

The limits of expert support for business decision-making in commercialization of innovation: A case study

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Abstract. Innovations provide a competitive advantage for modern organizations. However, commercializing innovations can be a significant and costly challenge that requires specific knowledge and considerable resources. Therefore, companies need to prioritize the most significant ones. Responding to the relevance, the article examines enablers of innovation commercialization. In the study, innovation experts, including business consultants and professionals, gave priority to theoretically based factors of innovation commercialization using AHP and RII methods. The study found that expert decision support is limited in helping to make decisions. Experts agree on the least significant factors of innovation commercialization but disagree on the priority ones. Furthermore, the study demonstrates that the level of ambition within an organization's activities is a crucial factor in determining the priority of innovation commercialization. These results invite a fresh perspective on the expert assistance.

Keywords: innovation commercialization; expert support; business decision-making; key factors; innovation management.

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1. INTRODUCTION

Innovation fosters companies to grow, to adapt to the times, and to gain a competitive advantage in the market. However, innovating is a complex task which requires specific readiness: knowledge from different fields and sub-areas, and cooperation of organizations as well as customers. The innovation process encompasses and integrates scope of the components one of which is innovation commercialization (Hohenberg & Homburg, 2019; Seclen-Luna & Regalado, 2020; Kurmanov et al., 2022; Duong et al., 2023). Innovation commercialization refers to a set of decisions, activities and actions aimed at bringing an innovation to market and has specific challenges due its nature.

The effectiveness of solutions in commercialization emerges over time, unlike some other stages of innovation implementation, for example, technological solutions have a relatively quick effect (Slater & Mohr, 2006). Therefore, credible knowledge is extremely important to properly assess the need for innovation commercialization's solutions and predict their outcome. According to the results of the bibliometric analysis by Shcherbachenko & Kotenko (2022), the factors of innovation commercialization are insufficiently examined in the literature. Researchers distinguish different factors of innovation commercialization (e.g., Lame & Kazempour, 2021; Datta et al., 2013) but their priorities are discussed in a minority of publications (Mawaddah et al., 2020; Munoz-Penas et al., 2024). Literature lacks a more generalized, conceptual approach on how to apply knowledge about innovation commercialization. This gap has consequences. According to research by Chiesa & Frattini (2011), many innovative products fail in the market due to poor commercialization, however, neither management theory nor practice provides clear recommendations for commercialization decisions. Moreover, the research by Daneshjoovash et al. (2021) disclosed that a lack of relation between university research and industry determines relatively weak results of innovation commercialization. Recommendations from researchers can help businesses to reduce risks in decision-making. On the other hand, according to Ardito & Svensson (2023), the type of knowledge used by a firm affects the likelihood and speed of innovating within organisations. The study by Ardito & Svensson (2023) demonstrated that applied knowledge enhances both the probability and pace of innovation, whereas the impact of basic knowledge is negligible.

Given the relevance, an aim of the paper is to theoretically and empirically define the key factors in the commercialization of innovation to provide sound recommendations to professionals and researchers interested in the commercialization of innovation. To this end, we have set four objectives: i) using thematic overview of recent literature, theoretically highlight significant factors of innovation commercialization; ii) to supplement the theoretical set of innovation commercialization factors using results of interviews with managers experienced in the implementation of innovations; iii) on the base of expert interview and with a help of Analytic Hierarchy Process (AHP) method, to divide factors of innovation commercialization by priorities; and iv) on the base of expert interview and with help of Relative Importance Index (RII) method, to supplement the priorities of factors gathered using AHP. The study is based on the premise that prioritising innovation commercialisation factors by innovation experts reflects applied knowledge rather than background knowledge.

For the research, methods employed include literature analysis, synthesis, secondary data analysis, qualitative and quantitative methods – expert surveys, analysed by two ranking methods.

The article consists of three sections: a theoretical overview of innovation commercialization drivers, a presentation of the research methodology, the results of the expert surveys, discussion, and conclusions.

2. LITERATURE REVIEW

2.1. Theoretical approach to innovation development and commercialization

Innovations play a role in the sake of competitiveness of organizations, however, there is still no consensus regarding innovating neither in business nor in the community of researchers. Depending on the branch of science or the field of activity of a company, the perception of innovation may differ. Innovation can be viewed as a product, process, new mindset, etc. (Audretsch et al., 2022; Jakubavičius & Stravinskaitė, 2020). Gambal et al. (2022) argues that an understanding of what is “innovation” changes as industries evolve, and note that currently operational innovations, business process innovations, and strategic innovations are distinguished as main innovation areas.

Speaking on innovation occurrence and development at organizations, the importance of multi-channel dynamic innovation ecosystems consisting of researchers, financiers, entrepreneurs, legislators, experts, and workers, in which dynamic processes of innovation and experimentation take place, should be stressed. An effective interaction between stakeholders is known as of key precondition for productive innovative activity (Audretsch et al., 2022; Jun & Kim, 2022). Innovating is a complex process that takes place in certain stages, which is influenced by both the internal and external environment of the organizations (Jun & Kim, 2022). A smooth transition from one stage to another requires appropriate resources, technologies, efforts, as well as competences for effective solutions, notes Audretsch et al. (2022), Seclen-Luna & Regalado (2020), Hohenberg & Homburg (2019) and others. Companies applying formal processes that are based on clearly defined decision criteria are much more successful in innovations (Seclen-Luna & Regalado, 2020). On the other hand, failures to develop innovations in specific sectors or firms can be caused by inadequate corporate infrastructure, low levels of outreach, lack of professionals and talent, and weaknesses in management systems (Wu, 2021). To get maximum benefit from innovations, organizations should understand that innovations can be understood in three ways: as an outcome, a process, or a mindset (Kahn, 2018). However, despite the type, all needed resources and components should be available while innovation implementation process should be well-managed.

