

THE TASKS OF KNOWLEDGE MANAGEMENT SYSTEM IN THE CONTEXT OF THE RISKS ASSOCIATED WITH THE INNOVATION PROCESSES

Magdalena JURCZYK-BUNKOWSKA

Summary: The purpose of this paper is to understand and describe what type of knowledge is created in the process of innovation in the context of risk management. Indicated the scope of notion: knowledge, knowledge management and knowledge management system. Main risk factors in the innovation process were identified as well as the tasks of knowledge management system in the context of risk management in innovation processes.

Keywords: knowledge management, risk management, knowledge management system, innovation process.

1. Introduction

Many organizations look to knowledge management as a solution to the new challenges of the information age. Feed the processes that spawn the production and integration of new knowledge in human affairs, and innovation with better organizational performance will follow. This advice was given by McElroy, head of Macroinnovations, to agencies wishing to implement successful Knowledge Management (KM) and learning strategies [1]. The research of KM is most often used to lower production cost through knowledge reuse, reduce cycle time and increase quality by sharing best practices, to seize and leverage intellectual capital through capturing more organizational knowledge.

One of the most natural and the most troublesome parts of management is the risk. Risk could be understood as something happening that may have an impact on the achievement of objectives. It includes risk as an opportunity, as well as a threat. Risk can be also defined as measureable uncertainty of outcome, whether positive opportunity or negative impact. So risk is associated with uncertainty. The introduction of efficient knowledge management system is intended to reduce uncertainty. In effect, this enables more effective risk management. Efficient risk management is particularly important in relation to innovation processes because of their uniqueness and creative nature. So, the core competency of the most effective and successful innovators is risk management. For these innovators, whether in new ventures or in a corporate setting, the ability to identify, prioritize, and systematically eliminate risks is what drives innovation forward.

He also described the approach of this kind of managers for risk management not as a safety procedure but as a learning process [2]. The main assumption of this article is that risk management should be formalized activities through innovation process conduction. So, it is necessary to create useful knowledge management system to their needs.

The purpose of this paper is to understand and describe what type of knowledge is created in the process of innovation in the context of risk management. How to systematize the knowledge on the risks in innovation processes? What assumptions should be adopted for knowledge management system in this area? What tasks such system should fulfill?

The first chapter of the article indicates the scope of notion: knowledge, knowledge management and knowledge management system. It also points out some of the factors of success in knowledge management and the proposed approach to create knowledge management system. The second point of the article is concerned with managing the innovation process indicating its main problems. In the third part of the article, main risk factors in the innovation process were identified. The fourth section presents the concept of stored knowledge of risk management in the structure based on extracting the three categories of innovation processes. This section also identifies the tasks of knowledge management system in the context of risk management in innovation processes. In conclusion section, reference is made to the main tasks of knowledge management system and establishes the effects of its use.

2. The issue of innovation process management

Innovation is definitely more than just coming up with good ideas or a single event; it is more of a process of making ideas work in practice and then commercializing them. Importantly this process can be managed. [3]. The innovation process involves three main phases. The first phases of innovation process are often called the fuzzy front end of innovation. The fuzzy front end is defined as the activities taking place before the formal, well structured development process begins. Activities in the front end of innovation process are often unpredictable and unstructured and therefore hard to manage. Nevertheless these activities have a major role in determining which projects to execute and affect strongly on the definitions of quality, costs and time frame of the project. [4]

The next two phases: the development and commercialization are more linear and structured. During the implementation, the high uncertainty of the early stages is gradually replaced with accurate knowledge about technological feasibility, market demand, competition and regulations. Research on all these factors naturally increases costs. Implementation phase can be further divided in three core elements, which are acquiring knowledge resources, executing the project and launching and sustaining innovation.[3]

From a managerial viewpoint, to understand the process of innovation is to understand the factors that facilitate and inhibit the development of innovations. These factors include ideas, people, transactions, and context over time. Associated with each of these four factors are four central problems in the management as follows [5]:

