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KEY COMPETENCE AS A BASIS FOR INNOVATION PROJECTS MANAGEMENT

By the implementing an enterprise development program, the existing key competence of the organization may undergo significant changes. Also introducing innovations, you can get not only benefits, but additional problems and even risks. It should be noted that an organization may have more than one key competence, especially when we deal with changes in the management structure or entering new markets. For this class of tasks, the classical linear optimization problem does not fit, since it does not take into account the additional conditions that arise when an organization transitions from one state to another, precisely due to the implementation of the development program. Therefore, to solve this problem, we need a dual problem. The **subject** of research in this article is the process of introducing key competence, as the main component of the management of innovative projects in the organization. **Objective**: to develop a tool for introducing key competence into an organization's work by solving a dual linear optimization problem. **Tasks**: to analyze the factors influencing the results and the possibility of introducing key competence in the organization's activities, to obtain a general algorithm for the transition from direct to dual competence. Research **methods**: logical generalization, analysis and synthesis, structural analysis. **Results**: The article considers the key competence of the enterprise as the main component of the management of innovative projects, which the company implements. Shown her place and the role that she plays. A project description model has been developed, which describes processes that take into account the impact of the production and economic system on project implementation. The article proposes a general algorithm for constructing pairs of dual linear optimization problems. The existing schemes of transition from a direct problem to a dual one are meaningful. Considering this fact, a generalized algorithm for generating pairs of related problems has been proposed and strictly proved. Formalization of the developed scheme makes it easy to get the correct pairs of dual problems. It is shown that the analysis of the key competence of the enterprise makes it possible to offer a new base for the formation of a strategic plan, the implementation of which will lead to the emergence (support) of a sustainable competitive advantage, as well as assess its potential in terms of financial plan and capabilities of the enterprise or business system as a whole. **Conclusions**: The tools for analysis and implementation of key competence in the organization's activities have been developed. The results obtained in during the study allow us to state that a new base has been proposed for the formation of a strategic plan for the development of an enterprise, the use of this base will lead to a sustainable competitive advantage, which will become possible when implementing key competences in the process of changing the management structure. Taking into account that an organization can have more than one key competence, the second competence is dual to the original, that allows a general transition from direct to dual competence.

Keywords: innovative project; management hierarchy; performance indicators; measurable effects; linear optimization; direct task; dual task; related tasks; objective function; system of restrictions.

Introduction

Modern scientific and technological progress is impossible without an intellectual product, that is the result of innovation. Innovation is a materialized result obtained from investing in a new technique or technology.

An innovative project is a complex measure that is not repeated, providing for the introduction of a new, limited in time, budget, resources, as well as clear instructions for implementation, designed for the needs of the customer. Project management is the managerial task of completing a project on time, within a set budget and in accordance with technical specifications and requirements.

Analysis of recent research and publications

Among the main scientific approaches in the field of project and program management, the following ones should be mentioned: systemic and program-oriented (V. M. Glushkov, B. Z. Miller, R. S. Pospelov, A. Iirikov, D. Cleland, and others); complex systems management theory (E. A. Druzhinin, M. D. Mesarovich, I. Takahara, N. N. Moiseev, Y. B. Germeier, V. L. Volkovich, V. S. Mihaljovich); classical theory of project management based on the PMBOK standard (V. I. Voropajev, S. D. Bushuev, N. S. Bushueva, A. I. Belokon, V. A. Rach, R. B. Tian, V. D. Shapiro, I. I. Mazur, B. A. Demidov, and others); system of knowledge on management of innovative projects and programs of enterprises – P2M (S. D. Bushuev, N. S. Busuheva, Hiroshi Tanaka, Shihenobu Ohara) [1–11].

The main principle of the program-target approach is planning from goals to means [6, 9]. The approach involves a comprehensive system solution of problems, taking into account all significant factors, relationships and constraints, and also implies the responsibility of all the performers for achieving the goal.

The complexity, variety of problems and systemic situations that arise in the organization system require the development of formal organization and management procedures. To do this, at the initial stage, according to the program-target approach, it is necessary to allocate the project's goals / objectives. The achievement of the desired result is based on the hierarchy of goals, the main methods, construction of them is described in the works [1, 12, 13].

