_studieshistory\\_agenda\\_theory\\_and\\_methodology](https://www.researchgate.net/publication/284725833_Critical_discourse_studieshistory_agenda_theory_and_methodology)
  57. Yoo, H. S., & Jung, Y. L. (2024). The effect of the commercialization failure of SMEs' R&D on survival. *IEEE Transactions on Engineering Management*, 71, 6078-6089. <https://doi.org/10.1109/TEM.2024.3378690>
  58. Zapata Huamaní, G. A., Fernández-López, S., Neira Gómez, I., & Rey Ares, L. (2017). The role of the entrepreneur in new technology-based firms (NTBFs): An analysis according to context. *Regional and Sectoral Economic Studies*, 17(2), 26-42. Retrieved from [https://ideas.repec.org/a/ea/eere/v17y2017i2\\_2.html](https://ideas.repec.org/a/ea/eere/v17y2017i2_2.html)
  59. Zellmer-Bruhn, M. E., Forbes, D. P., Sapienza, H. J., & Borchert, P. S. (2021). Lab, gig, or enterprise? How scientist-inventors form nascent start-up teams. *Journal of Business Venturing*, 36(1), Article 106074. <https://doi.org/10.1016/j.jbusvent.2020.106074>
  60. Zhihao, Y. (2022). What are the prerequisites for starting a start-up company? *Proceedings of the 2022 7th International Conference on Financial Innovation and Economic Development (ICFIED 2022)*. <https://doi.org/10.2991/aebmr.k.220307.296>



## APPENDIX A

Research sample (s. r. o. = LLC.; a. s., j. s. a. = plc., Inc., Co.):

1. 3IPK, a. s.
2. AgeVolt Slovakia, s. r. o.
3. Airvolute, s. r. o.
4. Alterras Therapeutics, s. r. o.
5. altFINS, j. s. a.
6. AR Visual, s. r. o.
7. Archee, s. r. o.
8. Astros Solutions, s. r. o.
9. AT Crystals, s. r. o.
10. BIONT, a. s.
11. BioX Technologies, s. r. o.
12. Bloomreach SK, s. r. o.
13. bot.media, s. r. o.
14. CEELABS, s. r. o.
15. Cognexa, s. r. o.
16. CropTech, s. r. o.
17. Danubia NanoTech, s. r. o.
18. DNA ERA, s. r. o.
19. EcoButt, s. r. o.
20. ENERGIA REAL, s. r. o.
21. FUERGY Industries, j. s. a.
22. Glycanostics, s. r. o.
23. GOSPACE LABS, s. r. o.
24. GROUND.COM.SPACE, s. r. o.
25. HighChem, s. r. o.
26. INFOTECH, s. r. o.
27. Innovatrics, s. r. o.
28. InoBat, j. s. a.
29. Malai Biomaterials Design, s. r. o.
30. MATSUKO, s. r. o.
31. MicroStep-MIS, s. r. o.
32. Mobilyze, s. r. o.
33. MTS, s. r. o.
34. MultiplexDX, s. r. o.
35. NanoDesign, s. r. o.
36. NEEDRONIX, s. r. o.
37. nettle, s. r. o.
38. NEUROCONSAN, a. s.
39. NG Aviation, s. r. o.
40. Nice Visions, s. r. o.
41. Nitroterra Technology, j. s. a.
42. Nuclear Power, a. s.
43. PANARA, a. s.
44. Panza Robotics, s. r. o.
45. PerBiotiX, s. r. o.
46. PeWaS, s. r. o.
47. Photoneo, s. r. o.
48. POWERTEC, s. r. o.
49. Proer, s. r. o.
50. RVmagnetics, a. s.
51. S-Case, s. r. o.
52. SEC Technologies, s. r. o.
53. SensoHealth Solutions, s. r. o.
54. SENSONEO, j. s. a.
55. SkyBean, s. r. o.
56. sli.do, s. r. o.
57. Soficreo, s. r. o.
58. Solargis, s. r. o.
59. Space scAvengers, s. r. o.
60. Spinbotics, s. r. o.
61. SuperScale, s. r. o.
62. Sygic, a. s.
63. Tachyum, s. r. o.
64. vacuumlabs, s. r. o.
65. vectary, s. r. o.
66. Virtual Reality Media, a. s.
67. Zdroje Zeme, a. s.

## APPENDIX B

Questionnaire outline. Stimulators and growth inhibitors of a new technology-based firm/NTBF:

0. Identification of the company
1. Characteristics of the new technology
2. Entrepreneur/founder/manager
3. Team
4. Business environment
5. Business model
6. Internal environment
7. Scaling
8. Factors affecting the performance of NTBFs
9. Performance indicators