Evaluation of the effectiveness of business ideas for innovation at an early stage of development

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Abstract. The urgency of evaluating business ideas at the initial formation stage has been substantiated. The main approaches to assessing innovative solutions in high-risk conditions, changing technological, organizational, informational and other factors are considered. An algorithm for creating a system for evaluating business ideas is proposed, including criteria for evaluating them at a qualitative level, and then evaluating them using a point scale. The choice of these criteria is substantiated. It is concluded that it is necessary to determine the weight of each criterion in the system for evaluating business ideas. Taking into account the peculiarities of a number of business ideas and their different effectiveness, the system can be supplemented, and the criteria themselves can be revised and adjusted. It has been established that the scores for each criterion can also be calculated more accurately. It is noted that for a more complete implementation of the proposed algorithm for constructing a model, applied developments will become a further direction of the authors' research. The result will be a universal method for assessing the effectiveness of business ideas, based on the use of the most general criteria for technological development.

1 Introduction

A scientific idea serves as the foundation of an innovative development that determines its profitability. Most often, it is developed in the process of fundamental research. Sometimes they are not aimed at generating income, but in some cases the research of scientific organizations is also focused on further commercialization. The results can also be considered as innovations, and the activities of scientific organizations can be built according to principles similar to the construction of an innovation process. This requires highly qualified specialists, a special organization of work, and often a long period of research. Therefore, such activities require considerable expenses from the state or commercial organizations and should at least pay off. The results of a number of studies can be used for commercialization, while others remain unclaimed.

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2 Problem Statement

Transformation of the results of fundamental research, with the possibility of their commercialization, is associated with initiation of an innovative project and investment of funds for its implementation. That is, performing applied research, development, marketing and market innovation. In all cases, the investment costs for the implementation of work at the indicated stages are quite large. This is due to the fact that a business idea at the initial stage of its development is rarely subject to an accurate description. In addition, at the stage of formulating an idea, the uncertainty of demand, costs and risks of financial losses are important.

For these reasons, an important scientific and applied task is to create a method for assessing the effectiveness of business ideas at the stage of their development.

3 Materials and Methods

When analyzing research in the field of evaluating business ideas, two fundamentally different areas were identified. The first, quantitative, reflects only the financial interests of investors, lenders and business founders. They are computerized and easy to use. Therefore, their popularity is understandable, but it does not always allow us to assess the potential of ideas, especially since this type of activity has largely become a business. At the same time, software tools are actively used, and the subjective criteria for evaluating the authors of digital systems do not always take into account the potential of fundamental scientific research, which can be the basis of evaluated business ideas. [1]

The second direction in the field of evaluating business ideas is based on the study of the most general laws of the development of technologies, markets, needs, resources and other important economic categories, which was started by J. Schumpeter when creating the theory of innovation [2-3].

4 Results

The second indicated direction is of a qualitatively different nature, and the assessments of new solutions are also initially qualitative, but in the future, they can also have a quantitative assessment. As part of this area, several approaches have been identified that can become a hypothesis for developing an apparatus for evaluating innovative developments. It will be the following assumption. The use of several approaches containing qualitatively different performance criteria and the generalization of their results in a single model will significantly increase the accuracy of evaluating business ideas. Thus, a set of dissimilar characteristics will make it possible to more accurately assess the potential, effectiveness of innovation and the possibility of its commercialization.

The main approaches to assessing the effectiveness of scientific developments and the potential for the implementation of business ideas based on them are the following.

The first approach is based on the study of the law of technological transformations and the accompanying changes in labor productivity indicators. The essence of the law formulated and justified by V.S. Muchnik is as follows.

The development of technology and technology in history has a number of stages, which are combined into three stages. The first stage, industrial, includes seven stages, which reflect the sequential division of the technological process into more fractional cyclic operations, their mechanization and control using the automation of systems.

The second stage, post-industrial, is based on low-level operation, flow and the creation of science-intensive products.

The value in these constructions is represented by quantitative characteristics of changes in socio-economic indicators by stages of technological development. They are based on the analysis of the results of using a variety of technologies in various sectors of the economy in many countries of the world.

With the growth of science intensity and digitalization of production, the technical factor exhausts its capabilities, therefore, the use of new resources is required. They are innovations in organization, production management, including changes in its structure, marketing solutions, active use of network data and digital solutions. At the same time, as before, the most important business ideas are being developed to create products with new consumer properties. As a result, a new, III stage and XI stage opens in the development of business ideas, which lead to new technological solutions.

The transition to stage III allows increasing the profitability of innovative developments on average up to 60-90%. This leads to an increase in the efficiency of business ideas, high competitiveness of specific developments and the entire national economy. It is assumed that stage III will develop in several stages in connection with the use of new solutions in the field of management and will approach the IV - socio-economic stage of transformations.

This approach was proposed at the beginning of the formation of the post-industrial stage of economic development; however, it is supported by rich statistical material from various sectors of the economy of many countries. The availability of numerical estimates of labor productivity for earlier stages allows us to calculate the corresponding values for the additional stage by extrapolation. Therefore, this scale can be one of the criteria in the system of indicators used to assess the effectiveness of business ideas. The dynamics of economic indicators by stages and stages of technological development are shown in table 1.

