A MODEL OF IDEA EVALUATION AND SELECTION FOR PRODUCT INNOVATION

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Abstract

Product innovation is one of key strategic guidelines for sustainable business and competitive advantage. The process of innovation takes significant resources, and it is extremely important during the front-end of innovation to choose a concept with high innovation potential. There is a consensus among researchers that the evaluation and selection of ideas is critical to innovation success. Current research indicates that companies carry out the selection of ideas ad hoc or intuitively, and that only a small number has defined methods and/or the methodology.
In this paper, we propose a rational and effective model of evaluation and prioritization of ideas, on the basis of which it is possible to make a choice of ideas. The model emphasizes a set of criteria for evaluating the efficacy of innovation, and defines the attributes for determining the value of each of the criteria. The proposed model represents a level in the methodology and can be applied separately or as part of the methodology. The development model is based on extensive research of the literature, empirical research and practical work. The application of the model was presented by the analysis of one practical case.

Keywords: Innovation, New product development, Early design phases, Idea management, Idea evaluation and selection

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1 INTRODUCTION

The competitiveness of a business depends significantly on its willingness and ability to continuously innovate products and services. Therefore, for a significant number of companies a continuous process of innovation has become a strategic priority. A survey conducted among 1356 respondents in various companies (AMA, 2006) has shown that two thirds of respondents believe innovation is "extremely important" or "highly important" for their company at that time. This data becomes more significant when we look at respondents estimates about the importance of innovation for the future of their company. About half of the respondents believe that innovation will be "extremely important" in the next 10 years, and 35% said it would be "highly important". Recent studies (Iversen, Kristensen, et al, 2009) indicate that 70% of CEOs consider innovation as one of the top three priorities for company growth.

Product innovation is a risky and uncertain process. For product innovation a large number of factors are important but the researchers agree that a system for innovation management is still the key, particularly in the earliest stage when it is necessary to identify business opportunities and find the best ways or ideas for their realization. The process of innovation management requires cooperation between different people and departments within the company, associated with the processes of research and development, marketing, sales, production, etc. (Dornberger, Suvelza, 2012). Innovation management is a multidimensional and nonlinear process, and it requires data access and specific or expert knowledge from different, often heterogeneous fields (Bullinger, 2008). The process of product innovation is mostly divided into the process of preparation of product development (PPD), process of new product development (NPD) and the process of product commercialization (PC) (Koen, 2001). The preparation of product development (PPD) (Stevanovic, et al., 2013) (in the literature it is usually known (Smith&Rainertsen, 1991) as Fuzzy-Front End (FFE) or (Koen, 2001) Front-End of Innovation (FEI), precedes the formal NPD (Khurana&Rosenthal, 1998). Identification and evaluation of business opportunities, creation, evaluation and selection of ideas, and the development and testing of new product concepts are the most important activities during the preparation of product development (Koen et al. 2001; Cooper, 2008; Stevanovic et al., 2014). Because of the crucial importance of new, creative ideas for the success of product innovation, the management of ideas is imposed as extremely important, and, according to some authors, a key process during the preparation of product development (Bullinger, 2008; Stevanovic, 2012; Alexe, et al., 2014). Therefore, the process of idea management is an object of interest for a significant number of researchers (Summa, 2004; Iversen, et al., 2009; Glassman, 2009; Stevanovic, 2012; Malik, 2014). Numerous models, methods and techniques that encourage creativity and creation of ideas, (Glassman, 2009; Bassiti and Ajhoun, 2013) have been developed. After the ideas have been collected, the question of quality and relevance of collected ideas or methods of storage, labelling, testing and improving the collected ideas is raised (Glassman, 2009; Stevanovic, 2012). The number of collected ideas, especially in cases of collection of ideas through open systems for idea gathering (open innovation), can be extremely large. Therefore, assessment, evaluation and selection of ideas are today most often carried out on the basis of expert multidisciplinary knowledge of participants in the process of innovation (Soukhoroukova et al., 2010). Such estimates are usually based on a limited number of criteria or an insufficient number of attributes that describe specific criteria.

