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CONVERGENCE OF PROJECT MANAGERS COMPETENCIES IN HYBRID WORLD

Abstract. Global trends that occur in various fields of knowledge with a significant acceleration affect the development of information technology and project management competencies, programs, and project portfolios. The paper aims to develop and study information technology and mechanisms for assessing the competencies of project managers for their development based on current trends and flexible methodology of Agile in project management in creating modern information and communication technologies in project management. Global trends that challenge the development of project management competencies and programs are related to global acceleration, digitalization of society, development of blockchain, cloud and fog technologies, active introduction of smart systems, the transition from "Rational economy" to "Behavioral economy", "Green economy", "Sustainable development economy" and "Circular economy". The convergence of these trends creates a new platform for the effective application of existing methodologies, knowledge systems, and methods of assessing the competence of project managers. Based on convergence, integration, and harmonization of project and program management methodologies, step-by-step research methods have been identified. The formation of an updated system of competencies lies in the change of paradigms from the traditional waterfall life cycle model to the Agile life cycle models of the projects. Decision-making in conditions of uncertainty based on data mining, from rational to irrational forms. The article examines modern hybrid information models of projects and programs that change the competency systems of project managers, convergent models and methods of decision making. At the same time, the change in competencies as actions or functions to be performed by project managers affects the competency model and evaluation system, including key competency indicators. A meaningful model of diagnostics of application of competence models and methods of project management in the digital and "behavioral economy" based on flexible methodologies is given. Some key competency indicators that are used in assessing the competence of a project manager based on his competencies in working in a project team are identified. Patterns of behavior of project managers in project product creation and project management are studied. The patterns allowed the authors to identify bottlenecks

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in the application of Agile project management methodologies in the convergence of trend information models and technologies. An example of information technology for managing the assessment of competence of project managers according to the IPMA Agile ICB model is given.

Keywords: information systems, convergence, hybridization, project, competence, behaviour pattern, project manager.

Introduction

Formulation of the problem. The digitalization, stratification of society, application of cognitive technology, fast development of competency approach in different files of the economy, and social and innovation on the global level are the modern trends. These trends and new information systems are the drivers of transformation society based on "Behavioral economy", "Green economy", "Circular economy" and "Sustainable development economy" concept [1, 2].

The use of benchmarking methods in project management is appropriate where a systematic approach to the transfer of knowledge from existing knowledge models to project management systems. Thus, benchmarking and analogy methods are tools that require further development of methods and models of convergence and integration of transferred methodologies, and their scientific and practical justification in the formation of new, more effective knowledge systems, approaches, and project management methodologies [3, 4].

The digitalization of economies and the active use of accumulated knowledge is one of the key drivers shaping the acceleration of global societies.

The problem discussed in this article is related to the creation of effective information systems for assessing the competence of project managers for their development based on the flexible Agile methodology [5].

This article aims to study the convergence of management systems competence and project management technologies based on global trends within the competency model.

Analysis of recent research and publications

A review of existing methodologies, models, methods, and mechanisms for managing innovation development programs of organizations in a crisis has shown that modern information technology and project management methodologies are usually transformed into standards supported by various professional structures such as P2M [6], PMBoK [7], PM^2, PRINCE2, MSP, Agile, IPMA ICB4 – "Standard for individual competencies for project management, programs, and portfolios" [9], IPMA OCB – "Standard for organizational competencies" [10], IPMA PEB – "Standard for assessing the effectiveness of projects" [11] and others. As a rule, such standards do not support the development of competence and leadership of project and program managers. ISO 21500 [8], ISO 21503, ISO 21504 standards on project management and administration, project programs and portfolios, construction of WBS structures, etc. play a special role. Standards have become necessary to transfer the best practices of successful organizations based on the strategy of effective use of intellectual assets to create value, increase productivity and efficiency. Unfortunately, the existing research standards do not work well in a crisis and turbulent environment. The weak point of their application and the creation of new methodologies that take into account the dynamics of the environment and its state is the application of knowledge accumulated by nature about the creation of living organisms. The professional application of such knowledge in creating the latest project management methodologies based on the theory of similarity is a conceptual idea of the authors' research. Another group of factors that influence the choice of research is global

