

Adaptation of industrial and energy enterprises to the implementation of the concept of open innovation

Roman Golov^{1,*}, Vitaly Smirnov¹, Tamara Narezhnaya², Anna Ovsyannikova³, Evgeniya Zhutaeva⁴, Evgeniya Sizova⁴ and Tatyana Makeeva⁴

¹Moscow Aviation Institute, Volokolamskoe highway, 4, Moscow, 125993, Russia

²Moscow State University of Civil Engineering, 26, Yaroslavskoye sh., Moscow, 129337, Russia

³Moscow state University of technology and management K. G. Razumovsky, 73, Zemlyanoy Val, Moscow, 109004, Russia

⁴Voronezh State Technical University, Moscow Avenue, 14, Voronezh, 394026, Russia

Abstract. The aim of this paper is to develop a methodological approach that allows an organization to use the concept of open innovation in its activity. As a result of the study, an algorithm for developing and implementing an open innovation model was formed, principles and quality indicators of companies' openness to innovation were structured, a mechanism for assessing and increasing the level of openness of a company to innovation was developed, and an approach to determine the correlation between coefficients of openness to innovation and economic indicators of company performance was proposed.

1 Introduction

The current stage of development of both the world and the Russian economy is characterized by the increasing role of innovation. The development and introduction of innovations in the company's production activity predetermines its effective competitive development within the industry and in the world economy.

However, practice shows that the traditional approach to innovation, which predominantly presupposes the use of the company's own developments, today becomes ineffective in many cases. For example, own developments often cannot be fully realized by domestic companies due to limited domestic resources and insufficient development in the field of R&D.

The theory of open innovation is an evolutionary stage of innovation management, following the post-industrial approach focused on the internal environment of companies, which often leads to duplication of existing developments and, as a consequence, the waste of resources and shortfall in profits. In the literature, such an approach is called "closed innovations".

The concept of open innovation lies in the development of internal management processes of R&D in the enhancing the company's interaction with the external

* Corresponding author: roman_golov@rambler.ru

environment, which is reflected in the diffusion of technologies based on the combined efforts of universities, national laboratories, companies that are in the stage of development or research of promising markets, suppliers, consumers, industry consortia.

In this regard, an important scientific task is the development of new approaches and methods to ensure effective innovative development of domestic companies in accordance with the current trends of the global market for innovations. The analysis of scientific publications shows that currently, in the economic literature, there are no methodological developments that allow forming a methodological approach to the organization of innovation activities of the company on the basis of the concept of open innovation. Such an approach should provide the company with the ability to effectively implement open innovation on an ongoing basis.

2 Materials and methods

Today, the paradigm of open innovation receives quite a lot of attention. The analysis of scientific publications on this topic has shown that researchers mainly focus on how to organize the implementation of open innovation, ignoring the requirements that a company must meet to realize open innovation. In this case, the objects of study are only a few innovative companies and the factors that determined their success in the field of open innovation. However, it seems more appropriate to focus on which infrastructure characteristics of the company should be developed in order to reduce the risk of possible failure. Most authors (Henry Chesbrough, Vareska van de Vrande and others) note today that there is a need for scientific knowledge regarding effective management of open innovation, as well as organization requirements that must be met for the sustainable development of a company within the framework of the concept of open innovation. This scientific problem is indicated in the literature as the problem of “contribution/result”.

Thus, we identified the need for practical tools that allow the company to adapt to the use of open innovation on an ongoing basis. The target indicators of such a toolkit will be innovation-oriented companies (companies that include innovation in the totality of their strategic objectives). The development of this toolkit requires an adaptive methodological approach.

In accordance with the above, we formulate and present in Table 1 the principles for using open innovation in a company (the correspondence of the formulated principles to the well-known Chesbrough’s principles of open innovation, Fig. 1) [1].

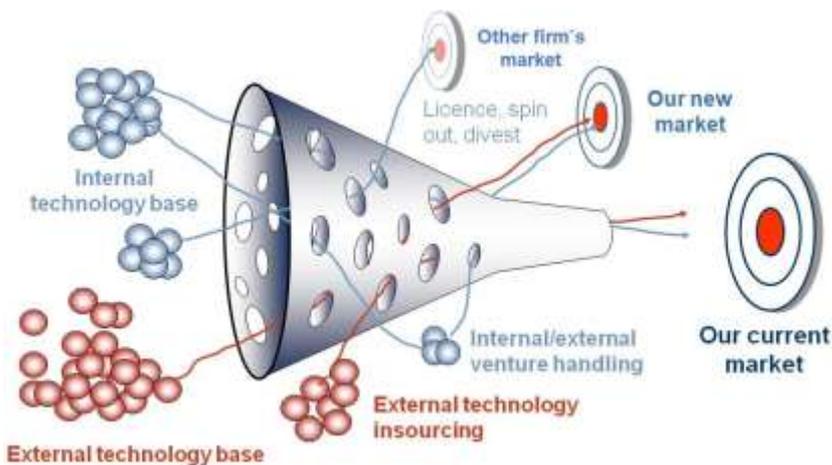


Fig. 1. Chesbrough’s principles of open innovation [1].

