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METHODS FOR INNOVATIONS AND MANAGEMENT OF THE INNOVATION PROCESS IN AN ENTERPRISE

Summary: The aim of the paper is to introduce the authors' selection of innovative methods and aspects, that were considered during the selection process. Fact, that demand for innovation and their management lately increases and at the same time knowledge of the methods for innovations management is usually not sufficient, was the main initiative for analysis and selection of innovative methods. When choosing the methods the creativity support and systematic support of each method were considered. The set of thirty-four passported innovative methods including their brief characteristics is the result.

Keywords: innovations, innovation management, enterprise, method, methods' passports.

Introduction

Studying innovation process and its managing led us to the question of choosing the right solution under the contemporary conditions and which method to choose. It resulted in the decision to gather existing methods. During a short time, we gathered more than five thousand various methods and their modifications, which could be usable in the field of solving the questions of innovations in business sphere. We used Czech, as well as foreign sources, in the form of books, journal and internet sources. Our aim was to find original sources or applications, if possible and to gather the information from them. Experiences from leading innovative enterprises were considered.

Gained description varied from very detailed to brief. Very often, the description contained only the main principle of the method. The time of the met-

hods' publishing played an important role in connection with the description. In many cases, the relationship between innovations and its management was not explicitly formulated. On the other side, we found the methods, which referred to innovations and innovation process. Available sources contained also concrete way of using the methods in enterprises with the reporting of the reached results. That is why we decided to choose the methods, that could be implemented in enterprises or could help in the finding innovative solutions, during the process of innovations' management.

The aim of the paper is to introduce the authors' selection of innovative methods and aspects, that were considered during the selection process.

1. Selection of suitable methods

The right selection of the method is one of the main prerequisite for success in the field of solving the innovations' problems. It is obvious, that the frequency of various methods or their variants increases. Apparently, it is associated with ruggedness of problems and disciplines. Orientation in a number of different methods may not be a simple task. Therefore, we were inspired by the ideas of publications having methodological character, that pay attention to methods, their development and applications. J. Mervart [1977], Z. Souček [2005], B.F. Blumberg et al. [2014], P. Gupta and B.E. Trusko [2014] and others should be mentioned.

Notion innovation is very often connected with the questions of creativity, invention, intuition as an expression associated with newness. This fact was regarded and the final methods' selection includes those methods, that focus on gathering real data, data processing, analysis etc. (so-called empirical or experiential methods), and also methods based on human intellect, on ability to bring hypotheses or mental models. These so-called theoretical methods are usually verified by the internal logic reflection and relationship to business and commercial practice. Therefore, these methods should be included in solving problems in the area of innovations.

In addition, we also found so-called intuitive methods. Intuition is often described as immediate, internal investigator's view of innovative task, resulting from investigator's feelings, ideas and existing practice. It is obvious, that purely intuitive methods bring unverified fundamentals. On the other hand, intuition can become the beginning of creative activity as a glimmer of new ideas. It is very important in context with innovations.

Study of innovation process showed, that it is necessary to apply rather a set of methods, according to how the innovative solution progresses. One method is

usually the basis of the other. General procedure for finding innovative solutions could be expressed in the following steps – modified on the basis of source J. Košturiak and J. Chal' [2008]:

1. Introduction to the problem, defining the problem and innovative tasks (project).
2. Measurement – market, customer needs processes, requirements and parameters.
3. Analysis of the problem causes constraints and bottlenecks analysis, critical processes and functions, identification of contradictions.
4. Searching solutions, overcoming contradictions, generating ideas, searching for variations in the properties of innovation, finding analogies and innovative inspiration.
5. Implementation of ideas, solutions testing, pilot projects, prototypes, tests on the market, experiments.
6. Extension of innovation on the market, uptake of innovation in the company, business plans, investment.
7. Implementation of innovation on the market, monitoring and evaluation of innovations and their effects.

In the process of selection of innovative methods the main emphasis is located in creativity and systematizes.