1. *The human problem of managing attention* because people and their organizations are largely designed to focus on, harvest, and protect existing practices rather than pay attention to developing new ideas. The more successful an organization is the more difficult it is to trigger peoples' action thresholds to pay attention to new ideas, needs, and opportunities.
2. *The process problem is managing ideas into good currency* so that innovative ideas are implemented and institutionalized. While the invention or conception of innovative ideas may be an individual activity, innovation (inventing and implementing new ideas) is a collective achievement of pushing and riding those ideas into good currency. The social and political dynamics of innovation become paramount as one addresses the energy and commitment that are needed among coalitions of interest groups to develop an innovation.
3. *The structural problem of managing part-whole relationships*, which emerges from the proliferation of ideas, people and transactions as an innovation develops over time. A common characteristic of the innovation process is that multiple

functions, resources, and disciplines are needed to transform an innovative idea into a concrete reality-so much so that individuals involved in individual transactions lose sight of the whole innovation effort.

4. Finally, the strategic problem is *creating an infrastructure that is conducive to innovation*. One of the elements of this structure should be a system of risk management.

Due to the fact that innovation involves lots of uncertainty (technical, market, social, political etc.) it is a high risk activity. Most of the developed ideas never make it to the market. Still, not to innovate is rarely an option to companies as it would mean certain failure in rapidly changing and fiercely competed environments. Efficient management is needed for innovations to be successful [3]. This also refers to risk management as part of managing the innovation process. Therefore, management of the innovation process should be supported by knowledge management system.

3. Risks factors in the innovation process

The broad definition of risk management indicates that it is a process ‘of understanding the nature of uncertain future events and making positive plans to mitigate them where they present threat or to take advantage of them where they present opportunities’ [6]. This author also points that a methodical approach to risk management enhances the ability of an organization to manage risks at all stages. The importance of systematic approach to risk management also highlights Edwards and Bowen [7] noting that it encourages decision-making inside an organization which is more controlled, more consistent and yet at the same time more flexible’. Very interesting approaches for shaping risk management in innovation process have been proposed by Tsohou et. al [8]. Submit them to the diagram in figure 1. There is no single, appropriate method to identification of risk factors. Can be used for this purpose brainstorming, analysis of documentation, technology questionnaire findings, Ishikawa diagram, etc. There is no possibility to identify all risk factors from the perspective of one part of the organization. This should be implemented within the an interdisciplinary team. It is good to know the different classifications of risk factors and identify them by category.

The level of risk is connected with various factors. Proper indication of the need for innovation is essential to the success of innovation. However, it is also necessary to specify the particular environmental situation and determine the right time for implementation of innovation.

Success will also depend on a market factor. When the company is known at the market and has strong relation with customer and also supplier and buyer, the risk is low. If the company is not at the market but has relations with customer (another product) and

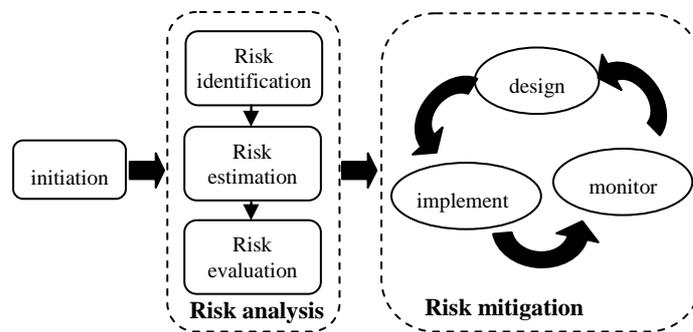


Fig. 1. The risk management stages [8]

suppliers and buyer are in coordination of innovation product, the risk is medium. The high risk will be taken, when the company is not in this market or the similar markets and doesn't have a relation with customer, suppliers and buyers. In addition to market knowledge, other important risk factors are:

- characterization of the recipients of innovation (e.g. the customers targeted by the product),
- involvement of the competitors, their number and position in the market,
- financial capacity of the company,
- experience in implementing innovation.