The organizational environment is also success factor of innovation implementation. Due to the unfavourable internal environment, the innovation may not be implemented at all, or its implementation may be simulated (Židonis & Raišienė, 2021). As noted by Veselovsky et al. (2019), some companies are “blinded” by a superficial understanding of innovation, which makes them vulnerable to competitors who have a broader perspective, deeper knowledge and better skills in the creation, implementation, and development of innovation. However, innovations will have no value until are valued by consumers in the marketplace. As Sergeevna (2021) notes, commercialization links science to economics, and generates benefits from innovation. Recognition from users exposes a result of both innovation and its commercialization (Schendel & Hitt, 2007). Despite the importance of knowledge on commercialization of innovations, the research does not provide unambiguous frameworks or empirically based sets of key factors. In recent literature, only Mawaddah et al. (2020) prioritizes factors of innovation commercialization by two-level hierarchy. However, the use the Technology-Organization-Environment (TOE) framework, which limits the applicability of the study to areas other than technology commercialization. The TOE theory has been criticized by numerous authors. Back in 2011, Baker (2011) commented that the TOE framework should be expanded, as the model lacks task characteristics and individual factors. The author suggests future researchers to enlarge and refine or develop the TOE in such a way that the components of the model are filled with aspects important for other types of innovation than technology innovation. In other words, it is appropriate to accumulate new and test existing knowledge about the factors of innovation commercialization.

Noteworthy, innovation commercialization is difficult in the field of technology transfer. Because technology is a means to an end for a customer other than the use of the specific technology itself, the success of technology commercialization depends even more on managerial competencies than when the innovative product itself is the result of innovation. Research suggests that the commercialization of innovative technologies and innovative products should be based on different strategies (Nieto Cubero et al., 2021), hence, companies should seek better understanding and proficiency in innovation commercialization. However, the literature does not only focus on the challenges of commercialization of innovations in technologies or other field, but research also examines groups of factors or individual important aspects of innovation commercialization as well.

According to Pynnönen et al. (2019), six focus points are critical in commercializing innovation. That are proof of innovation relevance, customer analysis, concept analysis, competition analysis, ecosystem analysis, and financial analysis. Meanwhile, Francis & Bessant (2005) approach the commercialization of innovation from innovation development management point of view. They highlight certain aspects toward the successful commercialization of innovation of which the first is innovation targeting system. Many companies are developing their products without looking to the future and without realizing whether their products will still be relevant. The second aspect is to involve employees. For instance, to use staff from different departments to come up with more diverse ideas in one group. Unfortunately, this aspect of innovation is often neglected, and decision makers underestimate the importance of employee as well as user involvement (Bradonjic et al., 2019; Franke & Lüthje, 2020; Jun & Kim, 2022). The third aspect is being able to reject ideas that would be too difficult to commercialize. The fourth aspect is to start with a functional prototype. Although the appearance of the product is especially important in terms of sales, it is not so much the function of the innovation itself. When starting commercialization activities, it is necessary to make sure that the main functions of the innovative product work flawlessly as was intended during the product development. The latter aspect is also emphasized by other researchers, such as Zhou & Wang (2020). The functional prototype deserves further investment in visual adaptation to market tastes. It is important to emphasize that successful companies first offer a new functionally and visually complete product to the target groups, gather consumer feedback, and improve the product and its market penetration strategies. Involving stakeholders in the development process, pilot launches, for example if it is a technological innovation, attracts more attention from stakeholders, consumers, and can lead to commercialization (Wang et al., 2021). Only a fully tested product is worth presenting to consumers. As can be seen, the commercialization of an innovation can be carried out on a narrow or broad scale. It depends on the business goals.

Companies seeking to commercialize their innovations should not lose sight of the functionality of the innovation to meet the expectations of potential customers and the competencies of future users. In other words, the biggest risk associated with the implementation of innovation is the market reaction to innovation. The consumer may or may not accept the innovation, and this depends to a considerable extent on whether the entity doing the commercialization of the innovative product will be able to demonstrate to the consumer the benefits and value of the innovation (Menna & Walsh, 2019).

An ability of a firm to adapt to changes and needs in the short term in an external environment contributes significantly to the successful commercialization of innovation (Min et al., 2020). Giving what the market wants guarantees the attractiveness of innovation. However, it should be stressed that consumers vary greatly in their motivation, abilities, and attitudes. Thus, companies seeking to commercialize innovations should have a realistic view of the market (Appel & Muller, 2021; Datta et al., 2013).

Lead users might facilitate the marketing process as they are commercially attractive based on the evidence that such users anticipate relatively high benefit from obtaining the solution to their need and are at the leading edge of important market trends (Franke et al., 2006; von Hippel, 2005).

Research also suggests that companies should think carefully about which employees will be responsible for the innovation commercial process. Regarding to failure in commercialize innovations, studies highlight the lack of managerial competencies, especially the lack of skills and experience in decision-making by managers. Delayed solutions can frustrate successful market entry with innovation. Hence, recruitment is important. It would also be a mistake to expect a quick result from the commercialization of innovation if not all employees, their knowledge, teamwork, and management support are mobilized (Daneshjoovash et al., 2021; Hohenberg & Homburg, 2019; Nieto Cubero et al., 2020; Pynnönen et al., 2019). There might be a benefit to employ user innovators in the company and exploit their motivation, knowledge, and market experience (Schweisfurth & Raasch, 2015).

Proper choice of communication channels is also a critical factor in determining the success of innovation commercialization (Daneshjoovash et al., 2021). Studies have shown that the choice of social media as a source of audio-visual advertising has a significant positive impact on success (Maghsoudi Ganjeh et al., 2019; Muninger et al., 2019).

The commercialisation of innovations can be positively or negatively affected by the availability of resources. All resources are important, from finance and time to materials, subcontractors, and employees themselves (Jakubavičius & Stravinskaitė, 2020). Researchers point out that time is a particularly critical factor in the successful commercialisation of innovations (Datta et al., 2013; Markman et al., 2005). Delays in bringing an innovation to the market can lead to a product, service or process being seen as outdated by consumers (Markman et al., 2005).

