



Empirical Analysis of Knowledge-Generation Strategies in the Real Sector of the Economy

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ABSTRACT

The aim of the research is to develop theory and practice of strategic planning in the field of knowledge generation as competitiveness factors of economic entities. During the research the following hypotheses were tested: 1) Sort of knowledge-generation strategy is also defined by the variety of changed resource and generated knowledge; 2) There is a correlation between the structure of costs for different types of knowledge and the quantity of new products made by the company; 3) There is a correlation between the structure of expenditures on different types of knowledge and profit growth due to new knowledge. This study focuses on the analysis of microdata (enterprise level) as the key instrument to reveal facts and hypotheses describing the innovation activities depending on the variety changed resource, the quantity of new products made by the company, structure of costs for different types of knowledge, profit growth. The authors prove that effective, innovative company development, particularly in the difficult economic condition, stresses the importance of organizing optimal cost structure for different types of knowledge.

1. INTRODUCTION

In the age of post-industrial society, the importance of knowledge factor as the source of company development demonstrates rapid growth. Knowledge becomes the strategic resource for improving the competitiveness of economic agents, and its generation makes an organically zero production cycle preceding the creation of almost every product. Therefore, one of the knowledge management tasks is to form knowledge generation strategy that transforms intellectual resources into higher productivity and efficacy, new cost and improved competitiveness. Thus, the aim of the paper is to develop theory and practice of strategic planning in the field of knowledge generation as competitiveness factors of economic entities.

Sustainable and high economic growth rates, as well as improved positions in the world labor differentiation process, do hinge on the availability of efficient mechanisms for continuous replenishment of knowledge and integration of scientific achievements in high-tech products

and services. As far as Russia is concerned, the pressing need for researching problems of the innovation process stems both from obvious the external challenges and the complex of domestic factors. Despite years of growth, as shown by many indicators reflecting the level and prospects of its economy, Russia has failed to develop an efficient National Innovation System (see (Gokhberg & Roud, 2012) for discussion). Moreover, the industry's structural misbalances and technological lags, fragmented institutional links, and low output of the science sector make Russia's standing extremely vulnerable and unsound from a global perspective and due to the world crisis, the gap is even likely to grow. In fact, most Russian companies have failed to acquire solid strategic interest to generating and implementing innovations, be it R&D or experimenting or acquisition of new technologies and IP rights. Stifled by legal, administrative, financial and other limitations, organizations and enterprises often use innovation behavior models and strategies that are unproductive in generating new knowledge.

2. KNOWLEDGE GENERATE STRATEGIES: CONCEPTUAL FRAMEWORK

Three main directions devoted to research of innovative firms' behavior are allocated in scientific, economic literature. *The first direction* develops within a neoclassical economic paradigm and investigates a variety of questions the most important of which went back to Schumpeter (1947): "What is the market structure that maximizes innovation", or: "Is competition conducive to technical advance?" The group's main research directions are the following: search of interrelation between structure of the market and size R&D (Loury, 1979; Lee & Wilde, 1980; Sah & Stiglitz, 1987; Delbono & Denicolo, 1991; García-Manjón & Romero-Merino, 2012); justification of factors of the firms which are promoting/interfering network interactions at R&D realization (Dasgupta & Maskin, 1987; Harison & Koski, 2009; Dahlander & Gann, 2010; Ferrary, 2011); identification of incentives to knowledge generation of firms, as already functioning (including monopolists), and again created (Arrow, 1962; Reinganum, 1983; Teece, 2010; Fastel, 2014).

Research object of scientists of the second direction (founded on the principles of an evolutionary paradigm) is innovation life cycle and separate stages of the innovative process (cumulative innovation). The cumulative innovation literature discussed here emphasized the technological dependency between stages – while allowing greater strategic independence (the set of firms participating in different stages were often completely unrelated) (Scotchmer, 1991; Denicolo, 2000; O'Donoghue et al, 1998; Bessen & Maskin, 2006; Hunt, 2004).

The third direction that investigates the innovative behavior of firms is various classifications of knowledge generation strategies. Academic literature usually separates competitive strategies based on knowledge and knowledge management strategy.

Strategies based on knowledge are types of strategies aimed at searching the most effective input of knowledge resource into action according to the main objectives and considering a market situation. A strategy based on knowledge is more concentrated on forming and using competitive advantages based on knowledge rather than on approaches to knowledge management and a introduction of knowledge management systems. [Saito et al., 2007.].

One of the attempts to systematize strategies based on knowledge is made by K. Sveiby (Sveiby, 2001). K. Sveiby suggests seven basic strategies three of which are aimed at developing human, organizational and relations assets; three others are human and organizational assets, human assets, relations assets. Seventh strategy is oriented towards the simultaneous development of all three types of intellectual assets (human, organizational and relations assets).