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trends. The global trend of transition to a "behavioural economy" has a significant impact on the creation of a new project management methodology. The global trend of transition to a new "behavioural economy" from the traditional "rational economy" significantly changes the nature of project management methodologies, programs, and portfolios and affects the competence, leadership and behaviour of managers. At the same time, the global trend of convergence of economies and key areas of development remains. The basis for convergence (approximation) is a rational and behavioural economy together with the digitalization of economies, the development of information societies, smart objects (houses, villages, cities), the use of blockchain, cloud and fog technologies, knowledge bases and innovations. These trends affect the global development of societies, public administration systems, projects, and programs for the development of the real sector of the economy**.**

Let look at the definition of convergence. From the Latin. Converge – "converge" defined as a process of convergence, convergence (in various senses), compromises. Convergence is not only interpenetration but also unification on the principle of complementarity [17].

It is also determined that during the convergent process, bifurcation parameters are detected, which turn a stable system into an unbalanced state. After passing the bifurcation point, the system enters a new equilibrium state.

The bifurcation point is defined as a critical state of the system, in which the system becomes unstable to fluctuations and uncertainty arises: whether the state of the system will be chaotic or it will move to a new, more differentiated and high level of an order [12]. Usually, the bifurcation point has several branches of attractors (stable modes of operation), one of which will go to the system. However, it is impossible to predict in advance which new attractor the system will occupy.

Unlike the term "convergence", "integration" (Latin Integratio – restoration, filling, from integer - whole) is the unification of any elements or processes.

Integration plays an important role in project management, as it provides a holistic vision of the project, from initiation, planning, implementation, and completion. Integration management should ensure systematic goal setting, including setting expectations for all project participants; systemic goal achievement, integrated vision of results, consolidation of all resources and project work on the way to achieving goals.

Integration management is implemented in all areas of project management and is a key factor in ensuring the integrity and sustainability of the project. Further, in the article, the term "convergence" will be used to indicate the process of convergence, the convergence of systemic characteristics of different objects of study. Convergence is a process whose boundaries are determined by the beginning of the next process - integration and which does not include the processes of interpenetration, connection.

The complexity and importance of integration management increase with scale and modularity, as we move from managing individual projects to programs and portfolios of programs and projects.

The project management team in the interaction of stakeholders determines for stakeholders only their general functions and the degree of influence on the project activities. This necessitates the abandonment of the term "governance" concerning stakeholders in its traditional sense [9]. For these reasons, the project management team's interaction activities are considered to be related to the performance of two key functions.

The first function is to moderate the mutual broadcast-understanding of messages between stakeholders related to the project situation. The global goal of moderating project activities, taking into account the actual conditions in the project and in the lives of stakeholders. The basic category is the "attitude" of each stakeholder to the situation [12].

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The second function concerns the measurement, evaluation and interpretation according to the criterion of homogeneity of the state of the interaction environment in a particular project situation [13].

The role of the basic category within the implementation of this function is played by the basic characteristics of the interaction environment - the project context (environment), the corporate culture of stakeholders and the cultural context of the project.

As elements of the mechanism of interaction management in project situations, first of all, interacting parties are considered - project stakeholders, the project management team (represented by the manager), and the person responsible for project interaction management. Each of the interacting parties is a carrier of a certain competence [16] and cultural context: stakeholders are carriers of the project context of corporate culture (hereinafter - the project context) of their organization, the project management team – the carrier of the cultural context of the project. The mechanism of interaction management and competence assessment based on the knowledge system IPMA ICB4 [9], is presented in the form of a sequence of blocks of action, each of which is considered in the relevant areas. The connection between the planes is established through the connections between the elements of the action blocks of adjacent planes. These areas are exam, self-assessment, preparation of a preliminary report, preparation of the final report, interviews, analysis of the project manager's activities in a business game or group situational exercise, etc. Information and communication technology should accompany all these actions to assess the competence of project and program managers and determine the final assessment.

Methods, organization, and results of research

Globalization and the turbulent state of global markets create specific conditions for the development of organizations. At the same time, an innovative development process is defined as a key factor of success. It is not easy to repeat the success based on previous experience. Whole industries try to use the best methods of work organization and manage the knowledge accumulated in organizations, but the vast majority of attempts to achieve excellence end in failure. Therefore, new methodologies and tools are needed to transform knowledge, as a best practice, into development projects and programs [16].

