

Article

Managerial Decision-Making Methodology to Support Innovation Activities: Evidence from Slovak Enterprises

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Abstract: The creation of innovations in enterprises is a topic that has a firm place in the scientific literature, and the authors describe several procedures and theories of the functioning of the innovation process in enterprises. One part of the innovation process is decision-making. In the article, attention is paid to the results of research on the decision-making process as an important and integral part of the innovation process. The elements of the decision-making process and their impact on innovation represent an area of possible exploration and development of theories on decision-making in the innovation process. It is here that we have proposed a methodology for decision-making in the innovation process. The management of innovation processes, of which decision-making is an important part, provides multiple points of error for enterprises. Errors are experienced by enterprises due to a lack of information or its misuse, the influence of communication and time, and also the lack of experience of employees. The aim of this paper is to highlight the different decision-making criteria and approaches to innovation activities in Slovak enterprises within the framework of the developed methodology and survey results.

Keywords: innovations; innovation process; management of innovation processes; managerial decision-making



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1. Introduction

Due to business practices, little attention is paid to the issue of decision-making in regard to the innovation process. This research issue opens up space for further scientific investigation and description of the elements of decision-making about the innovation process.

When studying several business environments, it is possible to point out a problem in setting up decision-making procedures. Some important elements of the decision-making process disappear. One of these elements is precisely the orientation to the process of choosing a variant of the solution to the innovation problem. The other parts of the innovation process are also related to this: the emergence of a need, the creation of an invention, the creation of an innovation, and the penetration of an innovation. As a result of inefficient decision-making, non-innovative procedures are introduced in companies, thus creating more room for the role of the manager to make mistakes in making decisions about innovations. The main problem is the non-use of innovation opportunities by enterprises due to errors in the innovation decision-making process.

The subject of this article is pointing out the results of a survey in the area of decision-making in the innovation process. It will mainly be about pointing out errors in the preparation of information for decision-making about innovations, errors in the innovative activities of the company in connection with their importance, and evaluating the research questions of the given issue.

After examining the opinions of authors dealing with this issue, it is possible to state that diverse research is underway on the issue of innovation processes. In companies, a

stronger effort to build an innovation process can be observed. In several cases, however, this innovation process does not bring the expected benefits, as it does not have clear established rules, metrics, or evaluation methodology. In many cases, company managers do not use decision-making techniques and procedures for creating and managing innovation processes.

Barriers to new innovations that affect businesses also play an important role in innovation. The article focuses on the preparation of a proposal for a solution that will help companies conduct an efficient and functional decision-making process in innovation management. This solution is based on an analysis of the current situation in the field of innovation activities in companies and the cooperation of the academic and industrial sectors. The decision-making methodology in the innovation process is adapted according to current research results, and consists of eight consecutive steps. The advantage of its implementation in the company is a better examination of the progress of the innovation process and its connection to the management activities of the company.

2. Theoretical Review

Five innovation vectors [1] are used for different types of innovation processes in different companies. In order to start the innovation process in the company, it is necessary that the individual managers responsible for innovations know their basics: (1) The innovation strategy should be synthetic and move the company forward. (2) The culture of the company that innovates must be tuned. (3) Create bold innovative solutions in the company. (4) Launch boldly innovative solutions quickly. (5) Invest in a solid solution.

In the progressive development of the theory of innovation, various authors refer to innovation as a state, change, process, step, etc. We present the following ways of perceiving innovation by different authors, focusing on the elements that characterize innovation: A new state of the structure [2,3]. New ideas and thoughts. New processes. New products. New social relations. New value for stakeholders [4–6]. Contribution to the individual, group, or society [7–9]. Promoting the competitiveness of the enterprise. Organizational and managerial change. Improving living standards and economic growth [4,5,7]. Moving away from traditional management processes and principles. The creative process. The combination of things. Leapfrogging qualitative change [10–13].

The innovation process description in a simplified form represents four basic phases: (1) the search for opportunities for innovation, (2) the selection and justification of the innovation, (3) the implementation of the innovation, and (4) the measurement of the benefits of the innovation [14].

Goffin and Mitchel [15] point out the importance of employees in the enterprise and setting the innovation strategy within the Pentathlon Framework.

It is also important to look at non-traditional innovation models. The authors of Salerno et al. [16] introduce a taxonomy of eight new innovation steps in the innovation process, which improves the positive impact on innovation due to unpredictable situations.

The authors Pierre and Fernandez [17] enter the issue of the innovation process with new additional variables that influence this process (fourteen important dimensions that influence innovation).

This supports the importance of innovation and the innovation process. The author also expresses the need for further research in the subject area, and the results of this article obviously complement them. These data also represent the basic starting points for the creation of a questionnaire survey.

The position of innovation in enterprises is further defined by the meaning of innovation management. Innovation management represents the core activity of an enterprise and the synergistic mechanism between technological and non-technological elements, including strategy, culture, and others. The lack of alignment between the creative process and the implementation of innovation causes performance constraints [18]. The relationship between innovation and standardization is a coordinating development relationship, not a conventional support or hindrance [19]. Researchers recommend decision-makers

pay attention to the tacit knowledge and experience of employees and translate it into tangible ideas and methods [20]. Innovation management in energy companies has a positive impact on both sustainability and performance [21]. Innovation decision-making is contingent on leveraging the breadth of experience and expertise of all actors involved in the process [22].

Authors in the scientific literature present several views on innovation management, and Havlicek emphasizes as the essence of innovation management a systemic approach to the implementation of changes that should be aimed at improving products, processes, or the position of the entire enterprise [23]. Innovation management and its linkages are mainly manifested in relation to strategic management, change management, project management, human resource management, value management, and process management. In work focused on decision-making in the innovation process, the most essential component of innovation management is the process view of innovation and its link to decision-making. Companies can be successful in a competitive environment by needing to develop organizational innovation and knowledge as well as innovation capabilities simultaneously, thus increasing their importance [24,25]. Intelligent innovation management is a prerequisite for better innovation outcomes and, consequently, better economic outcomes [26,27].

