

Integrated Management Analysis of Innovation in a Company

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Abstract— One of the key goals of any company willing to survive and thrive in today's world of transformations is to create and solidify its competitive advantages. The level and effectiveness of innovation in the company largely determines whether the goal is achieved. It is only possible to manage innovation effectively when this activity is viewed as an integral system that pulls together all processes of developing, creating and operating innovative facilities into a single innovation project. In order to manage such projects effectively, appropriate methods, procedures and indicators of management analysis need to be developed and applied. This type of management analysis is of comprehensive nature and includes the analysis of innovation performance, investment analysis, competitor analysis and marketing analysis. The main purpose of such analysis is to provide the managers and owners of the company with full, reliable and quality information about its innovation performance, untapped reserves and opportunities for their mobilization. When designing a system of indicators for integrated management analysis of innovation performance, priority is given to science and technology indicators and those of competitiveness, quality, heuristic and commercial potential of innovations. The results of such analysis could be used for substantiating the choice of alternative innovation projects that meet the criteria of this or that area of analysis; identifying the possibility of applying non-standardized analysis methods when conducting integration procedures and selecting the most successful innovation project; obtaining an overall assessment of innovation performance, trends and development factors.

Keywords—*integrated management analysis; innovation performance; company*

I. INTRODUCTION

One of the key tasks for any company willing to survive and thrive in today's world of transformations is to create and solidify its competitive advantages [5]. The level and effectiveness of innovation in the company largely determines whether the task is accomplished. Competition drives companies to build their economic strength by making a better use of available production and financial resources as well as by attracting investors for business overhaul or expansion [7].

This is preceded by innovative efforts in order to develop options for capital investment with the purpose of identifying and maintaining competitive advantages [10].

At the same time, it is only possible to manage innovation effectively when this activity is viewed as an integral system that pulls together all processes of developing, creating and operating innovative facilities into a single innovation project [8, 11].

In order to manage such projects effectively, appropriate methods, procedures and indicators of management analysis need to be developed and applied [9]. This, in turn, calls for identifying their place in today's market economy.

When defining the most important organizational and methodological aspects of this conceptually new type of management analysis one should assume that integrated management analysis of innovation performance is meant to combine the analysis of innovation performance as well as investment, competitor and marketing analysis [12].

II. OBJECTIVES AND METHODOLOGICAL PRINCIPLES OF INTEGRATED MANAGEMENT ANALYSIS OF INNOVATION PERFORMANCE

Integrated management analysis of innovation performance studies innovation (in the widest sense of the word, that is, including investment) in companies that have already shifted to an innovation-driven model of development, or are in the process of such transition.

The subject of integrated management analysis is the entirety of processes that generate required resources, costs and results in the course of innovation in a company.

The key purpose of integrated innovation analysis is to provide the managers and owners of the company with full, reliable and quality information about its innovation performance, untapped reserves and opportunities for their mobilization.

This objective breaks down into local goals (subgoals) that correspond to each of the four local types of management analysis.

To make integrated analysis more scientific, specific principles of its application should be established, such as the

principles of the "key driver" (that being innovation analysis) in partially integrated analysis, of the priority of the company's innovative activity within the sixth wave of innovation, as well as the principle of balance (of various stages of research and innovation; of one's own and borrowed innovative solutions).

III. SYSTEM OF ANALYTICAL INDICATORS

We believe that among the numerous indicators that characterize integrated innovation priority should be given to those of scientific and technical impact, competitive ability, quality, comprehensiveness and marketability of innovations [2, 3].

It appears worthwhile to consider the suggested indicators, first of all, within homogenous groups (based on each of the four local types of management analysis); secondly, to grade the analytical indicators according to three stages of the innovation process: the creation of an innovation; its adoption and obtaining the results [4].

Table 1 presents a system of 21 ultimate indicators for the comprehensive assessment of a company's innovation performance that was designed by the authors. The indicators are bundled together to form four groups corresponding to the local types of management analysis for their further integration.