The theory of management of innovative projects and programs of enterprises was proposed in 2009 [14]. Authors Bushuev S. D., Bushueva N. S., Hiroshi Tanaka, who formed a new "qualitative vision", adapted to the conditions of the development of technological clusters in Ukraine [3, 10], systematized the methods and models of management of innovative projects and programs of enterprises. Also, to the positive characteristics of this scientific approach certainly belongs the proposed by the researchers mechanisms of assistance to enterprises in the

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development and widespread use of innovations in the production activities that are used in the main production activity.

Formulation of the problem

Up to this day the development of the theory and practice of managing innovative projects took place in two directions: managing the process of innovation and innovation management as a project. In the early 2000s, D. A. Novikov showed that the design and process approaches are different ways of presenting the same processes occurring in systems [15], and if necessary, one can switch from one way of representing to another and back.

Thus, models describing the processes can be used to describe the projects. For example, the model of the corporation, proposed by Yu. A. Zelenkov [16], allows us to formulate the goals and existing possibilities of its implementation in the form of a tuple:

$$\Psi = \{UA, UV, UI, A, R, \Theta, w(\cdot), v(\cdot), \mathrm{I}, \Gamma\}, \quad (1)$$

where A – set of actions for achieving the goals; R – set of the results of actions; Θ – set of environment values; I – information that the agent has at the time of the decision; $\nu(\cdot)$ – benefits of the agent specified by the utility function; $w(\cdot): A \times \Theta \to R$ – result of activity, which depends on the action and the situation; $U = (UA, UV, UI)$ – vector of management, which includes institutional, motivational and information management; Γ – targets.

The given model in the existing conditions of the turbulent environment does not give a transparent picture of the description of the projects, because the influence of the production-economic system on the implementation of the projects is not taken into account. Therefore, there is a need to develop new models that take into account all these phenomena.

Presentation of the main material

To take into account the influence of the production-economic system on the implementation of projects, we must present the model of the production-economic system (1) in the following form:

$$\Psi = \{U, A, R, \Theta, w(\cdot), v(\cdot), \mathrm{I}, \Gamma, \varphi\}, \quad (2)$$

where $U = (UF, UB, UP, UV, UC, US, UI)$ – vector of management, which includes management of financing, production, production, implementation, marketing, scientific development, institutional management; $\varphi = (\varphi_1, \varphi_2, ..., \varphi_n)$ – vector models of product innovation projects presented in the form of a tuple:

$$\varphi_i = \{P_i, T_i\}, \quad (3)$$

where P – set of values of control parameters; T – set of project needs in resources; $i = 1, ..., n$ – project number.

Since most of the components of the tuple of the production and economic system of project implementation are quite well-known, consider the constituent that is one of the main components of any enterprise in general according to the author.

For successful competition it is necessary to formulate all competences of the organization and highlight the key. Key (distinctive, basic, exclusive, basic, unique, business competence) competence of the organization (also used the term "critical factor of the organization's success" – CFOS) – is the competence that lets the organization to solve tasks that are not suitable for most other players at the market, and establishes a new standard of activity in the industry and thus provides the owner with a competitive advantage.

According to G. Hamel and S.K. Prahaladu [17], the company should be perceived not as a set of business units that make it up, but as a combination of key competences – skills, abilities, technologies – that allow organizations to provide their customers with certain values.

Key competence is the strategic potential of the organization. Operational management of the company (ability to work effectively) is a way to benefit from this potential.

Signs of Key Competence:

- significance for consumers, their willingness to pay for competence, as for the most of the value they acquire;
- ability to change and adapt to new market requirements;
- uniqueness, probability of repetition by competitors;
- to be based on knowledge, not on the coincidence of circumstances;
- interconnectivity with several types of activities or products;
- relevance, compliance with the strategic aspirations of the market and organization;
- partnership opportunity to create a new key competence;
- clarity, accessibility of the formulation of competence for its unambiguous interpretation.

For competent actions, the key competence leads to the creation of unique products, ensures the organization of the championship when entering new markets and significant advantages in solving problems, which will later become a field of fierce competition. In a competitive environment, organizations seek to protect key competences in order to maintain a competitive edge.

Timely understanding of key competences opens the way to long-term leadership in the market, and conquered leadership in its turn requires focusing on key competences.