At the planning stage of innovation the company has the ability to influence which risk factors will be dealt during innovation process with. Task of the KM system is indication of the level of risk in the particular process of innovation and prompting how to manage this kind of risks factors. Plans are developed assuming occurrence of given situation. It is also possible to create alternative plans in case of occurrence of defined risk factors.

4. Knowledge management system

To define a knowledge management system it is first essential to define knowledge and knowledge management. There is no consensus on the nature of knowledge. The knowledge is dynamic by nature; it is created in social interactions among individuals and organizations. One of the knowledge definitions, which is favored by this article is: "Knowledge is the capacity for effective action." [9]. Knowledge can be divided in explicit knowledge, tacit knowledge and self-transcending knowledge (fig. 2). Explicit knowledge is knowledge that can be codified and therefore is relatively easy to communicate, process, store and transfer over the distances. Tacit knowledge means knowledge that is personal and difficult to formalize, making it more difficult to transfer and a more valuable asset. Tacit knowledge can be shared through common experiences, observations and imitation. Self-transcending knowledge is the ability to sense and presence the emerging opportunities. It is defined as "tacit knowledge prior to its embodiment".

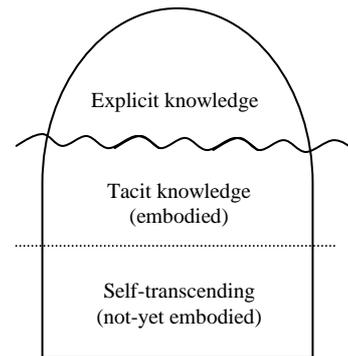


Fig. 2. Forms of knowledge [10]

In order to determine the tasks of knowledge management system in the innovation process it is advised to look at knowledge lifecycle phase from physical, human, and technological point of view (fig. 3). Knowledge itself is not manageable. What is manageable are the processes necessary to encourage the sharing of knowledge and the development of intellectual capital assets. Knowledge Management (KM) refers to a systematic and organizational specific framework to capture, acquire, organize and communicate both tacit and explicit knowledge of employees so that other employees may utilize them to be more effective and productive in their work and maximize the organization's knowledge. [12] The similar definition was presented by Armit Tiwana [13]. Knowledge management's general objective is getting the right information (explicit or tacit one) to the right people at the right time, so they can make the best use of it. In addition, it helps people to create knowledge and share and act upon information in ways that will measurably improve the performance of an organization and its partners.

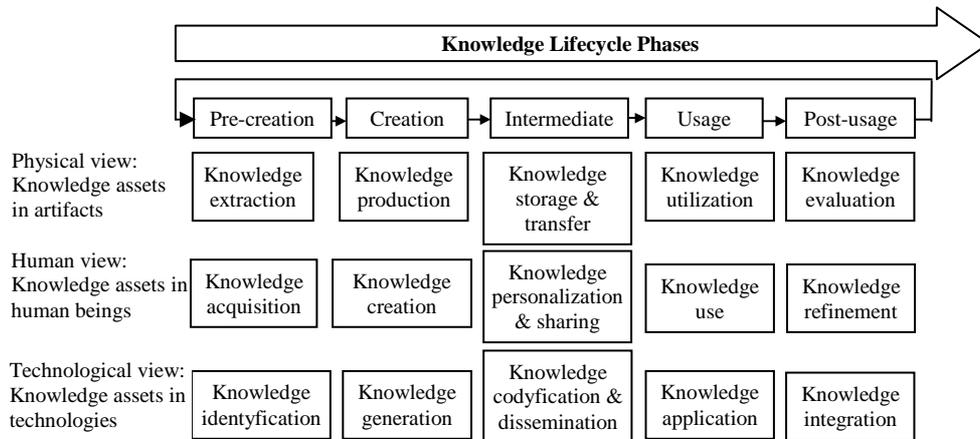


Fig. 3. Knowledge management functions in different stages of the innovation process [11]

