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International Scientific Conference**KNOWLEDGE-BASED CAPITAL OF COMPANY IN CONTEXT  
OF UNIFORM DIAGRAM OF FUNCTIONAL SYSTEM**

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evgeniya.nigay@vvsu.ru**Abstract**

The knowledge-based capital of a company is a key source of its competitive edge and it ensures its position in the markets. At the macrolevel, its development can help transit to the sixth technological paradigm and withdraw from the resource export economy in favor of innovations. To develop knowledge-based capital, it is necessary to understand what elements it comprises, the stages of their establishment, features of their interaction, and possible impacts of the respective processes on the company. We suggest using the systemic approach for these purposes and a uniform diagram for a functional system in particular. As a result, we determined the development scenarios for specific types of knowledge-based capital. We describe the ways of manipulating company resources (intellect types) to obtain the required types of knowledge-based capital. We characterize the methods of using knowledge-based capital organization and self-organization mechanisms to ensure its operation as a functional system. The results obtained can be used to formulate legal and policy documents at the federal and regional level that would stipulate the transformation of Russia's economy. The use of a uniform diagram of a functional system will present an opportunity to create a theory of knowledge-based capital in the long term that would describe its elements, stages of formation, and element interaction mechanisms. This will help identify the key instruments of effective work with this phenomenon to stimulate the transition to higher development levels.

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## 1. Introduction

One of the pressing issues of today's economy is the withdrawal from the export-based model in favor of the innovation model. The latter would ensure steady economic growth through groundbreaking technology, intensified production, and the development of non-material production factors at specific companies. The use of the export-based model is inefficient in the long term as material resources are not renewable. Knowledge-based capital is becoming the main source of a company's competitive edge. Its efficient formation and development require the understanding of what knowledge-based capital is, what its elements are, how they are formed, and how they interact.

The systemic approach is the main one in studying the phenomenon of knowledge-based capital. It helps prepare a list of its elements and explain how they interact, and what synergistic effects specific combinations may have. Many research works rely on this approach. According to Edvinsson and Malone (1997), the knowledge-based capital of a company is established as a combination of human and structural capital assets. Stewart (1998) identified human, structural, and consumer capital as its components. This position became universally accepted and it was developed in contemporary research works. For instance, Claver-Cortés et al. (2018) includes human capital, structural capital, and relationship capital into the list of knowledge-based capital elements. His structural capital is the same as organizational, and consumer capital is the same as relationship capital. Iazzolino et al. (2019) shares this point of view. Russian researchers generally have similar views on the elements of knowledge-based capital. For instance, Inozemcev (1995) describes the structure of knowledge-based capital as a combination of human capital, comprising experience, knowledge, and skills of the company employees, and structural capital, comprising intellectual property, as well as organizational structure, electronic networks, and databases. Some researchers do not just analyze the structure of intellectual capital but also the impacts its elements have on each other and the performance efficiency indicators of the entire company such as productivity (Albertini & Berger-Remy, 2019; Khosravipour et al., 2017; Pedro et al., 2018).

## 2. Problem Statement

While there are many research works available, their main drawback is the lack of a clear sequence of knowledge-based capital formation and development stages. We believe that applying the concept of functional systems is efficient in this respect.

## 3. Research Questions

The key problems of the research include the following:

- 1) the identification and analysis of the possible development scenarios for various types of knowledge-based capital in a company;
- 2) the development of methods to manipulate initial resources to obtain the required knowledge-based capital types;
- 3) the development of methods to ensure a more efficient operation of knowledge-based capital.

#### **4. Purpose of the Study**

The goal of this research is to identify the sequence of knowledge-based capital development stages in a company based on the adaptation as a reaction of a functional system to external impacts.

#### **5. Research Methods**

The research goal can be achieved through the categorical method of the Uniform Diagram of a Functional System (Razumov, 2008). The concept of the functional system was suggested by soviet psychophysiological P. K. Anokhin in the 1970es (Anokhin, 1975). Its key idea was viewing the objects in question as functional systems, i.e. the systems that were formed to achieve and maintain useful adaptive effects in response to environment changes. The basic categories of process diagram include the following:

- external (environmental) impacts, or changes in the environment that demand response;
- memory, or the experience of actions in similar situations, a set of antecedent events;
- resources, or the potential of the system or environmental elements that can be used to establish a functional system;
- stimulus, or the problem requiring solution;
- program module, or the area where the scenarios for possible external impact responses are developed. A mental experiment is carried out for each of these scenarios to select the best one.
- executive body, or a subsystem that executes the scenario (project, program) developed in the program module. This is the response of the functional system to the external environment stimulus;
- result, or the nature of the adaptive response to the external impact. It helps the functional system to train and improve through feedback.

