ATLANTIS PRESS
*Advances in Economics, Business and Management Research, volume 137*
**III International Scientific and Practical Conference "Digital Economy and Finances" (ISPC-DEF 2020)**

# Efficiency of Innovative Development of Industrial Enterprises: Improvement Assessment Tools

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***Abstract*—The necessity of improving the tools for assessing the economic efficiency of the innovative development of an industrial enterprise is substantiated. Known indicators for assessing innovation are "contemplative," record the processes that occur, but they do not show the effectiveness, do not compare the results and costs of innovation.**

**It is proposed to use the "indicator of innovative capital" as an indicator of assessing the economic efficiency of innovative development. The content of this concept is clarified - it means the cost advanced to certain innovatively oriented resources that allow creating and implementing innovations. The principles of the formation of innovative capital are defined: taking into account the development prospects of the organization; the need to achieve a balanced development of all components of innovative capital, innovative capital efficiency; rationalization of costs for the formation and maintenance of innovative capital, digitalization of the formation and maintenance of innovative capital (digital support). The structure of innovative capital, which includes human capital (availability of labor resources, knowledge, education, qualifications, professional competencies), has been clarified and substantively expanded; intellectual capital (unidentifiable intellectual abilities of employees, intellectual competences, creative competencies), patent capital (identifiable intellectual property created by employees and "acquired"), digital capital (it presents in all types of innovative capital as a component: digital literacy, mobility, flexibility - in human capital, cognitiveity, multifunctionality, creativity - in intellectual capital , skills and abilities to digitally formalize the results of scientific research - in patent capital).**

**A possible method of assessing innovative capital is outlined – it is the cost method and the problems of using are considered - certain difficulties with the assessment of formally unidentifiable abilities and competencies of employees.**

***Keywords: Innovative development, economic efficiency, innovative capital, human, intellectual, patent, digital capital***

## I. INTRODUCTION

Purpose of the study - Justification of the need to improve the tools for assessing the effectiveness of innovative development of an industrial enterprise, determining the principles and structure of the formation of innovative capital of an enterprise. To achieve the goal of the study, the following **tasks** were set: to analyze the used indicators-tools for assessing the innovative development of an industrial enterprise, to justify the possibility of using the indicator of innovative capital as an indicator of the economic efficiency of innovative development, to determine the principles of its formation, to suggest the structure of innovative capital.

As an object of study, a set of subjects of economic industrial activity is determined. The subject of this study is the processes associated with assessing the effectiveness of innovative development of an industrial enterprise.

In recent years, special attention has been paid abroad to assessing the effectiveness of various scientific and innovative programs [1-3]. Investment restrictions require a more thorough study of the effectiveness of innovative initiatives. In the United States, the STAR METRICS system is used to assess the effectiveness and efficiency of state research and innovation programs, which is focused on determining quantitatively measurable indicators based on information presented in known existing databases (reporting results, a kind of qualitative approach) [4]. In the United Kingdom, a system for assessing the effectiveness of research and

innovation programs implemented at universities was introduced - REF (Research Quality Assessment Framework, Research Excellence Framework) [5], based on the wide involvement of experts. Both methods for assessing the effectiveness of scientific and innovative programs are very laborious, both in collecting information and forming a data array.

Capital as one of the main factors of production and an indicator of performance has always attracted the attention of scientists. The concept of “intellectual capital” was introduced in 1969 by D. Galbraith as the concept of intellectual activity. T. Stewart, the founder of the concept of “intellectual capital”, defines it as everything that an employee of an enterprise knows (from knowledge and skills, competencies to patents) [6]. Yak Fitz-enz developed the theory of intellectual capital to concrete measurements of the value of workers [7]. In the assessment of ownership, the concept of intellectual capital is known and various methods for its assessment have been developed. The concept of "innovative capital" first appeared in the composition of intellectual capital in the works of G. Joyle (2000) and Van Buren(1999); human, innovative, process and client capital stood out. Innovative capital was considered as the totality of everything that can form intellectual property (intangible identifiable and unidentifiable assets).

In modern foreign studies, the need to assess the effectiveness of the innovative development of an enterprise is studied by various scientists, however, they are mainly devoted to only two components - human capital (its structure, connection with economic growth, formation and impact on innovative results) [8-10]. Other studies are devoted to intellectual capital, revealing its influence on the formation of competitive advantages, and clarifying the role of educational institutions (universities) [11-13].

Foreign research on the innovative development of an enterprise, organization, or company comes down to the search and justification of investment in innovation, the search for effective methods of stimulating innovation and the problems of using well-known methods for assessing the effectiveness of innovative projects. In the context of digital transformation, a clearer and clearer measurement of the effectiveness of the innovative development of an enterprise is required using a universal, a kind of integral indicator, which may be innovative capital.