Table 1. Dynamics of economic indicators by stages and stages of technological development

Stages	**I**							**II**		
Stages	**I**	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**IX**	**X**
Living labor productivity	*1*	*	*	*	*8-12*	*15-20*	*30-35*	*35-40*	*150-200*	*≥200*
Return on assets	*1*	*	*	*	*0,06*	*0,06*	*0,06*	*0,09*	*0,13*	*0,16*

The classifications of the stages of technological development proposed by other researchers are of no less importance. So, S.Yu. Glazyev developed a theory of economic structures, within which six such periods were identified. Each of them has its own resources, factors and achievements. It should be noted that the fifth mode, like the others, is divided into a number of stages, and its most important element is the digital economy. In turn, it also has stages of its development. And the sixth stage in the classification of S.Yu. Glazyev is predictive in nature and refers to the period 2030-2090.

A number of authors have similar views on the classification of stages of technological development. [4]

The second approach to assessing the effectiveness of business ideas is the scale of taxonomic assessments of prof. R. Koller. Table 2 shows the types (taxons) of transformations and their efficiency.

Table 2. Types (taxons) of transformations and their effectiveness

Type	**Content**	**Increased efficiency**
I	Creation of new functional structures and/or discovery of new areas of application	10-100 times or more

II	Using new principles	2-10 times
III	Creation of new design solutions within the framework of well-known principles	10-50%
IV	Optimization of parameters of technical and economic structures	2-10%

Thus, the scientist identified four taxons of transformations that differ in the content of solutions and their effectiveness.:

The first taxon is the creation of new functional structures and/or the discovery of new areas of application that provide an increase in performance from 10 to 100 times (or more). For the first taxon, not only technical and technological changes and changes in the organization of technological processes at specific enterprises are inevitable, but also approaches to the development of business ideas. Obvious examples of such business ideas and developments are the Internet, the bases and software built in it, which changed the life of mobile communications, and much more. And to create each such successful business idea, it took intellectual and financial investments that brought the developers a high income;

The second taxon is the use of new principles (physical, chemical, biological, organizational, managerial, etc.) that can increase performance by 2-10 times. With regard to the second taxon of transformations in domestic science, a method has been created to search for new principles of solution, including the construction of a functional structure and the formation of technical functions of elements in the form of physical transformations of input actions into an output result, as well as an algorithm for computer search for chains (sequential, parallel, combined) physical effects, implementing the specified technical functions. [5]

A significant number of patentable technical solutions in ten problem areas have been obtained by similar methods in Russia. They differ from those known in terms of economic efficiency from several times to several dozen times.

At present, experts see an increase in the possibilities of the search method for fundamentally new solutions in the creation of BigDate collective use systems, which are often called effect data banks (physical, chemical, biological, etc.), or knowledge banks. The importance of creating these banks is determined by the fact that any developer is able to use a much wider set of effects or their combinations than can be retained in the memory of one person or arise as a result of the conceptual formation of combinations. As a result, the likelihood of finding previously unknown and more effective solutions increases.

On the basis of national banks, an international bank for biological effects is being consistently formed. Using domestic data banks, Russian specialists have obtained a significant number of patents for medicines and have developed medical technologies that are significantly superior in efficiency to foreign analogues.

It should also be noted that the work performed on the creation of software environments and data banks also made it possible to prepare educational and methodological materials that are widely used in the educational process and are used in almost all domestic and foreign universities. [6-7]

At the present stage of the scientific and information age, the term "technology" is widely used to answer the question of how more effective artifacts are created. With regard to the development of science-intensive engineering artifacts, the idea of a low-operational flow is gaining universal recognition. This approach allows organizing the technological process in a self-adjusting mode, while simultaneously reducing investment and current production costs, increasing the environmental friendliness and comfort of the process.

If an enterprise is aimed at creating and using such technologies, then after the change of three generations of engineering solutions it is able to self-sustain the expanded

reproduction of all types of resources, including the cost of creating a scientific and technological reserve and mastering new processes. At the same time, business ideas include not only technical and technological, but also organizational and managerial innovations.

Therefore, a particularly significant direction in the data banks formation is their creation in terms of organizational and managerial effects and decisions. These, in fact, banks of business ideas allow to compare the developed business ideas with analogues or competitors, to assess the potential of the solution and its effectiveness.

The third taxon is the new design solutions creation, within the framework of well-known principles, leading to an increase in performance by 10-50%. Meaning of this type of transformations is quite clear, while they do not always require the business idea development;

The third taxon is the calculation and optimization of the parameters of technical and economic structures, which makes it possible to increase efficiency by 2-10%. Optimization of system parameters is often performed using software tools. Professionals of the economic profile are limited to structural changes that involve a change in the equity participation of known solutions. Business ideas of a technical and technological nature, as a rule, remain outside their field of vision, although they have great potential - for example, when developing and modernizing new types of products.