In this research, we tried to partially point out the ways of carrying out some activities in the process of idea management. Our goal was to develop a data model that will, on the basis of attributes, provide a description of ideas with a goal of their labelling, storage, sorting, improvements, and qualitative and quantitative evaluation of the process which is not necessarily tied to a specific product innovation. The second goal was to develop criteria and propose methods and methodology, and to check the applicability of the proposed methodology in the process of product innovation (Stevanovic, 2012). In this paper the part of the study, which includes a method of assessment and evaluation the efficacy of the idea, in meeting the expected value during product innovation, is given. Verification of the proposed method is demonstrated by applying it to a selected set of ideas by using different methods of multi-attribute evaluation.

2 RELATED WORK

Idea management is often an integral part of the process of product innovation. Idea management is a relatively old process, which can be found in practical use for a long time Toyota has a history of over

30 years of innovation management oriented towards the capture of ideas (Westerski, Iglesias, 2011). The process of idea management is the subject of a large number of researchers. According to Summa, (2004), idea management includes the following phases: generation or ideation, gathering, evaluation, development, implementation, and follow-up and rewarding. The author states that idea evaluation is a critical step in managing innovation. Another way of defining phases in the process of idea management is found in the work of Iversen et al., (2009), in which the authors point out the following processes: inspiring and involvement, generation and capturing, development and enrichment, evaluation and selection, implementation, post-implementation learning and feedback. In the paper Westerski, Iglesias, (2011) distribute a lifetime of ideas in five sections: generation, improvement, selection, implementation and deployment. According to Malik (2014), the process of idea management includes the following phases: genesis and gathering, evaluation and selection, feedback and recognition, implementation and idea bank. In their dissertation Glassman (2009) defines idea management as the process of capturing, storing and organizing ideas and also, idea management can be used to perform preliminary evaluation and screening of ideas as well as diffuse ideas across the company.

As can be seen from the analysed processes of idea management, all authors include and highlight the particular importance of the process of assessment, evaluation and selection of ideas as an integral part of the process. The reason for this is the need to reduce risk and ambiguity in product development. It's one of the reasons for the growing number of papers in the field of assessment, evaluation and selection of ideas. Montoya-Weis & O'Driscoll, (2000) as the criteria for idea evaluation cite: marketing, business, and human factor criteria. On the other hand, in the paper (Feyzioglu and Buyukozkan, 2005), the authors evaluate the ideas primarily through the "benefit" and "risk“, and propose a model consisting of eight criteria based on artificial intelligence and fuzzy logic. Aagaard, 2008, describes an example of idea evaluation for product development and emphasizes "the metrics are critical in idea evaluation and idea improvement ...”. In the study (Alves et al., 2005), the authors state that the process of reducing the number of ideas is based on the search for convergence techniques based on analytical and logical processes. In the study, "How do you measure the success potential and the degree of innovation of technical ideas and products" (Binz et al., 2007) , the authors claim that for technical products it is not enough just to be new, but it is also important to be successful in the market. Application of different methods for multi-attribute evaluation and group decision making can be found in Chang et al., (2008), in which the authors present a model of idea evaluation process in product development and clarify the application of the method. For the implementation of the assessment they use the following criteria: compatibility with the business strategy, synergy with other products, technological feasibility, market attractiveness and competitive advantage. Following the experience of other authors (Badizadeh, Khanmohammadi, 2011) emphasize the selection of ideas for product development based on a hierarchical structure based on eight criteria, four areas of benefits (profitability, efficiency, strategic effect and trade effect) and four areas of risk (financial, technical, managerial and personnel), and the selection is carried out using the AHP method (Saaty, 1980). Unlike other works, in (Ferioli et al., 2008), the authors assessed by determining the value of an idea through indexes for three aspects: the technological, economic and social aspect, and a whole range of attributes (criteria) whose valuation is used to calculate the index value for a particular aspect or value of an idea. In a detailed study about the criteria for selection of ideas for product development, Ozer, (2005), systematizes criteria that can be evaluated. In the above context, the author emphasizes the possible application of a large number of analyses: technical, marketing, financial, organizational, strategy, relationship, industrial, competitive, similar case, consumer and expert analysis. Regardless of the increasing number of works in the domain of assessment and evaluation of ideas, according to Yannou et al, (2013) "currently no clear method exists to select ideas or concepts with a strong potential for success in the market in the context of a start-up of an existing business".

