CONCEPT OF MANAGING FRONT END PHASE OF INNOVATION PROCESS

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Abstract
The paper is concerned with the management of front end phase of the innovation process. The most common models are presented here. Attention is paid to the characteristics that determine the management of this phase of the innovation process. A system assisting management in this area is proposed. This system relates to a wide range of innovations including any policy, structure, method or process, or any product or market opportunity that is perceived as ‘new’. The factors that determine the methods and tools which are used are pointed out. The need of using various approaches in management according to the duration and scope of innovation is indicated. The summary implies directions for further research.

Keywords
innovation management, innovation process, front end phase of innovation, model, classification.

Introduction

Innovation is an important force in creating and sustaining organizational growth. Schumpeter associated innovation with economic development [1]. He defined it as a new combination of productive resources. Since then, the concept of innovation has changed. Nowadays, the most popular definitions of innovations cover an aspect stressing that innovation comes from a process. This chain of activities starts with invention through development, production, market introduction, and finally ending with commercial success. Rogers gives the following definition of innovation: “An innovation is an idea, practice, or project that is perceived as new by an individual or other unit of adoption” [2]. The sense of this definition is to define a concept as ‘new’ from the point of view of the unit that deals with innovation. Innovation in this research is presented from this viewpoint. Second aspect of the definitions of innovation is market success. The term ‘market’ can refer to internal or external markets. In the case of internal markets, the innovation concern to e.g. production control, quality assurance, improving productivity. External market adopts innovation as a new product.

Innovations are developed on the way of innovation process. This article showed this process according to the following definition: “The innovation process refers to the set of organizational activities that aim at resulting in the innovation. It consists of three different phases: front end, development project and commercialization” [3].

This paper presents preliminary research that forms a prelude to a larger whole. This refers to issues related to the first phase of the innovation process, called ‘front end’ or ‘phase 0’. The most of key elements of the future innovation are defined during the front end phase. For example, these are quality, cost and timing. It gives a reason for engaging in this phase. Effort for the entire innovation process could be extremely high. Empirical study [4] showed that “the greatest differences between winners and losers were found in the quality of execution of pre-
development activities”. They indicate that two factors have a great role in product success: the quality of executing the pre-development activities, and a well defined product and project prior to the development phase. Next, the studies of Koen et al. [3] identified the front end as the key-contributing factor for large numbers of really new products introduced each year. Second reason of choosing front end phase as a key for was research [5], which shows:

- new product development is well structured and controlled, but
- early concept and design (i.e. front end of innovation process) is unstructured and uncontrolled.

There are various methods, tools and ‘good practices’ that are familiar and used in front-end phase of an innovation process. They are discussed on the basis of examples of different innovation processes implemented in various kinds of enterprises. They are referred by to authors of business or research publications. However, they do not specify the conditions and configurations for applying them for an innovation to succeed. The issue in question concerns the direction of research on the management of innovation processes. Their goal is to define sets of rules, tools and methods, creating a management system specific for this phase of the innovation process. It could be used in practice by managers and supported by appropriate computer applications. In this manner, routine analysis could be carried out continuously. It could lead to an increase in the innovativeness of an enterprise.

The thesis of this article is follows:

It is possible to identify classes of innovation process, for which a given set of methods and management tools will be adequate. The word ‘adequate’ means one that will enable one to take a correct decision regarding implementation of innovation and securing availability of adequate resources to implement innovation.

The major objective of this paper is answering the questions:

- What factors influence on managing ‘front end’ phase of innovation process?
- Is it possible to identify the class of innovation processes for which the approach will be similar?

The paper is organized as follows: first, front end phase of innovation process with specific elements is presented. Second, the aim of innovation management is discussed and determinants of its success are described. Third, the factor affecting management approach is indicated. Finally, the last section concludes the conclusions and directions of the future research.

Front end phase of innovation process

New product concepts either incremental or radical are created at the front-end phase. The term “fuzzy front end” was first introduced in 1985 and it captured wider attention in the early 1990s. The definition emphasized the uncertain and chaotic nature of the early part of the innovation process. Zhang and Doll state that this uncertainty or “fuzziness” in the front end emerges from unclear customer requirements, unproven and changing technologies, and an unpredictable, business environment [6]. Buckler stresses that the front end phase requires a different management culture and approach compared to the other phases of the innovation process, i.e. the development project or the commercialization phase [7]. P. Koen et al. [3] argue that because of the different nature of these phases, many of the management practices and activities applicable for the development project phase are inappropriate for the front end phase. It is therefore reasonable to develop a model or a systematic approach to effectively manage the front end of innovation. This kind of solution is undertaken. Figure 1 shows one of the most well known models, the so called “stage-gate-process”.