The financial aspect is important as well. According to Mawaddah et al. (2020), the more resources a firm devotes to innovation activities, the more likely it is that innovations will be successfully commercialized. In general, not only for finance but for any type of resource, it should be noted that improper allocation of resources has a negative impact on the commercialization of innovation (Cheah & Ho, 2021).

Finally, researchers of innovation commercialization focus on external factors of success. For example, Mawaddah et al. (2020) emphasise market orientation, consumer orientation, consumer / market maturity, knowledge and marketing, and stakeholder engagement which allows product testing, interorganizational collaboration, market configuration, and effective disclosure of benefits to the user. Other researchers also note latter aspect and argue that effective interorganizational partnership is one of the key components of innovation commercialization (e.g., Daneshjoovash et al., 2021; Engez & Aarikka-Stenroos, 2023; Min et al., 2020; Sutopo et al., 2019; Tam et al., 2019; Wang et al., 2021). Factors such as low focus on innovation, poor knowledge of market trends, ignorance of what the market needs and what does not, slow progress of the process to complete the prototype, etc., and can hinder innovation commercialization (Zhou & Wang, 2020).

Summarizing, researchers do not provide a complete spectrum of factors for the commercialization of innovations. It also remains unclear which factors are of priority. This cause difficulties in making decisions regarding the commercialization of innovations. Nevertheless, theoretical analysis led to identify three groups of factors as key to successful commercialization of innovations. There are tangible and intangible resources, innovation support system, and management (Table 1). Such a grouping of factors empowers to look at the commercialization of innovations from the point of view of organizational management.

Table 1

Factors for commercializing innovations.

No.	Factors and sub-factors	Supporting studies
1.	RESOURCES	
1.1.	Time	Datta et al., 2013; Jakubavičius & Stravinskaitė, 2020; Markman et al., 2005; Min et al., 2020; Wu, 2021.
1.2.	Finance	Civelek et al., 2021; Jakubavičius & Stravinskaitė, 2020; Pynnönen et al., 2019; Thi Mai Anh et al., 2019; Wu, 2021.
1.3.	Human resources	Al-Jobor et al., 2020; Ardito & Svensson, 2023; Daneshjoovash et al., 2021; Daniels & Amadi-Echendu, 2021; Hohenberg & Homburg, 2019; Jun & Kim, 2022; Masárová & Ivanová, 2023; Mawaddah et al., 2020; Nieto Cubero et al., 2020; Pynnönen et al., 2019; Sabatini et al., 2020; Thi Mai Anh et al., 2019; van Doren et al., 2022; Veselovsky et al., 2019; Wu, 2021.
1.4.	Competencies (knowledge, skills, experience)	
1.5.	Technical, technological, and other material resources	Bilan et al., 2023; Hohenberg & Homburg, 2019; Jakubavičius & Stravinskaitė, 2020; Mawaddah et al., 2020; Sabatini et al., 2020; Seclen-Luna & Regalado, 2020; Thi Mai Anh et al., 2019; van Doren et al., 2022; Wu, 2021.
1.6.	Infrastructure	
2.	SUPPORT SYSTEM	
2.1.	Cooperation with stakeholders (partners, subcontractors, co-creators, etc.)	Ardito & Svensson, 2023; Daneshjoovash et al., 2021; Daniels & Amadi-Echendu, 2021; Engez & Aarikka-Stenroos, 2023; Hohenberg & Homburg, 2019; Mawaddah et al., 2020; Min et al., 2020; Nieto Cubero et al., 2021; Oliinyk et al., 2023; Pynnönen et al., 2019; Sutopo et al., 2019; Tam et al., 2019; van Doren et al., 2022; Wang et al., 2021; Wu, 2021.
2.2.	Communication and Marketing	Coutinho et al., 2023; Daneshjoovash et al., 2021; Maghsoudi Ganjeh et al., 2019; Mawaddah et al., 2020; Muninger et al., 2019; Pynnönen et al., 2019; Sabatini et al., 2020; Appel & Muller, 2021.
3.	MANAGEMENT	
3.1.	Risk management	Mawaddah et al., 2020; Pynnönen et al., 2019; Tran et al., 2022.
3.2.	Handling with competitors	Seclen-Luna & Regalado, 2020.
3.3.	Data-driven solutions	Daniels & Amadi-Echendu, 2021; Sabatini et al., 2020; Ardito & Svensson, 2023.
3.4.	Planning	Thi Mai Anh et al., 2019; van Doren et al., 2022.
3.5.	Market analysis	Sabatini et al., 2020; Appel & Muller, 2021; Kollmann & Dobrovič, 2022.
3.6.	Analysis of the need for innovation (product, function, etc.)	Mawaddah et al., 2020; Menna & Walsh, 2019; Pynnönen et al., 2019; Sabatini et al., 2020; Zhou & Wang, 2020.
3.7.	Organization management (change management, activation of strengths and opportunities, coping with weaknesses, learning from experience, etc.)	Cheah & Ho, 2021; Hohenberg & Homburg, 2019; Jun & Kim, 2022; Mawaddah et al., 2020; Nieto Cubero et al., 2021; Pynnönen et al., 2019; Thi Mai Anh et al., 2019; Wu, 2021; Židonis & Raišienė, 2021.

Source: Authors' compilation.

3. METHODOLOGY

Considering the identified lack of the aspect of ranking innovation commercialization factors in the literature, three-stage research by interview was implemented.

In the first stage, a semi-structured interview of innovation development professionals was chosen to get initial understanding on what factors should be considered a priority in making management decisions related to innovation commercialization.

Research participants were found by posting an invitation on social network LinkedIn - professional network on the internet. This way, the pool of potential interviewees was broadened with aim to find professionals who have most experience in commercializing innovations. Guided by Wang et al. (2021), professionals who met the set criteria in two groups, i.e.: 1) working in innovation-intensive field, and 2) experienced in the creation, implementation and/or marketing of innovations - were chosen. The purpose of the interview was to define the factors and aspects of innovation commercialization that are critical for organizations in practice, and thus to complement the theoretically compiled set of factors of innovation commercialization. The semi-structured interview was applied, asking following questions:

Q1: What are the key factors and aspects of innovation commercialization, based on your professional opinion and experience?