#### **6. Findings**

Since any organization can be viewed as a social and economic system, it can be studied using the method of uniform diagram of a functional system (Figure 1):

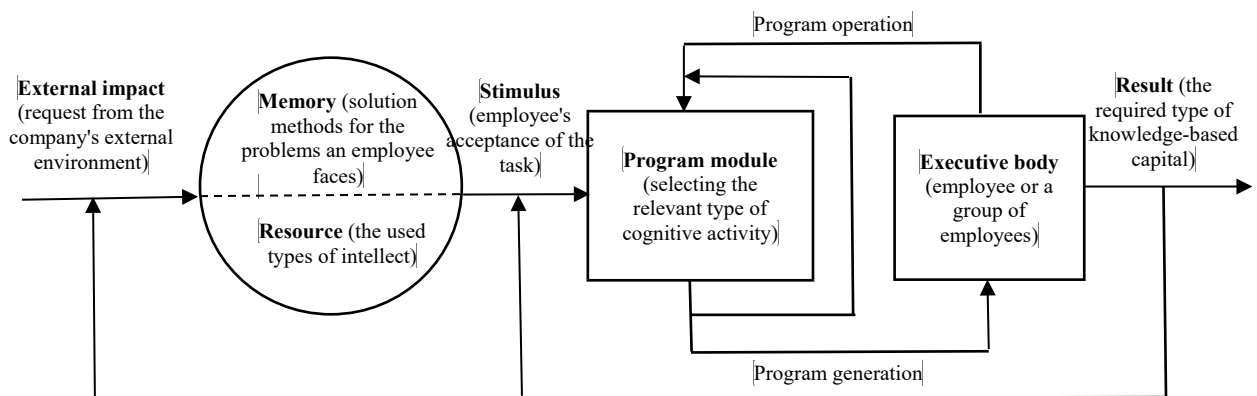
- external (environmental) impacts is a request from the company's external environment to establish and develop a specific type of knowledge-based capital;
- memory stands for any types of processes that employees use to solve the problems they face: stimulus-productive activities, heuristic activities, and creative activities (depending on how independent the employee is in selecting methods of work or even task selection);
- resources stand for types of intellect that can have different bases. The physiological basis arises from employee's having a certain level of intellectual abilities the psychological basis describes the employee's potential and the drive to develop their intellectual abilities; the social and economic basis reflects the ability to use it to achieve personal goals and solve problems of general economic development of the company.
- stimulus is the process of employee's task acceptance taking into account the available resources and memory. Different implementation methods can be used for the stimulus depending on its specific

features, provided that they ensure the required result (the formation of various types of knowledge-based capital);

– program module is the area of management interactions to develop a specific type of knowledge-based capital. This module may implement various types of cognitive activities: training, involvement, production optimization, self-improvement, client-oriented optimization, innovative activities (Nedoluzhko, 2016);

– executive body stands for an employee (or a group of employees) that ensures the development of a specific type of knowledge-based capital. The stimulus or the acceptance of the task drives the employee to perform relevant cognitive activities (the lower arrow is program generation) and implements it (the upper arrow is program operation);

– result is the formation and development of the required type of knowledge-based capital: human, organization, consumer (Nedoluzhko & Nigay, 2020).



**Figure 1.** The uniform diagram of knowledge-based capital as a functional system

We can identify two management problems that the company administration faces:

1) obtaining the result in the form of the required type of knowledge-based capital according to the request generated by the external environment. The aggregate development level of knowledge-based capital is determined by the development of its components. Initially, the company establishes human capital, i.e. the parameters and qualities of employees, and then it becomes the base for the development of other types of knowledge-based capital.

The diagram shown shows that the company administration has the potential to manipulate the resources available (the intellect of the employees established on various bases), the methods of resource manipulation (employees' methods of solving problems), and the methods of employees' acceptance of tasks. Suitable manipulation tools are systematized in Table 1.