The models of knowledge used in the study are classified as follows: simple (have only concepts); based on frames (have only concepts and properties); based on logic. It should be noted that the relationships used in the creation of the ontology are much less diverse than the terms, and, as a rule, not specific to a particular subject area. Axioms are used to model statements that are always true. Certain types of connections can be established between the basic terms of knowledge systems. The dictionary of terms in a particular field of application, the thesaurus with its concepts (concepts) and connections that define the terms of natural language, can be considered as knowledge [17].

The key principles of innovation project and program management systems are:

1. Focus the project or program on values creation and values migration to meet stakeholders.
2. Relationship of innovative projects and programs with corporate strategy.
3. Implementation of "lean management and production" tools together with the transition to Agile methodology.
4. Effective division of obligations and responsibilities in the project.
5. Orientation of competencies and management processes to create a project product and achieve goals.
6. Focusing the participants on the careful execution of works and efficiency of the project.
7. Communication in the context of a better future. Focus on benefits and obstacles to success.

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The considered principles form the basis of most of the used knowledge systems and methodologies for managing innovative projects and programs [6].

These principles define the system of conceptual terms of the strategic level in project management. At the tactical and operational level, a different system of principles and, therefore, terms of knowledge are applied.

Conceptualization of competencies in the management of innovative projects is usually carried out at the strategic level using the formal model described below.

From a substantive point of view, knowledge of an innovative project serves to present the concepts needed to describe both management and knowledge in general. In this regard, the knowledge of the innovation project includes universal scenarios of management activities to create a product and management process based on scientific knowledge, as well as knowledge of the subject area. Today it is becoming clear that the transition to a "Behavioral economy" depends significantly on the competence of project managers, teams and organizations. Modern organizations face an urgent task: to develop the competence potential of specialists to the full, which is extremely important for making the right management decisions based on the principles of necessary diversity of Ashby [14] and conducting reliable expertise during the project. However, it should 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 - a threat to the organization that has not formed mechanisms to retain such employees. At the same time, each employee is expected to learn to manage and develop their competencies. Artefacts and self-esteem are taken into account in the process of development. Such artefacts are the passage of various types of training of project managers.

Convergence model for hybridization of managing systems presented on fig.1.

In this model, there are two mechanisms – systematization within each level and harmonization between levels of the model.

The proposed systematization mechanism provides systematic processing of models of each level. Thus, elements of each level are systematized based on a matrix of incidents.

