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## **MODELLING OF EROSION OF THE AGILE LEADERSHIP PROJECT MANAGER COMPETENCES**

**Abstract:** The structure and functions of mechanisms of development and erosion of competencies in innovative projects of implementation of information and communication technologies are considered. The factors of development and erosion of competencies are determined and a model of competence and competency assessment for the successful implementation of information and communication technologies is identified, for example, for master's degree in project and program management. The proposed model of competence development of the project team for the creation and implementation project is based on the balance of factors of development of competencies of the innovation project and their erosion in the process of implementation. Investigation of factors of development and erosion of competencies in the management of innovative projects can adequately respond to changing the profile of competencies of innovation projects. At the same time, the analysis allows the project manager to form effective programs for acquiring certain competencies for team members and other interested parties. The proposed model of the factors of development and erosion of the system of competencies is tested on the examples which confirmed its adequacy and effectiveness.

**Keywords:** competences, competence, competence approach, innovative projects, development and erosion of competencies.

### **Introduction**

The world is developing rapidly on the basis of updating knowledge and active use of information and communication and innovative technologies in education and life. Such development requires the simultaneous development of systems of competencies and relevant competencies of specialists in the implementation of innovative technologies [1]. A generation of specialists is formed who are able to respond quickly to new knowledge, technological innovations, changing the market of competencies and educational information and communication technologies to train competent professionals in educational institutions, able to respond quickly to innovative challenges in certain fields of knowledge [2]. The

problems faced by professionals and organizations in the development and implementation of information and communication and innovative technologies are becoming more complex and dynamic over time. Typically, innovation project begins with a focus on modeling values, balancing and creating values, and it is no longer enough to use best practices alone. The complexity, short deadlines for the development and implementation of information and communication technologies, their uncertainty and innovative component require the advanced development of the competence of the staff that implements them [3]. With the increase of innovation, complexity and knowledge about products and services created in projects and programs, not only the value of knowledge and experience increases, but also the importance of the competence aspect of managers [4]. In this regard, the demand for competent professionals in all areas of innovation development is growing. The competencies of the project manager change objectively during her life for one reason or another. These categories are interdependent. In practice, in order to achieve the greatest efficiency, they try to achieve a dynamic approximation of human competencies and competencies, their respective characteristics, with an advantage in terms of levels and spectrum towards competencies.

The reasons for changes in the competencies of the project manager are internal to himself and are manifested in time changes in some important properties of her personality.

The reasons for changes in the competencies of the project manager (his duties, powers, responsibilities in relation to other systems) are external to the person and due to innovation and changes in the conditions of its activities, i.e. composition and structure, statics and dynamics of the project environment and environment. At certain points in time, these reasons can be considered objective in terms of changes in activities and project management processes.

Today, the labor market is faced with a large number of innovations and is gradually becoming a market of competence, and competence management, in these conditions, will play an increasingly important role in personnel management within the organization [5]. This primarily applies to innovative projects and programs in the field of implementation of information and communication and innovative technologies in education. All this is due to the fact that the type of scientific thinking is formed in the context of a system of competencies, methodological principles and standards that determine the structure of scientific knowledge and its form in terms of innovative development. Emphasizing the fundamental non-linearity of the processes of development and erosion of competencies under the influence of innovations in the implementation of projects, we define the need to introduce a new style of critical thinking. This style determines the feasibility of using the methodological model of research programs, which, acting as a form of knowledge development, naturally take competency-methodological activities beyond theories and conceptual systems as forms of fixing ready knowledge, beyond the barriers of scientific disciplines [6].

### **Analysis of recent research and publications**

Modern organizations face an urgent task: to reveal the competence potential of specialists in full, which is extremely important for making the right management decisions and conducting a reliable examination during the implementation of an innovative project. However, it must be remembered that for every employee who develops his career in the organization, such development is, on the one hand, a motivating factor, on the other - the threat of the organization to lose it. In this case, each employee is expected to learn to manage their own competencies and develop them [7].