![Fig. 1. Stage-Gate Model by Cooper [8].](image-url)
folio strategy formulation, which are typically assigned to strategic management.

Khurana and Rosenthal’s model and Cooper’s stage-gate process model, are a useful approach to visualize and structure front end activities, reduce the fuzziness, and ease communication. Lack of flexibility due to the sequential approach of the process models has often criticized.

Empirical studies [11] show that firms using a well-executed “stage-gate” process are more successful than firms without a systematic approach and a gate-driven system. But closer observation shows that the “stage-gate” approach has (only) proven helpful in the case of incremental innovation. And for innovations with a high market and/or technical uncertainty a sequential and formalized approach might be even counterproductive.

In summary, a formal approach to the front end phase is needed. The proposed linear models have proved useful in practice. Companies do not have major problems with their implementation. As result of this, they gain the profits from breakthrough products on the external market. In addition, we need to consider whether all the processes of innovation are implemented identically. Is the phases of their implementation are similar? Is new product development process dependent on factors such as: industry or company’s size? Would it be justified to include them in the model of the front end?

Specific of innovation management at front end phase

The front end of innovation has a very strategic nature and needs more attention from management. Generally, innovation management is the management of all activities involved in the process from idea generation to its successful commercial and practical application, named innovation [12].

The majority of failures are due to some weakness in the way the innovation process is managed. It depend upon two key ingredients technical resources (people, equipment, knowledge, money, etc.) and capabilities in the organization to manage them [13]. P. Koen says that the cause of failure of innovation is that ‘we base our innovation management decisions on a lot of things other than facts!’ [14]. It is therefore legitimate to seek a complex system of tools that can aid manager in decision-making process of the front end phase. Base of this system should be proper information analysis, and not what others seem to be doing or what senior leaders have done and believe has worked in the past.

The authors of the models showed in literature indicate eight following activities front end innovation process phase:

- opportunity identification,
• idea generation,
• idea screening and selection,
• concept development,
• concept testing,
• customer need assessment,
• technology verification,
• business analysis.

The result of this phase should be a well-defined product concept, clear development requirements and a business plan aligned with the corporate strategy [15]. In addition, the front-end phase should produce a formal project plan including resource needs, schedule and budget estimates, and a decision on how the product concept will be developed further [10]. Management of this phase will be focused on proper implementation of these tasks and their coordination.

Based on studies in ‘laboratory of practice’ Bessant and Tidd determine four cores themes emerge which are critical if we want to succeed in managing innovation [16].

• Understand what we are trying to manage – the better our mental models the more likely what do with them in the way of building and running organizations and processes will work.
• Understand the how – creating the conditions (and adapting/configuring them) to make it happen.
• Understand the what, why and when of innovation activity – strategy shaping the innovation work that we do.
• Understand that it is a moving target – managing innovation is about building a dynamic capability.

Innovation management in companies draws on their own experience and traditions. Empirical analysis shows that Polish enterprises do not treat innovativeness as a continuous process. Therefore it can be heard that there is no need to elaborate special methods and techniques for innovation management and to use well-known and checked tools for project management. It is possible during the stage of progress and new product development, however not possible in the earlier fragments of innovation process. All the problems with the use of project management techniques are generally caused by the high risk rate, uncertainty, and big variability of innovation process. It should be mentioned in more details about:

• experimental character of the work, which is often chaotic at the beginning,
• lack of possibility to estimate the finishing and beginning of certain phases of the process,
• lack of closed budget and estimations concerning the innovation rate of profit,
• team of workers which is variable and undefined before the beginning of the process,
• lack of clear directions followed by the lack of clearly defined responsibility.

Proposed approach to management front end phase of innovation process

Nohria and Gulati [17] defined innovation to include any policy, structure, method or process, or any product or market opportunity that the manager of an innovating unit perceives to be new. Similar definition in the context of scope is given by Damapour [18]: “the generation, development, and adaptation of novel ideas on the part of the firm”, and another [19]: “any idea, practice, or material artifact perceived to be new by the relevant unit of adoption”. In this way, innovation is understood in this article. It has a wider scope than just a new product. Innovation is considered here rather as an element of organization development. Every innovation becomes as a result of process. Therefore, front end appears not only in relation to portfolio management. This is one element of this concept, which differ her from the standard range of ‘front end’ research.