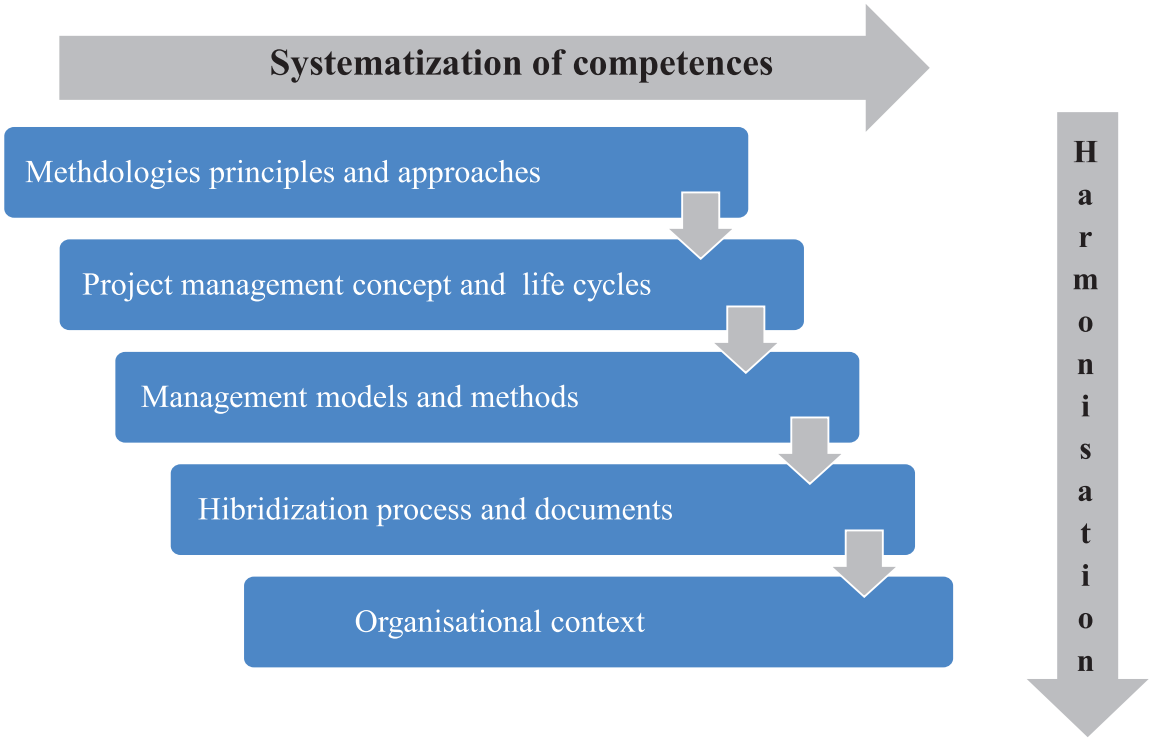

Fig. 1. Convergence model for hybridization of managing systems

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For example, the relationship at the first level between principles and approaches is systematized by a matrix. The elements of the matrix determine the system compatibility of individual principles and approaches. A value of 0 determines the mismatch of elements, 1-complete consistency. Matrices at other levels of the model are formed similarly. The task of the systematization mechanism is to determine the system compatibility of selected elements of methodologies.

The harmonization mechanism provides vertical connections between elements of adjacent levels. The task of the harmonization mechanism is to build a holistic model of methodology from selected elements.

There are three basic concepts for the further development for hybridization of managing systems:

1. Observe the system, how to track the characteristics of their systems for some time (evolution).

2. Approximation of the characteristics of systems in succession to each other is one to one.

3. The designation of the step and the world of system requirements at the "as is" mill.

The first of the other concept is to look at the parameters of the system in a dynamic frame, and the third in a static one.

If before the management of competence was considered as a desirable component of the management system of the organization, now it has become necessary. The development of the competence approach is associated with the application of the idea of research "field of competence" of the project manager and organization [9,10]. Under the field of competencies, we will understand the space of competencies in the areas of project management, product, and values creation. To implement the idea of the field of competencies, it is necessary to develop an appropriate management system based on the following principles:

- competencies must in the application of hybrid project management methodology be delineated (the principle of independence of the components of an effective model);
- the management system should include all field competencies related to the activities of the organization (the principle of completeness);
- 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 field competencies must be detailed to the required level (principle of differentiation);
- for all field competencies indicators should be developed to assess the competence of employees (principle of measurability) [11].

An example of the Agile certification of project and program managers developed by the authors is shown in Fig. 2.