The first step towards mastering the method of directed engineering creativity was taken by F. Zwicky, who created a method of morphological analysis and synthesis in technology. [8-10] The team of authors, which he has been leading, received over 10 thousand patents, many of which were implemented in practice. In the future, he was aimed at improving the methods of organization and management, where significant results were also obtained.

An important step in teaching invention was made in the 70s of the XX century. Supporters of idea of the inventions' algorithmicizing, having studied several thousand applications for inventions, found that inventors use an arsenal of only a few dozen logical methods. Researchers named, inventoried and described their content. The most important in this work were large-scale experiments in teaching the techniques of inventive work. With the use of these techniques in the learning process and after it, several thousand new technical solutions have been obtained, protected by copyright certificates. This led to the creation of schools for inventors. The inventions themselves cannot always be classified as business ideas, but the method of their creation is acceptable.

Later, on the basis of this analogue, "inventing machines" were created and put into mass production in the USA and Japan. With their help, hundreds of thousands of inventions in the field of technology were obtained. However, over time, interest in such software development declined and shifted towards more effective transformations.

Each heading of the transformation efficiency scale has a verbal description and adequate quantitative estimates. At the same time, the efficiency criterion is indicated ambiguously, which only indicates a qualitative assessment of business ideas and solutions based on them. The range of values for the growth of the efficiency of solutions is established by analogy with the stages and stages of technological transformations. In addition, there is a meaningful connection and correlation of these dependencies. For example, the upper limit of the efficiency values transformation scale may correspond to the tenth stage of technological development.

There is an assumption about the emergence of another, more effective than the first, taxon transformations. One of the consequences of scientific and technological development is the emergence in nature of the circulation of new, man-made physical, chemical and biologically active substances. The regularities of the circulation of these

substances, the qualimetry of their effect on flora, fauna, and humans are still poorly understood, there are no acceptable models of circulation and interaction.

It is important to note that today methods of developing technologies are actively being created that meet in advance qualitatively new human needs or create such needs. They allow you to identify new needs and develop fundamentally new business ideas, the implementation of which is very effective.

It should be noted that for all the significance and effectiveness of business ideas, no more than 10% of the efforts of their developers are spent on creating solutions related to the first and second (most effective) taxons. At the same time, the remaining 90% of efforts provide a lower total economic effect than the effect of first 10% of work, which reflects the well-known Pareto principle. [11-12]

Of course, priority attention in the development of business ideas should be given to those, the content of which is close to the most effective - the first and second taxons of transformations. However, their discovery and detailed elaboration inevitably necessitate the simultaneous appearance of transformations related to the third and fourth taxons. Therefore, the most effective direction for enterprises will be to change the prevailing share of taxons in the entire set of transformations. It would be advisable that 40-60% of business idea creation work is related to the first and second taxons.

The third qualitative approach to assessing the effectiveness of business ideas is based on the use of a certain form of motion of matter in it. When using already known effects, they are arranged as follows:

- organizational and economic;
- biological;
- chemical;
- physical and chemical;
- mechanical and physical.

In accordance with this procedure, they can be assigned a point assessment by analogy with the stages and stages of technological development. If a business idea uses the newly discovered effects of a fundamental nature for any form of motion of matter, its score can be increased.

The upper level of scores generally corresponds to the scale of stages and stages of technological development. In this case, it is also necessary to take into account the oscillations associated with the used form of motion of matter and the possible use of newly discovered effects of a fundamental nature.

The fourth approach involves evaluating a business idea based on calculating the science intensity of a business idea and an innovative project implemented on its basis. Verbal assessment includes two scales for qualitatively determining the effectiveness of a business idea:

a) high, above average, average, below average, low;

b) high-tech business ideas, typical business ideas. In the latter case, breakthrough business ideas can also be taken into account through the scoring, which do not yet translate them into the category of high, science-intensive, but noticeably increase its effectiveness in comparison with the average statistical one.

The generalized value of the score is calculated as the arithmetic mean according to the four proposed criteria. You can also use other methods for calculating the score.

5 Discussion

The number and content of the criteria that can be used to evaluate business ideas is far from complete and cannot be regarded as completely accurate. The business ideas

themselves are goals combined with ways to achieve them, therefore they can be evaluated using different methods.

The scores obtained need to be checked and confirmed, and, possibly, to correct the proposed hypothesis. In this case, it is necessary to rely on a recognized criterion for the reliability of scientific assumption - indicators of implemented projects or developed business plans for their implementation.

Among the indicators with which the comparison of scores will be made, it is necessary to choose the most generalizing and free from private influences. As such an indicator, it is advisable to take an indicator of the profitability of innovative solutions implemented using specific business ideas. This economic indicator is a relative value.

6 Conclusion

The degree of the scores convergence with the expected profitability indicators may indicate in favor or against the chosen scoring method and its details. Therefore, on the basis of the proposed algorithm for constructing a model, further direction of the authors' research will be applied developments - creation of a mechanism for assessing the model performance by analyzing implemented business projects and business ideas that are at the formation stage.

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