Knowledge management strategies are functional strategies that act as resource programs for providing basic strategies. They include a set of events and programs for the functioning of spheres and branches within the knowledge management system, a certain set of procedures, technologies and practices used in relation of company knowledge.

There are several types of typologies of knowledge management strategies presented in the academic literature. In most cases the following characteristics are used for classification of knowledge management strategies:

- *The use of own or borrowed knowledge* that is the balance between knowledge generated inside (knowledge generation) and outside the company (purchase, copying, and so on). When a firm is oriented towards inside knowledge generation, it can create own competitive advantages whereas introduction of outside knowledge makes a company more modern, stable and opens new perspectives. Therefore, it is possible to find an optimal combination of external and internal knowledge (Grant, 1996.).
- *The degree of changes made in company knowledge* (radical and increment). Radical training can require huge financial costs and bears higher risk but can lead to significant positive changes. Increment training also has advantages – continuous increase of knowledge is less risky, does not break organizational culture and routine, uses already existing knowledge resources (March, 1991).
- *The speed of implementing and spreading new knowledge in the company*. Companies are different regarding how learning and applying new knowledge are for them. This characteristic is partly related to the type of knowledge used by the company: own or borrowed. Own knowledge is typically quicker to apply and borrowed takes more time to implement. There are several reasons for that: a) there might be few (or none) supporters of borrowed knowledge inside the company; b) external knowledge is more to interpret and understand; c) strong the not invented here syndrome (Bierly & Chakrabarti, 1996).
- *Broad knowledge database*. The size of company's knowledge database depends on many factors, including the limitations of company resources allocated for knowledge increase. If these resources are limited, the company focuses on a narrow field in which it tries to gain competitive advantage (Hamel & Prahalad, 1994).

Knowledge-generation strategy can be considered a part of knowledge management strategy.

Knowledge-generation strategy is a combination of organizational activities and management approaches aimed at increasing competitiveness using new knowledge in company's activities.

In their previous papers, authors suggested the typology of increase knowledge strategies formulated within the framework of institutional and evolutionary paradigm. The typology is based on two principles: degree of formalization and knowledge lifecycle phase [Vlasov & Panikarova, 2015]. Suggested typology includes several strategies of new knowledge management in the companies:

- *Borrowed knowledge strategy*. The company uses formalized (evident) knowledge bought at information market on a legal (or illegal) basis.
- *Copied knowledge strategy*. This strategy is used when a company wishes to achieve the same result of using resources as its competitors. An attempt to copy existing results can be done by the company itself or with the help of consulting companies (which is more often the case).
- *Knowledge imitation strategy* has a lot in common with the previous strategy, but the vital difference is that an attempt to copy existing results leads to creating a new product (technology) with close qualitative characteristics.
- *Knowledge generation strategy*. The most difficult strategy to implement. It requires institutionalization of knowledge generation in the company and work with hidden (tacit) knowledge.

Depending on the depth of changes made in the technological process new knowledge of the firm can be subdivided into operational, structural and functional (Valenta, 1985).

Operational knowledge appears as a result of simple changes characterized by small material costs, no risk of implementing the change and, accordingly, minor change of income. In the process of creating operational knowledge, initial system characteristics do not change. Such knowledge appears as a result of the operational reaction to the change of external environment. The process of production operational knowledge leads to changes mainly in informational resources, basic information about markets, competitors, partners, spread channels, and so on.

Structural knowledge leads to deeper changes in the processes and are accompanied by more extensive material investments, a presence of risks that on the one hand can incur losses, but on the other might increase profit level of the company actions. Generation of such knowledge facilitates changes in organizational and structural resources of the economic entity; that is a combination of collective knowledge of personnel, organizational structure and culture, and so on.

Functional knowledge facilitates changes in the functional characteristics of the system or its parts, changes its functional principle and is characterized by significant financial investments, high implementation risks and a chance of obtaining high profit. Such knowledge leads to the change of technological processes; that is infrastructural resources (technologies and processes, ways and methods of production, and so on).

Analysis of academic literature has allowed authors to conclude that though there are several types of research on the process of a forming strategy of knowledge generation and increase nowadays there is no overall systematic concept of strategic management of creating new knowledge in the real economic sector or in the branch and territorial spheres.

This work was aimed at obtaining more detailed information on peculiar features of knowledge-generation strategies in the real sector of the Russian economy and clarification of certain results of the previous analysis.