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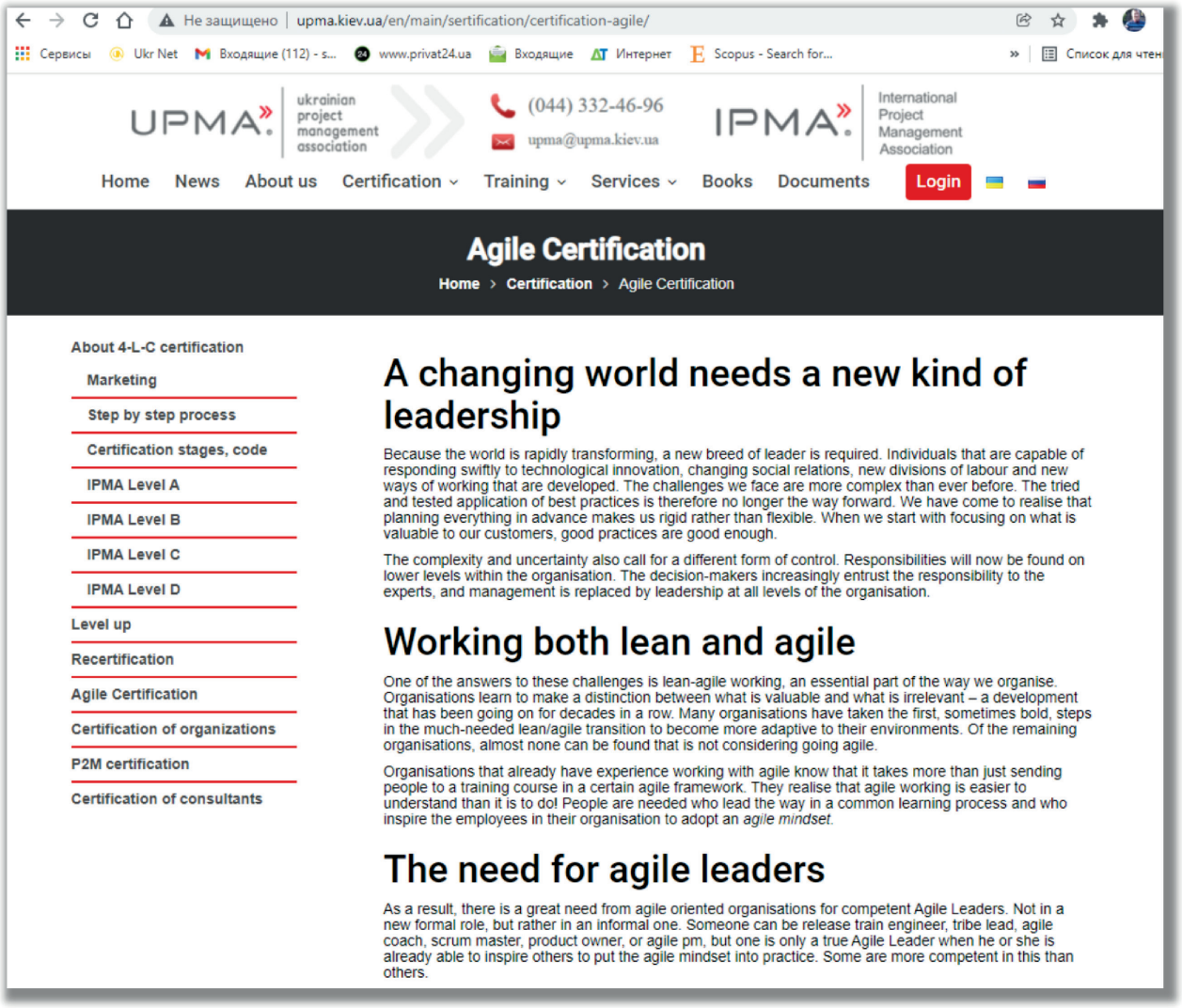

Fig. 2. Example of international Agile certification system for project managers

Studies of the development of the field of competencies for project and program management in product development showed slight fluctuations in the competence of employees who managed projects and created an IT product according to the Agile methodology (Fig. 2).

Agile transformation is conducted within the competence model of ICB4 in an Agile world [11]. Agile leadership is shaped by many factors and within competencies [11]. The list of such competencies of heads of organizations, project managers,and Agile leaders is given in Table 1.

Table 1. Comparison Project manager and Agile leader competencies

№	Key Competencies indicators	Traditional	Agile
1	Acknowledge, prioritise and review success criteria	4	7
2	Review, apply and exchange lessons learned from retrospectives and with other agile teams	4	8
3	Determine complexity and its consequences for the approach	4	6
4	Select and review the overall agile work approach	3	7
5	Design an initial (technical) product architecture	4	8

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The spider diagram of Comparison Project manager and Agile leader competencies is present in fig. 3.