3 Results

Let us turn to the applicability of the paradigm of open innovation in the Russian conditions. Taking into account the globalization of the world economy, a preliminary assumption can be made that Russia, at least in part, is characterized by general tendencies that the paradigm of open innovation corresponds to the current economic situation and allows for more effective innovation activity [2, 3].

According to the survey, a number of factors were identified, to each of which was assigned a weighting factor of significance k , obtained on the basis of pairwise comparison of the significance of factors by experts (the scores were added, and then the share of each factor in the total accumulated sum was calculated as a fraction of one):

- regress in the field of R&D – $k = 0.3$;
- lack of flexibility (ability to adapt to changing market requirements) - $k = 0.1$;
- inertness of the company's management in the commercialization of R&D results - $k = 0.1$;
- lack of interaction with world market leaders in the field of R&D - $k = 0.1$;
- weak development of the domestic market of intellectual property - $k = 0.2$;
- break-off between domestic developers and manufacturers due to distrust (developers sell intellectual property abroad, and manufacturers buy it and its results abroad) - $k = 0.1$;
- staff turnover and lack of managerial competencies of innovation managers - $k = 0.1$.

Table 1. Principles of using open innovation in a company [1, 4].

| Principles | Explanation |
|---|--|
| Attraction and use of external R&D | The active dissemination of knowledge, the expansion of the information field allows companies to use in their projects not only internal results of R&D but also external, focusing on a specific area, using and attracting the results of third-party R&D. |
| Profitability of external R&D | R&D results do not necessarily have to be created within the company in order to be profitable. Used external R&D can and should be effectively used in innovation and bring profit. |
| Interaction with external specialists | A number of factors, primarily, the emergence of new information and communication capabilities, contributes to an increase in the mobility of workers engaged in research and development. The use of external specialists (freelancers and employees of specialized organizations) is often more efficient because of their high competence in narrow areas. |
| Compliance of intellectual property with business model | In order for patented developments to be used in production and not to remain just a project because companies do not have the necessary resources, equipment, etc., compliance of the value of the idea or technology with the company's business model is necessary. |
| Creating a competitive business model | The company must build a sustainable competitive business model adapted to the implementation of open innovation on an ongoing basis. |
| Optimal ratio of internal and external R&D | The results of external R&D obtained in the course of the implementation of open innovation should be learned and adapted to the features of the company and the target market within its unique key competence, which serves as the basis for competitiveness. |

The formulated principles for the use of open innovation in an organization correspond to the four key functional areas of the organization's innovation management in terms of open innovation:

- R&D management;
- personnel management;
- intellectual property management;
- competitiveness management.

The problems of development of Russian innovation companies identified in the course of a survey of experts correspond to these four functional areas. Besides, Figure 1 shows the relationship between these problems and the principles of using open innovation in an organization, from the analysis of which it follows that these problems can be solved by using the principles of open innovation.

Based on the analysis of the theory and practice of open innovation, the author identified quality indicators indicating a high level of adaptation of the company to the use of open innovation. These indicators are subdivided according to the key functional areas of innovation management identified at the previous stage in the aspect of open innovation (Table 2) [5].

Table 2. Qualitative indicators of the openness of companies to innovation.

| Functional area | Qualitative indicators of the openness to innovation |
|----------------------------------|--|
| Personnel management | <ul style="list-style-type: none"> – conducting joint projects, research and development with external organizations and specialists (researchers); – development of individual components of an innovative product (service) by individual companies; – cooperation with the best personnel in the industry; – active interaction with universities and research centers, attracting young professionals; – loyalty to the participation of full-time employees in third-party projects; – personnel development based on the concept of lifelong learning. |
| R&D management | <ul style="list-style-type: none"> – use of ready-made developments that are available outside the company; – use of electronic databases for the search and selection of external R&D; – use by the company of both internal and external (joint) R&D; – study and use of national and global experience in managing innovations in relevant and other industries; – study and use of best practices and technologies of national and international suppliers and partners; – identifying new applications and hidden technological reserves of obtained R&D. |
| Intellectual property management | <ul style="list-style-type: none"> – implementation by the company of any obtained innovative developments under any conditions: in the company itself or outside it; – direct and reverse technology transfer; – acquisition by the company of intellectual property that meets its business model; – forming and managing a portfolio of simultaneously emerging (non-key) ideas; – management of intellectual property as a full-fledged asset (financial, strategic). |
| Competitiveness management | <ul style="list-style-type: none"> – full participation of the marketing service in the innovation process; – innovation management as one of the business functions; – implementation of innovation and intellectual property management in each business unit of the company; – an important role of suppliers and consumers in the innovation process; – active search by the company for innovations beyond its limits; – integration of own R&D activities and external R&D activities within a single business model. |

Together, these indicators form a general characteristic of the company's internal and external business processes, which can be described as “openness to innovation”. Based on the above, we can formulate the following definition:

The company's open innovation activity is understood as a joint activity with consumers and suppliers, universities and national laboratories, companies in the stage of development

or study of promising markets and industry consortia to research and develop, create and promote innovative products and technologies on the market on the basis of the principles of the concept of open innovation and using open business models [6, 7].

