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A Model for Countering the Information and Technical Threats of Intellectual Capital Management of Innovation-Oriented Systems in the Engineering Sector

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ABSTRACT

The modern economy is characterized by a sharp increase in the role of non-material factors (information and knowledge) in ensuring the competitiveness of individual enterprises and institutions, as well as national economies as a whole. Under these conditions, the ability to create, use and increase intellectual capital is the basis for the economic growth of engineering business entities. The main purpose of the study is to model the counteraction to the main threats of intellectual capital for innovation-oriented systems in the engineering sector of the economy. The relevance of the study is given by the fact that the formation and use of technical, economic, industrial, and other types of knowledge, the totality of which forms intellectual capital, is becoming an urgent problem for modern systems tuned to innovative development. The threats to managing the intellectual capital of innovation-oriented systems are now the most significant, since the achievement of the ultimate goals of the system itself depends on the efficiency of the use of intellectual capital. Taking this into account, intellectual capital is becoming a real and valuable target of criminal encroachments today, which requires scientists to form a clear model for countering these goals. The research methodology involves the use of mathematical methods of information support for the process of counteracting the negative impact of threats. According to the results of the study, we presented the modeling process. As a result, a model was built to counteract the main threats of intellectual capital for innovation-oriented systems in the engineering sector of the economy. Further research requires the construction of a mathematical mechanism for responding to new challenges to the intellectual capital management system for innovation-oriented systems.

1. INTRODUCTION

Every product or service we use in our daily lives is the result of a long chain of innovations, large or small, such as design changes or improvements that make a product more functional. Regardless of what product your business produces or what services it provides, it is likely that you regularly use and create a large amount of intellectual property. In such a case, you must systematically take the steps necessary to protect and manage intellectual property rights in order to obtain the best commercial results from their ownership.

Today, intellectual capital for any developed system is the basis of wealth, which determines competitiveness and is a key resource for its development. The problems of the formation and use of intellectual resources are closely related to the effectiveness of the implementation of innovative projects and effective counteraction to threats. The implementation of innovative processes related to the development of new technologies, new types of products, services, organizational, technical, and socio-economic decisions of an industrial, financial, marketing, or other nature require not only the expenditure of resources but also the use of special organizational and economic tools. In this regard, intellectual capital becomes not only a necessary resource for the implementation of innovations but also an effective organizational and managerial tool for developing the system and increasing its competitiveness.

Innovation-oriented systems usually use such types of knowledge as individual understanding and practice, professional experience, and creative solutions. They must create a knowledge spiral where tacit knowledge needs to be identified and disseminated so that it becomes part of every individualized knowledge base. The "Knowledge Spiral" is updated to rise to new and new levels, expanding the knowledge applied to different areas of the system. Modern information technologies play an important role in this. It is through them that knowledge becomes a source of high productivity, innovation, and competitive advantage. But all these complex systems become the object of the negative impact of both external and internal threats.

In the context of the rapid development of the information economy and the strengthening of globalization processes, on

the one hand, creating more opportunities for innovation-oriented systems (in particular, they provide access to the latest scientific and technological achievements, allow expanding sales channels, provide access to new international markets), and on the other hand, they increase competition, the key factors for ensuring competitiveness are intellectual capital and the effectiveness of its management.The presence of a significant intellectual capital of a modern enterprise is one of the main and defining competitive advantages that ensures the stable development of the enterprise and the consolidation of its position in the market by increasing competitiveness, since the effective use of intellectual capital enhances other competitive advantages and contributes to the formation of new ones.

Understanding this requires an assessment of the main threats that can negatively affect the management of intellectual capital of innovation-oriented systems. Intellectual capital management is not the only link in any innovation-oriented system and cannot consume all of its resources. At the same time, it turns out that resources are limited and, therefore, the system simply does not have as many resources to effectively respond to all risks and threats. A model for the correct distribution of these resources is needed.

The main purpose of the study is to model the counteraction to the main threats of intellectual capital for innovation-oriented systems in the engineering sector of the economy.

The main structure of the article consists of a review of the literature, a description of the presented research methods that were used, the results obtained as a result of the analysis, a discussion of the results obtained and formed on the basis of their conclusions.