Kerulova introduces the innovation process in the following steps: First is the idea generation phase, which is based on the certain innovation signals. Next, ideas are generated, usable but also marginally satisfactory solutions are sought, and a solution proposal is processed. In the next phase, ideas are accepted, proposals are tested, and an implementation plan is created. A part of this phase is also the decision on the selection of the chosen innovation solution. In the last stage of the implementation of the ideas, selected procedures are applied, and their impact on innovations is checked [2].

Thus, innovation can take different forms in a company, and several studies have identified key areas where companies can gain new advantages and develop their innovation capabilities. This enterprise development and the success of innovation activities may be dependent on managerial capabilities, or the suitability of the process implemented [28]. The main ways in which an enterprise can develop and support innovation activities are: investing in research and development [29], acquiring knowledge from multiple stakeholders [30], market-oriented development and culture [31], promoting knowledge sharing within the organization [32], understanding and engaging customers, and the importance of being able to articulate the value proposition to customers [33]. Collaboration is the basis for innovation creation and management of innovation activities [34].

According to Zauskova [18], the innovation process represents the preparation and gradual implementation of innovative changes; it is a process of creation and dissemination of innovations. Innovative changes are created by the gradual penetration of new ideas into the environment of the enterprise and their modifications by implementation. It is essential for enterprises to manage new thoughts and ideas and use them to create innovations. In addition, working with innovative ideas is also important to evaluate the different stages of the innovation process [19]. Innovation has become particularly necessary due to rapid technological development, a shortening of the product life cycle, the globalization of markets, and greater competitiveness [20,21].

3. Materials and Methods

The method of sociological questioning in the form of a questionnaire was chosen to investigate the issue, from which the primary data for the creation of this article was obtained. This method is used to investigate Slovak companies. Enterprises with 50–249 (medium-sized enterprises) and 250 or more employees (large enterprises) were included in the sample. The questionnaire survey took place in 2020. The size of this basic file is 3619 enterprises. With a total of 153 completed questionnaires, the sampling error represents 7.75%.

The areas covered by the questionnaire are:

- Analysis and preparation of information in relation to decision-making on innovations.
- Failure to use innovation activities in enterprises.

- Analysis of the importance of innovation activities in a company.
- Analysis of the causes of errors in the innovation process.
- Analysis of selected research questions about decision-making in the innovation process.

Subsequently, for the creation of a solution in the form of a methodology for deciding on the innovation process, semi-structured interviews were held with the selected companies that filled out the questionnaire to explain their answers. In the interview, there was also a discussion of the proposed methodology, while its individual steps were addressed. The specific companies selected were AT&T, EMTEST, GlobalLogic, Peikko, Hour, Hyperia, Softec, Avast, Inloop X, Transdata, Primabanka, M2M Solutions, Google, Goodrequest, and Scheidt & Bachmann. These companies is medium-sized with significant innovative activities in the field of business and operate in the city of Žilina in Slovakia

4. Results

The Slovak Republic companies from the Žilina and Bratislava regions were involved in the research, and then also from the Trenčín region. The questionnaire was primarily intended for medium and large enterprises with 50 to 249 employees or enterprises with more than 250 employees. Selected companies with up to 50 employees were also included in the research due to the actual organizational structures of companies containing 50 or more employees. These are businesses that, due to legislative advantages, operate formally as a grouping of smaller businesses and entrepreneurs. In total, results were collected from 153 study subjects. To the greatest extent, companies from the fields of trade and information technology participated in the research. Subsequently, it was construction, telecommunications, and education, with research and development. Duration of business operations on the market: 49% of businesses have been operating on the market for more than 20 years, 20% of businesses have been operating on the market for 11–15 years, and 16% of businesses have been operating on the market for 16–20 years. Shorter-operating companies make up a total of 15% of the research sample. As part of the basic characteristics of the companies, the form of company management was also examined. The research was attended by companies that take responsibility for action and have the opportunity to independently launch projects and innovations. A total of 59 subsidiary companies, which are under the influence of the parent company, were involved. In some cases, in the responses to the questions, it was stated that the parent company restricts some of the innovative activities of the subsidiaries. The businesses were operating on the basis of a strong partnership. This way of functioning represents a situation where one partner relationship can significantly influence the success of the company and its further operation on the market.

4.1. Analysis and Preparation of Information in Relation to Decision-Making on Innovations

Based on the comparison in the questionnaire survey, it is possible to point out the fact that in companies, someone other than the one who makes the final decision often has the competence and skills to prepare materials and analyze the situation. According to the mentioned results, in only 38.5% of cases, the same actor in the innovation process, who also decides on future innovations in the company, analyzes the situation and prepares information for decision.

According to the data in the Table 1, in 42.5% of cases, the general director decided on innovations. On the contrary, the preparation of information was, in most cases, ensured by a team of employees or the head of the department. The aim was also to find out the awareness of the employees and whether they could determine who in the company had been assigned the given responsibilities. The allocation of responsibility for the individual steps of the decision-making process is considered an important part of the efficiency and course of decision-making in the innovation process. Based on the results of the questions, in only three cases did the respondent not know how to assign the given responsibilities to certain jobs.

Table 1. Comparison of information preparation competence and innovation decision-making responsibility.

		Responsibility for the Analysis and Preparation						Total
		Head of Department	General Director	Staff Team	Staff Member	Do Not Know	Other	
responsibility for decisions	Head of department	16	1	11	5	0	1	34
	General director	24	15	12	12	1	1	65
	Staff team	8	1	14	1	0	2	26
	Staff member	3	0	4	12	0	0	19
	Do not know	1	0	1	0	3	0	5
	Other	0	0	1	1	0	2	4
	Total	52	17	43	31	4	6	

4.2. Failure to Use Innovation Activities in Enterprises

The investigated problem is the unused innovation opportunities of enterprises. Companies indicated the factors that cause the non-use of innovation opportunities in their company. The answers are shown in the Figure 1. The left axis shows the number of companies that identified the given factor as the cause of unused innovation opportunities. The cumulative number of responses is expressed on the right axis, which indicates the strength of some factors compared to others. Based on the above information, the most significant factor causing the non-use of innovation opportunities by companies is a lack of time. In this area, it is subsequently possible to divide this problem into smaller problems and determine where the given lack of time arises. In the position of an employee or working hours, the time fund can be adjusted by dividing tasks and examining work tasks. When looking at the length of innovation development, this factor represents a separate part of the process. The second most frequently cited factor is a lack of funds, followed by a lack of human resources. In this case, human resources can again be perceived as the expertise of employees, their number, or their time commitment.