At the same time, together with papers which emphasize attributes and criteria for assessing the value of an idea, there are a significant number of papers that highlight the depth of idea assessment, i.e. the level at which ideas are assessed. Thus, in the work of Achehoug et.al, (2013), the authors state that in their case the assessment of the quality of generated ideas is done by the executive director of the company. Before the assessment, all ideas are grouped in order to simplify the comparison, and equal ideas are eliminated. After the elimination, the remaining 210 ideas are evaluated by the executive director. As a significant number of empirical studies show, the existing processes of selection of ideas

tend to be ad hoc processes and somewhat intuitive (Herstat et al., 2004; Bullinger, 2008). This result in an unsatisfactory situation caused by the hardship of comparison of ideas and the abundance of ideas, and inadequate risk assessment and delayed stopping or starting of projects based on poorly chosen ideas (Montoya-Weiss & O'Driscoll, 2000). By establishing two independent assessment processes, a framework for assessing ideas containing a consistent methodology is created (Bullinger, 2008). Some authors (Stevanovic, 2012) recommend a separation of the process on a multiple levels with continuous supplementation of information on ideas from a defined set, and the implementation of assessment and evaluation by a large number of participants of different levels of knowledge and specialties.

Despite a significant number of papers and a significant number of studies, there are still a lot of unknowns between the processes of idea generation for product development and product innovation. There is no unique methodology for description, assessment, evaluation and selection of ideas. The above criteria are adjusted individually, on a case-by-case basis. According to the aforementioned report (AMI/HRI, 2006), which was based on a series of interviews with the companies that are considered the best in the group in the management of innovation, almost half of respondents (48%) said that they "do not have a standard policy for evaluating ideas,". In this study, 17% of respondents said that they use an "independent review and evaluation process", while 15% said "ideas were evaluated by the unit manager where the idea was proposed". These responses point to a clear lack of strategy in selection, or even in evaluation of ideas. The research presented is attempting to contribute to overcome these gaps.

In addition to findings presented in literature, the initial data for this survey was collected through own empirical research. The primary objective of this empirical study was to show how and when companies collect ideas, what are the motives for such endeavour, what are the companies' needs for ideas, the companies' capacity for gathering ideas, and which mechanisms are used for verification and selection of the ideas. In addition, the intent of the study was to determine whether the needs of the companies could be classified and generalized. The third groups of objectives sought to find what essential features of ideas are important for the companies for describing and assessing the value of ideas, and how the firm made a selection of ideas for new product development. The complete questionnaire contains a total of 106 variables grouped into 35 questions, in which they responded. The results can be found in Stevanovic (2012).

3 IDEA EVALUATION METHOD

As indicated above, one of the essential problems for the assessment and evaluation of ideas is a way of determining the transformation of the cognitive process of content analysis of collected ideas into a formal process for which an unambiguous methodology could be defined. An aggravating circumstance is an expressed multidimensionality of the process (application of ideas in many areas, the impact of ideas on many levels), its non-linearity (ideas build upon each other, connect and separate, etc.) and a large number of factors that affect the level of risk, i.e. the degree of uncertainty of the outcome of analysed events. Due to the complexity of the problem a decomposition process of assessment and evaluation of ideas was conducted (Stevanovic, 2012) on four levels. The first level is a fixed component of the process of idea management and presents a filtering, i.e. screening of collected ideas. After the first level, the ideas retained in the system are described by means of attributes, categorized and sorted. At the second level, qualitative and quantitative assessment is performed. The qualitative assessment primarily seeks to improve, group, clarify and complete ideas. Quantitative assessment determines the relevancy factor, which attempts to measure the value that the idea brings to the company, through the following criteria: benefit, novelty, risk, cost, with the goal of early recognition of extremely good and extremely bad ideas, guidance of ideas towards their potential application, and the creation of subsets of ideas for further evaluation (Stevanovic et al., 2013). At the third level, the capacity factor of collected ideas is assessed, which tries to determine how acceptable, applicable, and creative the ideas are and what their general potential for product innovation is (Stevanovic, et al., 2014). It should be noted that the product at this stage of innovation still do not have clearly defined goals. At the same time, the product requirements and restrictions are often not yet precisely defined, so the list of requirements and restrictions partially depends on the content of the analysed ideas. At the fourth level, the idea efficacy factor is determined, i.e. the subset of ideas is evaluated in relation to the objectives, requirements and limitations set out for the specific product in

order to achieve maximum technical, market, financial, customer and social effects of innovation. In this paper, we have decided to present a detailed method of determining precisely the idea efficacy factors.

