

Artículo de investigación

Development of the mechanism of formation of additional capabilities of the network design team as the basis of competitive advantages of IT companies

Разработка механизма формирования дополнительных возможностей сетевой проектной группы как основы конкурентных преимуществ ИТ-компании
Desarrollo del mecanismo de formación de capacidades adicionales del equipo de diseño de red como base de las ventajas competitivas de las empresas de TI
Desenvolvimento do mecanismo de formação de capacidades adicionais da equipa de design de rede como base das vantagens competitivas das empresas de TI

Recibido: 19 de abril de 2019. Aceptado: 6 de junio de 2019

Written by:

Sergey V. Novikov⁶¹

<https://orcid.org/0000-0001-6921-1760>

<https://www.scopus.com/authid/detail.uri?authorId=57192318711>

Natalia V. Komarova⁶²

Karen E. Dadyan⁶³

Abstract

The article shows the relevance of creating network project teams to improve the efficiency of project management. The purpose and objectives of the study is to create a mechanism for the formation of additional capabilities of network design teams to improve competitive advantages. The paper presents the results of experiments conducted by Jonathan Cummings and Carol Pletcher on the observations of several successful and unsuccessful design structures in the conditions of creating new products, communicating with customers and working on increasing operational performance. The results of the experiment revealed the advantages and disadvantages of network design structures and formed the requirements for an ideal project management system. The results of the experiments determined the additional capabilities of network design teams that form the competitive advantages of IT companies. These capabilities are presented as an external and internal resource of the network project team. The article develops a scheme of response of network structure to external influences. This scheme will further determine the competitive advantages of network design structures by creating new competencies. The response of the conventional

Аннотация

В статье показана актуальность создания сетевых проектных групп для повышения эффективности управления проектами. Выявлена цель и задачи исследования по созданию механизма формирования дополнительных возможностей сетевых проектных групп по повышению конкурентных преимуществ. Представлены результаты экспериментов, проведенных Джонатаном Каммингсом и Кэролом Плетчером по наблюдениям за работой нескольких успешных и неуспешных проектных структур в условиях создания новых продуктов, коммуникации с клиентами и при работе над увеличением показателей оперативной деятельности. По результатам эксперимента выявлены достоинства и недостатки сетевых проектных структур и сформированы требования к идеальной системе управления проектом. По результатам экспериментов определены дополнительные возможности сетевых проектных групп, формирующие конкурентные преимущества ИТ - компаний. Данные возможности представлены в виде внешнего и внутреннего ресурса сетевой проектной группы. Разработана схема

⁶¹ PhD in Economics, Associate Professor, Institute of Engineering Economics and Humanities, Moscow Aviation Institute (National Research University), 125080 Volokolamskoe highway 4, Moscow, Russia, ncsrm@mail.ru
elibrary.ru: https://elibrary.ru/author_profile.asp?id=807011

⁶² PhD, Associate Professor, Institute of Engineering Economics and Humanities, Moscow Aviation Institute (National Research University), 125080 Volokolamskoe highway 4, Moscow, Russia, komarova_n_v2001@mail.ru
elibrary.ru: https://elibrary.ru/author_profile.asp?id=825365

⁶³ Student, Institute of Engineering Economics and Humanities, Moscow Aviation Institute (National Research University), 125080 Volokolamskoe highway 4, Moscow, Russia, airbase2002@mail.ru

and network project team to the need for new competencies is also reflected in the present work. The mechanism of compensation of the revealed shortcomings and formation of additional opportunities of network design structures is presented. A schematic diagram of the cause-and-effect relationships of processes and subsystems that make up the mechanism of increasing competitiveness through the use of a network approach.

Keywords: competence, competitiveness, IT companies, mechanism, network project teams.

реагирования сетевой структуры на внешние воздействия. Данная схема в дальнейшем и будет определять конкурентные преимущества сетевых проектных структур путем создания новых компетенций. Схема реагирования обычной и сетевой проектной группы на необходимость в новых компетенциях также отражена в работе. Представлен механизм компенсации выявленных недостатков и формирования дополнительных возможностей сетевых проектных структур. Разработана принципиальная схема причинно-следственных связей процессов и подсистем, составляющих механизма повышения конкурентоспособности за счет использования сетевого подхода.

Ключевые слова: ИТ - компании, конкурентоспособность, компетентность, механизм, сетевые проектные группы.