As a result of the study, a model was formed to counter the main threats of intellectual capital for innovation-oriented systems of the machine-building sector of the economy, which will allow machine-building enterprises to protect their own intellectual capital in the most efficient and least costly way.

2. LITERATURE REVIEW

Deepening into the scientific literature on the management of intellectual capital and its impact on innovation-oriented systems, it should be noted that there is enough literature. Thus, summarizing the opinion of many scientists [1-3], it should be noted that they consider intellectual capital as an adequate form of manifestation of the productive and creative forces of a person in the information-network system, the elements of which receive a monetary and non-monetary evaluation, and accumulate. are capitalized, become intellectual property, enter the market and social circulation as a leading factor, cause productivity growth, provide additional income, improve the quality and standard of living of people and ensure sustainable innovative economic growth and social stability in society.

Some scientists and practitioners focus on a product that provides intellectual capital for innovation-oriented systems. For example, as noted by Uslu [4], the products of intellectual activity are products of the natural monopoly of the intellect of the creators, they are not completely alienated, but borrowed, and therefore can be the object of several transactions at once, do not have a material form, can be the object of multiple sales without damage for their content; are limited in the nature of the commodity form, since they do not turn into a commodity immediately, but only after their applied significance is discovered. And this is not only important for innovative development in the engineering field.

In general, the majority of scientists Manzaneque et al. [5], Yuan et al. [6], Agostini et al. [7] treat the intellectual capital management system of an innovation-oriented system as something that, by its nature, a management system should bring, namely, a certain result. The results of intellectual activity have a high level of novelty in the processes of formation and development of intellectual capital, which is associated with the socio-psychological characteristics of the individual, and the distinctive features of her thinking. Intellectual activity is aimed at inventing, obtaining novelty as a set of properties that characterize the radical changes in an object and give it the right to be called new. Novelty, providing a set of improved characteristics (properties, indicators, parameters, etc.), contributes to improving the quality and competitiveness of products (services). Combining the intellectual potentials of employees in the process of performing a creative task is characterized by a constructive synergistic effect on the entire system.

We believe that the intellectual capital management system is extremely important for innovation-oriented systems in the engineering sector of the economy and is very sensitive to the negative impact of various threats.

As noted in the scientific and practical literature [8, 9], the most vulnerable in the management of intellectual capital is the legal aspect. It is rights and patents that are very sensitive to external as well as internal threats. We also took this into account. The features of the demand for products of intellectual activity is the reality of their commercial use to obtain additional profit through the use of protected results of intellectual activity in the production and sale of products, as well as the sale of rights to use intellectual property in accordance with a license agreement. Sometimes some rights to use intellectual property objects limit the possibility of using other rights to intellectual property objects, which is also related to the strategy for the release of engineering products.

The issue of modeling the negative impact of threats on any complex socio-economic system has also been the attention of many scientists. Here we have the state level as one of the most complex socio-economic systems [10] or an analysis of the human resource management system [11]. We focus on those systems that strive to develop innovatively and cover the engineering sector.

Summing up the analysis of the scientific literature, it should be noted that today there is a need to present new ideas for finding methodological approaches for analyzing threats to intellectual capital management with the possibility of streamlining the management measures themselves to counteract this negative impact on innovation-oriented systems.

3. METHODOLOGY

Like any other theoretical scientific research, we apply a number of methods that together form our methodology. All the use methods operate and exist in scientific and practical activities, therefore, in this study, we are not trying to invent our own methods, but only to form a methodological approach based on existing ones to complete the task.

Table 1. Information matrix of identified threats to intellectual capital management of innovation-oriented system of the engineering sector

E_{ij}	Internal system threats	E_{ij}	External system threats
E_1	Low level of information support	E_1	Lack of digital specialty of the region
E_2	An inefficient error detection system	E_2	Legacy hardware
E_3	Machine Learning Challenges	E_3	Problems with the import of high-tech digital technologies
E_4	Poor data management	E_4	Low level of education in information technology
E_5	Digital literacy	E_5	Low government support for innovation-active socio-economic systems
E_6	Inefficient management of innovation processes	E_6	Lack of digitalization at the state level of government
E_7	Lack of use of cloud technologies	E_7	Lack of correlation between communication technologies and data on international companies

For better understanding and description, we can conditionally distinguish two groups of methods of our research methodology. The first one, like everything else, is the basic method. These include the method of analysis and systematization of scientific and practical information. Analysis, systematization and processing of information, mainly used in the literature review part. Thanks to the application of the abstract-logical method and deduction, introductions and conclusions were formed. General scientific research methods made it possible to fully analyze and systematize the acquired knowledge necessary for the study.