Innovations are here understood as the foundation for continuous development of enterprises. Their directions are generally determined by the market situation. This may be an increase in revenues and expansion on other markets by introducing new products. It may also be a cost system reduction for example by increasing productivity or enhancing technology. It is clearly defined by the company’s strategy. All innovations have to be consistent with this direction. This applies to minor improvements in particular activities and to the projects that involve reorganization of whole process and to the solutions which are important for the entire system of the organization. Assumption was adopted that an appropriate innovation is one that leads to the implementation of a company strategy no matter what scope of business processes is contained in the context of whole system.

Innovative projects can be very diverse. This is indicated by the very definition of ‘innovation’ presented at the beginning of this paper. Therefore, various classifications of innovation have been proposed. There are technological innovations (product and process) and non-technological (organizational and market). The level of “novelty” is another problem relating to the notion of “innovation”. In this case, in order to systematize, it is accepted to distinguish radical and incremental innovation [20] as well as disruptive and sustaining innovation [21]. However, none of these classifications is appropriate for the development of the manage-
ment system of the front end phase of the innovation process.

As indicated by observations, one has to adopt different means for the analysis of opportunities and effects of applying new technologies in distribution while other ones have to be taken on for investigations of applying innovative means for manipulation of materials in a warehouse. Consequently, a decision will base on different determinants when a change concerns the implementation of a new manufacturing technology than with regard to the introduction of a new machine tool.

Differences in the management of these innovative projects will concern:
- analysis of innovation opportunity including examination of the background,
- determination of the implementation time,
- approach, which is used in the search for possible solutions to the problem,
- estimation of the cost and return on investment,
- risk management,
- creation of project teams.

G. Moore, observed and described the change in the approach to the management with regard to innovation horizon [22]. He used this idea to market launch phase of innovation process. Based on his concept, duration and scope of impact of the project on a company system is proposed as the factor which differentiates approach to the management of the front end phase. This classification is similar to the one used by G. Moore, but not identical. In this way, three classes of innovative processes in every organization are identified, Fig. 4:
- innovation of current needs horizon, which is implemented in the short term (funded from current budget) and focused on a single area of activity,
- innovation of potential development horizon, middle term (covering 2 or 3 budget periods) 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 (associated with strategic financial decisions), which could create new possibilities for whole business e.g. a new product or technology.

The identification of innovation categories enables on to select an appropriate set of tools to apply to them. They will serve in acquiring ideas and assisting in the decision making process. Models, which are shown in point 2 relate to the innovation in the meaning of new products. The approach proposed in this paper has been therefore modified. Innovation is understood within a broader perspective. It will require additions or changes to the model of front end phase of the innovation process. The most important is that the link between each innovation project and the strategy of a company has been included.

Fig. 4. Categories of innovation in relation to the duration and impact on elements of the production system.
Booz & Hamilton [23] reported that for every seven projects at the idea stage, only one becomes a success. There are many other studies that reflect this number. The conclusion is that the energy spent on innovation needs to be tightly focused. Those ideas that have the highest potential are quickly identified to give them a greater likelihood of success.

Further research will focus on the development of a management system for the front end phase of an innovation process. It will relate to the broader concept of innovation as an element of a company growth. A change in the approach during the same stages of a process for selected innovation classes will be considered. The purpose of creating this system is to ensure continuity and regularity in the development of the business through innovation. Uses of appropriate tools in individual classes of innovative processes increase the effectiveness of their implementation. An improvement of outcomes relative to inputs is meant by this.

Similar classifications of innovative projects

Similarity of the classification presented in this chapter, involves relation to the scope, level and duration of innovation projects. The main difference is the perspective of this division: from the outside vs. from inside the organization. This is justified due to the fact that assumed classifications will be used in further research. Other differences lie in the detail of reference to the characteristic parameters of the each category. They arise from the main distinction. Similar but not identical, classification used by Stjernholm in studies of innovative projects [24]. The projects were categorized in the following categories:

1. Lifecycle management of existing products
2. New feature sets /radical improvements
3. New-to-the-world product categories

His findings indicate differences in risk for different categories of projects. Only 7 category 1 projects were terminated, 12 category 2 and 22 category 3 projects. The studies also indicate: the number of ongoing device development projects year after year, split between the 3 categories, the number of projects initiated per year between 1980 a 2008 year. They show a correlation between the number of projects in each category.