The evaluation of idea efficacy factors aims to create a priority list within the set of ideas, on the basis of assessment of the potential of each idea to produce the very results which are expected from the product. The evaluation of efficacy of ideas is based on three sets of data that are available at the time of an assessment. The first group is data about the ideas that we have in the system from previous activities of characterization, evaluation, upgrading, modifications, etc. The second group of data consists of objectives, requirements and constraints that we have defined in relation to the product which we are developing. The third group of data is comprised of metrics for the implementation of the assessment and evaluation of ideas, i.e. the criteria and attributes which we will analyse in the evaluation process and which we will try to determine. As already stated, the metric is often critical to the process of idea evaluation. The literature mentions various attributes which can be applied to similar evaluations. During empirical research, evaluation of a certain set of attributes was conducted in practice of companies. Following the results of a wide and detailed analysis of the available literature and empirical research, an unambiguous metric was determined for evaluating the implementation of potential ideas in order for their expected goals to successfully come to fruition. The determined metric is unambiguously applicable for all ideas from a set of ideas, and the basis of the defined vocabulary allows for an unambiguous communication between the different actors in the process of idea evaluation, regardless of their area of expertise and familiarity.

The tables below show the defined metrics. Each table contains the name of the criteria, attributes whose values are being determined; the basic question the assessor needs to know how to answer while evaluating attributes which is based on the content of ideas, their objectives and constraints, as well as numerical and descriptive values that correspond to the numerical values of attributes. Descriptive attribute values are initial and should be understood as approximate values. Also, numerical values of scores are adjusted to values of a numerical scale, which were defined in the survey as 1-9 (the main values being 1, 5, 9, the value 5 is an indifferent value, while 3 and 7 are major intermediate values). Such metrics corresponds both to the method of ranking and to the application of the method of comparison.

Table 1 shows the attributes and metrics for evaluation of technical values of ideas. Within the technical assessment we evaluate the possibility of productivity with available technology and resources, achievement of functionality, reliability, safety, ecologically, and aesthetics of products. It is important to assess whether certain ideas influence the defined attribute and whether it is more or less positive or negative

Table 1. Attributes and guidelines for assessment of technical values of ideas

TECHNICAL / PRODUCTION	**Basic question**	**Value**		
		1	**5**	**9**
PRODUCTIVITY	How the idea affects the possibility to production?	We do not have the necessary resources for the realization of such products	We have the necessary resources or resources can be easily found	We have the necessary resources, knowledge and ideas to improve our production knowledge
FUNCTIONALITY	How the idea affects the functionality of the product?	The idea does not provide the full functionality according to known criteria	The idea provides the expected functionality for set criteria	The idea offers more than the expected functionality of the set criteria
RELIABILITY	How the idea affects the reliability of the product?	The idea significantly reduces the reliability of the product	The idea does not significantly affect the reliability of the product	The idea increases reliability
SAFETY	How the idea affects the safety of the product?	The idea essentially reduces the safe use of a product	The idea does not significantly affect the safe of use of the product	The idea increases the safety of the product
ECOLOGICALLY	Does the idea affect the environment?	The idea has a negative impact on environmental parameters (energy, pollution ...)	The idea does not significantly affect the environmental parameters	The idea contributes significantly to environmental characteristics of the product (green product)
AESTHETICS	Does the idea affect the aesthetics of the product?	The idea reduces the overall aesthetics of the product	The idea does not significantly affect the overall aesthetics of the product	The idea contributes significantly to the overall aesthetics of the product

Table 2 shows the attributes and metrics to assess the market value of ideas. Within the market assessment of ideas it is necessary to determine whether the idea has any impact on competitiveness in relation to the products of other manufacturers, in relation to customer expectations and in relation to the distribution capabilities in the market.

Table 2. Attributes and guidelines for assessing the market value of ideas

MARKET	Basic question	Value		
		1	5	9
COMPETITION	How competitive is the idea with relation to the idea embedded in the competitor's product?	The idea is a worse solution than that of the competition	The idea poses a solution on par with that of the competition	The idea brings the dominant product over the competition
BUYER	How competitive is the idea with regards to customer expectations?	The idea brings a worse solution than customer expectations	The idea brings the expected solution to customers	The idea brings the solution significantly above customer expectations
MARKET	How is the idea competing against the expectations of the market?	The idea brings a worse solution than other solutions on the target market	The idea brings a solution in the rank of solutions on the market	The idea brings the solution above expectations and needs of the market

Table 3 shows the attributes and metrics to assess the financial value of ideas. Within financial evaluation of ideas it is necessary to determine the impact on some of the indicators that could have a significant impact on the financial results of operations such as sales volume, the rate of return, payback time, and whether the impact is positive or negative.