Specific methods included the method of mathematical notation, which made it possible to better graphically describe the identified threats in the results of the study. The main method is the methodology of hierarchical information compilation of processes. This method, through a series of calculations and the use of auxiliary methods for its complete implementation (mainly graph theory), is best suited for our task in the article.

An important part of the economy is the theory of fuzzy sets, used for strategic design, research of the state and pricing of the initiative of enterprises and closed groups. In general, in the economic field, methodology of hierarchical information compilation of processes are used to approve locally optimized solutions at each stage, and the final answer will also be optimized, which is the importance and value of applying the theory in question in the economic sphere.

It should also be noted the intermediate use in the discussion of the results of the study, the method of interviewing colleagues involved in the socio-economic system, which was chosen in our article.

According to our main methodology, we must determine and mathematically designate the main external and internal threats to the management of intellectual capital of an innovation-oriented system in the engineering sector of the economy. For this, our engineering company, where my co-authors and I have been working for more than 5 years, will serve as the best system. We won't need to pick up threats from the sky or single them out because of unverified experts. We will choose as an example those external and internal threats that exist in the practice of activities of a company familiar to us, which is an innovation-oriented socio-economic system.

So, the totality of the identified external and internal threats to the management of intellectual capital, we denote by the information subset $E_{ij}=\{E_1 \ldots E_n\}$ (Table 1).

Further calculations will involve the construction of matrices that allow you to form a graph of connections and contribute to the achievement of your goals. So, for further formation of the matrix of dependence of threats to the management of intellectual capital of an innovation-oriented system of the engineering sector, the following equality (1) must be fulfilled, according to the methodology:

$$E_{ij}=\begin{cases} set\ 1, if\ i\ affects\ j; \\ set\ 0, if\ no \end{cases} \quad (1)$$

In order to calculate all levels of the negative impact of threats to intellectual capital management, according to the rules of our methodology, it is necessary to achieve equality with respect to the subset of vertices of reachable threats ($L(E_i)$) and those that will be threats by predecessor vertices in the graph ($A(E_i)$) in the constructed graph (2):

$$G(E_i)= L(E_i) \cap A(E_i) \quad (2)$$

And those that will not be reached from any peak of threats (E) and will, according to the methodology, constitute the first level of response to those. At the same time, the following equality (3) must be satisfied for the remaining vertices of threats:

$$G(E_i)=A(E_i) \quad (3)$$

All calculation results according to the presented methodology will follow below in the text in the next chapter.

4. RESULTS OF RESEARCH

The first results of our study will be the construction of a matrix table of dependence between threats to the management of intellectual capital of innovation-oriented systems. Having carried out the necessary calculations and observing equality (1), we build the mentioned matrix (Table 2).

So, we are building a graph-model of links between hazards in the management of intellectual capital of an innovation-oriented system on the main data of Table 2 (Figure 1).

The next step involves the formation of a matrix table of the reach of threats to the management of intellectual capital of innovation-oriented systems based on the data in Figure 1. (Table 3).

The following results will be the formation of an iterative calculation matrix table for the formation of the level of response to one or another external or internal threats to the management of intellectual capital of the innovation-oriented system of the engineering sector. For this, equalities (2) and (3) presented above must be fulfilled. When equality (3) is fulfilled, we get the lowest level (Table 4).

Therefore, equality (3) holds for the external threat E_3 (Problems with the import of high-tech digital technologies). It should be noted that the lack of modern high-tech digital technologies is a global problem and requires more strategic

solutions. This can also be said about E_6 internal threats (Inefficient management of innovation processes). The fact is that it will not be possible to immediately quickly resolve the issues of managing innovative processes, it is necessary to implement a number of other measures, which then will positively affect this systemic process. We removed E_6 and E_3 and we get the following calculated matrix table (Table 5).