During the research the following hypotheses were tested:

- Sort of knowledge-generation strategy is also defined by the variety of changed resource and generated knowledge.
- There is a correlation between the structure of costs for different types of knowledge and the quantity of new products made by the company.
- There is a correlation between the structure of expenditures on different types of knowledge and profit growth due to new knowledge.

3. METHODOLOGY

Research project consisted of three stages.

Firstly, authors formed the stratified random sampling by way of stratification of the parent population (the enterprise of the manufacturing industry of Sverdlovsk region with a more than 100 employees). Selection criteria included "criteria of existence" of innovation costs. The list of companies whose innovative programs were chosen for further analysis consisted of 102 enterprises, from six industries (56 enterprises of mechanical engineering, 15 – a metallurgical complex, 9 – chemical industry, 9 – productions of construction materials, 3 – light industry, 10 – the food-processing industry).

The second stage, to identify the pattern of increase knowledge process and formulating recommendations in the field of strategic planning of knowledge increase, a series of focus group interviews with executives was carried out.

During the session with focus groups the following aspects were discussed:

- Which strategies of new knowledge management are most commonly used by the company in case of a) market research; b) organizational structure change, c) main assets change;
- What are the costs of research work in the structure of overall company expenditures if the main task is to change: a) information resources; b) organizational and structural resources; c) infrastructural resources?
- What amount of new products has been produced by the company during a year thanks to the increase of a) operational knowledge; b) structural knowledge, c) functional knowledge.
- How does company profit depend on changes the expenditures on the growth of a) operational knowledge, b) structural knowledge, c) functional knowledge.

The third stage included a series of structured interviews with representatives of leading organizations in the field of the innovative process.

4. RESULTS OF THE RESEARCH

4.1 Knowledge-generation strategy and the type of changeable resource

Results of the research demonstrate that in 75% while planning events on collecting information about markets use the strategy of knowledge borrowing (mainly recruiting consulting companies to do the job); in 12% copy knowledge from other organizations and only in 4% companies is implement the knowledge generation strategy (Table 1).

Table 1. The spread of used strategies of knowledge generation in the process of organizing activities on changing company's resources

<i>Types of increase knowledge strategies</i>	<i>Informational Resources</i>	<i>Organizational and structural Resources</i>	<i>Infrastructural Resources</i>
Borrowing	75%	16%	4%
Copying	12%	38%	7%
Imitation	9%	34%	12%
Generation	4%	12%	77%
Total	100%	100%	100%

Regarding conducting changes in the organizational structure, the most popular strategies among reviewed companies are: copying (38%) and imitation (34%). The average percentage of companies generating own knowledge in the process of changing organizational structure is 12%.

Regarding choosing this or that strategy while making changes in company assets generation is used in 77 cases out of 100 and other strategies in 23 cases out of 100.

Therefore, the research proves author's idea of existing interdependence between increase knowledge strategy and the type of changed resource

4.2 Introduction of new products and expenses on research

The introduction of new products is of great importance for the long-term development of a company. New products include pilot samples providing renewal of products in the future, items from introductory lot and items from the first commercial lot. New products are based on new construction or performance principles. There are three categories to describe the novelty for a product: a) absolutely new product with no analogs anywhere in the world; b) products manu-

factured for the first time in the Russian Federation with analogs abroad; c) product is new for the company, has analogs inside the country. In this research, authors do not subdivide new products into categories.