The key is called the competence of the highest order involved in the creation of the largest consumer value, which is a collective knowledge that allows you to organize and manage the use of other competences and abilities, and thus creates the additional consumer value.

It is the complementarity of the key competence created by the consumer value revealing its synergistic nature. At the same time, being virtually out of measure of abilities and products, key competences are not

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derivative from the market need: being somewhat universal, it is able to provide access (to be a key) to a range of markets that can vary greatly from each other.

Such properties of key competence are also noted by Prahalad and Hemel [18]. They believed that "key competences have three main characteristics: ... first, it gives potential access to a wide range of markets; secondly, it adds a significant consumer value to the final product perceived by the buyer; and thirdly, it takes a lot of costs and efforts to copy the key competence of the competitor." Various authors also offered other characteristics of key competence. To date, eight key properties have been identified.

First of all, key competences are inherent in complexity. It is a derivative of a set of resources and abilities, it is difficult to identify, it is invisible. A specific key competence can be used only within the framework of the business system in which it exists, that is, it is inherent only in the configuration of resources and abilities. Competence, unlike other assets of the organization, is not devoid of use. On the contrary, a number of authors noted this as the main strategic advantage that arises in the formation of competitive advantage on the basis of competence, it develops, its quality rises, its effectiveness is significantly increasing – it is the most durable and long-term asset of the organization. At the same time, the key competence is unique, that is, it can not be directly copied or used by competitors, and indispensable it can not be replaced by another competence. The key competences of the organization are better developed than competitors and consumer-oriented (by definition) from the beginning. And finally, since key competences include a set of other competences and abilities, it can be used for their mutual reinforcement.

The key competence lies in the intersection of the internal conditions of business and consumer preferences, that is the knowledge to receive the maximum share of consumer value. It is the increase in the additional consumer value due to the development of key competencies and is the basis for obtaining a stable competitive advantage. A higher consumer value of a product can be used to implement two basic types of strategies: differentiation or cost leadership. This suggests that the key competence provides the opportunity to obtain in the competitive struggle as a qualitative advantage related to product properties, and quantitative, relating to a more solid financial position. Next, it returns us back to the earlier conclusion about the universal nature of key competences, which provides opportunities for its manifestation in the consumer and industrial markets.

If we consider the key competence of the enterprise in terms of information theory, then we can see the following picture.

Combining knowledge gained through different approaches will improve the quality of management. It is known that entropy is a quantitative measure of chaos in the system and is determined by the number of permissible states of the system. With an increase in entropy, the dimension of the system or the number of independent factors – variables in the system model increases. With an increase in entropy, uncertainty and disorder increases, and to reduce it, it is necessary to add information to the system. [19].

K. Shannon found that when the two isolated systems $A1$ and $A2$ are merged into a single system ($A1$, $A2$) in which systems $A1$ and $A2$ interact efficiently, the entropy of the united system will be less than the set of entropies of the outcoming combining systems:

$$\mathrm{E}(A1, A2) < \left[\mathrm{E}(A1) + \mathrm{E}(A2)\right]. \qquad (4)$$

If $A1$ and $A2$ are the independent sets of elements of systems that do not have physical or informational interaction, then (2) will be a sign of equality. If the set elements of $A1$ and $A2$ can coincidentally interact, then:

$$\begin{aligned} &\mathrm{E}(A1, A2) < \left[\mathrm{E}(A1) + \mathrm{E}(A2)\right] \Rightarrow \\ &\Rightarrow \mathrm{E}(A1) + \mathrm{E}(A2) - \mathrm{E}(A1, A2) = \triangle Is \end{aligned}, \qquad (5)$$

where $\triangle Is$ – growth of structural information.

So, the right choice of key competency creates the additional information when combining two approaches: process and design.

It should be understood that when implementing a development program at an enterprise, the existing key competence of the organization may undergo significant changes. In addition, when introducing innovations, we can gain not only advantages but also additional problems and even risks [20]. In addition, it should be noted that the organization may have more than one key competence, especially if we are talking about introducing a change in management structure or access to new markets..