If previously competence management was considered as a desirable component of the management system of the organization, now it has become absolutely necessary [8, 9]. To implement it, it is necessary to develop an appropriate subsystem based on the following principles [10, 11, 12]:

- competencies must be clearly delineated (the principle of independence of the components of an effective model);
- the management system should include all competencies related to the activities of the organization (the principle of completeness) [13];
- the powers of employees should be clearly defined, periodically reviewed and take into account the current challenges of the organization (the principle of realism);
- all competencies must be detailed to the required level (principle of differentiation);
- for all competency's indicators should be developed to assess the effectiveness and competence of employees (the principle of measurability).

On this basis, the methodology of convergent development of innovation project management systems is formed [10]. The methodology determines what is a necessary attribute of convergence is structural or functional changes in project management systems. It should be noted that there is an inherent feature of a converged management system, which establishes a long-term balance of competence of the team and other participants in the innovation project in relation to each other. The main advantage of the convergent model of development of competence of management systems is the possibility of simultaneous use of the potentials of different management methodologies, based on competencies, for effective interaction of participants in the innovation project. According to these mechanisms and methods, there are three main concepts of research and determination of the convergence of innovation project management systems [14]:

1. Acquisition by the system under study of the characteristics of other systems under the influence of innovations and external factors over time (evolution).
2. Approximation of characteristics of innovation systems and competencies for their development due to mutual movement to each other.
3. Determining the degree and degree of similarity of systems in the state «as is» in order to assess the required competencies [16].

The first and second concepts consider the parameters of the system in a dynamic state, and the third - in a static one.

The first concept is reflected in the evolution of competencies, which results in convergent similarity, i.e. similarity of competencies of management systems, based not on their industry characteristics, but on a close set of features formed independently in different systems. The main reason for convergent evolution is the similarity of the nature of the influence of external factors on these systems of competencies.

Since project management is one of the types of human activity, accompanied by the use of a certain arsenal of competencies for methods, tools and instruments of practical implementation, there is a set of conceptual models formed on the basis of numerous experimental studies and theoretical generalizations of world best practice. The chronology of the development of competency systems and project management methodologies clearly reveals the gradual application of interdisciplinary integrated approaches, associated with awareness of the negative consequences of excessive enthusiasm for narrow specialization of competencies and insufficient use of their synthesis methods [17].

Because interpenetration arises as a result of ensuring the innovation of processes in various fields of science, technology, education, etc. it is an interweaving and interaction of elements of competences of the formed systems of these branches of activity. At the same time, organizational pathologies are formed in relation to the interaction of competencies [18].

The second concept is related to the process of forming new systems of competencies through the approximation of the characteristics of the systems due to the mutual movement to each other. In this case, the key issue is the sustainability of development and flexibility of the system of competencies [19].

To implement the second concept, it is necessary:

- to determine the main components of the process of convergence of competencies of management systems in the formation of new methodologies;
- to offer criteria for comparison of system characteristics of objects at their convergence concerning competences [20];
- identify the main methods of comparison and analysis of systems that can be used in the formation of new competencies of project management methodologies.

Developed using a convergent approach to competencies, methods and models become almost the only way to create and use innovative methodologies in the field of project management [21]. It should be borne in mind that it is impossible to use the methodology used in other systems without a thorough analysis of the competencies of the systems for the convergence of their basic characteristics.

The driving force of the process of systems development and the creation of new competency systems is the creative force of the innovation process, as the interaction of the environment and the individual in the formation of a technologically mature organization [22]. This force creates a disturbance of the static equilibrium of the cyclic flow of system life and raises it to a whole new level. At the same time, managerial innovation is mainly a creative action, and the manager is a leader and seeks to succeed through a wide range of new competencies. Such processes open the ability to think within new competencies, to act quickly and confidently to understand intuitively. Creativity, realized through innovative behavior, contains not only experimental actions with new technologies, management methods, but also the ability to separate from the set of possible competencies that are best suited for the effective solution of tasks.

Intuitive creativity is a logical consequence of competent preparatory work of the mind, intense substantiation of the problem, idea, plan. This type of creativity is characterized by such competencies as integrativeness, integrity, completeness of its results, a high level of foresight and proactivity, which gives intuitive creativity a natural character and focuses on technological breakthroughs [23].

To achieve success in the competent solution of innovative problems, new requirements are formed to the personality of the project manager, taking into account his competence and ability to innovative thinking, ability to use methods of convergence of systems in the formation of new tools for unique decisions in project and program management. Many leading domestic and foreign scientists deal with these issues, but in most cases, their research is limited to choosing the best methodology from the existing ones for certain conditions, and the issue of expanding competencies through methods of convergence and integration of systems of different branches of science is practically not considered.