With lower frequencies, the reasons for poor organizational structure, lack of interest in the company, and lack of innovation on the market were found in the answers. The lowest frequencies were missing partners and negative experiences with innovation activities. In the other option, the respondents indicated expertise and relations with the parent company, which approves each innovation proposal. Other factors also included long product introduction periods and long product life cycles, or the high input costs of some parts of the implementations. The respondents also mentioned the fact that the factors mentioned as obstacles to innovation are not present in the given enterprise, and the enterprise uses its innovation opportunities.

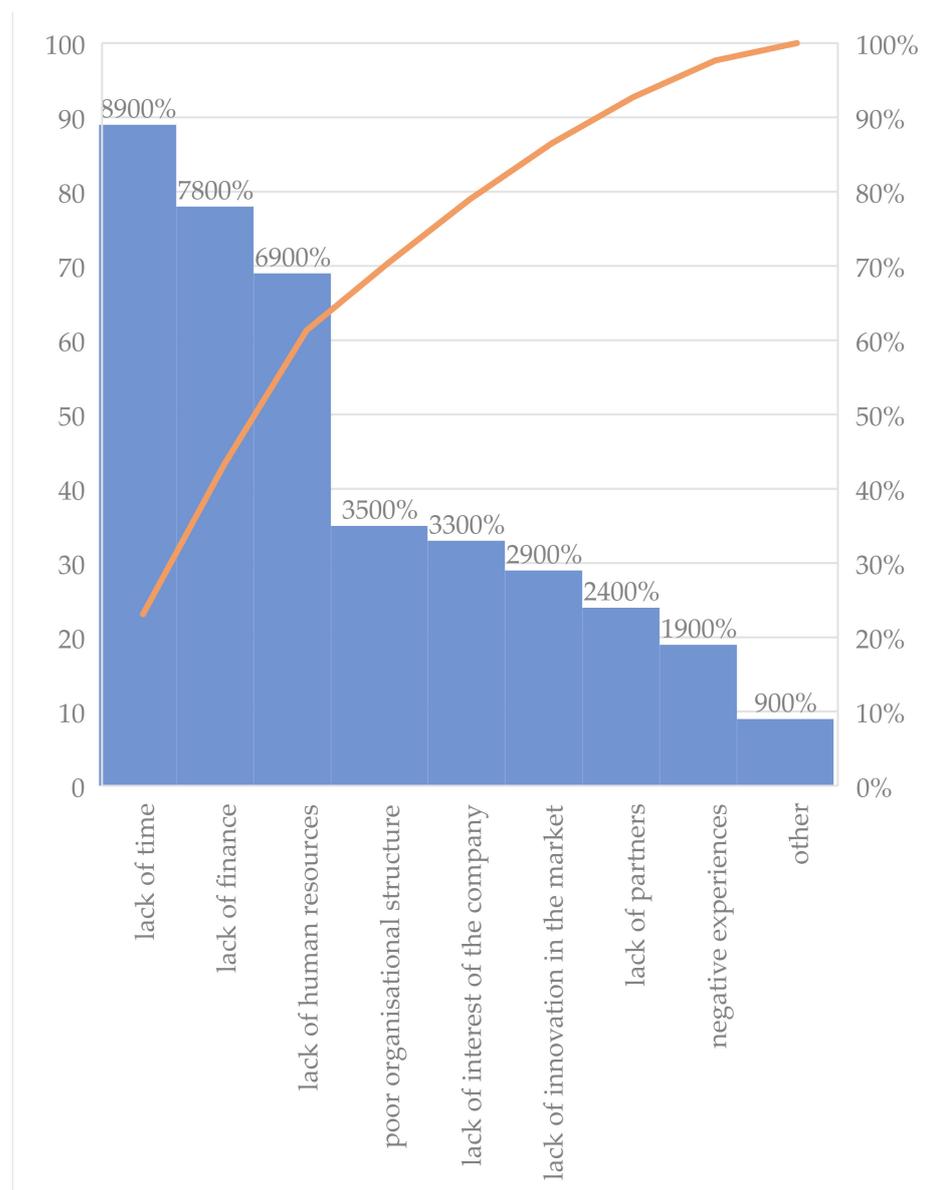


Figure 1. Factors causing failure to use innovation activities.

4.3. Analysis of the Importance of Innovation Activities in Companies

A significant contribution of the research is the expression of the relationship between the use of accurate evaluation metrics when making decisions about the innovation process in a company. The basic result of this comparison is the fact that companies that use accurate decision evaluation metrics determine more importance in the field of criteria for individual criteria. In the aforementioned division of enterprises, the most important criterion for all enterprises that use accurate evaluation metrics is the financial return on new investments. On the contrary, companies that did not agree with the statement about the use of accurate metrics when deciding on the innovation process assigned the least importance to the criteria. However, as an exception, companies that, according to the answers, do not use accurate evaluation metrics evaluated the criterion of experience and people who are available in the company to solve the innovation as the most important.