The key competence is at the intersection of internal business conditions and consumer preferences, this is the knowledge on which the maximum share of use value depends. It is the increase in additional use value due to the development of key competence that is the basis for obtaining a sustainable competitive advantage [21]. Higher consumer value of the product can be used to implement two basic types of strategies – differentiation or cost leadership. This suggests that the key competence provides an opportunity to obtain in the competition a qualitative advantage related to the properties of the product, and quantitative advantage related to a stronger financial position. Further this leads us back to the earlier conclusion about the universal nature of the key competence that makes it possible the manifestation in the consumer and industrial market.

Initial competence can be considered as a direct optimization task. In view of this, the second competence is dual to our initial.

It is advisable to obtain a general algorithm for the transition from direct to dual competence.

The classical task of linear optimization for such a class of tasks is no longer appropriate, because it does not take into account the additional conditions that arise when an organization moves from one state to another by implementing a development program. Therefore, to solve this problem, we will need a dual task.

Assume that the direct (source) linear optimization problem (LO) is given in the standard form [22, 23].

Let’s call the following LO problem a standard task:

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$$W_I = \sum_{j=1}^{n} c_j x_j \to \max,$$
$$I: \Omega_I: \sum_{j=1}^{n} a_{ij} x_j \le b_i, \ i = 1, \ \ldots, \ m,$$
$$x_j \ge 0, \ j = 1, \ \ldots, \ n,$$

or in the matrix form:

$$W_I = CX \to \max,$$
$$I: \Omega_I: AX \le B,$$
$$X \ge 0.$$

The problem with a double or a conjugate with it is called the task of the form:

$$W_{II} = \sum_{i=1}^{m} b_i y_i \to \min,$$
$$II: \Omega_{II}: \sum_{i=1}^{m} a_{ij} y_i \ge c_j, \ j = 1, \ 2, \ \ldots, \ n,$$
$$y_i \ge 0, \quad i = 1, \ 2, \ \ldots, \ m,$$

or in the matrix form:

$$W_{II} = Y \ B - \min,$$
$$II: \Omega_{II}: Y \ A \ge C^T,$$
$$Y \ge 0.$$

For ease of presentation of the material, we introduce and comment on the following designations: $\mathbf{c} = C = c = [\ c_1, \ c_2, \ \ldots, \ c_n \ ]$, $C \in \mathbf{R}^n$ – coefficients of the target function W_I direct LO problem,

$$\mathbf{x} = X = x = \begin{bmatrix} x_1 \\ x_2 \\ \vdots \\ x_n \end{bmatrix} = [\ x_1, \ x_2, \ \ldots, \ x_n \ ]^T, \ X \in \mathbf{R}^n,$$

- variable (unknown) values (plan) of a direct LO problem,

I – conditional designation of a direct task,

II – conditional designation of a dual task,

- matrix of coefficients of the system

$$A = [\ a_{ij}\ ]_{(m \times n)} = \begin{bmatrix} a_{11} & a_{12} & a_{13} & \cdots & a_{1j} & \cdots & a_{1n} \\ a_{21} & a_{22} & a_{23} & \cdots & a_{2j} & \cdots & a_{2n} \\ a_{31} & a_{32} & a_{33} & \cdots & a_{3j} & \cdots & a_{3n} \\ \vdots & \vdots & \vdots & \vdots & \vdots & \vdots & \vdots \\ a_{i1} & a_{i2} & a_{i3} & \cdots & a_{ij} & \cdots & a_{in} \\ \vdots & \vdots & \vdots & \vdots & \vdots & \vdots & \vdots \\ a_{m1} & a_{m2} & a_{m3} & \cdots & a_{mj} & \cdots & a_{mn} \end{bmatrix}$$

of limitation of the direct task,

$$\mathbf{b} = B = b = \begin{bmatrix} b_1 \\ b_2 \\ \vdots \\ b_m \end{bmatrix} = [\ b_1, \ b_2, \ \ldots, \ b_m \ ]^T, B \in \mathbf{R}^m \ -$$

coefficients of the right-hand sides of the system of limitations of the direct task,

$$\mathbf{y} = Y = y = \begin{bmatrix} y_1 \\ y_2 \\ \vdots \\ y_m \end{bmatrix} = [\ y_1, \ y_2, \ \ldots, \ y_m \ ]^T, \ Y \in \mathbf{R}^m \ -$$

variables (unknown) values of the dual problem of LO.