Q2: What advice would you give to organizations seeking to commercialize innovative products, technologies, and solutions?

Q3: What factors could negatively affect the commercialization of innovations?

The first question was intended to name the specific key drivers of innovation commercialization, while the further questions were used to expand and complement the first one as well as to discuss the issue and provide recommendations. Interview participants were asked to answer questions in writing, so researchers' possible influence on the respondents' answer was eliminated.

Choosing the sample size, we relied on the principle of information saturation, which states that adding more participants to the survey becomes pointless and ineffective when the information provided by the informants begins to repeat itself (Hickman & Longman, 1994; Miles & Huberman, 1994). Thus, the interviews were stopped with answers from seven interviewees. Two of them represented the logistics technology sector, one - the IT product development sector, one - the innovative communication technology sector, and three professionals represented R&D sector in the physics, natural science, and agriculture. For the purposes of research ethics, no information was gathered about informants' gender, age, and other demographic data. Such data would be redundant as the study did not aim to compare dependent and independent variables.

After analysing the answers, results were summarized and factors promoting and inhibiting the commercialization of innovations from the point of view of innovation implementation professionals were defined. It was found that the factors named by professionals can be grouped into three groups analogous to result of theoretical analysis, that are 1) resources (human resources; non-material resources: time and knowledge; personal resources: creativity and intuition, professional competencies, expertise in the innovation area; technical and material resources; financial resources); 2) support (financial sponsorship; partnerships and cooperation with stakeholders; communication and marketing), and 3) management (human resource management; team management; collaboration process management; time management, appropriate decision-making; planning; product quality management; risk management; handling with of competitors; market analysis; testing a prototype to find out if it meets customer needs).

Finally, a theoretically and empirically consolidated set of innovation commercialization factors was compiled and adapted to be evaluated in the second stage of expert interview by using the AHP method, and the third stage of expert interview by using Likert scale and RII method.

AHP allows the structuring of multicriteria management decisions and gives possibility to measure qualitative data by quantitative parameters. AHP is usually used in research on the scientific and practical application of knowledge management, in research on the introduction of a new product to the market, and

in other areas of innovation development and organization performance (e.g., García-Melón et al., 2022; Han & Gu, 2022; Relich, 2022). AHP is based on pairwise comparison matrix. The preference relations are filled in by the decision-maker judgments and presented using ratio scale proposed by Saaty (1977). Consistency Ratio (CR) is important to learn the validity of the use of the measure and to ensure if judgments made by expert are satisfactory for further analysis. Following Saaty (1977) recommendations, the CR threshold over 0.1 (10%) was not exceeded.

RII is a non-parametric method used to analyse structured survey data for ordinal measurement of respondent views (Sakhare & Patil, 2019). RII is used by researchers to assess the relative importance of factors in relation to a set goal, and then rank them according to the value of indices (Tholibon et al., 2021). RII is widely used in various research areas, such as engineering (Gündüz et al., 2013; Isa et al., 2021; Khatib et al., 2020), employee satisfaction (Lee & Park, 2021; Tholibon et al., 2021), etc.

For the second stage of the study, the search for potential interviewees was carried out by using the snowball method while the selection was based on purposive sampling which is considered reasonable for expert survey. Purposive (expert) sampling is used to gather knowledge based on specific expertise (Campbell et al., 2020). Following Palinkas et al. (2015), two criteria – the role in the field and potential to gain insights from various perspectives - for the experts' selection were defined: i) experience in business consulting or lecturing on innovation; and ii) versatile knowledge on innovation implementation into the practice. In this stage, five experts from Lithuania and Hungary, who met requirements of expertise, were invited, and agreed to participate in the research (Table 2).

Table 2

The expertise of interviewees in the 2nd stage of the research.

Expert	Area of expertise	Experience in the field
E1	R&D, University-Industry cooperation	20+ years
E2	Innovation development, innovation marketing	10+ years
E3	Innovation management	10+ years
E4	R&D, Innovation commercialization	5 years
E5	R&D, Innovation and Technology transferring, innovation commercialization	10+ years

Source: Authors' results.

The expert interview was conducted in 2022. The reasons for choosing the two countries were twofold: objective - a similar situation from the point of innovation (according to the GII 2022 rankings (Dutta et al., 2022), Lithuania stands in 39th place while Hungary - in 34th place), both countries belong to the EU, both countries have parallels in the innovation development environment due to historical circumstances (Lithuania was occupied by the Soviets, and Hungary belonged to the bloc of socialist countries), and subjective – the possibility to attract high-level experts to participate in the research interview. Following Palinkas et al. (2015), we applied qualitative parameters to the sample size. Specifically, we defined two conditions of inclusion to the sample: a) informant's motivation to participate in the study. We rejected participants who noted, for example, that they did not have "a lot of time" for the survey, said that "even without the survey, everything was clear from the start", etc.; b) to be able to argue and express one's opinion articulately. For example, we excluded participants from the sample who revealed during post-survey reflection that "I judged by gut feeling" or "some factors are very similar, it was difficult to understand what they mean". AHP method requires high compatibility of answers from decision makers, thus, we focused on the above listed criteria, while ignored the principle of information saturation common in in-depth interviews. In the meantime, it was more important for us to find out how objectively knowledgeable experts in innovation prioritize the factors of commercialization of innovations, instead of accumulating a pool of informants in which unequivocal trends of answers would emerge. In our research, all pairwise comparison

questionnaires filled by interviewees met the CR threshold requirement. This led to assurance that the experts have a deep understanding of the research object and were selected appropriately.

In the research instrument, a total of 18 factors were presented to the experts for pairwise comparison, which were obtained by combining the results of the theoretical analysis and the interviews of innovation professionals, as described previously.