The third concept provides tools for determining the degree and degree of similarity of systems in the state «as is» in order to assess the necessary competencies for successful management of innovative projects for the introduction of information technology and digitalization of social activities. Project management is carried out in a certain environment, which is a complex of various (economic, technological, social, cultural, etc.) factors [24]. In a broad sense, management is a fundamental general functional property of the objective world, organic and inorganic nature, conscious and natural forces, which are characterized by the qualities of regularity, expediency, goal-setting and focus on the outcome of action [25]. At the same time, the convergence of competencies is objective today. After all, the diversity of such complex processes as innovative development, evolution of society, culture, management, etc. is studied on a single conceptual basis. The study of the philosophical foundations of innovative strategies for the development of project management competencies should be carried out taking into account the convergence of humanitarian and natural paradigms,

which is associated with the departure from rigid traditional rational models of knowledge and changing criteria of rationality. This thesis is inherent primarily in the development of competency markets for the introduction of information and communication technologies as key drivers of development.

**The aim of the article** is to analyze the models of development and erosion of the system of competence of the team of managers in the implementation of innovative projects and programs for the introduction of information and communication technologies in education.

### **Research methodology**

We will consider the development of competence in the context of the implementation of innovative projects and programs. The key driver will be information and communication technologies. The main hypothesis of the research is that the key factor of successful implementation of innovative projects and programs is the active development of the system of competencies in the processes of management, creation and migration of values based on the competence of managers.

The term erosion means «erosion», «destruction» is used in relation to the term competence as a semantic characteristic of competence. In other words, erosion, for one reason or another, is not subject to competence, but to competence. In this case, the phrase change of competencies or modernization of competencies associated with objective changes that occur with the project environment in the pace of its implementation, regardless of the state and changes in the competencies of project participants. Competence can be normative, i.e. one that is provided by the requirements of the project, and personalized, i.e. one that is consciously assigned and implemented by the project participant as an individual. The discrepancy between normative and personal competence is considered as an erosion of personal competence in relation to normative competence.

Competence structures are considered in the form of a dynamic system that changes under the influence of innovations and innovative projects and programs, as a system of competencies is subject to development and erosion at the same time due to external and internal factors. The application of modern methodologies for managing the development of complex socio-economic systems is increasingly associated with the use of innovative ideas, methods, and approaches borrowed from other sciences. Transdisciplinary is becoming a major feature of the sciences that study «evolving complexities.» The current state of development of economic, social, technical systems forms new requirements for the processes of management and decision-making and competence of stakeholders in such systems. To do this, analogy methods are actively used in creating new methods and models of decision-making borrowed from other fields of knowledge. To enable the use of such methods it is necessary to consider:

- the degree of complexity of management systems in different industries;
- the degree of convergence of these systems;
- competence and innovative thinking of the stakeholders of the innovation project.

The convergence hypothesis is a statement that no matter how different management systems are in the process of innovative development, ineffective obsolete competencies are rejected while maintaining effective and implementing new competencies that need innovative projects and their products. Because of this, they become relatively similar after gradual selection. This is largely due to the innovative development of knowledge systems, methodologies, techniques and technologies that reduce the difference between management systems in different industries, creating a single methodological basis, taking into account the specifics of projects and programs. In this case, according to the convergence hypothesis, if the control object at the initial stage is further from the position of stable equilibrium, the rate

of its development will be higher than the system closer to the equilibrium state. Accordingly, in the long run, the differentiation can be smoothed. The process that opposes convergence - «divergence» is used in control systems to determine the movement on different trajectories. At the same time, fundamentally new competencies appear, which require the development of stakeholder competence.

### **Modeling of processes of development and erosion of the system of competence of innovative projects**

Erosion of competence determines the negative changes over time, the decrease over time for one reason or another (not related to the purposeful process of human education) the level of human ability to perform certain activities, which may be due to various reasons. For example, forgetting over time, or for pathological reasons, data, facts and processes, loss of certain knowledge, skills or abilities due to prolonged lack of practice, etc.