Table 2. Matrix table of dependence between threats of intellectual capital management of innovation-oriented systems

Internal threats							
E_{ij}	**E_1**	**E_2**	**E_3**	**E_4**	**E_5**	**E_6**	**E_7**
E_1	0	0	0	1	1	0	1
E_2	0	0	0	0	0	0	0
E_3	0	0	0	0	0	0	0
E_4	0	0	0	0	0	0	0
E_5	0	1	1	1	0	0	0
E_6	1	0	0	1	1	0	0
E_7	0	0	0	0	1	0	0
External threats							
Eij	E1	E2	E3	E4	E5	E6	E7
E1	0	0	0	0	1	1	1
E2	1	0	0	0	1	1	1
E3	1	1	0	1	0	1	0
E4	1	1	0	0	1	1	0
E5	0	0	0	0	0	1	0
E6	0	0	0	0	0	0	1
E7	0	0	0	0	0	0	0

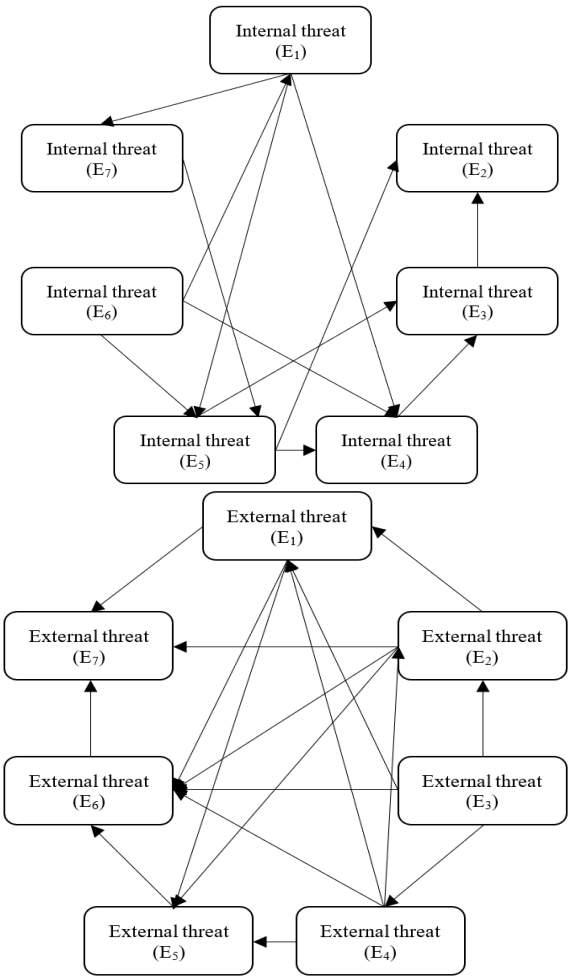

Figure 1. Graph-model of links between threats to the management of intellectual capital of an innovation-oriented system (developed by the authors)

Table 3. Matrix table of the reach of threats of intellectual capital management of innovation-oriented systems

Internal threats							
E_{ij}	**E_1**	**E_2**	**E_3**	**E_4**	**E_5**	**E_6**	**E_7**
E_1	1	1	1	1	1	0	1
E_2	0	1	0	0	0	0	0
E_3	0	1	1	0	0	0	0
E_4	0	1	1	1	0	0	0
E_5	0	1	1	1	1	0	0
E_6	1	1	1	1	1	1	1
E_7	0	1	1	1	1	0	1
External threats							
Eij	E1	E2	E3	E4	E5	E6	E7
E1	1	0	0	0	1	1	1
E2	1	1	0	0	1	1	1
E3	1	1	1	1	1	1	1
E4	1	1	0	1	1	1	1
E5	0	0	0	0	1	1	1
E6	0	0	0	0	0	1	1
E7	0	0	0	0	0	0	1

Table 4. Iterative calculation matrix table for forming the level of response to threats to intellectual capital management of the innovation-oriented system of the engineering sector