Since innovation commercialization decisions depend on the innovation pusher's goal, we asked experts to evaluate factors with two different innovation commercialization goals in mind: “quick profit” and “building reputation and awareness, expanding into the international market”. Using the AHP method, the resulting weights are based on the principal eigenvector of the decision matrix. Thus, experts evaluated 153 pairs of innovation commercialization factors on a scale of 1 to 9, with following main values: 1 – equal importance, 3 – moderate importance, 5 – strong importance, 7 – extraordinarily strong importance, 9 – extreme importance (with 2, 4, 6, 8 values being in-between the main values, in case decision maker cannot assign one of the main values). Following the same logic, the reciprocal values served as a means of judging the inverse preference between factors in a pairwise comparison. After the evaluation, the factors were arranged and three conditional groups of factors according to significance were distinguished. The first group covered key factors or high priority factors (1-6 places in range or a highest third of the ratings), basic factors (7-12 places in range or a middle third of the ratings), and auxiliary factors (13-18 places in range or a lower third of the ratings).

In the third stage of the study, a different approach to factor evaluation was taken by applying different purposive sampling criteria for experts, as well as different instrument for factor evaluation, RII. We further narrowed down the population of experts for our study. Following the recommendation of Creswell and Plano Clark (2011), we selected experts who met criteria of exceptional domain knowledge and personal experience with the subject. So, while in the second stage the experts had academic, governmental, and consultancy nature of work with innovations, in the third stage, the criteria for purposive sampling were set to solely include experts who directly work with innovations. That includes commercialization of innovations, their expansion to other markets, evaluation of innovation purchase, or those responsible for acquiring buyers of innovations. We have ensured that the experts have the listed qualities by analyzing information about the individual's experience on LinkedIn. Eight experts met the activity area and experience requirements, and agreed to participate in the research (Table 3).

Table 3

The expertise of interviewees in the 3rd stage of the research.

Expert	Area of expertise	Experience in the field
E1	Startup Building	5 years
E2	Startup product management	4 years
E3	Startup Building & Growth, Foreign Investments	5 years
E4	Innovation knowledge transfer, Public-Private Partnership	4 years
E5	Innovation management in E-archive services	7 years
E6	Startup, Sustainable Change Coaching	3 years
E7	Process management innovations	5 years
E8	New Business Development	9 years

Source: Authors' results.

In total, our sample of experts, whom we asked to prioritize the factors of innovation commercialization, consisted of 13 individuals. The literature emphasizes that there is no answer to what sample size is sufficient in qualitative research, especially when the size of the expert population cannot be determined (Malterud et al., 2016). Akins et al. (2005) note that it can be found studies whose conclusions

are based on the results of interviews with 5-6 experts, as well as a survey of a dozen, tens or even several hundred experts. The sample for this study can therefore be considered adequate.

Bearing in mind that the AHP method evaluates factors in pairwise comparisons without the decision maker explicitly seeing a full list of factors, the RII method was chosen as a complementary method that allows the decision maker to see all factors at a glance. Following this method, respondents evaluated factors in relation to the same innovation commercialization goals as in the second stage of the research: “quick profit” and “building reputation and awareness, expanding into the international market”. Respondents were presented two identical lists of factors, goal of commercialization being the only difference. Respondents evaluated the factors for each goal on a 5-point Likert (1932) scale, where: 5 - Particularly significant, 4 - Moderately significant, 3 - Relatively significant, 2 - Not significant enough, and 1 - Insignificant. Finally, the answers were calculated using RII equation (1), where w – assigned value; A – maximum value; N – number of respondents.

$$RII = \sum \frac{w}{A \times N} \quad (1)$$

Finally, both expert groups' data was analysed, summarized and the research conclusions and insights were proposed.

4. EMPIRICAL RESULTS AND DISCUSSION

Obtained data reveal that the judgments of experts were unevenly distributed when they evaluated the factors of innovation commercialization in the context of the pursuit of quick profit (Table 4).

Table 4

Determinants of commercialization of innovation in the context of quick profit

Category	Expert1		Expert 2		Expert 3		Expert 4		Expert 5	
	Priority weight	Rank	Priority weight	Rank	Priority weight	Rank	Priority weight	Rank	Priority weight	Rank
1 Time resources	7,5	5	4,5	9	1	16	5	18	1,3	13
2 Financial resources	12,4	3	4,40	10	5,6	6	11,7	3	0,9	14
3 Technologies and other material resources	4,6	9	7,1	5	1,2	14	4,3	9	0,5	17
4 Infrastructure	3	11	1	16	2	11	1,3	17	0,6	16
5 Human resources	9,1	4	13,2	3	0,9	18	4,1	11	3,9	8
6 Competencies (knowledge, skills, experience)	18,4	1	4,8	8	1	17	6,1	6	8,4	5
7 Financial sponsorship (clients, state)	1	18	1	17	7,6	5	12,1	2	1,6	12
8 Stakeholder cooperation	1,2	17	0,9	18	1,2	15	10	4	9,4	4
9 Communication and marketing	4,9	7	7,2	4	17,6	1	13,6	1	6	6

10	Harnessing strengths and opportunities	3	10	6,3	6	4	9	2,9	15	3,6	9
11	Knowledge of weaknesses	2,3	13	4,4	11	1,4	13	3	14	3	10
12	Risk knowledge and management	1,6	16	1,1	15	3,3	10	4,3	10	4,6	7
13	Knowledge of competitors	1,9	14	4,9	7	11,7	4	3,8	13	22,5	1
14	Knowledge of market characteristics	1,7	15	14,2	2	5,1	8	4,3	8	17,1	2
15	Knowledge of the need for innovation product	5,5	6	17,9	1	5,4	7	4,8	7	12,9	3
16	Planning (including budget)	4,6	8	1,3	14	1,4	12	2,8	16	0,8	15
17	Learning from experience	14,8	2	3,1	12	14,1	3	4	12	0,4	18
18	Data-driven solutions	2,5	12	2,5	13	15,6	2	6,3	5	2,4	11

Source: Authors' results.