The development of methodologies for managing innovative projects allows us to identify the following mechanisms for the formation of new and erosion of old competencies:

- development of knowledge in various fields;
- transfer of knowledge and technologies;
- transition to flexible Agile technologies;
- breakthrough technologies, benchmarking, kaizen and others;
- self-organization and evolution of systems;
- formation of stakeholder competence to understand the development and erosion of the competence system.

Consider the model of Gestalt factors of development and erosion of competencies, which is based on a system model of application of innovative and information and communication technologies in the acquisition of competence of students (Fig. 1). It is clear that the above model of Gestalt is a phenomenon of an incomplete model of competencies that are in the implementation of innovative projects and are constantly evolving. The model focuses on groups of factors of development and erosion. These factors work simultaneously and interact with each other.

By the nature of the causes, the erosion of competence can be natural and anthropogenic. Natural changes in competence are due to objective factors of a natural nature, such as age «burnout» of a person's personality, mental and physical condition. Anthropogenic causes are related to factors caused by human activity, such as loss of certain competencies due to unhealthy lifestyle.

At the rate of flow, the erosion of competence can be normal and accelerated.

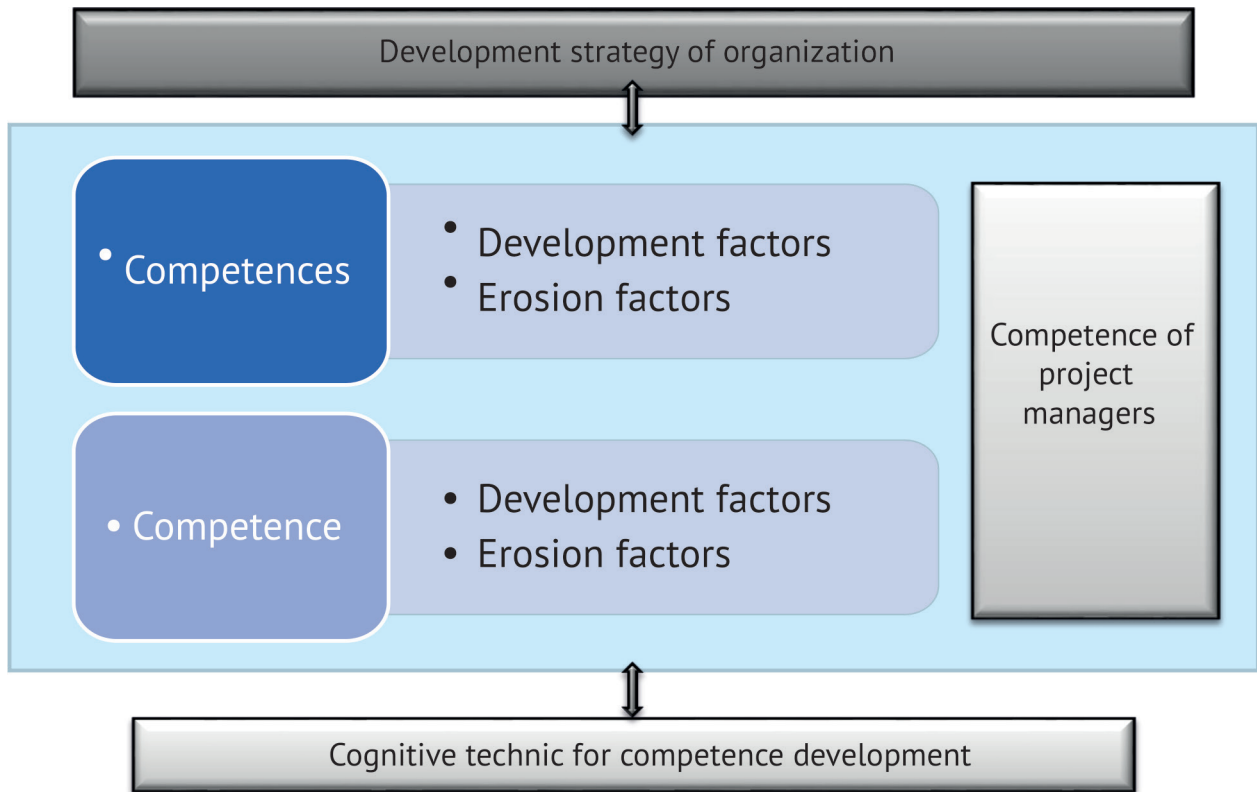


Fig. 1. Model of competence development in the implementation of information technology

Normal erosion of competence has a relatively low rate, is observed throughout human life, does not lead to rapid, abrupt and, usually, unpredictable negative changes in the level of a person's competence.