We consider employees as the core of business management. Enterprise processes and also innovations are realized with the help of employees or by employees. The level of novelty, cognition, combining ability, ability to find innovative potential of an enterprise, but also "right" to make a mistakes, that can be implemented in managing activities refers to the level in which method, style or management rules fit in our selection of methods for innovation management. Interconnection of innovation process with business management can be a problem in business practice. That is why we looked for the methods, that could answer the question. These methods should consider among others:

- purpose of using innovative methods – it is necessary to know what and why should be solved, in what relation is the role of innovative solutions to the corporate strategy,
- character of solved innovation problem – selected innovative method must match the problem addressed and the situation in which solution occurs,
- practical feasibility – an innovative method must be feasible using the resources, that are available for the problem solving (workers' skills and resources for the purpose of applying the method, cost and time constraints associated with using a method, solving known/new issues etc.),
- practical use of innovative methods – application of the method should also be effective.

2. File of passported innovative methods

For the presentation of found methods we have decided to use method of passport. Passports of the methods have uniform formal structure (Table 1). Passports contains following data: name of the method, keywords and brief description of the method followed by the main parameters of innovative method – information about possible implementation of the method in terms of the type of innovation, concretely:

- for what kind of change the method is suitable for (in scale: product changes, process changes, marketing changes, organizational changes),
- for what order of innovation problem (respectively difficulty) is the method suitable for (in scale according to F. Valenta [1969; 2001]: rationalizing changes (zero until the second innovative order – symbolically expressed as $I^0 – I^2$), incremental qualitative changes ($I^3 – I^6$), radical qualitative changes ($I^7 – I^9$)).

Another parameter relates to stages in the innovation process, in which the method is used. Stages in the innovation process are divided into:

- phase 1 – Invention creation (ideas searching and creating, research approaches to problems solving, assessment of the needs, market etc., business sieve),
- phase 2 – Innovation creation (preparation of innovation program/innovative project, applied research and development, production),
- phase 3 – Innovations spreading (commercial usage/monetization, another use/innovation transfer/liquidation/resp. recycling).

In a separate passport point conditions and requirements for application of the methods are characterized such as difficulty level of concrete method, the advantages of the method, and the pitfalls of the methods application. It is followed by a comment, which is used for pointing out of some aspects of the method. Passport is finished by the literature references and also additional information for the more detailed study of given method or its application.

Table 1. Structure of innovative method passport

1. Name of the method
2. Key words
3. Brief description

4. The main parameters of innovation method:
  • Nature of the change
  • Order of innovation problem
  • Phase in innovation process

5. Conditions and requirement
6. Comment
7. Sources and literature

The passport file is not large. It includes 34 methods. Table 2 shows the methods names and brief characteristics – see the end of the paper. We knowin-

gly did not include general methods, that relate to managerial decision-making process, planning, organization, management, control. We have not also incorporated herein generally applicable methods of project management, such as methods of network diagrams, critical path, Gantt charts, etc. Table 3 shows sample of concrete passport of the method.

Table 2. List of the passported methods

Number	Methods name	Brief characteristics of the method
1	2	3
1	Analysis of frequency and frequency levels of innovation flow	Analysis of changing of consecutive innovation
2	Analysis of the force field of innovation	Analysis of the driving and braking forces of the innovation field
3	Analysis of innovation life cycle	The course of innovation of a certain quality in time.
4	ARIZ-85C	Contradiction, the algorithm of creative problem solving, technical evolution laws
5	Balanced Scorecard	System of balanced indicators of business performance. Interconnection of strategy and operational management
6	Benchmarking	Comparisons and benchmarking of business performance
7	Bisociation	Linking previously mentally separate dimensions (perspectives)
8	Brainstorming	Group search for the greatest possible number of ideas (without rating)
9	CREAX	Contradiction, self-experience + using other methods of contradictions
10	Delphi method	Anonymous questioning of experts and the search for a consensus of opinion on the issue
11	DIVA	Contradiction, searching for variations in the properties of a product or process
12	Heuristics	Solving problems for which we do not know the algorithm or more accurate method
13	Value analysis	Functional and value view of the problem
14	Inverse value analysis	How differently and better utilize existing function (property) of the object
15	Method of genetic algorithms	Use of the principle of evolutionary algorithm to solve the problem (finding new innovations)
16	Method Ideo	Active and empathic listening to people (customers)
17	Method for measuring innovation potential	Objectified indicators for measuring the critical points in the enterprise
18	Method PAEI	Analysis of four roles in the lifecycle of enterprise.
19	Method of rules for solving complex innovation	A set of rules for managing complex innovation in the enterprise
20	Six hats method	Parallel thinking in six different roles
21	Method of applying the innovative rules (commandments) in the enterprise	Operationalization of innovative recommendations for managing innovation in the enterprise
22	Monitoring social networking and Internet diaries	Systematization and facilitating work with information from electronic networks
23	Morphological analysis	Creating permutations of the basic elements in the search for new innovations
24	Mind map	Graphical mapping of the human thought process during problem solving
25	Risk of the business innovation project	Elimination of negative factors due to dispersion of effects resulting from innovation