The experts' opinion differed most on such aspects as stakeholder cooperation and financial sponsorship, learning from experience, and human resources. On the other hand, the experts appeared to be quite unanimous in assigning low values to infrastructure, risk knowledge and management, harnessing strengths and opportunities, knowledge of weaknesses, planning, and time resources. Finally, the experts' evaluations differed less when they evaluated the factors of commercialization of innovations in the context of the desire to earn reputation and awareness to be ready to expand to the international market (Table 5).

Table 5

Innovation commercialization factors in the context of expansion to an international market

Category		Expert 1		Expert2		Expert3		Expert4		Expert5	
		Priority weight	Rank	Priority weight	Rank	Priority weight	Rank	Priority weight	Rank	Priority weight	Rank
1	Time resources	2,4	13	0,8	18	10,1	4	7,1	4	0,7	17
2	Financial resources	2,1	16	6,2	8	8,7	6	2,7	16	6,4	6
3	Technologies and other material resources	2,3	14	7,5	5	3,3	11	2	17	6	7
4	Infrastructure	3	10	1,1	16	0,9	16	1,6	18	0,8	16
5	Human resources	4,4	7	14	1	3	12	7,1	3	8	4
6	Competencies (knowledge, skills, experience)	14,2	1	13,2	2	3,6	9	5,7	7	3,4	9
7	Financial sponsorship (clients, state)	1,2	18	1,8	14	1	15	3,7	12	0,8	15
8	Stakeholder cooperation	3,1	9	1	17	9,6	5	6,6	5	1,1	14
9	Communication and marketing	13,3	3	7,2	7	6,9	7	21,6	1	2,1	10
10	Harnessing strengths and opportunities	3,5	8	2,4	13	5,1	8	7,5	2	2	11
11	Knowledge of weaknesses	2,2	15	1,3	15	3,6	10	2,9	15	1,6	12
12	Risk knowledge and management	1,3	17	3,8	12	0,8	17	6,3	6	1,3	13
13	Knowledge of competitors	7,8	5	4,4	11	15,9	1	5,3	8	13,5	3
14	Knowledge of market characteristics	7,4	6	8,1	4	10,6	3	5,3	8	22,5	1
15	Knowledge of the need for innovation product	13,4	2	8,1	3	14,1	2	4	10	17,1	2
16	Planning (including budget)	2,8	12	6,1	9	0,7	18	3,2	14	0,4	18
17	Learning from experience	12,4	4	7,2	6	1	14	3,5	13	6,8	5
18	Data-driven solutions	3	11	5,6	10	1	13	4	10	5,5	8

Source: Authors' results.

In this case, factors such as time resources, stakeholder cooperation, technologies and other material resources were characterized by contradictory assessments. On the other hand, experts gave positive assessments to factors such as human resources, knowledge of competitors, knowledge of market characteristics, and knowledge of need for innovation product. Finally, the experts rated the role of such factors as infrastructure, risk knowledge and management, planning, financial sponsorship, and knowledge of weaknesses as having lowest significance.

Comparing the ranks of the factors in both contexts - quick profit and expansion to international market - the spread of experts' views on the most significant factors and their agreement on the least significant factors are shown in Figure 1.

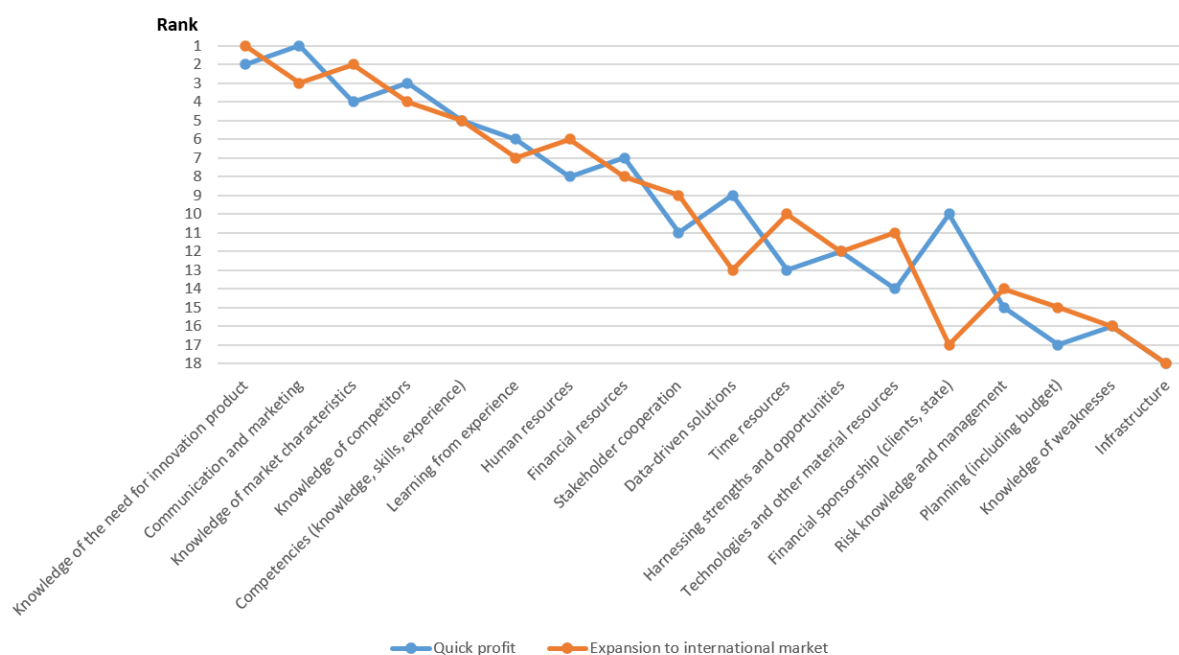


Figure 1. Expert-assessed ranks of innovation commercialization factors by objective, using AHP method.