In this part of the research outputs, a comparison of the importance of the criteria for companies in relation to the percentage of unsuccessful innovations that were approved by the company is presented. The Table 2 shows the values according to the failure rate of innovations after approval to start the innovation process, while with the most important

criteria, the rate of innovation failure is at the level of 51–75%. A significant specificity in Table 2 is the position of the criterion of the expected length of the market launch process, which has a significantly higher value for the most unsuccessful companies. Conversely, the most important criteria for more successful businesses were experience, people, and the market. Since in this case it is the opinions of the respondents, which in some cases are more accurate, and it can be assumed that in some cases it is an estimated percentage of failure, the results of extreme values in the form of the most successful and least successful enterprises can be mitigated if there is a small number of respondents. Respondents state the importance of individual criteria for their company. The most important criterion when counting all the answers is the financial return on investment. Almost 60% of companies consider this criterion to be completely important, and another 30% consider it rather important. This criterion is followed by other strong criteria, which are the state of the market and the effort to achieve a leading market position in the given area. The experience of the employees and the people in the company, as well as the preliminary interest of the customers, the strength of competition, binding customer interest, technical excellence, and expected length of the market launch process, as well as the state of development, patentability, and complexity, achieved a medium value of importance. The least significant criterion for companies was the cost of early termination of the innovation process, which would have been approved with the given innovation.

Table 2. Comparison of innovation criteria in success rate.

		Percentage Ratio of Unsuccessful Innovations after Starting the Innovation Process.						Total
		0%	1–25%	26–50%	51–75%	76–100%	Do not know	
Selection criteria	Financial return	3.17	3.47	3.67	3.64	3.5	3.05	3.42
	Complexity	2.25	2.48	2.57	3.18	2.5	2.24	2.49
	Experience and people	3	2.91	3.1	3	3	2.76	2.93
	Patent protection	2.42	2.52	2.43	2.82	3	2.67	2.55
	Market	2.5	3.13	3.14	3.18	3	2.76	3.03
	Development status	1.92	2.64	2.52	2.82	3	2.71	2.59
	Technical excellence	2.33	2.79	2.43	3.64	3	2.52	2.73
	Pre-existing customer interest	2.42	2.98	2.67	3.18	3	2.86	2.89
	Expected time to launch on the market	1.83	2.64	2.48	3.18	3.5	2.67	2.61
	Strength of competition	3	2.59	2.9	3.55	3	2.81	2.77
	Efforts to achieve market leadership	2.92	2.97	2.9	3	3	3.1	2.97
	Costliness of early termination of the innovation process	2.08	2.36	2.14	2.64	2.5	2.33	2.33
	Bound customer interest	2	2.76	2.71	3.27	3.5	3.05	2.78

4.4. Analysis of the Causes of Errors in the Innovation Process

The causes of decision errors in the innovation process at the companies were also investigated. For the above errors, respondents commented on the impact of the error on the enterprise in the form: minimum impact, medium impact, maximum impact, and on the frequency of occurrence of the error in the form: rarely, moderately often, often. The Figure 2 shows the reasons, comparing the impact and frequency.

The most serious error from the point of view of the surveyed companies is the insufficient amount of information. This reason for errors is the most serious for enterprises in terms of impact on the enterprise and also in terms of frequency; it is the most frequent problem. Subsequently, enterprises perceive the importance of the personal characteristics of managers and the lack of communication among employees. Criteria that have a large

impact on enterprises but do not occur as frequently are misinformation in IP decision-making and mismanagement of finances. Conversely, a frequently occurring problem that enterprises consider to have a weaker impact is the use of expert opinion. Criteria that enterprises tend to consider less important include inadequate information systems and unclear competencies and responsibilities. For these two criteria, it should be pointed out that although respondents report their low impact on decision-making in the innovation process, they identify other factors that are interrelated as important. For example, lack of information can be addressed at the same time by improving information systems, or communication in teams can be fostered by the correct assignment of competences and responsibilities in the team.

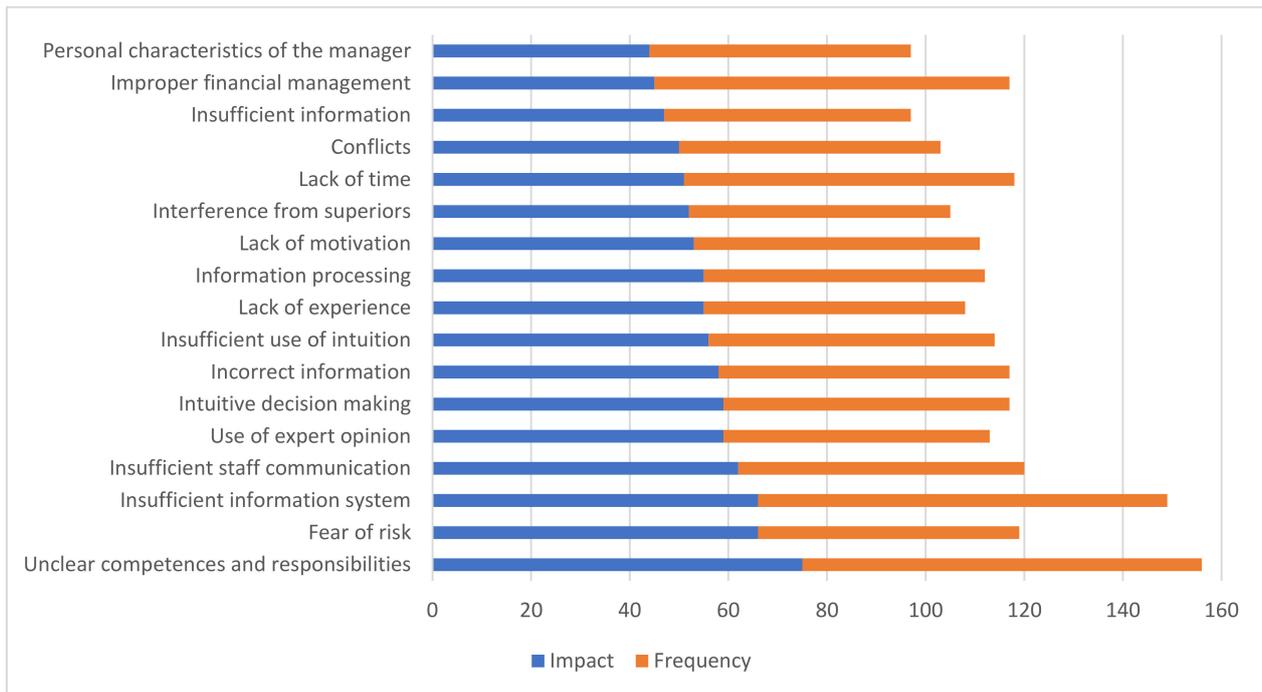


Figure 2. Impact and frequency of decision errors in the innovation process.