Table 3. Attributes and guidelines for assessing the financial value of ideas

FINANCIAL	Basic question	Value		
		1	5	9
SALES VOLUME	What is the impact of the idea on the expected sales volume of the product?	The idea will negatively affect the sales volume of the product	The idea itself will not affect the sales volume of the product	The idea will positively affect and can be expected to significantly raise the volume of product sales
RATE OF RETURN	How ideas affect the rate of return on investment?	The idea will negatively affect the rate of return on investment (difficult return)	The idea will not affect the expected return on investment (safe return)	The idea will significantly raise the rate of return on investment
PAYBACK TIME	How ideas affect the time of payback time?	The idea has already extended the payback time	The idea will not significantly affect the payback time	The idea will significantly shorten the payback time

The following table 4 shows the attributes and metrics for assessing the value that idea brings to the customer. As part of this evaluation it is necessary to determine whether the idea has any impact on defined attributes (user necessity for the product, the novelty of such product for the user, the usefulness which the incorporated idea brings to the user and the usability of such a product). This is extremely important in the case of product development for specific user groups.

Table 4. Attributes and guidelines for the assessment of customer value of ideas

CUSTOMER	Basic question	Value		
		1	5	9
NECESSITY	How users will evaluate the necessity of products based on the idea?	Users will negatively assess the need for the realization of the idea	Users will remain neutral towards the needs for the product based on the idea	Users will strongly emphasize the necessity of products based on the idea
NOVELTY	How will users evaluate the novelty the idea introduced?	Users will negatively evaluate the novelty the idea introduced	Users will remain neutral towards the novelty the idea introduced	Users will be considered significant the novelty the idea introduced
USEFULNESS	How will users evaluate the usefulness the idea brought to the product?	Users will negatively evaluate the usefulness of a product based on the idea	Users will remain neutral towards the usefulness of a product based on the idea	Users will considered the usefulness significant
USABILITY	How will users evaluate the usability of the product?	Users will negatively evaluate the usability of the product based on the idea	Users will remain neutral toward the usability of the product based on the idea	The idea brings a substantial increase in the usability of the product

Table 5 shows the attributes and metrics for assessing the value that idea brings to the community in which the product is distributed and used. As part of this evaluation, it is necessary to determine whether the idea has impact on defined attributes or not.

Table 5. Attributes and guidelines for the assessment of the social value of ideas

SOCIAL	Basic question	Value		
		1	5	9
IMPORTANCE	How much will the idea contribute to the importance of the product for users?	The idea would adversely affect the significance of the product for users	The idea will be on par with the expectations for importance for product's users	The idea will significantly contribute to increasing the importance of products for users
EMPHASIS	How the idea will contribute to highlighting of the product by the user?	The idea will negatively highlight the possession of the product	The idea would be neutral towards highlighting the possession of the product	The idea will substantially raise the highlighting of ownership of the product (self-advertising)
COMMITMENT	How the idea will contribute to commitment from the users?	The idea will negatively affect the commitment of the user to the product of the manufacturer	The idea will not have a substantial impact on commitment of the user to the product of the manufacturer	The idea will significantly contribute to increase the commitment of the user to the product of the manufacturer
AFFORDABILITY	How idea contributes to the affordability of the product?	The idea will adversely affect the possibility of procurement of products by customers / users	The idea will have no impact on the possibility of procurement of products by customers / users	The idea will significantly increase the possibility of procurement of products by customers / users

Valuation of ideas for these criteria and attributes is carried out quantitatively, according to qualitative values indicated in Tables 1 to 5. Figure 1 shows the hierarchy for the application of evaluation and ranking of success factors of ideas.