Resumo

Este artigo mostra a importância de criar equipes de design de rede para melhorar o gerenciamento de projetos. O objetivo e a tarefa do estudo foram identificados para criar um mecanismo para a criação de novas capacidades das equipes de projeto de rede para aumentar as vantagens competitivas. Os resultados dos experimentos realizados por Jonathan Cummings e Carol Fletcher são apresentados após observar o trabalho de várias estruturas de design bem-sucedidas e malsucedidas no contexto de criação de novos produtos, comunicação com os clientes e trabalho para aumentar os indicadores operacionais. Os resultados do experimento revelaram as vantagens e desvantagens das estruturas de projeto de rede e permitiram formar os requisitos para um sistema ideal de gerenciamento de projetos. Os resultados dos experimentos determinam as capacidades adicionais das equipes de design de rede, que formam as vantagens competitivas das empresas de TI. Essas características são apresentadas como um recurso externo e interno da equipe de design de rede. Um esquema de resposta da estrutura da rede aos impactos externos foi desenvolvido. Este esquema permitirá, no futuro, determinar as vantagens competitivas das estruturas de projeto de rede, criando novas competências. A resposta das equipes de projetos convencionais e de rede à necessidade de novas competências também é refletida neste artigo. Além disso, é fornecido um mecanismo para compensar as deficiências detectadas e criar mais capacidade para as estruturas de projeto de rede. Uma estrutura de referência para os elos causais entre processos e subsistemas que constituem um mecanismo para aumentar a competitividade por meio de uma abordagem baseada em rede foi desenvolvida.

Palavras-chave: competência, competitividade, empresas de TI, equipas de projectos de rede, mecanismos.

Resumen

En este artículo se muestra la importancia de crear equipos de diseño de red para mejorar la gestión de proyectos. Se ha identificado el objetivo y la tarea del estudio de crear un mecanismo para la creación de nuevas capacidades de los equipos de proyectos en red para aumentar las ventajas competitivas. Se presentan los resultados de los experimentos realizados por Jonathan Cummings y Carol Fletcher tras observar el trabajo de varias estructuras de diseño exitosas y fallidas en el contexto de la creación de nuevos productos, la comunicación con los clientes y el trabajo para aumentar los indicadores operativos. Los resultados del experimento revelaron las ventajas y desventajas de las estructuras de diseño de red y permitieron formar los requisitos para un sistema de gestión de proyectos ideal. Los resultados de los experimentos determinan las capacidades adicionales de los equipos de diseño de red, que forman las ventajas competitivas de las empresas de TI. Estas características se presentan como un recurso externo e interno del equipo de diseño de red. Se ha desarrollado un esquema de respuesta de la estructura de red a los impactos externos. Este esquema en el futuro hará posible determinar las ventajas competitivas de las

estructuras de diseño de red mediante la creación de nuevas competencias. La respuesta de los equipos de proyectos convencionales y de red a la necesidad de nuevas competencias también se refleja en este artículo. Asimismo, se proporciona un mecanismo para compensar las deficiencias detectadas y crear más capacidad para las estructuras de diseño de red. Se ha elaborado un marco de referencia para los vínculos causales entre los procesos y los subsistemas que constituyen un mecanismo para aumentar la competitividad mediante un enfoque basado en la red.

Palabras clave: competencia, competitividad, empresas de TI, equipos de diseño de red, mecanismo.

Introduction

Previous scientific works showed the relevance of creating network project teams to improve the efficiency of project management, especially in the implementation of complex, non-standard projects in the shortest possible time. It was proved that the network project team combines the capabilities of a conventional project team and the opportunities brought to it by the personal connections of the participants, which means that there is an additional resource that further provides a competitive advantage of the project team.

The aim of this study is to develop a mechanism for creating competitive advantages of project teams through a network approach.

To achieve this goal, the following tasks have been set and solved:

- revelation of the main set of additional features of network groups by the analysis of the conducted experiments on work of project groups;
- definition of the requirements for the mechanism of formation of additional capabilities of network design teams;
- investigation of the response processes of conventional and network groups on the external market impact;
- substantiation of the possibilities of increasing competitiveness and the emergence of new competencies of project groups due to their transformation into a network;
- development of the mechanism of formation of additional capabilities of the project team.

The hypothesis of the study is that the transformation of a conventional project group into a network one makes it acquire characteristics that ensure the success of the project group and increase the competitiveness of IT companies.