Internal threats			
E_{ij}	**$L(E_i)$**	**$A(E_i)$**	**$G(E_i)$**
E_1	1, 2, 3, 4, 5, 7	1,6	1
E_2	2	1,2,3,4,5,6,7	2
E_3	2,3	1,3,4,5,6,7	3
E_4	2,3,4	1,4,5,6,7	4
E_5	2,3,4,5	1,5,6,7	5
E_6	1,2,3,4,5,6,7	6	6
E_7	8	1,6,7	7
External threats			
E_{ij}	**$L(E_i)$**	**$A(E_i)$**	**$G(E_i)$**
E_1	1,5,6,7	1,2,3,4	1
E_2	1,2,5,6,7	2,3,4	2
E_3	1,2,3,4,5,6,7	3	3
E_4	1,2,4,5,6,7	3,4	4
E_5	5,6,7	1,2,3,4,5	5
E_6	6,7	1,2,3,4,5,6	6
E_7	7	1,2,3,4,5,6,7	7

Table 5. Iterative calculation matrix table for forming the level of response to threats to intellectual capital management of the innovation-oriented system of the engineering sector

Internal threats			
E_{ij}	**$L(E_i)$**	**$A(E_i)$**	**$G(E_i)$**
E_1	1, 2, 3, 4, 5, 7	1	1
E_2	2	1,2,3,4,5,7	2
E_3	2,3	1,3,4,5,7	3
E_4	2,3,4	1,4,5,7	4
E_5	2,3,4,5	1,5,7	5
E_7	8	1,7	7
External threats			
E_{ij}	**$L(E_i)$**	**$A(E_i)$**	**$G(E_i)$**
E_1	1,5,6,7	1,2,4	1
E_2	1,2,5,6,7	2,4	2
E_4	1,2,4,5,6,7	4	4
E_5	5,6,7	1,2,4,5	5
E_6	6,7	1,2,4,5,6	6
E_7	7	1,2,4,5,6,7	7

Further, equality (3) is fulfilled for the external threat E_4 (Low level of education in information technology) and the internal threat E_1 (Low level of information support). It should be noted that debugging information support in any system with a complex structure is a difficult process. And it cannot be solved exclusively by operational measures. Management measures of a tactical nature should be taken. This also applies to the educational process. Increasing information technology literacy is a complex process, but it poses a threat to the entire engineering sector. Therefore, it requires the use of tactical management measures. Extraction of these threats allows to form the following iterative matrix table (Table 6).

Equality (3) will be fulfilled this time for the external threat E_2 (Legacy hardware) and the internal threat E_7 (Lack of use of cloud technologies). The lack of popularity among managers of the socio-economic system in the use of cloud technologies causes a feeling of concern for the engineering sector. Our innovation-driven system is experiencing the same problems. As a company that has a complex socio-economic systematization at all levels, it is a mistake not to use cloud technologies. This should be corrected as soon as possible. Removing E_2 and E_7 generates the following matrix table (Table 7).

Omitting the demonstration of subsequent calculations, the results show that the highest level of threats among internals is occupied by E_2 (Inefficient error detection system). This is due to the fact that the innovation-oriented system we have chosen has problems with the efficiency of error detection and is a very critical signal that requires prompt intervention and the fastest possible elimination of the problem.

At a higher level, from the side of external threats, the highest level is occupied by E_7 (Lack of correlation between communication technologies and data on international companies). Yes, in our country, innovation-oriented complex systems have problems of cooperation in the international market and are still not able to reach the same level with high-tech companies. This poses a significant threat and therefore one should catch up with others in this process as quickly as possible.

Consequently, the final stage will be the construction of the matrix model itself for streamlining management measures to counter threats (Table 8).