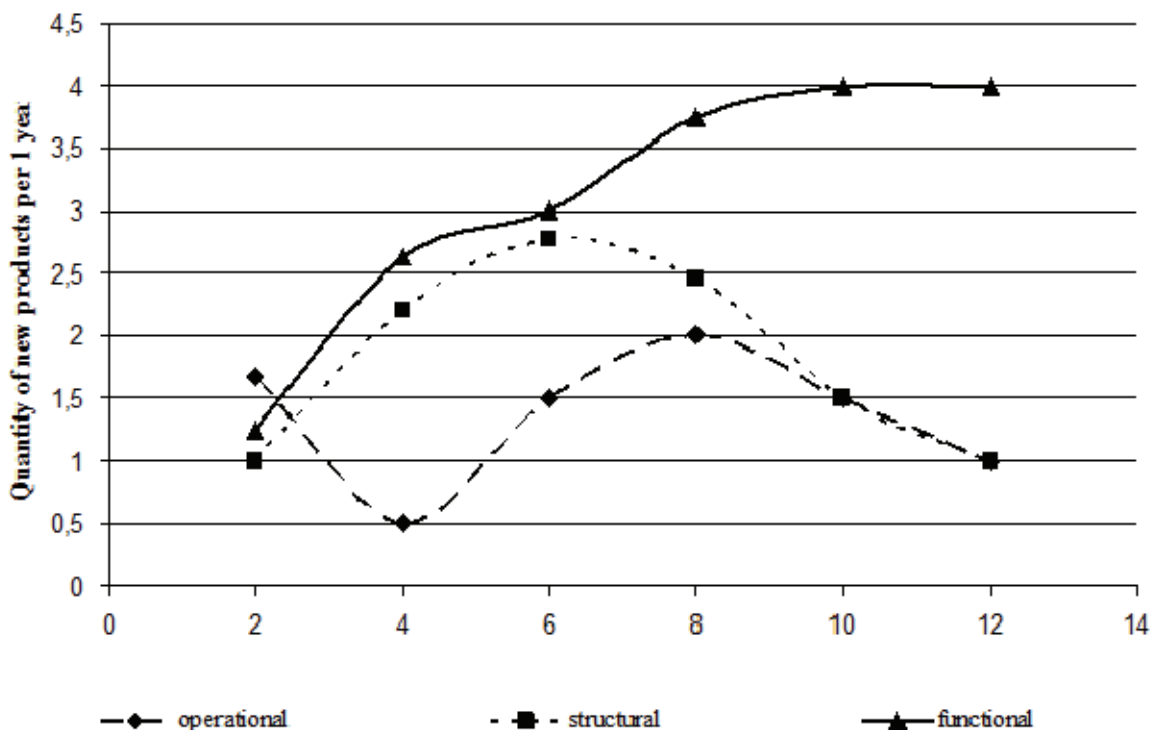
Analysis of data obtained leads to several conclusions. There is a direct interrelation between the amount of new products and cost structure of knowledge generation. The new product is preceded by costs for purchasing new research equipment or modernization of existing equipment, costs for samples, lab tests and experiments, licensing and patenting – all this implies costs on functional knowledge increase. Structural knowledge increase implies costs on the reproduction of human and organizational assets of research branches and naturally at some point (at about 6% of research costs in the total costs structure of the company) the feedback of this knowledge reaches its peak (2,8 new products per year) and later decreases. By this data it is possible to adapt and transform previously made products into new ones that would better fit into market requirements.

Pic. 1 demonstrates four fragments on horizontal axis corresponding to four types of knowledge-generation strategy.

A) *Borrowing strategy*. Research costs are about 0-4% of total company costs. When a share of research costs is minimum, innovative process is slow (1 - 5 new items per year with all types of knowledge). In that case, operational knowledge plays an important role in product renovation though it decreases when research costs share grows.

B) *Knowledge imitation strategy*. Research costs are about 4-6% of total company costs. Product renovation is faster than with borrowing strategy (5,5 – 7 new product items per year). Most of new products appears due to functional and structural knowledge increase (about 80%). The role of operational knowledge in the product renovation, in that case is growing.

Figure 1. The interrelation between the quantity of new products and costs on different types of knowledge generation.



C) *Knowledge copying strategy*. Research costs are 6-8% of total company costs. Product renovation is about 7-8,3 new items per year. The role of functional and operational knowledge in the process of new product manufacturing increases while structural knowledge is less important.

D) *Knowledge generational strategy*. Research costs are more than 8% of total company costs. Product renovation is stable at eight new product items per year, but more than half of new products appear due to functional knowledge increase. The role of operational and structural knowledge decreases.

4.3 Profit increase and knowledge generation costs structure.

The main objective of any organization should be maximal benefits increase as compared to costs. For a commercial company, benefits come in the form of profit.

For most companies increase of research costs usually has a positive influence on profit. Our research makes an attempt to define the way knowledge costs structure influences company profit increase.

With minimal research costs (up to 1 % of total company costs) the influence of operational, structural and functional knowledge on profit is the same. However, the increase research costs leads to the significant growth of functional knowledge importance for the company profit increase in comparison with operational and structural knowledge. Partly it is related to specific features of companies under analysis (machine building and metallurgy), whose competitive advantages are mainly formed by resources and in-plate base.