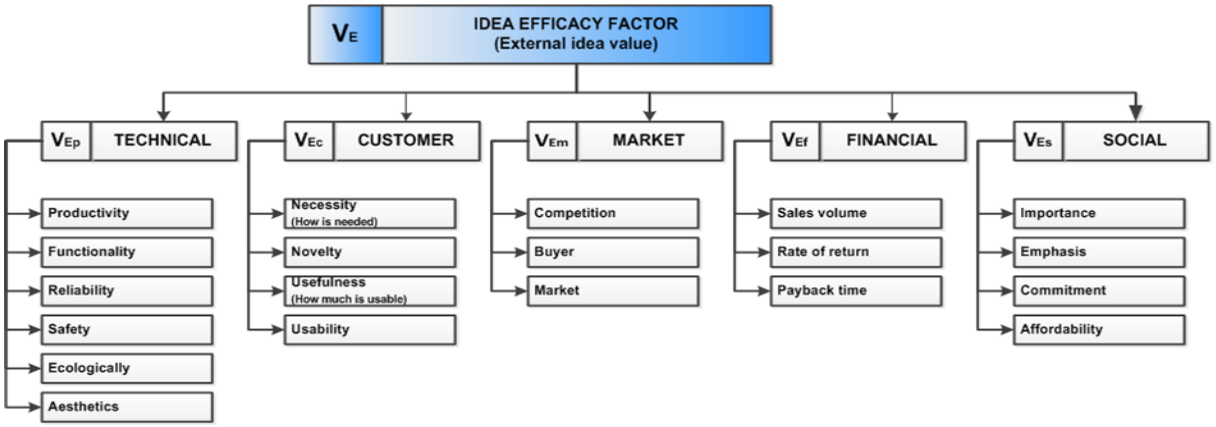


Figure 1. The hierarchy of criteria for assessing ideas efficacy

On the basis of the conducted assessment, each of the ideas becomes described with five new values

$$V_E = V_E\{V_{Ep}, V_{Ec}, V_{Em}, V_{Ef}, V_{Es}\}$$

Determining the value of the success factors of idea VE is carried out according to the following formula:

$$V_E = w_{Ep}V_{Ep} + w_{Ec}V_{Ec} + w_{Em}V_{Em} + w_{Ef}V_{Ef} + w_{Es}V_{Es}$$

Where the following is true:

$w_{Ep}, w_{Ec}, w_{Em}, w_{Ef}, w_{Es}$ Normalized values of importance of each criterion in the set of criteria

$V_{Ep}, V_{Ec}, V_{Em}, V_{Ef}, V_{Es}$ The values of criteria, which are determined as the geometric mean value of corresponding attributes

4 PRACTICAL CASE

During the study, effects of different methods for support multi-attribute decision making were unknown, although it was expected that the application of the method should not be of crucial influence. During the idea selection process, the decision-maker is not aware of a large number of facts from the environment, including the transformation process (design process), and the final state (final product). The number of alternatives, the number and type of criteria, the number of decision makers and the complexity of the procedure are the main features of the complexity of the decision problem. The case of evaluation and selection of ideas is a typical example of multi-attribute decision making (MADM). In MADM a set of ranked alternatives is created from the final set of predefined alternatives described by explicit attributes. A significant factor for the application of certain MADM methods is the possibility of implementation of a sensitivity analysis, which includes an assessment of the potential impact of changes in value of the criteria on the final rank of alternatives. Taking that into account, for the purposes of this study we selected to perform evaluation and selection of ideas using one method of individual assessment of attributes and criteria and one method of comparison in pairs and ranking on the basis of such estimates. For the application of the first mode, we selected the Simple Additive Weighting-SAW (Afshari et al., 2010) method, and for the application of the second mode we chose the Analytical Hierarchy Process-AHP (Saaty, 1980).

4.1 Definition of examples for the implementation of evaluation

Evaluation of the proposed method and the determination of the index of the core values of the idea were carried out on the sample of collected ideas for the development of new functionalities to improve existing products (Stevanovic et al., 2014). Requirements, objectives and constraints have been defined for the product, and the process of idea collection has begun. Students in several groups participated in the idea generation and collection process (the method used being 6-3-5 (brain writing)). We collected a total of 189 ideas which pointed to the possibility of realization of the defined product and/or its parts. After the process of idea gathering, eligibility checks were conducted

according to the following four criteria: strategic, ethical, ecological and general suitability. After the eligibility checks, 62 ideas have been rejected, and 127 ideas have been retained for further evaluation.

Qualitative evaluation of the ideas was performed by describing the features of ideas and the opinion of the assessors about the ideas. It was estimated that some of the ideas need to be improved, while other ideas did not receive a passing grade by the evaluators. Once the qualitative evaluation has been completed, 26 ideas have been retained for quantitative evaluation. In addition, one group of ideas was incomplete, and was referred back to the authors for refinement and improvement. After the qualitative evaluation 11 ideas have been retained for further assessment.