Table 6. Iterative calculation matrix table for forming the level of response to threats to intellectual capital management of the innovation-oriented system of the engineering sector

Internal threats			
E_{ij}	**$L(E_i)$**	**$A(E_i)$**	**$G(E_i)$**
E_2	2	2,3,4,5,7	2
E_3	2,3	3,4,5,7	3
E_4	2,3,4	4,5,7	4
E_5	2,3,4,5	5,7	5
E_7	8	7	7
External threats			
Eij	L(EI)	A(EI)	G(EI)
E1	1,5,6,7	1,2	1
E2	1,2,5,6,7	2	2
E5	5,6,7	1,2,5	5
E6	6,7	1,2,5,6	6
E7	7	1,2,5,6,7	7

Table 7. Iterative calculation matrix table for forming the level of response to threats to intellectual capital management of the innovation-oriented system of the engineering sector

Internal threats			
E_{ij}	**$L(E_i)$**	**$A(E_i)$**	**$G(E_i)$**
E_2	2	2,3,4,5	2
E_3	2,3	3,4,5	3
E_4	2,3,4	4,5	4
E_5	2,3,4,5	5	5
External threats			
Eij	L(EI)	A(EI)	G(EI)
E1	1,5,6,7	1	1
E5	5,6,7	1,5	5
E6	6,7	1,5,6	6
E7	7	1,5,6,7	7

Table 8. The matrix model of countermeasures against information and technical threats of intellectual capital management of innovation-oriented systems

Necessary countermeasures	**Regulation of internal threats**	**Necessary countermeasures**	**Regulation of external threats**
Application of operational management decisions	Inefficient error detection system	**Application of operational management decisions**	Lack of correlation between communication technologies and data on international companies
	Machine Learning Challenges		Lack of digitalization at the state level of government
Application of operational-tactical management decisions	Poor data management	**Application of operational-tactical management decisions**	Low government support for innovation-active socio-economic systems
	Digital literacy		Lack of digital specialty of the region
Application of tactical management decisions	Lack of use of cloud technologies	**Application of tactical management decisions**	Legacy hardware
	Low level of information support		Low level of education in information technology
Application of strategic management decisions	Inefficient management of innovation processes	**Application of strategic management decisions**	Problems with the import of high-tech digital technologies

Summing up, and making certain intermediate results of the study, we want to note that our main task was to demonstrate the ability of new methodological approaches to contribute to effective process management. In our case, such processes are the management of intellectual capital for complex innovation-oriented systems. Any system, be it social or economic, faces threats sooner or later. Today, in the era of digital technologies, and critical dependence on information support, the greatest threat to the intellectual capital management system in the engineering field is played by information technology threats.

5. DISCUSSIONS

Discussing the results of the study, we identified a number of threats that affect the management of intellectual capital in innovation-oriented systems. Of course, the presented list is not exhaustive, however, it allows us to say what threats to systems may exist today. We chose our own place of work in one of the socio-economic systems because it is there that we know the so-called "internal information and innovation kitchen" and can show our own research in practice. As a result, we would like to know their opinion. To do this, a questionnaire method was used solely to identify what our colleagues think. This survey should not be called professional and expert, but it allows you to show small, intermediate results of practical application. Further research will cover professional opinion due to the practical application of the proposed model (Figure 2).

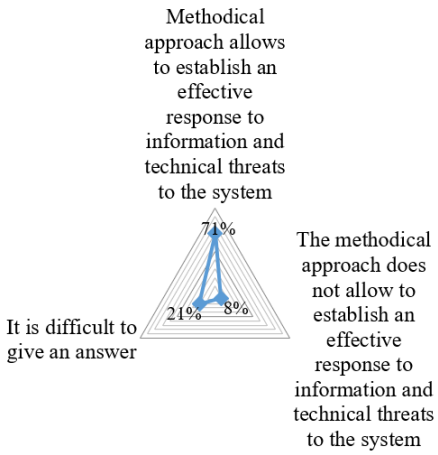

Figure 2. The results of the discussion of the application of the methodical approach in the practical activity of the innovation-oriented system (developed by the authors)

Most scientists [12, 13] in the course of studying the intellectual capital management system focus on its strategy. It is noted that the elements of the strategy cover all areas of the socio-economic system and are usually aimed at increasing production and improving product quality and reducing costs. The strategy for managing the intellectual capital of the socio-economic system should be flexible, provide opportunities for decision-making in the shortest possible time and contribute to an increase in the number of tasks to be solved. However, in our opinion, it is advisable to use the definition, measurement of intellectual capital, and its management strategy to analyze the state and composition of intangible assets, and their effective use, which allows you to more accurately assess the cost of the system, its attractiveness for shareholders and investors, and improves the efficiency of socio-economic work system as a whole.