KM includes four knowledge processes: knowledge creation, knowledge storage, knowledge distribution, and knowledge application. Another definition highlights that, knowledge management is the leveraging of collective wisdom to increase responsiveness and innovation. [14]. Jeanne Holm, Chief Knowledge Architect at NASA's Jet Propulsion Laboratory, points the most important factors of knowledge management success, fig. 4. She highlights a crucial role of culture referring to the example of Japanese and American approaches to knowledge management. If people are unwilling to share their own knowledge or to use information from others, knowledge management will fail. However, she says that most people want to share what they know, but incentive structures neither reward them for doing so, nor allow them the time to share.

To add value to KM there is a need for Knowledge Management System (KMS), which facilitates the generation, preservation, and sharing of knowledge [16]. Realizing the importance of knowledge as an organizational asset that enables sustainable competitive advantage, many firms are developing KMS designed especially to facilitate the sharing and integration of knowledge, thus making a distinction between data and information.

4.1. Concept of knowledge categorization in risk management of innovation process

The scope of information and knowledge created and used in the processes of innovation are different in each of the three categories of processes.

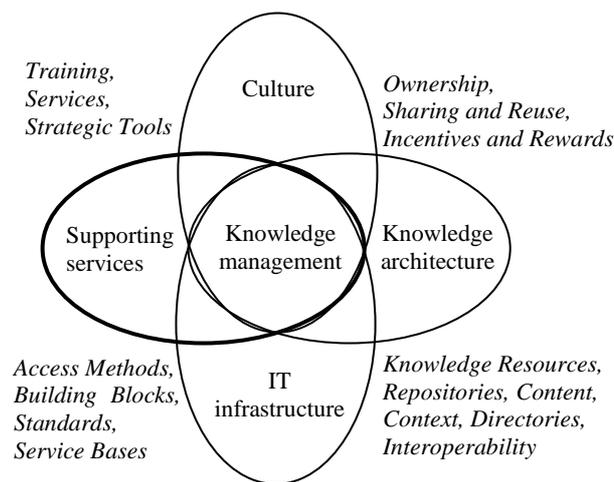


Fig. 4. Knowledge management critical success factors [15]

The way of separating each of this category is discussed in detail in other author's publication [17]. Distinguishes between the following three categories of innovation process:

- innovation of current needs horizon, which is implemented in the short term and focused on a single area of activity,
- innovation of potential development horizon, middle term having an impact on a few associated activities creating a part of process or whole process,
- innovation of creating new business horizon, long term range, which could create new possibilities for whole business e.g. a new product or technology.

Each of these categories is characterized by necessity of different approach to the risk management. It is related to differences between the innovation processes in terms of:

- process scope (e.g.: production system, particular task, single process),
- frequency,
- novelty level,
- the possibility of precision in creating innovation budget,
- similarity to other innovations projects,
- complexity of communications between units,
- risk tolerances,
- risk categories,
- decision making levels,
- changeability of environment.

The process of risk management starts with identification of potential risk. Starting from this stage through all the next steps listed on the top of the cube (figure 5), the methods and tools will differ depending on the category of innovation processes placed on the right side of the cube. Various means are available and these include the use of: risk registers, experience, intuition, analysis of assumptions, analysis of hazards, etc.

Identified risk factors should be quantified to establish their potential impacts on the project basing on risk factor asses and analyze. This should be done objectively and accurately and qualitatively or quantitatively [19] observed that “in most analyses only a few key risks are investigated and it should be easy to see which those risks are”. This observation suggests that major risks should not be ignored at the expense of minor risks. Only a good and effective evaluation can inform the categorization of risks as either major or minor.