Methodology

The methodology used in this study includes adhocratic command management, the creation of network design structures, flexibility and situational management. The methodology for creating network project teams has a set of interrelated and interacting scientific methods. As a result of the use of the market relations methodology, it was previously determined that the IT services market can be considered as a mixed model of the market structure, because monopolistic competition and oligopoly are present there. The competitive advantages of IT companies were determined using Porter's models. This analysis showed that competitive advantages of the company can be provided on the basis of the product differentiation strategy in the following areas:

- complexity;
- uniqueness;
- quality of IT services and software products;
- high level of specialists.

In this paper we use the tools of the theory of planning the experiment to solve the first problem of the study. Requirements for the designed mechanism were determined using the theory of inventive problem solving. To solve the third and subsequent tasks we use the methods of system and situational analysis considering the life cycle of the project team. It was found that the life cycle of the project team can also affect the competitiveness of the company. The life cycle of the project team is closely related to the life cycle of the project. The patterns that arise between the elements and participants of the project life cycle and the project team are the subject of more detailed discussion and deserve to be investigated in a separate study. In this paper we limit ourselves to their unconditional connection, as it is due to the inability of the project team without the project.

Results and discussion

To solve the first problem, we will perform a study of the results of the experiments conducted by Jonathan Cummings and Carol Pletcher of the work of several successful and unsuccessful project groups (Cross & Cummings, 2004):

- when creating new products;
- working with clients;
- with improved operational performance.

The experiments were considered on the example of conventional project teams because success or

failure is a consequence of the combination of qualities of both conventional and network groups. Also, the development of these qualities generates the basis for creating competitive advantages (Cummings & Cross, 2003). The descriptions and results of the experiments are reflected in Tables 1-3.

The results of the experiments allow us to assert that the network group has the exact qualities of an ordinary project team, which ensured its success in performing the tasks of experiments and the ability of the network group to find new solutions and perform projects better and faster (Dmitriev & Novikov, 2017).

Table 1. Results of the experiments on the creation of new products by the project team

Experiment with creating new products	
Successful project team	Unsuccessful project team
Conditions	
Conditions: Selected two project teams that do not know about the existence of each other. One of them had a reputation as successful, the other was its complete opposite.	
Task	
Task: The project teams received the task. They should have been developed the created product and made the maximum profit from it. They had two different ways.	
Implementation	
<p>A successful project team has developed a completely new product. At the same time, it relied on an external project network, which included specialists from outside and inside the organization. The successful project team used marketing, research, development and improvement of the production process.</p> <p>The following actions were performed:</p> <ul style="list-style-type: none"> • personal connections, • advices of the colleagues, • customer feedback, • specialists of third-party organizations, • market analysis, • a joint programme with hardware suppliers, • creation of laboratory stands for testing. <p>Result: a successful project team used not only internal but also external resources to achieve the goal.</p>	<p>The unsuccessful group developed a product line based on technical and production knowledge that was only available within the team.</p> <p>Result</p> <p>Result: unsuccessful group, despite having sufficient resources to create innovations, relied only on internal capabilities and limited itself to improving the existing product line.</p>

Table 2. Results of experiments with clients

Experiment with creating new products	
Successful project team	Unsuccessful project team
Conditions	
Conditions: Selected two project teams that do not know about the existence of each other. One of them had a reputation as successful, the other was its complete opposite. In a certain segment of the market for the current group of buyers it is necessary to perform a qualitative change of the existing product	
Task	
Task: These project teams should have been worked on changing the existing product in response to changing market trends.	
Implementation	
A successful project team engaged a project network that included clients, consultants and external staff. The incoming information was necessary to create a completely new solution for customers and create a new business.	Therefore, the unsuccessful group was updating of a product being guided by one purpose, to keep business. The unsuccessful group used knowledge that was exclusively within the group and supported by information received from clients.
	The unsuccessful team only expected the client to provide the necessary information. Based on this information, the project team created a solution.
Result	
Result: as a result, the successful project team has created a new project team of employees from seven different branches and two divisions of the company on four continents. In addition, large information resources from outside were attracted.	Result: unsuccessful project team coped with the task. It kept the business, but missed the opportunity to create a better solution and achieved less success. Although, it had all the necessary resources, but did not use the principles of obtaining information, which were implemented by a successful project team.

Table 3. Results of experiments on improving operational performance

Experiment with creating new products	
Successful project team	Unsuccessful project team
Conditions	
Conditions: Selected two project teams that do not know about the existence of each other. One of them had a reputation as successful, the other was its complete opposite.	
Task	
Overall objective: to change the structure and working methods of the company to increase its efficiency and profitability.	
The task of a successful group: to transform the product delivery channel through third parties (brokers, resellers, etc.) into a direct delivery channel directly to customers.	The task of an unsuccessful project team: to turn a single business unit into a division of a larger one.
Implementation	
A successful project team has engaged the project network to increase customer knowledge and also	The unsuccessful team applied the project network method only partially in the

technical, regulatory and geographic information to change the supply chain and enter new market segments.