As noted by Urba et al. [14], the use of digital technologies can lead to an improvement in the situation of intellectual capital and significantly improve the innovation-oriented state of the system. We also took into account digital technologies, but together with it, we took into account the threats that they can bring.

Other scientists [15, 16] note that it is better to identify threats through an analysis of the state of intellectual capital. This allows you to identify weaknesses, which is a consequence of the low cost of intellectual capital, and through weaknesses try to turn them into strengths.

Some authors focus on the complex counteraction to threats to the intellectual capital management system of the socio-economic system [17, 18]. They note that effective countermeasures require an integrated approach that will maximize the value of all measures.

Of course, we are not the first to look for ways to model threats and improve intellectual capital management. However, most scientists [19, 20] single out either general or socio-economic threats. Yes, they are also important, but when it comes to innovation and intellectual capital, here one should understand the significance of the impact of Industry 4.0 on the engineering sector and therefore, the threats that have the greatest impact are those that have an information technology nature of a negative impact.

Taking into account the review of the literatures [12-20], we can say that today this topic is relevant and important, while this problem has not yet been fully studied and there are significant obstacles in the formation of such a model for countering threats to intellectual capital management of innovation-oriented systems that would take into account all its components and all types of threats.

It should be noted that there are many types of innovation-oriented systems and it is difficult to cover them all in one study. We have chosen a socio-economic system in the form of an engineering enterprise producing a variety of engineering products. The experience of the authors of the article and their parallel practical activities and engineering in the field allows, from a practical point of view, to create opportunities to highlight the threats that they see in the systems where they work. Our research results differ from similar ones, and, first of all, this concerns taking into account the specifics of innovation-oriented systems and presenting a methodological approach that will allow us to clearly and correctly form and organize all problems and threats.

6. CONCLUSIONS

Summing up the conclusions, I would like to emphasize that in modern practice, the attitude to intellectual assets as capital requiring management, unfortunately, is very rare. It can be said that the management of intellectual capital is rarely determined by the priorities of strategic development for innovation-oriented systems. This means that, for the most part, intellectual capital is left without purposeful management or simply idle. To demonstrate the need to manage intellectual assets, one should try to correlate them with a group of tangible assets. Think idle production facilities, unused inventory, and excess cash. Approximately this potential remains unrealized in a situation where there is no

management of intellectual capital. Putting together all these forgotten assets (both intangible and tangible) - and we get a significant potential in the income of any socio-economic system.

Intellectual capital management has excellent potential to become a successful strategy in the future. Managers of the new millennium must understand both the tangible and intangible components of intellectual capital. They must direct their activities in such a way that they ensure the harvest of knowledge. These managers will need the kind of behavior required to find and value intellectual capital and then manage this capital as an asset of an innovation-oriented system.

Intellectual capital is considered an integral component and implies the integrated management of all constituent assets. Trying to manage a single intellectual asset in isolation from others suggests a lower level of efficiency. The negative impact of threats also falls on all this. The most effective method for assessing these threats is to understand how best to counter them and with what resources.

The strategy for managing the intellectual capital of an innovation-oriented system depends on the operating environment. In this situation, it is necessary to determine which threats should be countered operationally. For this, it is advisable to form and use a model for countering threats to intellectual capital management.

In our study, we did not take into account all possible threats, but the focus was shifted to information technology, which is very closely related to digital information technology, which is used by innovation-oriented systems.

According to the results of the study, we presented the modeling process. As a result, a model was built to counteract the main threats of intellectual capital for innovation-oriented systems in the engineering sector of the economy. It should be noted that the model we have formed is the basic part and the main difference of our study differs from similar ones, and first of all it concerns taking into account the specifics of innovation-oriented systems and presenting a methodological approach that will clearly and correctly formulate and systematize all problems and threats. This study will allow the management of an engineering sector to analyze the activities of their own company in terms of protecting intellectual capital and choose the level of intervention in the management system. Such systematization and clarification is, of course, a new component of the issue of protecting intellectual capital management of innovation-oriented systems.

Further research requires the construction of a mathematical mechanism for responding to new challenges to the intellectual capital management system for innovation-oriented systems.

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