The strategy of innovative development of Russia for the period up to 2020 defines three main priorities for innovative development: the development of human capital (the development of human resources of the innovative economy); increasing innovative activity of the business (new products, technologies, markets, the formation and activation of "innovative business); activation of innovations (the formation of "territories of innovation", the formation and development of innovative infrastructure, the effective development and commercialization of science) [14-17]. In these conditions, the innovative component of the industrial enterprise is updated. Despite the importance of industrial innovation, unfortunately, there is no universally accepted and universally recognized and objective toolkit for assessing the economic efficiency of the innovative development of an enterprise [16, 18]. It is necessary to develop and propose a new system of indicators (assessment tools) of the economic efficiency of the innovative development of the enterprise.

## II. Methods of the Study

The study used the provisions of the theory of enterprise management, the theory of industrial economics, the concepts of sustainable development, the scientific foundations of strategic management, the theory of valuation and analysis of enterprise value, cost analysis, set forth in the works of famous Russian and foreign scientists, methods of statistical observation and analysis, methods, mechanisms and industrial enterprise management tools, methodology and tools for assessing the effectiveness of the organization.

## III. The Results of Study

The improvement of the tools of economic efficiency of the innovative development of an industrial enterprise, according to the authors, consists in the proposal to use the indicator of innovative capital (taking into account the principles and structure of its formation).

The scientific novelty of the research consists in the development of theoretical principles and the development of recommendations on the possibility of using an indicator - an instrument for assessing innovative development - innovative capital. Principles of formation of innovative capital are formulated. The structure of innovative capital is clarified (human capital, intellectual capital, patent capital, digital capital). The use of the indicator of innovative capital will allow a more objective assessment of the economic efficiency of the innovative development of an industrial enterprise.

## IV. Discussion of the Results of Study

The content of the concept of “innovative development” in the scientific literature is interpreted as a qualitative change in the process of economic activity, based on the constant search for new products, goods, new technologies that expand the market opportunities of the enterprise on the basis of various innovations [19, 20].

**Existing tools for assessing innovative development.** At present, the innovation activity of industrial enterprises can hardly be overestimated; innovation is a priori inherent in industrial production. However, to assess the level, economic efficiency of innovative development and its dynamics (to identify problems and outline ways to solve them), the modern methodological base does not allow. Well-known and frequently and widely used indicators for assessing the effectiveness of innovations (including indicators of project efficiency) are not suitable in this case. Known indicators allow you to evaluate some of the point results of the implementation of innovations. In our opinion, the cost-based approach to assessing the results of innovative development would be more objective and useful. As an indicator of the effectiveness of innovative development, you can use the indicator of innovative capital.

Unfortunately, nowadays it is possible to evaluate the effectiveness of innovative development, innovative activities of an organization only on the basis of a number of statistically observed and statistically measured indicators (Rosstat information, website, and thematic collections of Rosstat). Information on innovation involves general information, for example [21] (information on Russia for 2015-2018): specific gravity of organizations implementing technological innovations (2.6 -2.1%), specific gravity of innovative goods in the total volume of shipment, specific the weight of organizations (8.4-6.5%) engaged in marketing (2.7-2.1), organizational (1.8-1.3) and environmental innovations (1.6-0); the value of innovation costs (at actual prices) (all types and for certain types of innovations); a review (by the number of organizations using advanced technologies, which implies the creation of a "general informational" picture of innovative activity in the country and some sectors (fields of activity) and in individual regions.The given statistical information is, of course, necessary and important, but it is an overview and statement (contemplation) of completed actions. However, the effectiveness of innovation (a special set of indicators) leaves the field of view. In this case, we do not consider the assessment of the effectiveness of individual innovative projects and innovative measures, in this case (pointwise) economic efficiency can be estimated by the well-known set of indicators of project efficiency. In our opinion, it is possible to evaluate the economic efficiency of the innovative development of an industrial organization by evaluating the innovative capital of an industrial enterprise, region, or country.