4.5. Analysis of Selected Research Questions about Decision-Making in the Innovation Process

Part of the research was also the expression of the degree of agreement or disagreement with the determined research questions and statements describing decision-making about the innovation process in the company. The results are presented in the Figure 3. The respondents took the most agreeable position towards the statement that the evaluation of decisions in the innovation process is crucial for learning and improving the company. Up to 40% of respondents strongly agreed with this statement, while another 45% of respondents rather agreed with the statement. With this statement, it is important to remember that the respondents who agreed that the evaluation of decisions is crucial for learning and improving the company subsequently indicated the company's negative approaches to evaluation metrics, or other ways of evaluating and working with information in the other questions of the questionnaire. Respondents also expressed their agreement with the statement in the wording: managers who have more freedom in the company when deciding on innovations achieve better results from their decisions. Together with the results of other questions, it can be said that excessive control by superiors or partner companies is perceived negatively by the respondents; however, it is necessary to follow certain frameworks of the innovation process and measure the results. This topic was also investigated with the claim that managers' intuition is inappropriate when making decisions in the innovation process and that it is necessary to rely on measurable indicators. Despite a slight predominance of negative statements, opinions on this issue were evenly

divided between agreeing and disagreeing. From the point of view of further research, it is possible to compare other respondents' answers on the basis of these questions and thus better describe the sample set of enterprises.

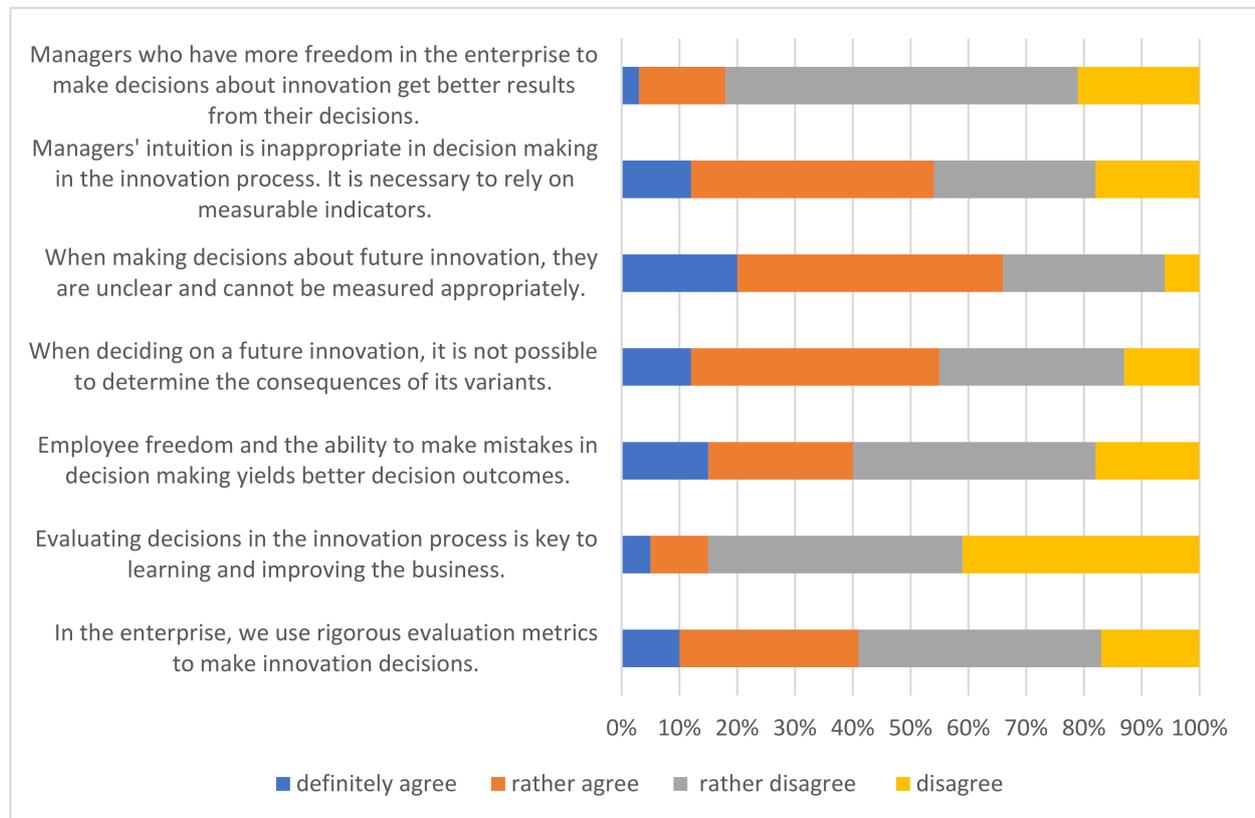


Figure 3. Levels of agreement with selected research questions about decision-making in the innovation process.

Compared to the statement about managers' freedom, the statement about employees' freedom, which states that employees' freedom and the ability to make mistakes in decision-making yield better decision outcomes, was perceived more negatively by respondents. Respondents' perceptions of the opportunity to make a mistake were also split between positive and negative, with only a slight preponderance of positive responses. It is also not true, according to respondents' views, that the outcomes of innovation decisions are unclear and cannot be measured appropriately. Up to 70% of respondents would be inclined toward the opposite. On this issue, comparison with the use of accurate evaluation metrics is also important. Although a large proportion of respondents agree that innovation outcomes can be measured, they do not use accurate evaluation metrics in the enterprise when making innovation decisions. For the last statement, worded: when deciding on a future innovation, it is not possible to determine the consequences of its variants, respondents are again split between two opinions, with 60% of respondents rather disagreeing and therefore stating that the consequences of variants can be determined.