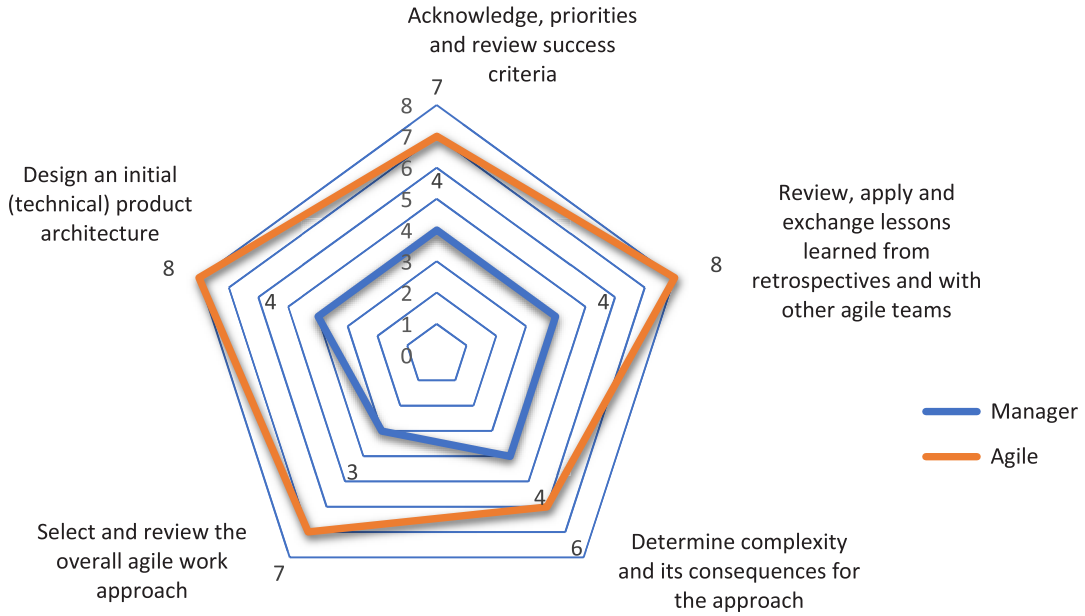

Fig. 3. Spider diagram of Comparison Project manager and Agile leader competencies

The studies were conducted based on assessments and self-assessments of the control group of project managers who have been internationally certified under the ICB4 for Agile world model by Key Competence Indicators, which form the basis of the competency assessment model. The spider diagram of Comparison Project manager and Agile leader competencies is present in fig. 3.

Results of Gap analyses of these competences show maximum differences between elements: Select and review the overall agile work approach, Review, apply and exchange lessons learned from retrospectives and with other agile teams.

The study involved 10 professionals who have been certified by the model ICB4 [11]. Individual assessments of Agile leaders and Managers Perspective patterns were obtained.

Table 2. Expert assessments of the Agile Leader's Perspective competencies

Agile leader Competencies	Experts										Average
	1	2	3	4	5	6	7	8	9	10	
Know the principles of agile work and the way they are applied.	6	7	8	7	6	6	8	6	7	6	6,75
Know the principles of agile programme management and the way they are deployed.	8	9	8	8	7	9	7	7	8	6	7
Know the principles of agile portfolio management and the way they are deployed.	9	7	8	7	9	7	8	8	7	8	7,75
Align the agile work with supporting function	8	9	8	8	6	9	9	8	8	8	8,25

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The end of the Table 2

Align the agile work with the organisation's decision making and reporting structures and quality requirements	7	9	9	8	9	9	8	9	9	9	8,75
Align the agile work with human resource processes and functions	9	8	9	8	9	8	8	9	9	9	8,75
Align the agile work with finance and control processes and functions	8	9	8	8	9	10	9	8	9	9	8,75
Bridges the principles of traditional management and agile work.	9	8	8	8	9	9	7	9	9	8	8,25

The average values of competency scores were taken as the basis for constructing the Agile leader's behaviour pattern, which, together with Managers' assessments, is shown in Fig. 3.

Table 3 presents expert assessments of the Perspective competencies of the Manager of organizations.

Table 3. Expert assessments of the corporate Manager Perspective competencies

Manager Competencies	**Experts**										**Average**
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	
Know the principles of agile work and the way they are applied.	7	8	7	7	8	6	8	6	6	7	7
Know the principles of agile programme management and the way they are deployed.	6	7	6	5	6	5	7	6	5	6	5,9
Know the principles of agile portfolio management and the way they are deployed.	6	5	7	5	6	6	5	6	7	5	5,8
Align the agile work with supporting function	5	6	6	7	5	5	7	7	6	7	6,1
Align the agile work with the organisation's decision making and reporting structures and quality requirements	4	5	5	4	5	4	3	4	5	4	4,3
Align the agile work with human resource processes and functions	7	7	6	7	8	6	8	6	7	7	6,9
Align the agile work with finance and control processes and functions	6	6	6	5	6	6	7	5	6	6	5,9
Bridges the principles of traditional management and agile work.	7	7	7	8	7	6	6	8	7	6	6,9

Comparison behaviour patter Agile leader and manager according to Key competence indicators is shown in Fig. 4.