Result

Result: the successful group attracted external resources to increase its knowledge of the supply chain. This action allowed to perform the task with maximum quality and success.

process of absorption and integration of a small business unit into a larger one.

Result: there were difficulties in the transition to a new system of control of material consumption related to customer service. They arose during the transition to a new automated system for working with laboratory data, as well as a new reporting system.

The use of project teams does not create any competitive advantages. Competitive advantages arise when the project team can implement projects ahead of competitors in quality and timing, performing projects that cannot be performed by anyone else or offering fundamentally new solutions that open up new opportunities and create competitive advantages to customers (Dmitriev & Novikov, 2018). Thus, it is necessary to increase the capabilities of the project team (Komarova & Dadyan, 2019).

The development of all systems goes in the direction of increasing the degree of ideality. In an ideal system, weight, volume and area tend to zero, and its ability to do the work is not reduced. In other words, if there is no system, its function is saved and executed (Komarova, Zamkovoij & Novikov, 2018). All technical systems strive for perfection, but there are very few ideal systems (Komarova & Dadyan, 2019).

Thus, the results of the performed experiments allow us to assert that the network group has the qualities of an ordinary design team, which ensured its success in performing the tasks of experiments (Merrone, 2010). Based on the results of the experiments, the capabilities of the network group allow projects to perform better, faster and find new solutions.

The main requirement for the mechanism being developed is that it is necessary to create such a project team:

- its existence does not affect the operational processes of the company (if in addition to project activities, the

company also carries out operational activities);

- does not initiate the situation of splitting the resource into unrelated parts and does not cause its shortage;
- able to solve complex and completely new tasks in the shortest possible time;
- has the ability to autonomously and quickly provide themselves with all the necessary resources to solve any problems;
- offer fundamentally and qualitatively new solutions that create competitive advantages not only for the developer, but also for customers.

The implementation of the above qualities will lead to the emergence of a network project team. The qualities are the main additional resources (Table 4).

Network project teams also have shortcomings (Table 5), but their number is not large, and the number and quality of advantages overlaps the manifestation of these shortcomings (Novikov, 2014). Nevertheless, it is necessary to consider the list of shortcomings.

Next, a mechanism was developed to compensate the weaknesses of the network project team to solve two problems:

- creation of additional resource;
- additional resource configuration.

Table 4. Advantages of network project team

The strengths of network project teams, which are the basis of additional resource and new opportunities. They were identified through research by Jonathan Cummings and Carol Pletcher
<ul style="list-style-type: none"> • Interest and commitment of participants. • In the case of a project network, the risks associated with the limited perspective of an ordinary group are reduced and the horizons and boundaries of the group are expanded. • Employees of project networks go beyond the boundaries of the organization in search of new ideas or knowledge. • As the horizons and boundaries of the group expand, it increases the resource and capabilities of the group. • The project network has a stable structure of the project team, which constantly draws new resources from outside (through personal connections of employees). • Obtaining and updating resources from outside, in turn, allows you to perform non-standard complex projects and significantly reduce the time for their implementation. • Narrow specialization allows you to have a high level of competence. In-depth performance of a narrow task. • The command structure provides a responsibility that may be lacking in the informal relationships of staff. Responsibility is more distributed.

Table 5. Weaknesses of the network project team

Disadvantages of network project teams identified on the basis of research by Jonathan Cummings and Carol Pletcher. (In the figure are marked by blocks with a gray background, the compensation mechanism is developed)
<ul style="list-style-type: none"> • Not all employees have an understanding of their place in the network structure. • There is a need of development of a number of regulatory documents for new employees with remote work. <p>There is a need of additional elaboration for:</p> <ul style="list-style-type: none"> • information security issues related to the development and transfer of information; • regulations of the classified information and obligations of confidentiality after the termination of the employment relationship; • procedures for the provision of information security, technology and development tools.

Ultimately, the ability to compensate for weaknesses also increases competitive advantage, as it increases the group's capabilities (Komarova, Zamkovej & Novikov, 2018). The schematic diagram of the processes that cause different capabilities of the network and the usual project team is shown in Figure 1. This scheme demonstrates a qualitative advantage in the proposed solution of the network design team over the usual one and it is the basis for creating

competitive opportunities (Novikov & Veas Iniesta, 2018).