5. Discussion: Methodology of Decision-making in the Innovation Process

Based on the above findings and research, the following methodology is proposed for decision-making in the innovation process:

1. The context of the innovation process.
2. Identification of the type of innovation process and stakeholders.
3. Determining the characteristics of the problem and the goal of decision-making.
4. Technological and financial–business analysis.

5. Creation of variants and criteria.
6. Choice of variant.
7. Database creation, testing, and evaluation.
8. Conditions for the use of decision-making methodology in the innovation process.

1. The context of the innovation process

Decision-making in the innovation process takes place under conditions of uncertainty. The innovation process itself seeks to introduce change into the business environment and stimulate and accept new ideas that are applied in the form of innovations. The first stage of understanding the innovation process is the identification of innovation opportunities. At this moment, the first decision input parameters are determined. Similarly, a team that works in the innovation process is formed, which represents an important element of the decision-making process from the point of view of the organizational structure—the company, the project, and also the decision-making process itself. The members of the organizational structure and its form and relationships influence the decision-making stakeholders in the innovation process. The second phase is the analytical part in the form of technological and financial–business analysis, together with the influence of the properties of the solution and the goal of the process. In the innovation process, the creation of ideas to solve the innovation opportunity is subsequently shown. This part affects the decision-making process, its detailed activities in decision-making represent the proposal of solution variants and gradually move to the determination of criteria. The third phase in the decision-making process is then assuming the consequences of the variants and examining their impact on the solution, which can be linked to the innovation process with an introduction to the evaluation of solution ideas. In decision-making, this step represents an important part, and the evaluation takes place in detail in the process of choosing a variant. The next steps after the decision are interconnected in the processes, and the decision-making model takes a look at this part of the process with regard to the current state found in the investigated companies. Subsequently, there is a significant part of the assessment of decision-making efficiency that is not important in the basic innovation process and its model representation. However, from the point of view of the decision-making process, it represents an important tool for improving and learning about the company.

2. Identification of the type of innovation process and stakeholders

In deciding on the innovation process, the determination of its type plays an important role. The type can be determined based on the characteristics of the innovation process, customer relations, product type, or management method. These are mainly the following types: (A) Traditional process. It is a model in which innovation ideas are discovered by ideas from employees or from databases and previous research. (B) Sales forecasting. It expresses the possibility of anticipating the customer's requirements, then developing the given innovation (requirement) and offering it to the customer. (C) Forecasting sales based on a certain customer specification. The company and the customer can agree on the procedure and cooperation. In this case, companies offer the developed product simultaneously to several customers and thus try to achieve a higher return on investment. (D) A process started by request. The company becomes a certain part of the customer and primarily fulfills a development role. In this case, the customer plays an important role, primarily as an interested party in the innovation process. Among the most important influences on the innovation process are stakeholders and organizational structure. The mentioned types also affect the position and use of communication tools in the process, the division of internal and external communication within the company, and correct, timely, and truthful communication.

3. Determining the characteristics of the problem and the goal of decision-making

The decision-making problem is connected with the problem of the innovation process. Its solution should contribute to improving the situation in a certain area of the market

and determine the direction of the innovation process. When defining a decision problem, the stakeholders involved are responsible for setting the conditions for the solution. The involvement of experts manifests itself in the process significantly when determining the goal that should solve the decision-making problem. Based on the characteristics of the necessary solution, a goal is determined, according to which it is possible to monitor the success and efficiency of the innovation process. The properties of the necessary solution in the company are influenced by competence, responsibility, and methodological instructions based on the management of decision-making problems in the company. The creation of a goal in the company takes place in such a way that it meets the basic conditions for further use in the process—this means that the goal is: (a) sufficiently specific based on expert opinions and proposals, (b) it is possible to measure parts according to the performance of the selected variant, (c) it is possible to accept the solution and subsequently approve it from the point of view of suitability, (d) realistic from the point of view of experience, so that the goal is appropriate for the company, the project, and the specific expected innovation, and (e) time-limited due to the progress of the innovation process, it is necessary to meet the goal by a certain date. Setting the goal in this case can take into account the difficulty of new technology development and customer requirements. In cases where there is a need to change the goal or problem, the process with changed parameters can be considered new.

4. Technological and financial–business analysis

From the point of view of the procedure and methods, it is primarily about compliance with certain criteria for an effective and detailed investigation of information. For a correct analysis, as preparation for decision-making in the innovation process, the following conditions are indicated: involvement of experts, obtaining a sufficient amount of information—review of all sources, obtaining quality information—it is suitable for what it is needed for, obtaining reliable information—true, up-to-date, sufficient time for analysis, the possibility of supplementing information later if necessary. The decision-making marked in the model based on the obtained information advances the solution further according to the evaluated information. The analytical part can also be introduced in companies in the form of a feasibility study, which focuses on technological, business, and financial analysis. First, the sources and inputs of the processes, complexity, effects on the company and other products, available technologies, production facilities, competitive solutions, and human potential are examined. Subsequently, costs, returns, resources, time, customer interest, competition, segmentations and market entry barriers are examined.

5. Creation of variants and criteria

If we creating variants, than it is necessary to start with the initial analysis of the issue. The resulting technological solutions, in which the financial–business analysis did not show a serious problem with financing or application on the market, become variants in decision-making. The variants that subsequently enter the decision-making process must solve the problem of the innovation process. For the success of the process, it is important that the company avoid accepting the first possible solution. In this case, it happens in companies that the first possible solution is accepted, the shortcomings of which are revealed at a later stage of the evaluation. It is advisable to analyze all possible ways of solving the given problem at the beginning. Nevertheless, variants may have common parts.