TABLE 1. SYSTEM OF ULTIMATE INDICATORS OF INTEGRATED MANAGEMENT ANALYSIS OF A COMPANY'S INNOVATION PERFORMANCE

Indicator of integrated management analysis of a company's innovation performance	Stages of innovation process		
	Creation of innovation	Adoption of innovation	Obtaining results
1. Indicators of innovation analysis:	+	+	+
1.1. of the breakthrough nature of innovation	+	-	-
1.2. of scientific and technological impact	-	+	-
1.3. of innovative involvement	-	-	+
1.4. of innovation marketability	+	-	-
1.5. of innovation incentives	-	-	+
2. Indicators of competitor analysis:	+	+	+
2.1. of competitive advantage	-	-	+
2.2. of innovation intensity	+	+	-
2.3. of process innovation intensity	-	-	+
2.4. of technological dependence	-	+	-
2.5. of legal protection of innovations	-	-	+
2.6. of design phase length	+	-	-
3. Indicators of marketing analysis:	+	+	+
3.1. of comprehensive product innovation	-	-	+

3.2. of adoption of cutting-edge technology	+	-	-
3.3. of demand for process innovations	-	-	+
3.4. of application versatility	-	+	-
4. Indicators of financial and investment analysis:	+	+	-
4.1. of government-backed financing	+	+	-
4.2. of the company's dependence on commercial loans	+	+	-
4.3. of the company's financial independence	+	+	-
4.4. financial indicator of technological dependence	+	+	-
4.5. of capital participation by foreign investors	+	+	-
4.6. of capital participation by domestic investors	+	+	-

Source: the table was developed by the authors

Let's consider the makeup of each group of indicators.

The first one combines five indicators of innovation analysis itself. They mainly characterize the scientific and technical level of innovations being developed. The indicators that we include in the group are:

the indicator of the breakthrough nature of innovation (1.1) that reflects the share of cutting-edge process and product innovations in the total number of process and product innovations;

the indicator of scientific and technological impact of adopted innovations (1.2) shows the share of novel product innovations (that is, excluding modifications and upgrades) in the total number of product innovations;

the indicator of innovative involvement (1.3) is the share of all innovative products, including modifications and upgraded ones, in the company's output;

the indicator of innovation marketability (1.4) is calculated as an average number of license agreements per process or product innovation;

the indicator of innovation incentives (1.5) is the ratio of net profit from innovation (in the broadest sense of the word) to the company's salary budget for innovation workers;

The above indicators of innovation analysis reflect primarily the scientific and technical level of the process of creating innovation, its market capabilities and incentives for innovation. However, it would be hard for a company to become truly established and succeed in this field by only paying attention to these indicators and ignoring rivals' achievements. It is necessary to exploit the possibilities of competitor analysis that draws upon the data of competitive intelligence that seeks to reveal the strengths and weaknesses of the key competitors [1].

The second group of indicators – those of competitor analysis – include six analytical indicators:

the indicator of competitive advantage (2.1) is a mean score value of competitiveness of innovative products. It is

calculated based on the share of innovative products at each level of competitiveness in the total amount of shipped innovative products and the score value of each level of competitiveness;

the indicator of innovation intensity (2.2) shows the total number of created process or product innovations per developer;

the indicator of process innovation intensity (2.3) is calculated by dividing the number of employed process innovations by the total number of technological processes;

the indicator of technological dependence (2.4) is the ratio of process or product innovations employed (adopted) under license agreements to the total number of created process or product innovations;

the indicator of legal protection of innovations (2.5) is calculated as the ratio of the number of product innovations that are protected by at least two documents (a patent, a utility model, a design patent or a registered trademark) to the total number of created product innovations;

the indicator of design phase length (2.6) shows the average time (number of years) required for creating (adoption, employment) of process or product innovations;

The indicators of competitor analysis describe only the relations of the company being studied with its existing and potential competitors and ensuing improvements to its strategy of innovation. It is, therefore, necessary to combine innovation and competitor analysis with marketing research data.

The third group of indicators – those of marketing analysis – is made up of four analytical indicators:

the indicator of comprehensive product innovation (3.1) is the ratio of the number of product innovations that conform to a set of key requirements (economic, after-sales service, consumer safety) to the total number of created product-innovations;

the indicator of adoption of cutting-edge technology (3.2) is the share of advanced technologies in use by the company that employ process innovations to the total number of advanced technologies (under the Classification of the Federal State Statistics Service);

the indicator of demand for process innovations (3.3) is the ratio of the number of designed and employed process innovations in the company to the total number of process innovations it designed that have found application across the industry;

the indicator of application versatility (3.4) is calculated as the ratio of the fields of application of process/ product innovations to the total number of consumer markets in the national economy.