4.2 Evaluation of ideas using the SAW method

Determining the success factors of ideas is carried out by determining factors of importance of each of the defined criteria, and assessment of the value of each idea using the defined metrics. During the evaluation, four assessors estimated the value of the attributes for each of the remaining 11 ideas. A total of 20 attributes were evaluated for five criteria. In the following table (Table 6) the results of the assessment of one of the assessors by SAW methods are shown.

Table 6. Index of Idea Efficacy by applying the SAW method

IDEA EFFICACY FACTOR																											
	Technical value							Market value				Financial value				Customer value					Social value						
Idea / Criteria	Productivity	Functionality	Reliability	Safety	Ecologically	Aesthetics	V_{Ep}	Competition	Buyer	Market	V_{Em}	Sales volume	Rate of return	Payback time	V_{Ef}	Necessity	Novelty	Usefulness	Usability	V_{Ec}	Imprtance	Emphasis	Commitment	Affordability	V_{Es}	V_{E^*}	V_E
Wi	0,30							0,20				0,20				0,20					0,10						
1	5	5	5	5	5	5	5,00	5	5	5	5,00	5	3	3	3,56	5	3	5	5	4,40	5	5	3	5	4,40	4,53	11,6
2	5	3	3	3	5	3	3,56	3	3	5	3,56	5	3	3	3,56	5	3	5	3	3,87	3	3	3	3	3,00	3,56	9,1
3	5	3	3	5	5	3	3,87	1	1	5	1,71	5	3	3	3,56	3	3	1	1	1,73	1	1	1	5	1,50	2,71	6,9
4	5	3	3	3	3	3	3,27	3	3	5	3,56	5	3	3	3,56	3	3	3	3	3,00	3	3	3	3	3,00	3,30	8,4
9	5	7	5	5	5	5	5,29	5	5	5	5,00	5	3	3	3,56	5	5	7	5	5,44	5	5	3	5	4,40	4,83	12,3
13	5	3	3	1	1	3	2,26	3	3	5	3,56	5	3	3	3,56	3	3	3	1	2,28	1	1	1	3	1,32	2,69	6,9
21	5	3	3	1	1	3	2,26	3	3	5	3,56	5	3	3	3,56	3	3	3	1	2,28	1	1	1	3	1,32	2,69	6,9
22	5	3	3	3	3	3	3,27	3	3	5	3,56	5	3	3	3,56	3	3	3	3	3,00	3	1	1	3	1,73	3,18	8,1
23	5	3	3	3	3	3	3,27	3	3	5	3,56	5	3	3	3,56	3	3	3	3	3,00	3	1	1	3	1,73	3,18	8,1
24	3	3	3	3	3	3	3,00	3	3	5	3,56	5	3	3	3,56	3	3	3	3	3,00	3	1	1	3	1,73	3,10	7,9
25	7	7	5	5	7	5	5,92	7	7	5	6,26	5	3	3	3,56	5	5	7	7	5,92	5	5	5	5	5,00	5,42	13,8
																										39,18	100,0

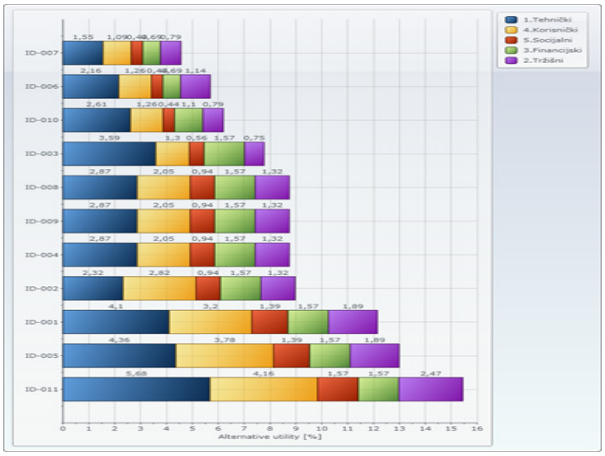
On the basis of assessment of evaluators for each attribute, the value is calculated for each of the criteria. The value of criteria is calculated as the geometric mean of the attribute values from a set of specific criteria. The normalized value of the index is presented in the last column for comparison with other index values of ideas. On the basis of idea ranking a subset of ideas is selected for the implementation of the process of selection of ideas for product development.