When designing the criteria, you can proceed according to the proposed criteria in Table 3. These are approved at the company and project levels. These criteria may differ; in general, not all criteria that are used in the company may be used in the project due to the differences between individual projects and products. The proposed criteria are based on the conducted research; they contain the most used and most important criteria for companies. When working with criteria, the expertise of the employees who select and approve the criteria and who subsequently work with the criteria is very important. After approval, the criteria are assigned a value—the weight of the criterion in the project. For every company, in this procedure, it is necessary to examine the formulas existing and functioning in the company, i.e., those that can be best used in the given conditions.

These conditions are influenced by the type of business, the type of innovation process, employees and teamwork, the nature of customers, and the product. The criteria differ in individual cases and according to the type of innovation process.

Table 3. Example of selection and weighting of criteria in an enterprise and an innovation project.

Use in the Business	Criterion	Use in the Project	Criterion Weight in the Project
X	financial intensity	X	0.2
X	financial return	X	0.1
X	budget		
X	feasibility/implementation cost		
X	benefit for the customer	X	0.15
	public benefit		
X	benefit to the enterprise		
X	differentiate from competitors		
X	risk	X	0.15
X	customer opinion		
X	customer interest	X	0.2
X	personal assessment		
X	time commitment		
X	staffing	X	0.2
X	utilization of company resources		
X	impact on the company's name		

On the basis of research, it can be shown that financial return is very important for companies, and in companies, this criterion has the greatest weight. This model procedure cannot be generalized because such a procedure requires specific and demanding compliance with the conditions of the mentioned innovation management method. Recommended key criteria for businesses are: financial return, feasibility, staffing, time requirement, customer opinion, and risk. However, the necessary decision-making in the innovation process of companies is the individual adjustment of criteria weights.

6. Choice of variant

In the innovation process, a variant of the solution is selected. The company determines which calculation will be used to evaluate the variant, while the suitability of the Analytic Hierarchy Process (AHP) and TOPSIS methods has been confirmed based on the investigation. The basic condition for the use of a certain decision-making method of variant selection is the manager's ability to work with this method. It is necessary to ensure that experts and their recommendations are not left out of the innovation process. After determining the criteria and their weights, the criteria are applied to individual solution variants. In this procedure, the variant selection method is applied according to the decisions and capabilities of the company's managers.

The procedure of the AHP method is a hierarchical progression of each variant through a pairwise comparison of values, which can also be performed together in one step. The optimal solution is based on the evaluation of the criteria and their weights. The TOPSIS method is used to solve the listed solution variants and selection criteria, with the aim of choosing the variant that is most similar to the ideal solution. After determining the objective of maximizing or minimizing the values of individual criteria, the ideal solution and the distances of specific variants are calculated.

7. Database creation, testing, and evaluation

When checking the results, the company proceeds based on the set goal of the decision-making process in the innovation process. In this part, the involvement of decision-making stakeholders who have the competence to control the results and understand the set target states is essential. The control is not one-time; it needs to be repeated based on the next stages of the innovation process. The check also includes a check of the correctness of the procedure, the evaluation method used, and the selection of the variant. Evaluation of the effectiveness of decision-making takes place on the basis of experience. Just as the results of the process evaluation enter the set of solutions to decision-making problems, it is also important for this process to have knowledge of the issue in question. This knowledge is archived in a specific database. Next, the spent resources—primarily financial and human—are examined, and the results of the process are evaluated.

The creation of the database takes place from a professional managerial point of view. Methodological instructions are created from the database. Methodological instructions are used as recommendations for specific activities—the identification of innovation opportunities and the proposal of the properties of the necessary solution. According to methodological instructions, it is possible to recommend to managers and experts how to proceed where mistakes were made in a specific case. The effectiveness of the SRRP creation process is supported by the prescribed framework, which the company can use to create structured information and implement the given structure in the company's information system. Framework structure:

- Case identification: keywords, responsible person, type of innovation process, financial coverage of the project, product.
- Basic data on the case: stakeholders in the process, customer, criteria, errors, time constraints.
- Procedure: procedure of methods, evaluation criteria, results of analysis, selection, and development.
- Results: financial evaluation, time allocation, customer feedback, suggestions for improvement, elimination of procedure errors.

Using case identification indicators such as keywords, identification of the responsible person, product, scope of finance in the project, and type of innovation process, it is possible to quickly search for similar cases, examine dependencies and trends, and create comprehensive recommendations for management. A simple description contains quick details about the case, and the procedure describes the methods used, the criteria and their evaluation, the results of the analysis, and also how the selection and development of the prototype take place. The results summarize recommendations and evaluations, on the basis of which it is possible to create methodological instructions for the process, or to search for individual cases and solutions. Suitable tools that can be used to build SRRP are: Taskade 2.0, Slite, Nuclino, Notion, Intercom Educate, Confluence, and ProProfs Knowledge Base. Taskade 2.0 offers the possibility of a structure and an infinite hierarchy of documents in a collaboration environment, as well as examples of resolved databases, fast database searches, and knowledge storage. The Nuclino tool is suitable for teams that connect several areas and departments of the company, especially areas other than technological focus.

8. Conditions for the use of decision-making methodology in the innovation process

Part of the decision-making methodology in the innovation process are the brief conditions for using the proposed methodology. First of all, it is necessary to ensure the appropriate organizational structure of the company for the functioning of the methodology and decision-making procedures. The connection of interested parties must correspond to the possibility of connecting individual departments and elements of the organizational structure of the company. In cases of insufficient adaptation of the organizational structure, serious communication problems can arise in the company. Related to this is the condition for the involvement of experts. Based on the research, the involvement of company

experts is necessary from the beginning of the decision-making process in the innovation process. The critical points of involvement of experts in the process are the identification of innovation opportunities, the definition of the decision problem, the determination of the goal, and technological analysis, option selection, and evaluation. Communication also involves the involvement of stakeholders from the external environment, especially when defining the decision-making problem and the interests of the company director. The innovation process is strongly linked to the company's culture. The possibilities of applying new ideas and the nature of innovations depend on the approach of the company and its employees. Some procedures cannot be applied generally to all businesses. For this reason, the methodology is designed so that companies can adjust selected parts of the process according to the conditions and needs of the implemented projects. In this way, the process is also influenced by the motivation of the employees. The results of the process can be distorted based on the insufficient motivation of employees in connection with their way of managing responsibility.