Accordingly, for a preliminary assessment of the level of openness of the company to innovation, the presence of the indicators presented in Table 2 should be assessed. As a tool for such an assessment and for building a profile of openness to innovation, the author proposes a model presented in Figure 2 [8, 9-11].

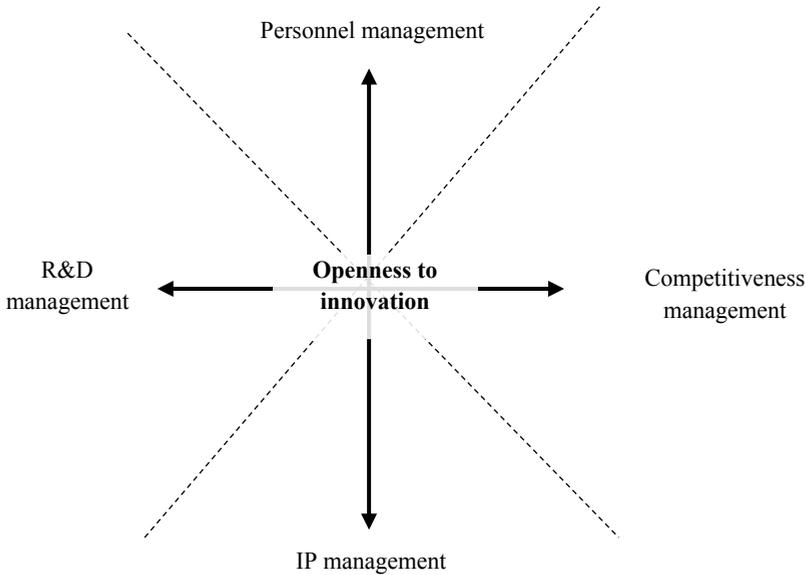


Fig. 2. Model of company's openness to innovation.

The constructed graphical model assumes plotting on the axes, each of which corresponds to one of the four key functional areas of the organization's innovation management in the aspect of open innovation, such a number of divisions, which shows how many of the proposed quality indicators of each functional area corresponds to the company's innovation activity. On the basis of the obtained marks, a profile of company's openness to innovation can be obtained, which is subject to analysis in three areas: first, determination of specific indicators that have a negative value; secondly, determination of the degree of compliance with the concept and principles of openness to innovation of each of the selected functional areas compared to others, and thirdly, the ratio of the profile of company's openness to innovation to the same profile of competing companies.

4 Conclusion

Thus, the developed model can be used for a preliminary assessment of the company's openness to innovation, including structural and comparative ones.

The practical significance of our study lies in the fact that its main provisions and results can be used by industrial and construction enterprises, research, educational and consulting organizations in solving problems of innovation management, namely, in determining ways to effectively manage companies' innovations on the basis of the concept of open innovation.

References

1. H.W. Chesbrough, *Open Innovation: The new imperative for creating and profiting from technology* (Harvard Business School Press, Boston, 2003)
2. V. Khmel, S. Zhao, IATSS Research **39(2)**, 138-145 (2016)
3. L. Kanapeckiene, A. Kaklauskas, E. Kazimieras Zavadskas, S. Raslanas, Expert Systems with Applications **38(11)**, 14196-14207 (2011)
4. S.V. Domnina, E.V. Savoskina, N.V. Shekhova, Procedia Engineering **153**, 741-746 (2016)
5. V. Platon, S. Frone, A. Constantinescu, Economics and Finance **8**, 204-210 (2014)
6. J. Panibratov, World Applied Sciences Journal **23**, 144-148 (2013)
7. N. Safronova, E. Nezhnikova, A. Kolhidov, MATEC Web of Conferences, doi: 10.1051/mateconf/201710608024
8. A.K. Orlov, I.Y. Chubarkina, MATEC Web of Conferences **106**, 08015 (2017)
9. I. Ilin,, A. Levina, O. Iliashenko, MATEC Web of Conferences, **106**, Article number 08066. (2017) doi:10.1051/mateconf/201710608066
10. I. Ilin, S. Shirokova, A. Lepekhin, E3S Web of Conferences, **33**, Article number 03007 (2018) doi:10.1051/e3sconf/20183303007
11. I. Ilin, A. Levina, A. Abran, O. Iliashenko, Measurement of enterprise architecture (EA) from an IT perspective: Research gaps and measurement avenues. Paper presented at the *ACM International Conference Proceeding Series, Part F131936*, 232-243. (2017) doi:10.1145/3143434.3143457