We introduce for the consideration the systems of covariant and contravariant vectors.

$$\mathbf{a}_j = a_j = \begin{bmatrix} a_{1j} \\ a_{2j} \\ \vdots \\ a_{nj} \end{bmatrix} = [\ a_{1j}, \ a_{2j}, \ \ldots, \ a_{nj} \ ]^T \in \mathbf{R}^m, \ j = 1, \ 2, \ \ldots, \ m,$$

- vector-columns (covariant vectors) of the matrix A for the system of restrictions Ω_I for a direct problem,

$$\mathbf{a}^i = a^i = [\ a_{i1}, \ a_{i2}, \ \ldots, \ a_{in} \ ] \in \mathbf{R}^n, \ i = 1, \ 2, \ \ldots, \ n \ -$$

vector-lines (contravariant vectors) of the matrix A for the system of restrictions Ω_I for a direct problem.

In this case, the matrix A of the coefficients of the system can be represented in a vector form:

$$A = \begin{bmatrix} \mathbf{a}^1 \\ \mathbf{a}^2 \\ \vdots \\ \mathbf{a}^m \end{bmatrix} = [\mathbf{a}^1, \ \mathbf{a}^2, \ldots, \ \mathbf{a}^m \ ]^T = [\mathbf{a}_1, \ \mathbf{a}_2, \ldots, \ \mathbf{a}_n \ ] \in \mathbf{R}^m \otimes \mathbf{R}^n,$$

and a pair of dual tasks has the third record form:

$$W_I = (\mathbf{c}, \mathbf{x}) \to \max,$$
$$\Omega_I: (\mathbf{a}_j, \mathbf{x}) \le \mathbf{b}, \quad \text{– direct task,}$$
$$\mathbf{x} \ge 0,$$

$$W_{II} = (\mathbf{b}, \mathbf{y}) \to \min,$$
$$\Omega_{II}: (\mathbf{a}^i, \mathbf{y}) \ge \mathbf{c}, \quad \text{– a dual task to the given line.}$$
$$\mathbf{y} \ge 0.$$

Summing up, we finally have three forms of writing the definition of a dual problem to a standard LO problem:

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$$W_I = \sum_{j=1}^{n} c_j x_j \to \max, \qquad W_{II} = \sum_{i=1}^{m} b_i y_i \to \min,$$

$$I:\ \Omega_I : \sum_{j=1}^{n} a_{ij} x_j \le b_i,\ i = 1,\ \ldots,\ m, \xrightarrow{def\ \ Dual} II : \Omega_{II} : \sum_{i=1}^{m} a_{ij} y_i \ge c_j,\ j = 1,\ 2,\ \ldots,\ n,$$

$$x_j \ge 0,\ j = 1,\ \ldots,\ n, \qquad y_i \ge 0,\quad i = 1,\ 2,\ \ldots,\ m,$$

$$W_I = CX \to \max, \qquad W_{II} = Y\ B - \min,$$

$$I : \Omega_I : AX \le B, \xrightarrow{def\ \ Dual} II : \Omega_{II} : Y\ A \ge C^T,$$

$$X \ge 0, \qquad Y \ge 0,$$

$$W_I = (\mathbf{c}, \mathbf{x}) \to \max, \qquad W_{II} = (\mathbf{b}, \mathbf{y}) \to \min,$$

$$I : \Omega_I : (\mathbf{a}_j, \mathbf{x}) \le \mathbf{b}, \xrightarrow{def\ \ Dual} II : \Omega_{II} : (\mathbf{a}^i, \mathbf{y}) \ge \mathbf{c},$$

$$\mathbf{x} \ge 0, \qquad \mathbf{y} \ge 0.$$

The unity or duality of the above definition will be justified by a certain sequence of operations, which, in the case of cyclic application, should lead to a direct problem, that is

$$I \xrightarrow{def\ \ Dual} II \xrightarrow{def\ \ Dual} I,$$

where $\xrightarrow{def\ \ Dual}$ – a set of rules for the transition to a dual task.