Most often, an additional resource in a network group already exists (Novikov, 2018). And since it is created in accordance with the requirements of a particular project, we can assume that to some extent it is already configured. Therefore, it is necessary to configure an additional resource. Although, you can create an additional resource or network from scratch.

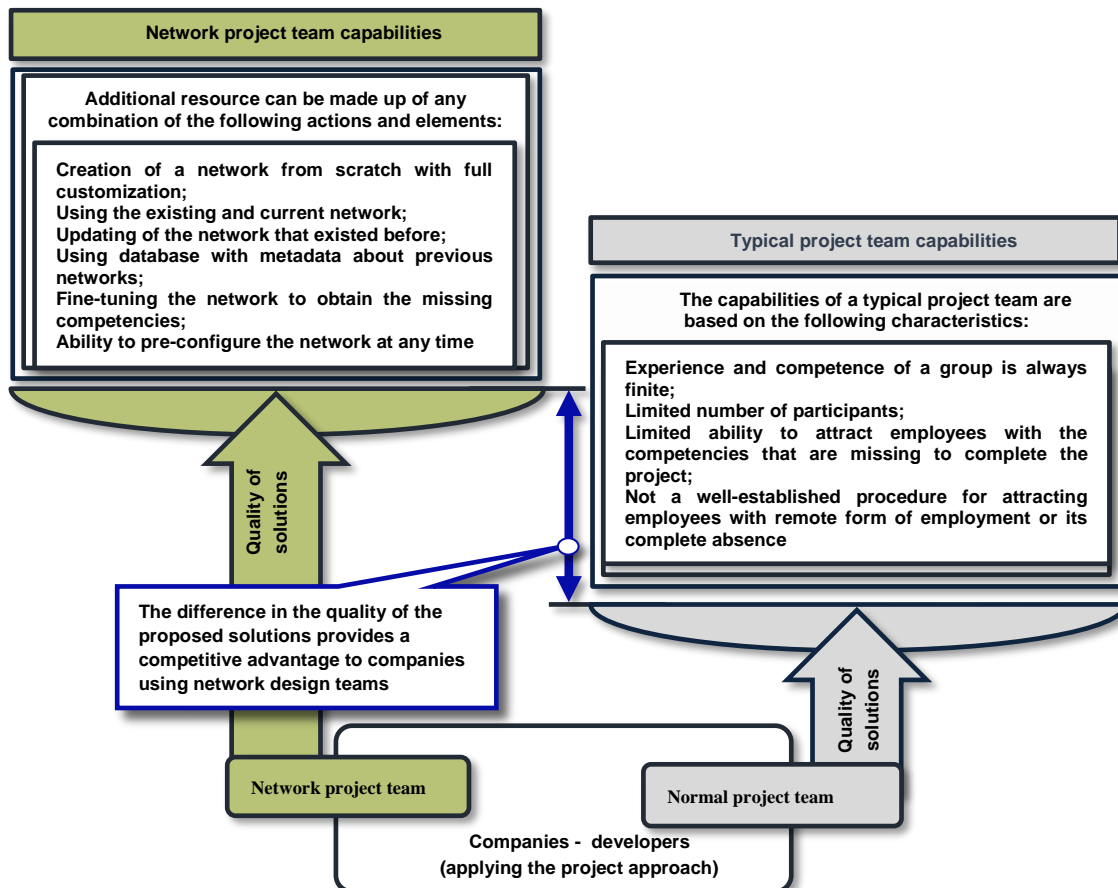


Figure 1. Schematic diagram of the processes that determine the different capabilities and quality of solutions network and conventional design team

But before you perform pre-configuration of an additional resource, we will analyze its components and the mechanism of the formation (Novikov, Komarova & Dadyan, 2019).

The additional resource of the network project team consists of an internal and an external resource.

- The internal resource is based on the capabilities of a typical project team that the network inherits.
- External occurs as a result of the transformation of an ordinary group into a network group and consists in the inclusion in the structure of the group of those employees who have the key competencies to perform a specific task.

There is a schematic diagram of the processes that cause different capabilities of the network and the usual project team and the qualitative difference of the proposed solutions. The basic components of the additional resource capabilities of the network project team and the components of the capabilities of a conventional project team are disclosed in the same scheme. The concept reflects the list of processes that cause different quality capabilities of the network and the usual project team, which further determine the competitive advantages (Pinkovtskaia, Balynin, Arbelález Campillo, & Rojas-Bahamón, 2019).