4.3 Evaluation of ideas using the AHP method

Evaluation of ideas using the AHP method was carried out with the new four evaluators. The evaluation was conducted using the web version of the MakeITRational software. Below, appraisers, according to their inclinations and their best knowledge determine the importance of each criterion. The appraisers performed the defining of the significance of criteria by comparing them in pairs; the first group did it by determining the value of ideas for each criterion by direct evaluation of the attributes and the second group by comparison in pairs. The results of evaluation are shown in the tables for each of the sets of criteria for which the estimation was done. Table 7 shows the results of idea evaluation by AHP method.

Table 7. Index of idea Efficacy by application of the AHP method (group 1)

Idea / Criteria	TECHNICAL / PRODUCTION	MARKET	FINANCIAL	CUSTOMER	SOCIAL	EFFICACY VALUE
ID-001	10,0	10,4	8,8	10,5	14,9	**10,2**
ID-002	7,3	8,3	5,1	9,3	10,2	**7,6**
ID-003	9,3	4,6	8,8	4,2	5,4	**7,0**
ID-004	8,4	8,3	8,8	6,7	10,2	**8,2**
ID-005	13,5	13,5	12,4	14,6	14,9	**13,6**
ID-006	7,3	8,3	8,8	6,8	4,4	**7,6**
ID-007	5,7	8,3	8,8	6,8	4,4	**7,0**
ID-008	6,4	8,3	8,8	7,9	6,2	**7,6**
ID-009	8,4	6,1	8,8	7,9	6,2	**7,8**
ID-010	7,5	8,3	8,8	7,9	6,2	**7,9**
ID-011	16,2	15,7	12,4	17,3	17,1	**15,6**
	100,0	100,0	100,0	100,0	100,0	**100,0**



5 DISCUSSION

The implementation of the evaluation for the case under consideration, the set of 11 ideas, collected the results of the evaluation of a group of assessors by the SAW method, and the results of the evaluation by two groups of assessors by the AHP method. These results are marked with SAW, AHP1 and AHP2. How the results are correlated was verified by using the Pearson and Spearman coefficient of rank. Calculated correlations are positive and have a value greater than 0.8, which indicates that there is a correlation between the success factors of certain ideas by using the SAW method and application of the AHP method for both groups of assessors and that it is a strong positive correlation. The existence of a strong positive correlation is indicated by the values of efficacy indexes of ideas derived by evaluating the value of the idea (Figure 2.).

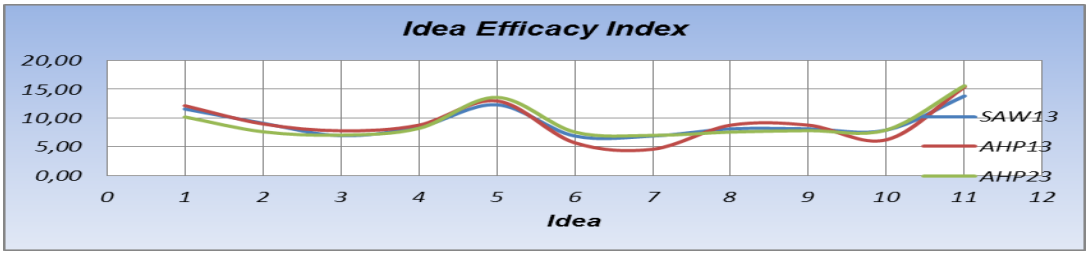


Figure 2. The comparison of the results of the idea Efficacy evaluation

6 CONCLUSION

Approach applied in the study primarily aimed to discuss the phenomenon of ideas selection underlying the concept of future products. By studying the life cycle of ideas in NPD, the processes through which ideas pass were identified. Following the conclusion of the need to assess and evaluate the idea on multiple levels, methods are suggested for assessment and evaluation of ideas, one of which is the assessment of the performance of ideas in achieving the expected effect, as shown in this paper. Quantitative assessment of the success of the idea was carried out on the basis of the proposed criteria, attributes and unique metrics, which provide the ability to communicate between assessors during the evaluation, comparability of the estimated values, and finally an unambiguous set of ranked ideas. Verification of the proposed method showed a high degree of applicability of the multi-attribute method of decision-making and a high degree of correlation of results obtained by different methods. Contrary to expectations, the time required for the implementation of the valuation of ideas, with the support of appropriate software, is not longer than the time that would be spent on an "ad hoc" estimation, which encourages and promotes the practical adaptation and application of the method.

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