A careful analysis of the definition of a dual problem for a standard form of representation of a direct problem, allows us to determine the necessary for the transition to a dual task operation $\xrightarrow{def\ \ Dual}$:

- Extreme requirements of the objective functions of direct and dual tasks are opposite to the plan:

$$W_I \to \max \xrightarrow{def\ \ Dual} W_{II} \to \min;$$

- For a task on the target function max the inequalities presented in the system of restrictions must have a sign $\le$;

$$\sum_{j=1}^{n} a_{ij} x_j \le b_i,$$

- the coefficients of the objective function of the dual task are components of the vector of the right-hand sides of the system of restrictions of the direct problem LO;

- matrix of A^{T} dual problem of the restrictions system Ω_{II} is transposed to the matrix A system of restrictions of the direct task Ω_I (It is true as $YA = A^T Y^T$);

- right sides of the system of restrictions of a dual problem $\Omega_{II} : (\mathbf{a}^i, \mathbf{y}) \ge \mathbf{c}$ are the coefficients of the target function $W_I = (\mathbf{c}, \mathbf{x}) \to \max$ of the direct task;

- each limitation-inequality of the system of restrictions of a direct problem is an integral dual variable

$$\Omega_I : \sum_{j=1}^{n} a_{ij} x_j \le b_i \xrightarrow{def\ \ Dual} y_j \ge 0,\ i = 1,\ \ldots,\ m;$$

- each integral variable of the direct LO problem corresponds to the restriction-inequality of the dual

$$x_j \ge 0 \xrightarrow{def\ \ Dual} \Omega_{II} : \sum_{i=1}^{m} a_{ij} y_i \ge c_j,\ j = 1,\ 2,\ \ldots,\ n.$$

Note that the different forms of writing linear optimization tasks are equivalent – they store a set of solutions. It is possible to achieve this provided that equivalent conversion techniques are used to move from one form of task to another.

Thus, a certain equation of the system of restrictions of the linear optimization problem is equivalent to the system of two inequalities:

$$\sum_{j=1}^{n} a_{ij} x_j = b_i \Leftrightarrow \begin{cases} \sum_{j=1}^{n} a_{ij} x_j \le b_i, \\ -\sum_{j=1}^{n} a_{ij} x_j \le -b_i. \end{cases}$$

Randomized variables can be represented as a difference of 2 integral variables:

$$x_j = u_j - v_j, \qquad u_j \ge 0,\quad v_j \ge 0.$$

The transition from the restrictions-inequalities to the restrictions-equations is performed by adding an integral (balance) variable:

$$\sum_{j=1}^{n} a_{ij} x_j \le b_j \Rightarrow \sum_{j=1}^{n} a_{ij} x_j + x_{n+i} = b_i,\ x_{n+i} \ge 0,\ i = 1,\ \ldots,\ k.$$

To simplify the transformation of linear optimization tasks into different forms of writing, the transition from maximization to minimization of the target function and vice versa is also used:

$$W_I = \sum_{j=1}^{n} c_j x_j \to \max \Leftrightarrow W_I = -\sum_{j=1}^{n} c_j x_j \to \min.$$

Ensure that the operations and transformations introduced are performed by the conjunction chain for the above set of tasks:

$$I \xrightarrow{def\ \ Dual} II \xrightarrow{def\ \ Dual} I.$$

Let us represent a dual problem in the form of a problem at the maximum and, applying the

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rules of transition and equivalent transformations, we prove the conjugacy of a pair of problems: the dual problem of a dual gives a direct direct problem.

Thus, it is confirmed that the main feature of the duality of the pairs of LO tasks is the possibility of bringing them together to one another by definition (dual to double is a direct task).

In order to implement the development program, taking into account the availability of several competencies in the enterprise, in the implementation of innovation, the operations of transition from the direct task to the dual task presented in the general form of the record.

$$\begin{array}{rcl} \mathrm{W}_{\mathrm{II}} = -Y\,B - \max, & & \mathrm{W}_{\mathrm{I}} = -\left(C^{\mathrm{T}}\right)^{\mathrm{T}} X - \min, \\ \mathbf{II}:\ \Omega_{\mathrm{II}} : -Y\,A \le -C^{\mathrm{T}}, & \xrightarrow{def\ \ Dual} & \mathbf{I}:\ \Omega_{\mathrm{I}} : -AX \le -B, \quad \Leftrightarrow \\ Y \ge 0, & & X \ge 0, \end{array}$$

$$\Updownarrow$$

$$\begin{array}{rl} & \mathrm{W}_{\mathrm{I}} = C\,X - \max, \\ \Leftrightarrow & \mathbf{I}:\ \Omega_{\mathrm{I}} : A\,X \le B, \\ & X \ge 0. \end{array}$$