Classification of innovation proposed by Kathryn A. Baker [25] is constructed in a similar way. She introduced the notion of ‘levels of innovation’ to clearly differentiate between newness and impact. In terms of impact, the effect of an innovation can range from: (1) contributing to fairly small improvements to products or to the way things are done, (2) causing a fundamental transformation in the resulting products or services and/or the process technology of an entire industry, or (3) transforming the market place and/or the economy as a whole.

This division applies to innovation perceived through the prism of the entire economy. In the next part of this publication innovative capacity on the individual level, project level, organizational level and environmental level are examined.

John Cleveland, author of ‘A framework for manufacturing innovation’ [26] notes that innovations can be differentiated by the breadth of their scope. Innovations can range everywhere from a significant improvement in a business process, to a radical redesign of the company’s entire business model. As the scope of the innovation increases, the level of complexity and risk associated with it also increases. It is crucial to emphasis the importance of distinctions presented in this paper because innovations are not just products and technology. Innovation needs to be understood in a broad context – it is about innovation in all aspects of the business, including processes, services, methods, management practices, strategy and business design, not just products and technology. The “innovation continuum” runs from incremental process improvements to radically new business designs. Each company needs to make choices about how much resources it will focus on which part of the continuum. This is consistent with the idea of applying a different approach to the management of different categories of innovation projects. It needs to be mentioned that the categories are derived from the perspective of the particular company so that each organization could decide to allocate their resources between the three categories of projects. This conception should be the base for building management system innovation in the enterprise. Classifications presented in this chapter create merely a framework for more general considerations.

Conclusions

Presented in the article the concept of the front end managing is based on the extracting of three categories of innovative projects. It is the basis for further research on the innovation management system. The idea is to select the right tools to manage the specified class of problems. This article refers to implementation of certain tasks in the front end phase of innovation.

It represents the beginning of the innovation process, which has the most significant effect on
the final result. The word 'appropriate' in relation to the management tools and methods, shall mean the one that allows to make the right decisions with the lowest expenditures. In the case of innovative projects which are characterized by a high level of uncertainty is primarily associated with the acquisition of relevant knowledge and information. Therefore a rationalization of approach is proposed. It consists of using a variety of management tools available and methods that will allow to decide on the basis of a significant facts in a given perspective. It helps to avoid applying excessively expensive solutions to meet the requirements. The way to achieve this is to view the innovative projects in the enterprise through the prism of shown classification.

The main goal of front end is to ensure that decisions and choices serve the best interests of the company and fulfill its long-term strategic objectives. A guideline, which has showed in many articles are too general to ensure an efficient link between strategies and operative activities in the context of 'front end' management. Approach for making decisions on this level has to be more systematic for practical use.

On the basis of research a thesis for further work has been formulated. Selection of appropriate methods, tools and management procedures depends on the nature (classes) of innovation. Classification of innovation for the front end management system should be based on the criterion of the duration and the impact on the enterprise system. This approach enables one to apply adequate tools and methods for obtaining and analyzing information. It also facilitates the proper of knowledge management and ensuring appropriate resources in a given innovation process.

Conclusions which lead to research based on this thesis are as follows:

- Elements and critical decision points in the front end and define information have to be identified together with necessary decision criteria, thus ensuring that innovation becomes more controllable and managed.
- Methods and tools, which used in every kind of innovation process, have to be properly chosen in the context of amount of information needed and already available. Different methods and tools require different kinds of input information to gather results.
- Front end is cross-functional process, so they need unique competences and special kind of leader's skills. Furthermore, the management of process realized by several functional units requires a formalization of procedures.
- Defining the purpose of business development from various perspectives will enable their hierarchical subordination to a strategy.
- Isolating innovation classes allows rational organization of innovative processes in terms of their cost structure.
- During the front end of innovation process information is gathered to reduce uncertainty. Adopted classification of innovation can provide to obtain information adequate to the needs.
- The possible creation of software management front end phase of innovation processes will offer a step towards the effective support of managerial decisions in the field of innovation management.

References