Compiled by the authors calculation.

Source: Authors' results.

The second stage of our study demonstrated that experts emphasised the role of effective information, communication, and knowledge management as well as competencies and knowledge of competitors through defining five key focus areas in the innovation commercialization (Table 6).

Table 6

Key focus areas in innovation commercialization.

Key focus areas	Profit	Expansion
Communication and marketing	1	3
Knowledge of the need for innovation product	2	1
Knowledge of competitors	3	4
Knowledge of market characteristics	4	2
Competencies (special knowledge, skills, experience)	5	5

Source: Authors' results.

Following the dissemination of experts' views on the drivers of innovation commercialisation, the RII method was used in the third stage of our study to complement the ranks of factors obtained using AHP and to further narrow down the most and least important factors. After the experts rated the importance of the innovation commercialisation factors in terms of both quick profit and expansion into international markets, the RII was calculated and ranks were assigned according to their relative importance indices (Table 7).

Table 7

RII-based rankings of innovation commercialization factors in the context of quick profit.

Item rank	Item	Frequency of responses					Total resp. (N)	Weighted total	Item Mean	RII
		5	4	3	2	1				
1	Time resources	6	2	0	0	0	8	38	4,75	0,95
2	Financial resources	5	3	0	0	0	8	37	4,625	0,925
3	Communication and marketing	6	1	1	0	0	8	37	4,625	0,925
4	Financial sponsorship (clients, state)	5	2	1	0	0	8	36	4,5	0,9
5	Human resources	5	1	2	0	0	8	35	4,375	0,875
6	Competencies (knowledge, skills, experience)	5	1	2	0	0	8	35	4,375	0,875
7	Knowledge of competitors	4	3	1	0	0	8	35	4,375	0,875
8	Knowledge of market characteristics	4	2	2	0	0	8	34	4,25	0,85
9	Stakeholder cooperation	3	3	2	0	0	8	33	4,125	0,825
10	Risk knowledge and management	4	2	1	1	0	8	33	4,125	0,825
11	Knowledge of the need for innovation product	4	1	3	0	0	8	33	4,125	0,825
12	Planning (including budget)	4	2	1	1	0	8	33	4,125	0,825
13	Technologies and other material resource	2	4	2	0	0	8	32	4	0,8
14	Harnessing strengths and opportunities	2	4	2	0	0	8	32	4	0,8
15	Data-driven solutions	3	2	3	0	0	8	32	4	0,8
16	Infrastructure	1	4	2	1	0	8	29	3,625	0,725
17	Knowledge of weaknesses	2	2	3	1	0	8	29	3,625	0,725
18	Learning from experience	1	1	3	3	0	8	24	3	0,6

Source: Authors' results.

As observed in Table 7, the experts ranked time and financial resources, communication and marketing, and financial sponsorship as the most important factors in the pursuit of quick profits. The experts were most divided on the importance of knowledge of risk management, planning, infrastructure, knowledge of weaknesses, and learning from experience factors, with four possible importance ratings assigned for these factors across the group. However, the experts were less divided on the factor importance in relation to innovations' expansion to international markets (Table 8).

Table 8

RII-based rankings of innovation commercialization factors in the context of expansions to international markets

Item rank	Item	Frequency of responses					Total resp. (N)	Weighted total	Item Mean	RII
		5	4	3	2	1				
1	Communication and marketing	6	2	0	0	0	8	38	4,75	0,95
2	Knowledge of weaknesses	6	2	0	0	0	8	38	4,75	0,95
3	Knowledge of market characteristics	6	2	0	0	0	8	38	4,75	0,95
4	Competencies (knowledge, skills, experience)	4	4	0	0	0	8	36	4,5	0,9
5	Harnessing strengths and opportunities	4	4	0	0	0	8	36	4,5	0,9
6	Knowledge of competitors	4	4	0	0	0	8	36	4,5	0,9
7	Data-driven solutions	5	2	1	0	0	8	36	4,5	0,9
8	Human resources	4	3	1	0	0	8	35	4,375	0,875
9	Stakeholder cooperation	4	2	2	0	0	8	34	4,25	0,85
10	Risk knowledge and management	3	4	1	0	0	8	34	4,25	0,85
11	Planning (including budget)	3	4	1	0	0	8	34	4,25	0,85
12	Financial resources	3	3	2	0	0	8	33	4,125	0,825
13	Technologies and other material resource	2	3	3	0	0	8	31	3,875	0,775
14	Financial sponsorship (clients, state)	1	5	1	1	0	8	30	3,75	0,75
15	Learning from experience	2	3	2	1	0	8	30	3,75	0,75
16	Knowledge of the need for innovation product	2	2	3	1	0	8	29	3,625	0,725
17	Time resources	1	4	1	2	0	8	28	3,5	0,7
18	Infrastructure	2	1	4	0	1	8	27	3,375	0,675

Source: Authors' results.

In this case, as observed in Table 8, the experts' views aligned towards the importance of communication and marketing, competencies, knowledge of competitors, knowledge of weaknesses, knowledge market characteristics, as well as harnessing of strengths and opportunities and data driven solutions. Six of the most important factors got assigned a rating no less than 4 (moderately significant), and data driven solutions got only one expert's importance rating assessment of 3 (relatively significant). The least important factors include technologies and other material resources, financial sponsorship, learning from experience, knowledge of the need for innovation product, time resources, and infrastructure.

Overall, the second group of experts had different views on the factors of average importance (ranks 8 to 12), but similarly to the previous group, second group of experts had resembling views on the most and least significant factors (places 1 to 7 and 13 to 18, accordingly) regardless of the objective of commercialization.

Data obtained from completely different group of experts in the third stage of our study shows resembling trend to the previous group. To further analyse this resemblance, a comparison of the first and second group of experts' answers are compared in the Figure 2, showing the ranks of the factors in relation to both goals, with a trendline showing the average rank of the factors.