Accelerated erosion of competence is faster than normal and is usually accompanied by noticeable negative changes, even degradation, complete loss of the level of a person's competence. Moreover, anthropogenic erosion is not always accelerated and vice versa.

Development factors are formed under the influence of global following groups of trends. The first group of development factors is determined by the digitalization of the economy, the growth of global capacity of computer systems, their openness and data transfer speed. The factors of development are the construction of intelligent systems at different levels of society, the use of knowledge bases, large data processing, information protection systems based on blockchain technologies, the application of a competency approach in schools and educational standards, cloud and fog computing and innovation.

The second group of factors is related to the paradigm shift and the transition from a «rational economy» to a «behavioral economy». The basic postulate of «rational economy» shows that a person makes a choice based on the possible optimal result. Irrational decisions are often made in the transition to a «behavioral economy.» These factors affect the processes of competence development of individuals, organizations and businesses, the economy and the global economy.

The third group of factors for the development of competence is based on the convergence of knowledge. This means that no matter how different information technologies and management systems differ in the process of competence development, they reject ineffective tools while maintaining effective ones. Because of this, they become relatively similar or close after such a gradual selection. This is largely due to the development of knowledge, large data processing technologies and methodologies, techniques and technologies that focus on

value creation and reduce the distance between information systems for the development of competencies of different industries, creating a single methodological basis [24, 25]. In the process of competence development based on information systems, benchmarking technologies are widely used, transfer of best practices, which are not always sufficiently substantiated, have a clear integration and harmonization for their practical implementation. The use of benchmarking methods in the development of competence is appropriate where a systematic approach to the transfer of knowledge from existing knowledge models to project management systems.

Consider the model of erosion of the system of competencies of innovative projects for the introduction of information and communication technologies.

The first factor in the erosion of competencies is associated with the rapid growth of requirements for the competence of managers of innovative projects, both in subject areas and in management. This is a factor of erosion, which leads to the decline of inflexible organizations with closed paradigms of innovation. At the same time, it is critical to increase the mobility of competent staff and expand the boundaries of competence.

The second factor of erosion is related to the loss of trust in information and communication technologies as a tool for acquiring competencies. This is due to the large number of unproductive computer training systems and primitive competency testing systems. The ability of companies to attract competent staff to the beginning of the project in the absence of an effective system for the development of new competencies of innovative development leads to a loss of trust of stakeholders.

The third factor of erosion is determined by the imperfection of the formation of team competencies and the use of creative technologies implemented in the development of information technology. At the same time, earlier tense relations are formed between the incentives of the research group that initiates the innovation project and the development groups that formed the ideas. As product life cycles shorten and external options grow, it becomes more and more important for organizations to increase the rate of metabolism from which they process knowledge and form the necessary competencies.

The fourth factor of erosion is determined by the dynamic increase in competence requirements due to the demise of obsolete competencies and the expansion of new competencies related to the implementation of innovative projects.

### **Example of application development and erosion of competencies model**

Consider the model of innovative development of information technology in distance education based on the expansion of existing information technology. The Department of Project Management of the Kyiv National University of Construction and Architecture has been implementing distance education technologies in project management programs for fifteen years. During this time, more than a thousand masters in project and program management have been trained, who have successfully implemented innovative projects and programs in Ukraine and abroad. One such project was the New Safe Confinement of the Chornobyl NPP, where the vast majority of managers consisted of graduates of the department. Specialists trained in the distance education program worked in international teams and demonstrated a high level of competence in the implementation of this program. Table 1 defines the initial value assessment and development drivers at the beginning of the project by six experts who worked on the implementation of the above program. They identified assessments of product value, learning process, business and development.