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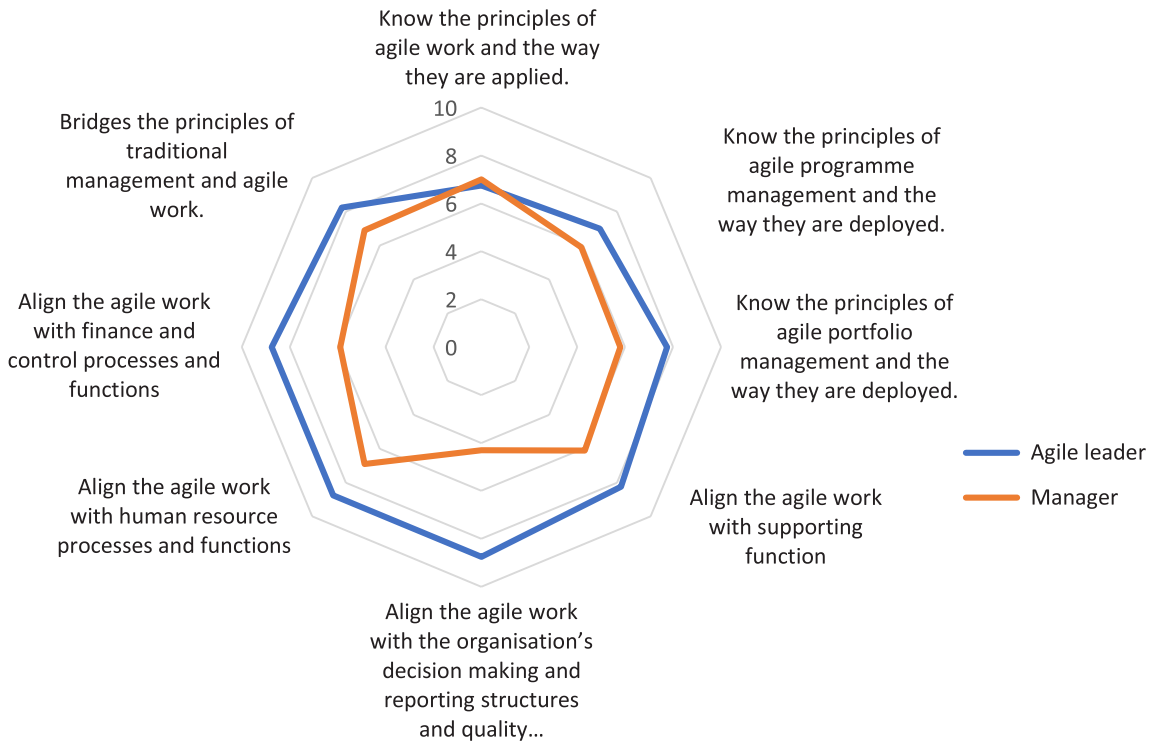

Fig. 4. Comparison behaviour pattern Agile leader and manager according to Key competence indicators

The analysis of the flexibilities of the Agile Leaders and Managers behaviours identifies significant gaps in incompetence across individual key competency indicators. For example, in the Leadership competency element by key competency indicator "Align the agile work with the organisation's decision making and reporting structures and quality requirements".

The diagram shown in Fig. 4 indicates that the applicant does not have sufficient principles of Agile project portfolio management. Such an assessment is determined in the process of passing a written exam and requires the applicant to practice this element of competence.

Rapid changes and transformations, the task for the project manager is to determine and agree on the requirements of project participants, which form the initial data for management decisions during its planning and implementation. In solving such problems, the project manager must not only identify all stakeholders and take into account their requirements but also calculate the optimal parameters of their interaction to achieve success. At the same time, project participants in the process of its implementation invest and receive from the project different values and influence the project, based on their interests, competencies and the degree of involvement in the project.

The most difficult assessment of competence, in terms of information technology, is the assessment of intuitive creativity. Intuitive creativity is a logical consequence of significant preparatory work of the mind, intense substantiation of the problem, idea, plan. This type of creativity is characterized by holistic, integrative, integrity, completeness of its results, a solid and realistic level of predictions, which gives intuitive creativity a natural character. Behavioural economics uses conditional optimization. The choice in project management is a limited budget, time of implementation and alternative solutions.

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Jet control of complex systems was introduced in the 60s of the last century in the construction of automatic control systems "by deviation". The application of the principles of proactive management based on perturbation control and prediction mechanisms has formed an approach that is rarely used in automatic control systems but is used in many mechanisms created by living species. Therefore, the application of analogies with wildlife in response to disturbances and predictions of crisis events is the idea of benchmarking.