In the next step, there is a general schematic diagram of the response of the network design team to external disturbance (Figure 2). The requirements of business to information systems (IS) are considered as external influences.

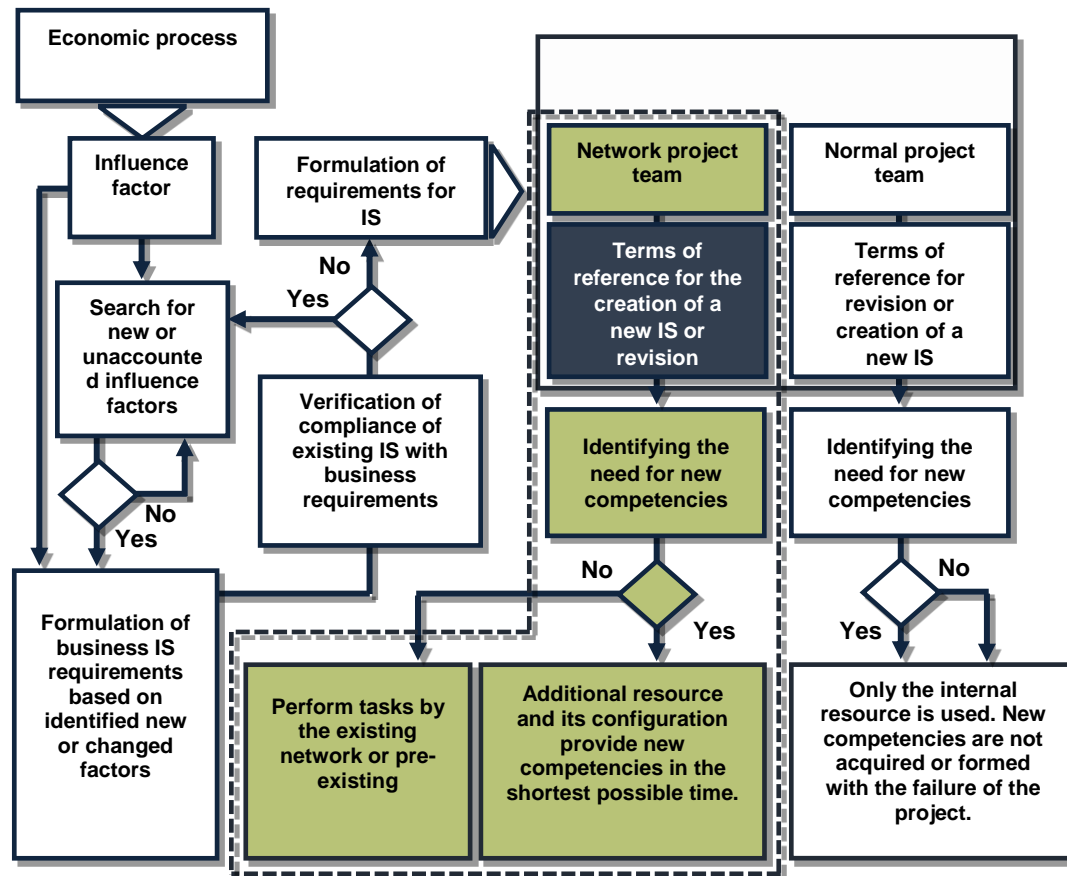


Figure. 2. The general concept of the response of conventional and network project team to the need for new competencies.

Further, on the basis of the general principle scheme of response, an internal mechanism was developed (Figure 3) directly forming the reaction of the group.

The mechanism is part of the overall concept. The principle of its operation is based on the

capabilities of an additional resource (Novikov, 2018). It allows you to configure or pre-configure the network under changing conditions and compensate for the weaknesses of the network design team.