**Innovative capital. Concept, principles of formation.** Many scientific publications on the evaluation, planning, financing of innovation. With all the variety of economic instruments, there is no objective, and integral indicator of assessing the economic efficiency of innovative development. The authors of this article propose the use of an indicator of innovative capital. There is no generally accepted content of the concept of "innovative capital". In the dictionaries, Innovating capital is interpreted as capital participating in the turnover of innovative organizations or used to finance innovative projects, or as the ability of industries or enterprises to produce high-tech products that meet the requirements of the world market [9]. Scientific research in the field of formation, organization's capital structure is well known. However, there are very few scientific papers about the innovative capital. For example, in [22-24] innovative capital refers to the value expression of the totality of innovative projects that are under development or already representing intellectual property, but in this case, innovative capital is presented only as a cost quantity (market valuation procedure is carried out) of a set of specific innovative projects, both in the process of their creation (which is very difficult), and already fixed by formal documents. Another point of view - innovative capital is the value advanced to specific innovative resources (knowledge, competencies, business qualities and specific people), leading to the creation or acquisition of innovations [25]. The second definition is more specific in essence, but more difficult to implement (the assessment procedure). In our opinion, innovative capital is the value advanced in certain innovatively oriented resources that allow creating and implementing innovations. Therefore, the main goal of creating, maintaining and increasing innovative capital is to meet the needs of the organization in the sources of innovative development. Purpose allows you to determine the principles of formation of innovative capital: taking into account the development prospects of the organization; the need to achieve a balanced development of all components of innovative capital, the effectiveness of the use of innovative capital; rationalization of costs for the formation and maintenance of innovative capital, digitalization of the formation and maintenance (digital support) of innovative capital.

**Innovative capital. Structure.** Innovation capital in some scientific publications appears as a structural component of the intellectual capital of an organization (human, organizational, process, cultural capital and innovative capital), as one of the elements of the intrinsic value of an enterprise [22, 23]. Some authors define human capital as the structural component of intellectual capital, which also includes relationship capital (consumer, client, brand, market) and structural (organizational) capital [26.27]. The author [28] compares intellectual capital (human capital, organizational capital, consumer capital-client) and innovative potential (interaction, competence, resources, corporate culture). Other authors distinguish intellectual (organizational capital), human capital, social-reputational capital [22]. The given structure of intellectual capital in the presented hierarchy to innovative capital assigns an "auxiliary" role, this is not correct. It is innovative capital is created by people, i.e. active participants in the innovation process, their physical efforts (labor), their intellectual abilities (competencies), using the identified results of intellectual work (patents). The specific structure of innovative capital, in our opinion, should be (supplemented [25] and expanded content): human capital (availability of labor resources, knowledge, education, individual professional abilities, qualifications, professional competencies, personal, psycho-physiological abilities that form the competencies of an industrial enterprise-organizations by workers participating in the labor process, i.e., individual and collective human capital) [30,31]); intellectual capital (unidentifiable intellectual abilities of employees, their knowledge and skills, intellectual abilities, intellectual competences, creative competences that form the competencies of an industrial enterprise [32,33]), patent capital (identifiable intellectual property objects both created by employees of the enterprise and "acquired": possession and use [34]). All components of innovative capital can generate profit when used, and, accordingly, it can be estimated using methods of assessing value.

In addition, it currently makes sense to talk about digital capital. The generally accepted concept of digital capital has not yet been formed. The definition of digital capital includes the possibility of developing methods for analyzing big data, approaches to processing data flow, the formation of special information systems, the use of a variety of digital services. Digitalization makes special demands on human capital; digital literacy is becoming the core competency [35-38]. Therefore, in our opinion, digital capital is the cost advanced to certain innovation-oriented resources that allow you to

create and implement innovations: human capital (digital component - digital literacy, mobility, flexibility), intellectual capital (digital component - cognition, multifunctionality, creativity), patent capital (digital component - skills and abilities to digitally formalize the results of scientific research and implementation of innovations - digital ie support).

Summing up, it should be noted that mainly in scientific developments the known measured statistically observable and statistically measured indicators of innovative activity of the enterprise are used, however, all of them are "contemplative" indicators that do not allow evaluating the economic efficiency of innovative development of an industrial enterprise.

A new toolkit for assessing the economic efficiency of innovative development is proposed - an indicator of innovative capital (with the indicated structure - human, intellectual, patent and digital capital). The principles of formation of innovative capital are determined, a review of possible methods for assessing innovative capital is carried out. Only by incrementing innovative capital can we evaluate and manage the innovative development of an industrial enterprise.

## V. Conclusions

The study allows us to draw the following conclusions.

1. The concept of "innovative development" of an industrial enterprise has been clarified.
2. The necessity of improving the tools for assessing the economic efficiency of innovative development is justified; existing indicators of innovative activity, statistically measured and statistically observable, allow us only to state what has happened and are called "contemplative indicators."
3. The content of the concept of "innovative capital" has been clarified, the principles of the formation of innovative capital have been determined.
4. The structure and content of the components of innovative capital - human, intellectual and patent and digital capital — has been clarified, and digital capital is present as a component in all of the listed capitals, can (should be measured) both the digital component of human, intellectual and patent, and in total as an independent part (type) of innovative capital.

A further direction of the study is the formation of a system of specific criteria and indicators of innovative capital of an industrial enterprise and methods of its assessment.

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