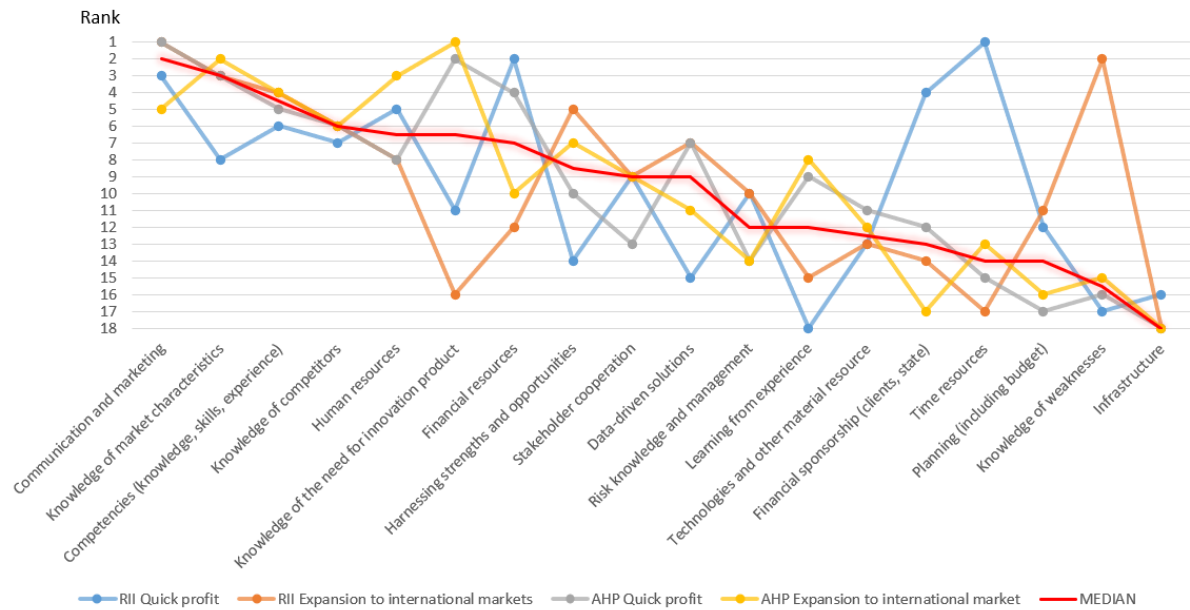


Figure 2. A comparison of innovation commercialization factor ranks between two expert groups

Source: Authors' results.

Research results demonstrate that the most significant aspects in innovation commercialization are communication and marketing, knowledge of market characteristics, competencies, knowledge of competitors, and human resources. For innovative product to be successfully commercialized, it is necessary to know and understand the specifics of the market, to have competencies to manage the internal and external processes of the organization, to effectively manage the available time, human and financial resources. All this can help reduce the probability of errors and failures in the commercialization of innovation.

At the other end of the importance spectrum, the data from two completely different groups of experts show that factors such as infrastructure, planning, learning from experience and technologies and other material resources do not have a significant contribution to the success of innovation commercialisation in practice. As innovative products operate in a little explored area, these factors do not add the same value to the commercialisation of innovation as other areas outside innovation.

5. CONCLUSIONS

The commercialization of innovations is a complex and multifaceted activity that lacks comprehensive research and knowledge on a set of determinants for the successful implementation. The implementation of innovation commercialization can be optimized by identifying the factors that lead to success and reducing the barriers faced by the organization. The factors presented in this paper are highly interrelated; however, only those in the top positions are of significant importance for consideration. A theoretical analysis indicated that resources, support, and promotion, as well as management, are pivotal elements in the innovation commercialization process. Nevertheless, the results of the expert interviews indicated that the relative importance of the innovation commercialization factors may vary depending on the organizational goals. Moreover, some factors have been found to exert no significant influence on the commercialization of innovations, regardless of the commercialization objectives.

The study provided better understanding about the potential limitations of expert assistance in the decision-making process. In our case, the experts were not always unanimous on most important factors in the commercialization of innovation, nevertheless, they expressed very similar views on which factors are least important. This highlights the assumption that experts can help reduce the range of decision alternatives but relying strictly on expert recommendations may not be the ideal option for making the decisions. Thus, it is important to choose experts and apply their recommendations in practice wisely. In areas such as innovation, there is no one answer to what is important, as opportunities and circumstances must be considered. A company knows what is best for it and should consider what is important and not when considering the expert recommendations about factors.

The results of the study also confirmed observation of an applied nature. The lack of soft skills in innovation commercialization management can be a stumbling block. The process of commercialization of innovation can be most hindered by inadequate communication, poor leadership style or lack of motivation in the team compared with a lack of infrastructure or financial support.

This study provides practitioners with guidance on how to identify relevant knowledge for commercializing innovations. The scientific literature primarily serves an educational purpose and does not offer specific recommendations on which resources to prioritize. Therefore, researchers can assist in applying the identified factors to practical cases. Collaboration between researchers and practitioners could be enhanced if researchers acted as consultants, providing research-based insights to organisations.

In summary, the paper concludes that the commercialisation context is critical for decision making and that expert assistance has its limits. Priorities in implementing innovation commercialisation should be chosen with the business objective in mind, and expert advice should be used as an additional means to reduce risk, without expecting the unambiguous best solution.

5. LIMITATION OF THE STUDY AND FUTURE RESEARCH

The study used qualitative research methods to address the challenges of identifying the importance of factors/criteria. The experts for the study were also selected on the basis of carefully defined criteria. Finally, the consistency of the experts' opinions met the threshold requirements. However, the opinions of the participants in our study did not agree on the importance of some of the factors for innovation commercialisation. It is possible that this result was due to the fact that the experts represented different areas of innovation activity where the key determinants of success may be different. Thus, despite the cost-relevant observations on the role of external experts for firms, our study has some limitations, so that future research on the determinants of innovation commercialisation would be useful. It is worth checking whether the results of this study are still valid by conducting specific research on the key factors of innovation commercialisation by industry.

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