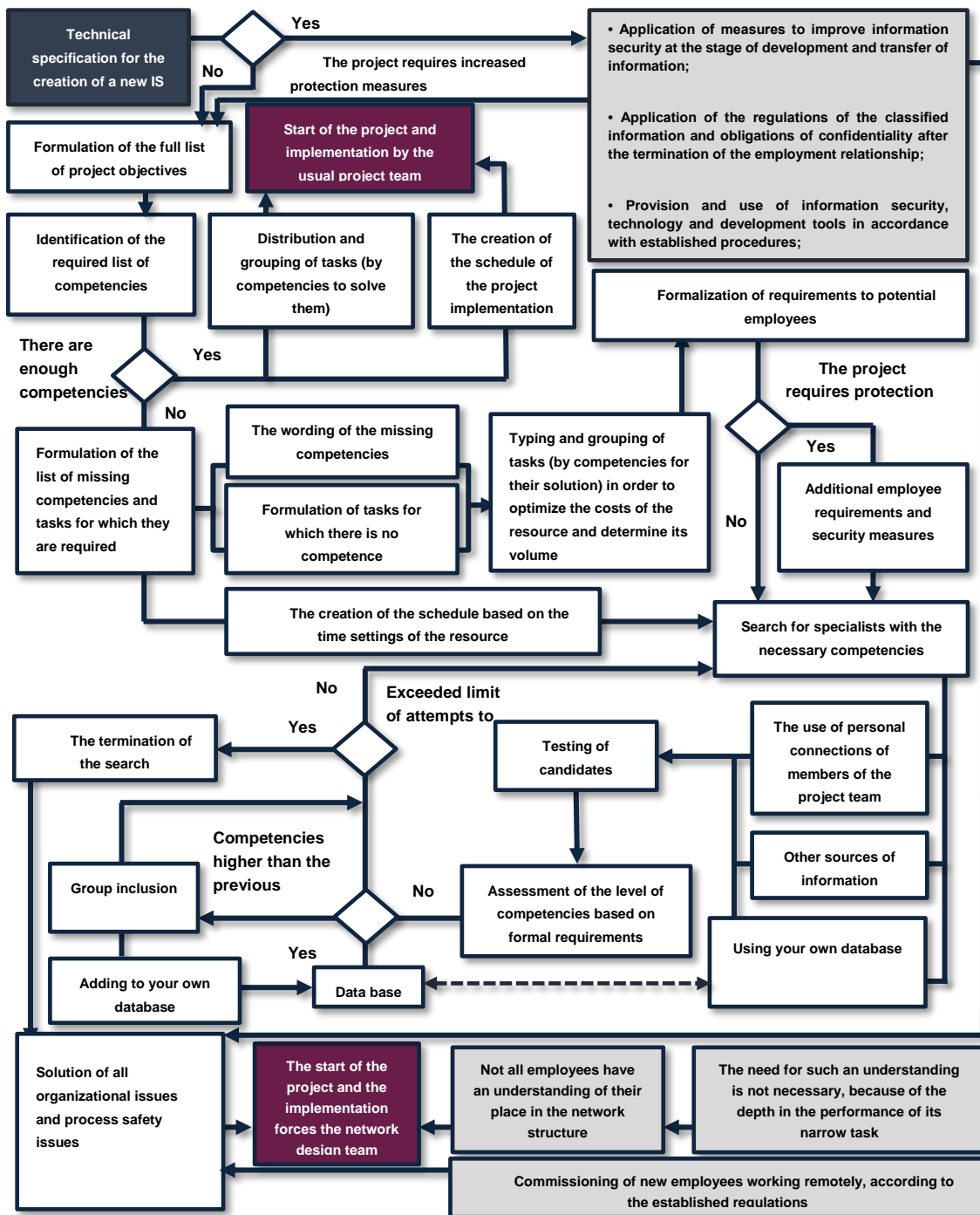


Figure 3. The mechanism of formation and configuration of additional resources, as well as compensation for the shortcomings of the network project team

All situations in which it is advisable to use the plan-scheme of the resource formation mechanism is reduced to two groups of cases (Novikov, 2018). Although its application in any other cases is not limited, except for considerations of expediency. So, it is:

- application of the mechanism in the first phase of the life cycle;

- application of the mechanism at the second and subsequent stages, if the parameters of plasticity do not exclude its application.

In all cases, the reasons for the application are almost always the same. Only the weight of the cause and the degree of complexity of measures

to eliminate or compensate for the consequences may be different.

Conclusion

There is a mechanism for the formation of additional capabilities of the network project team in this article, which considered various internal and external processes and developed subsystems to work with these processes, which are components of this mechanism. The possibility of increasing the competitiveness of

IT companies using this mechanism can be represented in a single schematic diagram (Figure 4):

- it creates a holistic picture of a mechanism to improve competitiveness through the use of a network approach;
- it gives an understanding of the moment of completion of the development process;
- it illustrates the establishment of this mechanism.