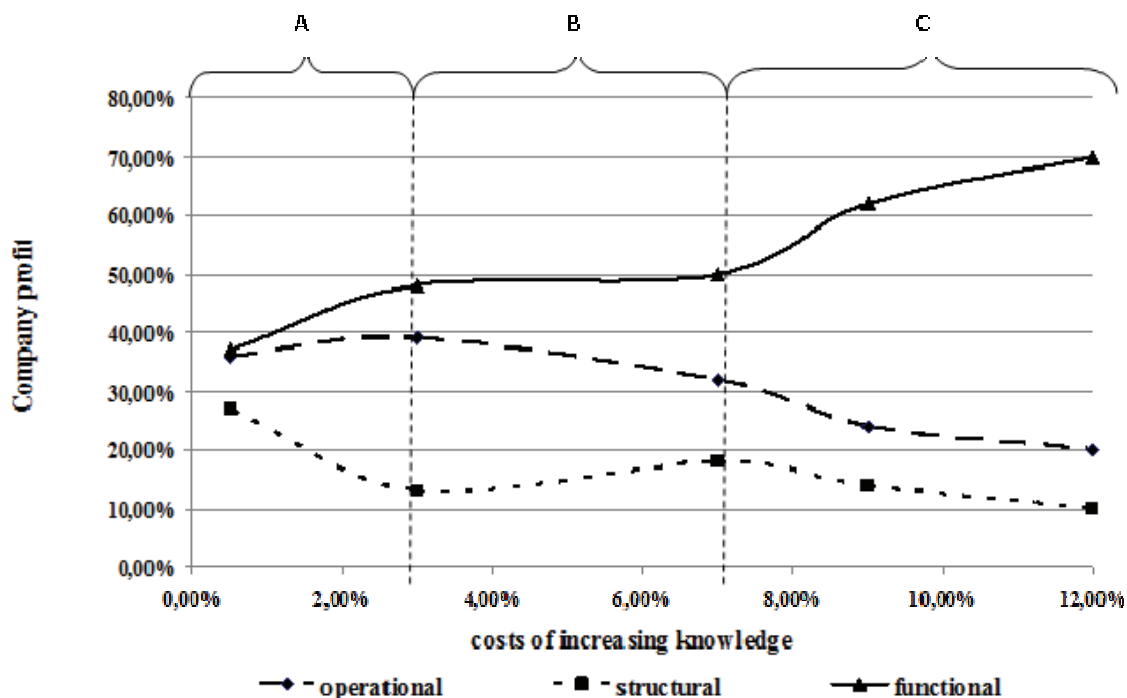
Pic. 2 represents three fragments of horizontal axis corresponding to three different types of knowledge-generation strategies.

A) *Borrowing strategy*. The share of research costs is 0 - 3% of total company costs. Here the influence of structural knowledge on profit decreases as the share of research costs grows whereas the importance of functional and operational knowledge increases. When research costs are 3% of total company costs the importance of operational knowledge for profit growth reaches its peak. The most demanded knowledge resource at this point is related to information about product markets and production factor markets necessary for company development. Therefore borrowing strategy implies achieving profit maximization mainly due to operational knowledge.

B) *Copying/ imitating strategy*. Research costs are 3% - 7% of total company costs. At this point importance of functional knowledge for profit growth does not change with the increase of research costs, whereas operational knowledge importance decreases and structural knowledge importance increases. The most demanded knowledge resources at this point include collective knowledge of company staff their skills and abilities, organizational culture oriented towards knowledge and progressive organizational structure, that is structural knowledge. Therefore, the copying/ imitating strategy is aimed at maximizing profit due to structural knowledge increase.

C) *Knowledge generation strategy*. Research costs are 7 - 12% of total company costs. The importance of functional knowledge increases whereas structural and operational knowledge are less important for profit growth. The most important knowledge resource at this point is functional knowledge that provides technological innovations; that is scientific and technological information and know-how.

Figure 2. The interrelation between company profit and costs of increasing knowledge of different types.



5. CONCLUSIONS

As a result of conducted research:

1. Authors suggest a typology of increase knowledge strategies that allows for improving efficacy, systematizing and optimizing knowledge generation processes in the companies according to the general development plan of the company and the type of basic competitive strategy. The practical importance of the obtained results is a chance to decrease risks and increase the efficacy of activities aimed at knowledge generation in the company.

2. Empirical results show the following patterns of forming increase knowledge strategies at industrial companies: when informational resources change companies tend to use borrowing strategy; changes of organizational and structural resources of the company usually require copying and imitation; in most cases knowledge generation strategy is used to change infrastructure resources.

3. There is an interrelation between the new products manufactured by the company and the structure of costs for different types of knowledge. The numbers for the given parameters are defined for different knowledge increase strategies.

4. There is an interrelation between the growth of profit due to new knowledge and cost structure for types of knowledge. We know that with minimal research costs operational, structural and functional knowledge has the same influence on profit. The growth of research costs increases the importance of functional knowledge for company profit growth.

Authors believe that effective innovational development of the Russian companies, particularly in a challenging economic situation, first of all, requires optimal (that is oriented towards firm needs) cost structure for different types of knowledge. It is strategic knowledge management conditioned by company's basic strategy, its aims and development trends that give the most significant effect in the field of ensuring competitiveness.

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