**Table 1.** Management tools depending on the selected object

Management object	Management tools
Resources	- specific requirements for employees hired by the company
Stimulus	- specific requirements for employees hired by the company; - the use of various motivation types; - specific types of problem statement; - the nature of responsibility fixed on employees; - the use of various project models
Memory	- a combination of behavior training and problem statement types used in specific ways

Company management can ensure the availability of the required qualities in employees using two different methods: forming a set of requirements when hiring and developing required qualities during work, which is a preferred alternative because, in this case, it is possible to avoid personnel recruiting expenses. Besides, required employee parameters may change according to the changes in the requests from the external environment.

The manipulation of the required result can take place when the employee accepts the task (motivation in the diagram). The key tools which allow the managers to manipulate the acceptance of the task by employees include the following:

- creating a list of requirements for the initial qualities of employees. It is necessary to determine the levels of intellectual abilities, thinking originality, and psychological parameters of the employee. These requirements will vary depending on the desired result (human, organizational, or consumer capital and their combination). Thus, this tool is used for both creating resources required to obtain the specified result at the company, and motivating the task acceptance by employees;

- motivation from managers. The employee must be interested in performing the task because it is their responsibility, and failure to do so will cause sanctions against them. In this case, the simplest type of activity is used, the stimulus-productive activity based on the purely mechanical performance of tasks. A high level of motivation stipulates that the employee has the opportunity for personal and professional growth as a result of solving the problem they were faced with and a chance to learn something new and obtain new qualities. In this situation, heuristic activity is used because the employee can find the most efficient way of solving the problem. Finally, the most developed activity (creative) is based on the employee's ability to formulate problems, whose solution can yield the best results for the company;

- specific type of problem statement; Company management can formulate the task so that it would be the easiest to solve it using standard methods. A situation when the problem is new and lacks any specific solutions is more complicated. The most difficult situation for the employee is when there is a general direction of activity specified but no specific tasks. In this case, the employee independently determines their tasks and the methods of their performance;

- the nature of responsibility fixed on employees. If the managers prioritize employee's selection of simpler cognitive activity types (training, involvement) based on the use of preset or known practices, the employee's responsibility is at the minimum. If they stipulate implementing more complex cognitive activities based on finding new solutions for problems or selecting brand-new tasks, the employee's responsibility must be higher, which is achieved through the specific actions from managers, e.g. Involving employees in global decision making or making employees take decisions in the context of company values;

- the use of various project models. When designing organizational systems, company managers have to develop project models. These models include six subunits:

- arrangement of work;
- scaling-up of work;
- rotation of work;
- enrichment of work;
- model of a social engineering system;
- model of organization development.

These models reflect that the nature of changes in work and its parameters is becoming more complex: from the simplest model where all actions performed by the employee are determined by the managers from the very beginning to the most complex one where the degree of uncertainty of the nature of decisions made and actions selected is at its maximum.

At the level of memory, a combination of current behavior training problem statement types is used in a way that stipulates that to implement simple cognitive activities it is sufficient to use certain behavior training methods (reflex behavior, training based on employees' behavior in a group, personal experience-based training). These types of training are successfully combined with specific types of the problem statement. If the problem is formulated so that the employee cannot solve it independently or without asking their colleagues if it does not have any elements of challenge or novelty, and if its solution does not require any actions that contradict the employee's previous actions, the stimulus-productive activity is applied. In the opposite situation, heuristic and creative activities are maintained.

2) determining the nature of the result obtained in by the company resources available. This management problem occurs less often than the first one and it complements it. However, it is also relevant because its solution helps to compare the required result with the one that can be predicted taking into account the resources and conditions at the company.

## 7. Conclusion

Using the methods of a uniform diagram of a functional system against the company's knowledge-based capital allowed us to obtain the following results.

1. We identified and analyzed the possible development scenarios for various types of knowledge-based capital in a company.
2. We identified the possible manipulation methods for initial resources, that can be represented by various types of intellect, to obtain the required knowledge-based capital.
3. We determined the possible methods of ensuring the efficient operation of knowledge-based capital as a functional system through the identification of its organization and self-organization mechanisms.

The results obtained can be used in legislation and target program activities aimed at the use of intellect as a factor in the establishment of a knowledge-driven economy.

The use of this method will help formulate a comprehensive theory of knowledge-based capital in the long term, the use of which will provide an opportunity for the implementation of efficient knowledge-based capital management to prepare it for the upgrade of systemic and organizational structure.

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