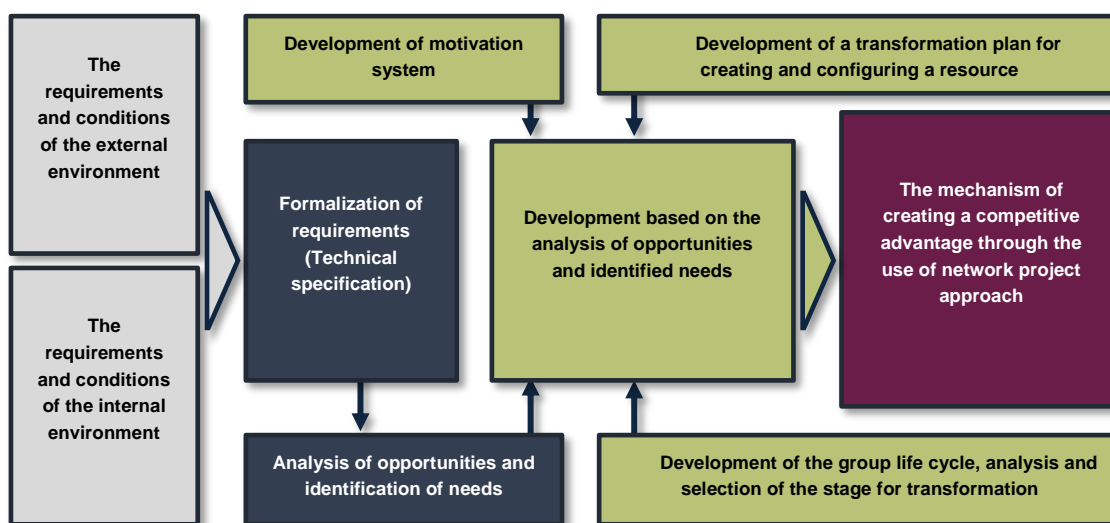


Figure 4. Schematic diagram of cause-and-effect relationships of processes and subsystems that make up the mechanism of increasing competitiveness through the use of a network approach.

References

- Cross, R & Cummings, J. (2004). Tie and Network Correlates of Individual Performance in Knowledge-Intensive Work. *Academy of Management Journal*, 47(6), 928-937.
- Cummings, J. & Cross, R. (2003). Structural properties of work groups and their consequences for performance. *Social Networks*, 25 (3), 197-210.
- Dmitriev, ON & Novikov, SV (2017). Conception of managing of fuzzy-institutional meso-level organizational separations in a context of product projects internationalization. *European Research Studies Journal*, 20(4), 277-289.
- Dmitriev, ON & Novikov, SV (2018). Economic Assessment of Federal Scientific Programs. *Russian Engineering Research*, 38(4), 326-329.
- Komarova, NV & Dadyan, KE (2019). Improving the state of human and technical resources of it projects in the context of the fourth industrial revolution through the use of network project teams. XIV international scientific and practical conference "Russian Science: Goals and objectives», Ekaterinburg, Russian Federation.
- Komarova, NV & Dadyan, KE (2019). Use network project teams to improve project management. *Danish Scientific Journal*, 2, 7-9.
- Komarova, NV, Zamkovej, AA & Novikov, SV (2018). The Fourth Industrial Revolution and Staff Development Strategy in Manufacturing. *Russian Engineering Research*, 39(4), 330-333.
- Komarova, NV, Zamkovej, AA & Novikov, SV (2018). Rethinking the Education of Aviation Specialists for a New Era. *Russian Engineering Research*, 39(3), 268-271.
- Merrone, J (2010). Team Boundary Spanning: A Multilevel Review of Past Research and Proposals for the Future. *Journal of Management*, 36(4), 911-940.
- Novikov, SV (2014). Contract system in the procurement of goods, works and services. Textbook. Moscow: Dobroe Slovo, 176.

Novikov, SV & Veas Iniesta, DS (2018). State regulation of the development of the connectivity of the Russian territory. *Espacios*, 39(45), 20.

Novikov, SV (2018). Russian Support for Innovation and Export Growth. *Russian Engineering Research*, 38(4), 305-308.

Novikov, SV (2018). Strategic Analysis of the Development of High-Technology Manufacturing Facilities. *Russian Engineering Research*, 38(3), 198-200.

Novikov, SV (2018). The features of innovative processes in the Russian Federation: analysis of current practices. *Espacios*, 39(9), 2.

Novikov, SV, Komarova, NV & Dadyan, KE (2019). Research opportunities to improve the competitiveness of it companies through the use of network project teams. *STIN*

Pinkovtskaia, IS, Balyinin, I, Arbeláez Campillo, DF & Rojas-Bahamón, MJ (2019). Small business development in Russia: results of the assessment of sectoral structure and number of employees. *Espacios*, 40(7), 6.