Table 1. Initial evaluation and initiation of the Innovation Development Program in the Leadership competency

Value type and development programs	Purpose of value realization	Drivers of innovative development	Initial Value	Current Value
Product value design in a manufacturing environment <i>Creative</i>	Product Value	New Technologies	0,5	0,7
		New materials	0,5	0,6
		Innovative design	0,6	0,8
Creating value in a manufacturing management environment <i>Operational</i>	Process Value	New Design Techniques	0,6	0,7
		New Design Products	0,6	0,65
		New business processes	0,5	0,6
Formation of business value within a project-driven environment <i>Creative</i>	Business value	New markets	0,7	0,7
		New business models	0,4	0,5
Business value development <i>Transformational</i>	Development value	Reform strategy	0,5	0,6
		Solution of problems	0,6	0,8

From the model, project behavior based on drivers of innovative development, we see that the reform strategy and new design methods have been subjected to erosion factors. This is due to the high dynamics of creating new distance learning platforms and methods for designing distance learning courses.

Average estimates of the impact of factors of innovative development and erosion of competencies are shown in Fig. 2. In Fig. 2 we see two competencies that have been eroded. It is a reform strategy and new design products.

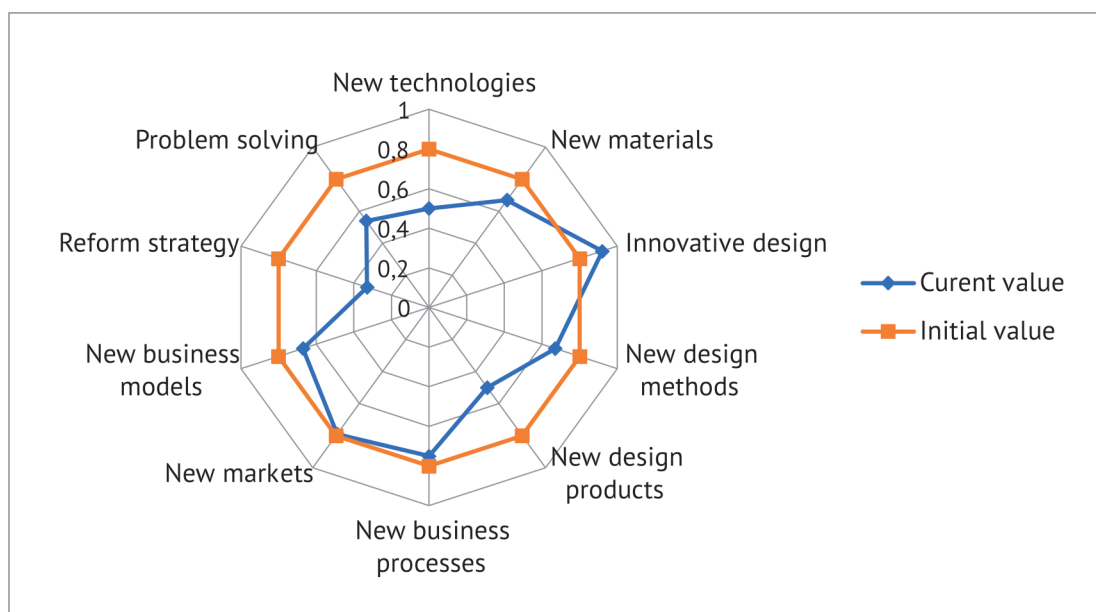


Fig. 2. Model of factors of innovative development by competence Leadership

Based on the results of the analysis of the initial implementation plans, it was decided to switch to the Agile project management methodology. The project was formed within 5 sprints. The results of assessments of the importance of behavioral competence Leadership in the application of Agile methodology for each of the six components of the product are given in table 2. Note that the initial level of leadership competency was 7.

Table 2. Results of behavioral competency assessments for project product components

Product component						
Sprint Number	Core of IT system	Users interfaces	Security module	Integration module	Training program	Marketing
1	8	7	6	3	2	4
2	7	5	5	3	2	5
3	4	7	3	4	2	8
4	4	6	5	4	3	7

Such assessments were formed according to the five key indicators of this competence, which are given in table. 3.