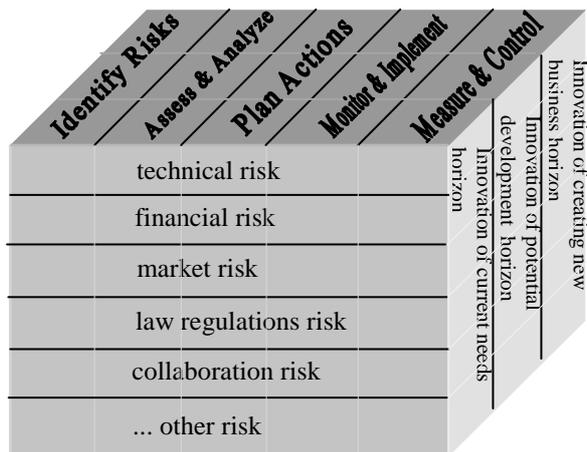


Fig. 5. Framework for knowledge management at the risk of innovation process

4.2. Issue of knowledge management system for risk management in innovation processes

The main requirement of any risk management cracking system is to capture all phases of the life cycle of risk. The task of knowledge management system is to organize information so that people can easily find it, used it and share it. This structure also has to permit acquisition of the relevant knowledge at a given stage of the innovation process and due to the category. This structure also has to permit acquisition of the relevant knowledge due to the stage of innovation process and due to the category of innovation processes. In the context of this article knowledge management system should enable communication and documentation extend throughout all of the functions of risk management at innovation process. The main areas of risk management are presented in fig. 5, on the top of the cube. They provide specific sub-process with their inputs and outputs.

1. Identify risk – problems and opportunities, scope, context and associated risk issues. Inputs are plans of innovation process (with necessary resources) and environmental analysis. Output is a list of risk.
2. Asses and analyze the risk – assessment of key risk, determining degree of exposure, expressed as likelihood and impact, ranking risks with considering risk tolerance. The company should estimate probabilities of events and the impact of their consequence and also prioritize these different risk factors in order to solve them. Innovation process is inherently risky, so company cannot solve all the risks. Inputs could be expert opinion, hazard analysis, technical analysis, experience. Outputs are risk evaluation, classification and prioritization.
3. Plan actions - identifying and analyzing options-ways to minimize threats and maximize opportunities-approaches, tools. Decide what, if anything, should be done about risks.
4. Monitor and implement the action – Observation of the risks during the process of innovation.
5. Measure and control – verification of the effects of actions taken by measuring the parameters of the innovation process or/and observation, incidents evaluation and signalization to the management unit.

It should not be forgotten that access to more information does not innately give people the ability to make better decisions. The information that people have access to needs to be accurate and timely. Someone needs to take responsibility for the content of the information, as well as keeping or putting that content in context.

5. Conclusions

Fear of the risk is often a barrier to take up innovative projects. For this reason, one of the most important tasks of knowledge management system is to decrease concerns to undertake innovative process. Innovative projects in different categories should become everyday life of the companies because due to this the company achieves a stable and significant competitive advantage. It also affects to create the culture of innovation and growth of knowledge in the enterprise. Implementation of the KMS has to improve the efficiency of innovation processes and also avoid knowledge loss and stimulate knowledge grow and creation [20]. The tasks of knowledge management system for the issue of risk management are as follows.

1. Acceleration and objectivity of risk's factors assessment for all categories of innovation process.
2. Ensuring proper concentration to the most important risk factors of particular category of innovation process.
3. An indication of the risk factors which are important at particular stage of the innovation process.
4. Reducing problems associated with failing to take account of relevant and typical risk factors in the category of innovation process. Supporting the identification of key risk factors.
5. Assisting choice regarding the use of appropriate methods and tools in the risk management in innovation process.
6. Determination of the necessary information for proper risk management at the particular stage of the innovation process.
7. Orientation in risk management on long-term goals rather than short-term optimization. E.g. reduction costs in a given stage of the innovation process by the abandonment of some kinds of analysis.
8. Formalization of following decisions in accordance to the strategy of particular company: avoiding risk, obtaining additional information and risk transferring.

Acknowledgement: Author would like to thank Polish government agency: National Science Centre for financial support of this research project (Nr 4025/B/H03/2011/40).