table 2 cont.

1	2	3
26	Managing the process of creative thinking	Phase of creative thinking
27	Synectics	Systematic exchange of expert opinions to generate new ideas
28	Rating system of innovation indicators by EU	Standardized set of identifiers for evaluating innovative level of the country
29	System Analysis and Synthesis	Method of solving complex problems – systemic skeleton for working with innovation
30	TRIZ	Contradictions, patents and knowledge base, possible methods for solving technical problems
31	WOIS	A comprehensive system of generation and selection of innovative solutions, evolutionary spiral
32	Classification of innovation by innovation orders	Characteristics for incorporation of solved innovation into certain innovation order
33	Elaboration of innovative characteristics in accordance with the Oslo Manual	Innovative interpretation of data – technical and non-technical innovations
34	Value Stream Mapping	Method of visual mapping the value flow in the product manufacturing from its concept to the hands of the customer

Table 3. Example of elaborated method of passport

1. Name of the method TRIZ (original name in Russian language Těoria rešenia izobretatělskich zadač, author G.S. Altšuller)
2. Key words qualitative innovation, creative problem solving, contradictory elements, ideal results, patents
3. Brief description TRIZ represents a method for creative solutions of difficult problems. The method was based on studying worldwide patents and generalization of successful practices. The method leads a user from unclear problem situation through a detailed analysis of the formulation of innovative task to proposals of possible solutions and their verification. TRIZ is scientifically sophisticated, structured approach to problem solving by creative methods with the aim to find concepts for improving the product or service. By using an analysis of world patent TRIZ describes possible solution concepts and provides inspiration for innovation of specific product. The vast majority of problems, that require solutions usually reflect the need to overcome the dilemma or existing compromise between two contradictory elements. The main purpose is by using the appropriate tools to find superior solutions, that overcome so called compromise solutions to problems. TRIZ basically uses two complementary methods: analytical functionally cost analysis (FNA), a synthetic method in the form of algorithm for solving the inventive tasks (ARIZ). Functionally cost analysis helps to answer the question "what" and "why" has to be improved, respectively innovated. It helps the user to: • find the nature of the problem in a technical system, i.e. product or process, • identify key elements according to performance of functional, problem and cost significance of elements, • choose the correct innovative assignment for the aim in accordance with the trends of development of science and technology, • formulate correctly and concretely innovation assignment: "what" and "why" should be improved in a system. Correct innovative assignment and from them correctly derived innovative tasks are more than half a successful solution. The algorithm for solving the inventive tasks (ARIZ) helps to find answers to many questions of "how" could and should be tasks solved, in accordance with concentrated experiences of generations of inventors in the research process of algorithmic type. Solving tools ARIS help users: • formulate technical and physical contradictions in the innovation assignment and the specific inventive task, • abstract model of the problem and describe the technical function in solving problems, • to find innovative (inventive) ideas of solving the technical contradiction (problem, function) on the basis of recommendations, • evaluate found ideas of solutions by comparison with trends in the development of science and technology, • evaluate found ideas of solutions by comparison with the condition of techniques in a branch.

table 3 cont.