Table 3. Key Indicators of Competence Leadership in the application of Agile

Nº	The name of the key indicator
1	Initiates actions and actively offers help and advice
2	Participates in project management and shows commitment to the team
3	Provides competence development, coaching and mentoring for leadership and improves the performance of individuals and teams
4	Makes appropriate efforts and influences others to achieve goals
5	Facilitates, ensures compliance and consideration of decisions

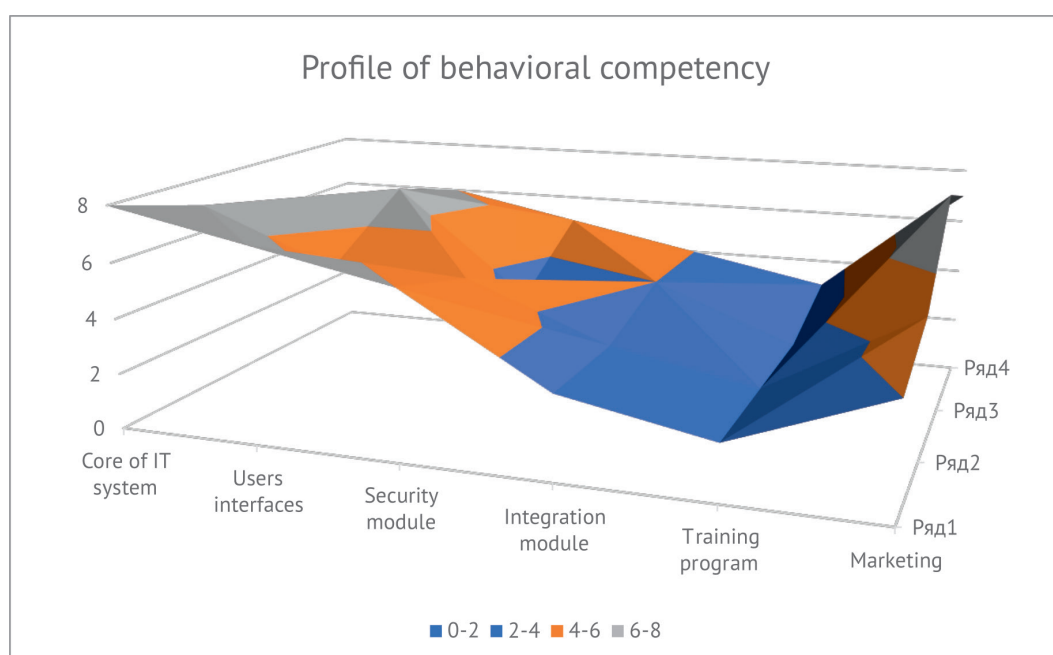


Fig. 3. Modeling of behavioral competence changes Project sprint leadership

The results of the modeling of behavioral competencies show that the component of the training program on the first three sprints was subjected to the greatest erosion. The integration module has been eroded by the first and second agile. The behavioral safety module was eroded in the third sprint.

An Agile leader acts primarily by setting his own example, helping to build relationships with the stakeholders he works with. The degree of self-determination that a team receives depends

on their competence (knowledge, skills, abilities and abilities). The quality of leadership is determined by the level of integration of specific team members. An agile leader is one who (proactively) removes obstacles and allows teams to achieve goals and create project value.

### **Conclusions and prospects for further research**

The proposed model of development and erosion of the competence of the Agile project team to create and implement changes in education is based on the balance of factors of development of competencies of the innovative project and their erosion in the life cycle.

The study of factors of development and erosion of competence in the management of innovative projects in education allows to adequately respond to changes in the profile of activities and competencies of innovative projects. At the same time, such an analysis allows the project manager to form effective programs for the acquisition of certain competencies by team members and other stakeholders over time. Thus, the time mismatch between human competencies and competencies provided by the project requirements arises for two reasons: on the one hand, due to the erosion of competencies (in the above sense), and on the other hand, due to the objective development of the project. This discrepancy can and should be addressed through targeted training, trying to «smooth out» the temporary discrepancy between the educational characteristics of project participants and their new project competencies, thus ensuring the convergence of competencies and competencies, their long-term balance in some acceptable range.

The model of factors of development and erosion of the system of competencies proposed by the authors is tested on the examples of application of Agile methodology in the implementation of the project management department of Kyiv National University of Construction and Architecture. The implementation confirmed the adequacy and effectiveness of the model and methods of analysis of the development and erosion of competencies, and as a consequence of competence.

As a direction of further development should be identified methods and algorithms of proactive response of the Leader to the development and erosion of competencies, forming appropriate development programs for team members that ensure the success of innovative projects in education.

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