Conclusion

The concept of key competence is highlighted in the work – it is the competence of the higher order involved in the creation of the highest consumer value, which is a collective knowledge, which allows to organize and manage the use of other competences and abilities and, thus, creates an additional consumer value. It is analysis of the key competence of the enterprise, based on which an innovative project is carried out, provides an opportunity to propose a new basis for the formation of a strategic plan, the implementation of which will lead to (sustain) sustainable competitive advantage, as well as assess the potential of this plan from the standpoint of financial standing and capabilities of the enterprise or business system as a whole. For the first time, strictly defined transition operations to a dual task from a direct task presented in a general form of record are strictly defined. In view of this, the transition to a dual task is a simple formal order. For the existing pairs of binary problems, their true character is strictly proved, as the main criterion for the formation of pairs of bipartite.

References

1. Druzhinin, Ye. A. (2006), Methodological bases of risk-oriented approach to resource management of engineering projects and programs [Metodolohichni osnovy ryzyk-oriyentovanoho pidkhodu do upravlinnya resursamy proektiv i prohram rozvytku tekhniky] : diss. ... doctor of techn. Sciences: 05.13.22 / Druzhinin Yevgeny Anatoliyovych, Kharkov, 593 p.
2. Voropaev, V. I. (2014), "Functional models of project management for different stakeholders" ["Funktsional'nyye modeli upravleniya proyektnoy deyatel'nost'yu dlya raznykh zainteresovannykh storon"], *Project and Program Management*, No. 4.
3. Bushuev, S. D., Bushueva, N. S. et al. (2010), Creative technologies of project and program management [Kreativnyye tekhnologii upravleniya proyektami i programmami] : Monograph, Kyiv : Sammit-knega, 768 p.
4. Belokon, A. I., Malanchi, S. A., Antonenko, S. V., Kotsyuba, T. V., Alkubalight, T.A.D. (2018), "Analysis of the significance of the project stakeholders", *Bulletin of the Pridneprovsk State Academy of Civil Engineering and Architecture*, No. 2, P. 81–94.
5. Rach, V. A. (2009), "Problems of information security in project management in the era of knowledge economy" ["Problemy zakhystu informatsiyi v upravlinni proektamy v epokhu ekonomiky znan′"], *Project management and production development*, No. 2, P. 156–160.
6. Tyan, R. B., Ivanov, S. V. (2009), Investment projects in the framework of strategic enterprise management [Investitsionnyye proyekty v ramkakh strategicheskogo upravleniya predpriyatiyem]: Monograph. D. : Makovetsky, 404 p.
7. Mazur, I. I., Shapiro, V. D., Olderogge, N. G., Polkovnikov, A. V. (2014), *Project management* [*Upravleniye proyektami*], Moscow : Omega-L, 959 p.
8. Bushuev, S. D., Bushueva, N. S. (2006), *Project Management: The Basics of Professional Knowledge and the Competence Assessment System of Project Managers (National Competence Baseline, NCB UA Version 3.0)* [*Upravleniye proyektami: Osnovy professional'nykh znaniy i sistema otsenki kompetentnosti proyektnykh menedzherov (National Competence Baseline, NCB UA Version 3.0)*], Kyiv : IRIDIUM, 208 p.
9. Bushueva, N. S. (2007), Models and methods of proactive management of organizational development programs [Modeli i metody proaktivnogo upravleniya programmami organizatsionnogo razvitiya]: Monograph, Kyiv : Science. Svit, 199 p.
10. Hiroshi Tanaka (2006), "Integrated management of multiprojects in contracting organizations"["Kompleksnoye upravleniye mul'tiproyektami v podryadnykh organizatsiyakh"], *Project and Program Management*, No. 2.
11. Shigenobu Ohara (2005), "Application of the P2M methodology in civil engineering and analysis of the results" ["Primeneniye metodologii R2M v grazhdanskom stroitel'stve i analiz rezul'tatov"], *Project and Program Management*, No. 3.
12. Grashina, M., Duncan, V. (2006), *Fundamentals of Project Management* [*Osnovy upravleniya proyektami*], SPb : Peter, 208 p.
13. Parkhomenko, O. M., Osievsky, A. (2000), *Machine-Building Enterprise Management: Functions, Organizational Structure, Personnel* [*Upravleniye mashinostroitel'nym predpriyatiyem: funktsii, organizatsionnaya struktura, kadry*] : Uch. Allowance, Kharkiv : Nat. aerospace. un-t "KhAI", 160 p.
14. *Guide to the management of innovative projects and programs: T. 1, version 1.2* [*Rukovodstvo po upravleniyu innovatsionnymi proyektami i programmami : T. 1, versiya 1.2*] / [trans. in Russian language ed. S. D. Bushueva]. – Kyiv : Sciences. Svit, 2009, 173 p.