Supplementing the Theoretical Model of the Innovation Process Based on the Results of the Investigation

Results can be compared in the classic concept of the innovation process, such as in the Penthation framework by Goffin and Mitchel [15]. In this model, we can implement our outputs and the results of research into decision-making about innovations within Slovak companies.

The Penthation framework is built from the following phases that create the company's innovation strategy: (1) the search for opportunities for innovation, (2) the selection and justification of the innovation, (3) the implementation of the innovation, (4) the measurement of the benefits of the innovation. Of course, the involvement of employees is an important part in the innovation process.

Our research enriches this framework in parts: The first step of the Penthation framework is enriched by considering our data in steps one and two of our proposed invasion process. Step two of the Penthation framework is augmented by steps three and four of our framework. Step three of the Penthation framework is explained within our proposed innovation process through steps five and six. The fourth step of the Penthation framework is enriched with step seven. Our step eight, i.e., decision-making conditions, enriches the whole process of the strategy of the innovation process with conditions and the way in which the company manager should decide and manage innovations. For a better understanding, we compiled the following methodological process, in which we combined the Penthation framework and our proposed framework:

0. Innovation strategy and employee involvement.
 - 0.1 (8.) Conditions for the use of decision-making methodology in the innovation process.
1. Search for opportunities for innovation.
 - 1.1 (1.) The context of the innovation process.
 - 1.2 (2.) Identification of the type of innovation process and stakeholders.
2. Selection and justification of the innovation.
 - 2.1 (3.) Determining the characteristics of the problem and the goal of decision-making.
 - 2.2 (4.) Technological and financial-business analysis.
3. Implementation of the innovation.
 - 3.1 (5.) Creation of variants and criteria.
 - 3.2 (6.) Choice of variants.
4. Measurement of the benefits of the innovation.
 - 4.1 1.3 (7.) Database creation, testing, and evaluation.

6. Managerial and Theoretical Implications of Research

The proposed solution needs to be implemented based on certain conditions resulting from the research and findings. The limitations of the proposed solution are divided into the sections below. These limitations have managerial as well as theoretical implications.

- Being primarily intended for medium and larger organizational structures. The basic limitations of the proposed methodology are determined by the subject of the research. Since the investigation was focused on enterprises with 50 or more organizational structure members working in a correspondingly large organizational structure, the solution proposed in the paper can be primarily applied only to similarly sized enterprises.
- Compilation of the methodology on theoretical foundations in conjunction with research in enterprises. The paper is developed as a scientific work with an emphasis on methodological procedure and the use of appropriate theoretical sources. The studied theoretical knowledge significantly influences the development of the methodology, which in some parts can create complexity for practical use.
- The conditions for the implementation of the solution. The factors that influence the implementation of the solution include mainly the corporate culture, the people involved in the innovation process in the enterprise, the organizational structure of the enterprise, and the correct understanding of the methodology in the enterprise.
- The need to adapt the methodology to the corporate environment and the dynamics of the innovation environment. The concept of the methodology is designed so that the necessary inputs for decision-making in the innovation process are set in the specific conditions of the enterprise, which means that it is necessary to adapt the recommendations in the methodology for decision-making in the innovation process to the enterprise. It is not possible to describe in detail a process as complex as decision-making in the innovation process in a way that is suitable for every situation.
- Limited possibilities for using the PoC method according to the type of business. The proof-of-concept method offers many benefits to businesses in the form of saving time and money, and it also offers the opportunity to work on multiple solutions simultaneously. However, some innovations do not offer the possibility to test partial solutions, and it is necessary to develop a prototype or test the functionality of a larger innovation at once.
- Focusing parts of the research on information technology businesses. Due to the research setting, the characteristics of the research subject, and the availability of research implementation in software development companies, some parts of the research are influenced by the environment of information technology companies.
- Limited areas of investigation and design. The above limitations of the solution design offer guidance and recommendations for the enterprises and situations in which the methodology is intended. It helps to better select the appropriateness of using the design, or to modify the enterprise environment in advance so that the proposed solution can be successfully implemented.

7. Conclusions

Today's environment of constant change and technological development puts businesses in a position where they need to actively seize opportunities and compete for customers. Innovation plays an important role in this struggle and is becoming one of the main competitive advantages. In order for businesses to develop appropriate innovations and to manage the innovation process properly, it is essential to make the right decisions. Based on the analysis of theoretical knowledge in the fields of innovation, innovation processes, and decision-making, it can be argued that the views on the issue of decision-making in the innovation process are not unambiguous. In theory and practice, decision-making procedures in the innovation process are not clearly defined, and the issue needs more attention in research.

The primary research is on the results based on a questionnaire survey. According to the information found, a methodology for decision-making in the innovation process is then proposed. Enterprises use different criteria for decision-making, and in some cases, they have no idea about the correct course of action in decision-making. The proposed methodology for decision-making in the innovation process offers room for further investigation, opening up possibilities for revealing the impact of information systems or methods used on innovation processes and also creating adapted corporate decision-making procedures in the innovation process.

Decision-making in the innovation process is an important area of business. Its effectiveness is dependent on the people in the enterprise and also on the processes and decision-making framework used, and therefore it is a site of gaps and also differences in the output of processes based on differences in human potential.

The results and correctness of decision-making in the innovation process cannot be detected immediately; this process can be classified as a long-term process of the enterprise because some indicators of the appropriateness of decisions can only be evaluated after a period of use of the product by customers, which in some cases represents months or years. Due to the long cycle of decision validation in enterprises, the improvement and modification of decision-making in the innovation process takes place over several generations of employees, and it is necessary to maintain its structure during several organizational changes in the enterprise, for example, a change in the stakeholders of the process.

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