4. The main parameters of innovative method Objective change character: • method is particularly suitable for product and process innovation. Order of innovative problem: • method suitable for marginal qualitative changes (I3 – I6) or radical qualitative changes (I7 – I9). Phases in innovation process: • creation of inventions, entrepreneurial sieve (phase F1), • method suitable for creative search of qualitative innovation (phase F2).
5. Conditions and requirements for application • assumptions for application are seen in very good familiarization with the method and acquiring its methodic, • the method requires knowledge from the field of theory and associated models, requires high level of abstract thinking and training; moreover it requires very good teamwork, • advantage of TRIZ method is offering possibilities for high qualitative changes instead of searching small, conservative changes, • TRIZ method has a software support in the form of knowledge (expert) system Goldfire Innovator. Software supports analytical and also research parts of the TRIZ method. It is also a search of relevant information and even knowledge in electronically available Internet environment (patents, significant information portals, deep web etc.), • The drawbacks of the method: TRIZ is not easily applicable. We recommend using the experiences of those who have already implemented the method in practice or study and use it.
6. Comment The method is still developing the theoretical and practical level in connection with the growing interest of companies in using intellectual knowledge from different fields of human activity. In the last decade, TRIZ has entirely dominant position among the methods of technical support for creative work. Method respects the necessary systemic approach in the phase of analyzing the problem (what to solve in order to reach the settled goal) and leads to correct formulation of assignments (briefly, clearly). In the synthesis phase the method supports necessary creativity of researcher (search for solutions, ideas, concepts of solutions) by recommendations from the sources studying. Forms such as Siemens, General Motors, Procter and Gamble, BMW, Schneider Electric, NASA a many others use this method. Also the Czech enterprises such as Linet spol s r.o. use the method. The method has also been used at VUT in Brno, VSB-TU Ostrava, TU Liberec and ČVUT Prague. The method can be applied in every industry and in every branch of service. TRIZ becomes a universal method of analysis the problem solving, which depends on the particular area of the problem, while relying on specialist knowledge in these areas.

Sources: [Altšuller, 1998; Bielski, 2013; Devojno, 1999; Kassay, 2013; Švejda et al., 2007].

3. Problem of the methods efficiency

Experiences from concrete enterprises showed, that methods that were effective in one situation, can be totally ineffective in other, even similar situation. Business practice shows, that different situation can have a different character, conditions, different resources can be available and situation can be a part of more complex problem.

During the collection process of the innovative methods into the database, we also found the methods, that ultimately preclude the more innovative business efforts. These methods are sometimes referred to as negative methods of innovation management. Briefly, it can be characterized as the methods reliably and systematically destroying innovation activities. They are even able to de-

stroy the entire enterprise. They are often used unwittingly, without the initial intention to make mistakes, damage or liquidate the company. In this context, findings useable for project safety destroying represents an example of negative recommendations from the field of project management [Rosenau, 2000]:

- start an innovation project as soon as possible,
- describe vague and unclear outcomes and assignment,
- a lot of tasks and minimize competence,
- if possible – only informal information,
- all are responsible for everything,
- let „important" people to act,
- as many committees for assessing and improving processes,
- any "reasonable" comment is necessary to integrate.

What can help us to avoid improper use of methods for innovations? It is probably a character of solved innovative problem, especially its factual side, the level of novelty, requirements for solution complexity.

Conclusion

Not each idea, that is produced will lead to desirable effect. Creative activity is the core of innovations. From an innovative idea to its actual implementation, exercisable at the market is doing very arduous and long journey with an unclear outcome in advance. Selection and using suitable methods for seeking and realization of innovative solutions is one of the assumptions for reaching effective business results.

Practitioners, who are able to implement innovations in the business sector, now clearly what needs to be done. In short, it is a few steps, which include:

- generating new ideas, which represents the driving force of innovation,
- selection and acceptance of new ideas, which have to be accepted by corporate culture,
- creation of appropriate infrastructure for implementation of new ideas and removal of barriers to implementation,
- gaining supporters of an innovation project,
- implementation and dissemination of the innovation on a market,
- paying substantial attention to the people in the company.

List of elaborated passports follow a prime research intention – awareness increasing of existing innovative methods. Passport form seemed to be useful from the point of view of standardization in description of the methods and cha-

racteristics associated with innovations. Another possible way of using passport report have appeared. Three of them are as follows:

- transfer of passports in the electronic database system,
- targeted monitoring of suitable innovation methods using in the whole innovation process,
- monitoring of practical usability of the methods.

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Słowa kluczowe: innowacyjność, zarządzanie innowacjami, przedsiębiorstwo, metody, metody rekomendowane.