The above indicators of marketing analysis reflect the standing of a company that is engaged in innovation in the market of innovation.

Six indicators are included in the fourth group – that of financial and investment analysis:

the indicator of government-backed financing (4.1) is the proportion of the amount of received public funding to total spending on innovation from all sources of financing;

the indicator of the company's dependence on commercial loans (4.2) is calculated by dividing the amount of commercial loans for innovation by the total amount of money spent on innovation that comes from all sources of financing;

the indicator of the company's financial independence (4.3) the ratio of the company's own funds invested in innovation to total spending on innovation from all sources of financing;

the financial indicator of technological dependence (4.4) is the proportion of money spent to buy license-protect innovations to total spending on innovation from all sources of financing;

the indicator of capital participation by foreign investors (4.5) is the ratio of foreign investment in innovation to total investment in innovation in the company;

the indicator of capital participation by domestic investors (4.6) is computed as the ratio of domestic investment in innovation to total investment in innovation in the company.

The above-described indicators of financial and investment analysis lay out the sources of financing and investment in innovation in the company being studied.

IV. INFORMATION SOURCES AND METHODS

We believe that the main sources of information for integrated management analysis of innovation activities are up-to-date statistics, financial accounting data, findings of a specially conducted expert survey in the industry being studied, competitive intelligence data and the results of consumer and customer surveys.

When selecting a method of integrated management analysis of innovation, one can opt for any of the six classification groups of methods [6]: non-formal (logical) method, elementary methods of microeconomic analysis; traditional methods of economic statistics, mathematical and statistical methods, methods of decision theory, methods of financial computing.

V. AREAS OF APPLICATION

The obtained results of analysis can be used:

1. for the development of the theory and methodology of economic analysis to substantiate the choice of alternative innovation projects that meet the criteria of a specific area of local analysis and to identify the possibility of applying non-formal analysis methods when conducting integration procedures and selecting the most successful innovation project;

2. for improving information and analytical provision for managerial decision making in order to obtain a comprehensive assessment of innovation performance, trends and development factors; to identify untapped reserves and opportunities for growth; to work out a range of extrapolation and exploration forecasts for the short-term, mid-term and long term perspective; to design a concept for the development and improvement of innovation management in the foreseeable future; to create alternative strategies for reaching innovation goals; to develop targeted regional programmes of state support for priority innovation areas; to build a system of indicators and monitoring of innovation.

VI. CONCLUSIONS AND FURTHER RESEARCH

The previous sections enable us to come to the following conclusions:

it is only possible to manage innovation effectively when this activity is viewed as an integral system that pulls together all processes of developing, creating and operating innovative facilities into a single innovation project;

the effective management of such a project calls for developing and employing a new kind of management analysis – integrated management analysis of innovation that incorporates the analysis of innovation performance, investment analysis, competitor analysis and marketing analysis;

the obtained analytical results can be used not only for enhancing information and analytical provision of innovation management in a company, but also for further development of the theory and methodology of economic analysis.

The conceptual and methodological framework of integrated management analysis described above is only an outline of this new area of research and practice and provides a sort of theoretical guidance for further development of this analytical tool of innovation management, especially in terms of its application.

There are several trends in which research into integrated management analysis of innovation can be furthered:

expansion of the system of key indicators of integrated management analysis of innovation (Table 1) and their further elaboration with the purpose of ensuring greater accuracy of comprehensive research into innovative performance;

development of the criteria of qualitative assessment of the deviation of the actual values of the key indicators of integrated management analysis of innovation from their baseline values in terms of materiality;

establishment of standard values for each key indicator of integrated management analysis of innovation and the introduction of a three-group classification (best, medium, worst);

creation of a method of ranking innovation performance through scoring by experts who use the key indicators of integrated management analysis;

development of economic and mathematical models and software that would make it possible to use integrated management analysis of innovation for innovation management.

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