References

1. McElroy M.: Second-Generation KM: A White Paper. Knowledge Management vol. 4(3), 2000.
2. Gilbert C., Eyring M.: Beating the Odds When You Launch a New Venture, Harvard Business Review, May 01, 2010 pp.92-98.
3. Tidd J., Bessant J., Pavitt K.: Managing innovation: Integrating Technological, Market and Organizational Change. John Wiley & Sons, West Sussex, England, 2005.
4. Herstatt C., Verworn B. Nagahira, A.: Reducing project related uncertainty in the "fuzzy front end" of innovation – A Comparison of German and Japanese product innovation projects. International Journal of Product Development vol. 1/ 1, 2004, pp.43-65.
5. Van de Ven, A.: Central problems in the management of innovation. Management Science, 32 (5), 1986, pp. 590-607.
6. Taplin, R.: Risk Management and Innovation in Japan. Britain and the United States. Routledge, UK, 2005.
7. Edwards, P. J., Bowen, P. A. (2005). *Risk Management in Project Organization*. University of New South Wales Press Ltd. Australia.
8. Tsohou A., Karyda M., Kokolakis S., Kiountouzis E.: Formulating information systems risk management strategies through cultural theory, Information Management & Computer Security, Vol. 14 / 3, 2006, pp.198 – 217
9. Argyris C.: Knowledge for Action. CA: Jossey-Bass, San Francisco 1993.
10. Scharmer C.: Self-transcending knowledge: sensing and organizing around emerging opportunities. Journal of Knowledge Management vol. 5/2, 2001, pp. 137-150.

11. Xu J., Houssin R., Caillaud E., Gardoni M.: Macro process of knowledge management for continuous innovation. *Journal of Knowledge Management*, Vol. 14/ 4, 2010, pp.573 – 591.
12. Alavi M., Leidner D. E.: Review: Knowledge Management and Knowledge Management Systems: Conceptual Foundations and Research Issues. *MIS Quarterly* vol. 25/ 1, March 2001, pp. 107–136.
13. Tiwana A.: *The Knowledge Management Toolkit: Orchestrating IT, Strategy and Knowledge Platforms*. Prentice Hall, 2002.
14. Frappaolo C.: Implicit knowledge. *Knowledge Management Research & Practice*, Volume 6/ 1, March 2008 , pp. 23-25
15. Holm J., Olla P., Moura D., Warhaut M.: Creating architectural approaches to knowledge management: an example from the space industry. *Journal of Knowledge Management*, Vol. 10/ 2, 2006, pp.36 – 51.
16. Duke S., Makey P., Kiras N.: *Knowledge Management (Report Series)*. Vol. 1, Butler Group, Hull, UK, 1999.
17. Jurczyk-Bunkowska M.: Concept of managing front end phase of innovation process. *Management and Production Engineering Review*. Vol.2, No. 1, March 2011, pp.19-26.
18. Jurczyk-Bunkowska M., Jungowski K.: Solutions for innovation management system: approach based on Theory of Constraints. *Proceedings of the 12th International CINet Conference: Doing More with Less*. Aarhus, Denmark, September 2011, pp. 425 – 435.
19. Smith N.J., Merna T., Jobling P.: *Managing risk in construction projects*. Blackwell, Oxford 2006.
20. Jurczyk-Bunkowska M., Jungowski K.: Perspectives of knowledge management system application in innovation processes. *A Study based on Experience of Polish IT Company*. *Proceedings of the International Conference on Knowledge Management and Information Sharing*, Paris, France 26 - 29 October, 2011 SciTePress – Science and Technology Publications, ed. Joaquim Filipe and Kecheng Liu, pp. 287-293.

PhD. Magdalena JURCZYK-BUNKOWSKA
 Institute of Processes and Products Innovation
 Faculty of Production Engineering and Logistics
 Opole University of Technology
 45-370 Opole, Ozimska 75
 tel./fax.: +48 77 423 40 44
 e-mail: m.jurczyk@po.opole.pl