The main features of modern processes of development of organizations in crisis conditions based on projects and programs are:

1) increasing the factor of dynamism and uncertainty in the activities of organizations;

2) stratification of society and change of lifestyles at all levels: individual, social, organizational, global;

3) political involvement of oligarchic society and fear for the future in a crisis;

4) the transition to a "behavioural economy";

5) strengthening migration processes;

6) decentralization of responsibility for the quality of work.

One of the important components of project management is forecasting, which is to identify possible ways to solve management problems based on existing knowledge and experience. Such forecasting is based on the generalization of experimental data and knowledge of objective patterns of development of phenomena observed in the project. The implementation of such functions is based on knowledge and best practices stored in the structured memory of project managers and organizations.

In psychology and physiology, there is voluntary and involuntary memory; according to the nature of the manifestation there is figurative, verbal-logical, mechanical, emotional, and conditioned-reflex memory; by type of perception – visual, auditory, olfactory, motor, and visceral memory. One of the main characteristics of memory is the time, or duration, of storing information. According to the storage time, memory is divided into short-term and long-term. In the first case, the information is stored for seconds or minutes, in the second - for days, months and years. In a detailed analysis of the temporal characteristics of memory using a more detailed division into sensory, or ultrashort (storage time less than one second), primary (several seconds), secondary (several minutes to several years), and tertiary (information is stored for life). Sensory and primary memory are short-term, secondary and tertiary-long-term memory [1].

Immune memory – the ability of the immune system to respond to the secondary penetration of foreign objects (pathogens) by the rapid development of specific reactions by type of secondary immune response. The realization of this effect is provided by stimulated mechanisms of reactions that do not perform effector functions. Considering the organization by analogy with the behaviour of a living cell, we determine the key characteristics of immune memory. The phenomenon of immune memory is manifested in both humoral and cellular reactions. Memory cells circulate in a resting state, and upon repeated contact with a foreign object from a reaction called the "immune response". Immune memory can be stored for a long time and requires training based on new knowledge and experience in implementing organizational development programs. Currently, organizational development in a turbulent environment is an urgent scientific and technical problem. Such development means some purposeful changes introduced by managers to increase the efficiency of the organization based on modern project management methodologies. At the same time, "some organizations are developing dynamically and more successfully than others, others – as if standing still, others – are experiencing a crisis that does not pass" [2]. Indicators of this situation are ineffective development management methodologies. If the organization successfully implements complex projects, such as a bank – a new credit policy, a chain of stores – the

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sale of a new product, then they, of course, want to spread successful experiences. After all, one of the advantages of the organization is the ability to generate significant income using well-verified projects. Depending on the strategies of innovative organizational development programs, the level of "heredity" and "variability" of the project is determined, which reveals the essence of how each phase of the project life cycle reproduces itself in a new project and how "hereditary changes" occur. Based on this, the development of program management methodologies based on genetic models of projects becomes relevant. In a general sense, the methodology will be understood as a way of doing business in the organization [12].

The intersection of project managers' competences and project management competencies is based on behavioural competencies. This forms the structure of the chromosome, which reflects the creation of the product and the result of the project and the project management process.

Conclusion

The proposed model of convergence of methodologies in their hybridization is based on the given principles, concepts, and life cycles, models, and methods of different in nature methodologies, processes, documents, and organizational context.

The obtained results can be used in the formation of teams of project managers involved in projects with hybrid methodologies for their implementation.

The information and communication technology for assessing the competence of project managers based on the IPMA ICB4 model was determined. The principles of evaluation and application of the competence approach to the development of project management systems, programs, and project portfolios are analyzed. The proposed principles are the basis of a proactive approach to the development of project managers' competence based on the convergence of global trends. Trends are related to the digitalization of countries, the transition to a behavioural economy, the application of a competency-based approach in educational institutions and educational standards, accelerating development through the use of flexible methodologies.

Application of analogies of formation of competence of project managers with physiological and biological processes, allowed to define immune mechanisms in the development of project managers. Today, the convergence and benchmarking of knowledge based on analogies between different systems are just beginning to develop and is one of the areas of promising research by the authors. Promising research is the application of a competency-based approach to the creation of information and communication technologies, the creation of value platforms in the development of organizations, the use of biological analogies to build protective mechanisms of information and communication systems.

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