ISSN 2522-9818 (print)
Сучасний стан наукових досліджень та технологій в промисловості. 2019. № 1 (7) *ISSN 2524-2296 (online)*

15. Novikov, D. A. (2007), *Project Management: Organizational Mechanisms* [*Upravlinnya proektamy: orhanizatsiyni mekhanizmy*], Moscow : PMOFT, 140 p.
16. Zelenkov, Yu. A. (2012), "Strategic IT development planning. Model of strategic decision making under uncertainty" ["Strategicheskoye planirovaniye razvitiya IT. Model' prinyatiya strategicheskikh resheniy v usloviyakh neopredelennosti"], *Information Management*, No. 4, P. 26–38.
17. Hamel, G., Prahalad, K. (2002), C*ompetition for the Future. The creation of the market of tomorrow* [*Konkurentsii za budushcheye. Sozdaniye rynka zavtrashnego dnya*], Moscow : ZAO "Olympip-Business", 288 p.
18. Hamel, G., Prahalad, K. (2005), *Strategic flexibility* [*Strategicheskaya gibkost'*], SPB : Peter, 384 p.
19. Prangishvili, I. V. (2000), *System approach and system-wide regularities*. Series "Systems of Management Problems" [*Systemnyy pidkhid ta zahal'nosystemni zakonomirnosti*. Seriya «Systemy problem upravlinnya»], Moscow : SINTEG, 528 p.
20. Nazarova, G., & Nazarov, N. (2017), "The analysis of structural configurations for implementing competitive strategies", *Innovative Technologies and Scientific Solutions for Industries*, No. 2 (2), P. 132–137. DOI: https://doi.org/10.30837/2522-9818.2017.2.132.
21. Kuznetsova, I. (2017), "Formalizing the technology of management as a constituent of the organization core capabilities", *Innovative Technologies and Scientific Solutions for Industries*, No. 2 (2), P. 116–123. DOI: https://doi.org/10.30837/2522-9818.2017.2.116.
22. Hetmantsev, V. D. (2001), *Linear algebra and linear programming* [*Liniyna alhebra i liniyne prohramuvannya*], Kyiv, Lybid, 250 p.
23. Romanyuk, T. P., Tereshchenko, T. O., Prisenko, G. V., Gorodokova, I. M. (1996), *Mathematical programming* [*Matematychne prohramuvannya*], Kyiv, Libel, 312 p.

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КЛЮЧОВА КОМПЕТЕНЦІЯ ЯК ОСНОВА УПРАВЛІННЯ ІННОВАЦІЙНИМИ ПРОЕКТАМИ

При реалізації програми розвитку на підприємстві існуюча ключова компетенція організації може зазнавати значних змін. Крім того, при впровадженні інновацій можна отримати не лише переваги, але і додаткові проблеми та, навіть, ризики. Слід зауважити, що організація може мати більш ніж одну ключову компетенцію, особливо, якщо мова йде про впровадження зміни в структури управління або виходу на нові ринки. Для такого класу задач класична задача лінійної оптимізації не підходить, тому що не враховує додаткових умов, які виникають при переході організації з одного стану до іншого, саме за допомогою реалізації програми розвитку. Тому для вирішення цієї проблеми знадобиться двоїста задача. **Предметом** дослідження в даній статті є процес впровадження ключової компетенції, як основної складової управління інноваційними проектами у діяльності організації. **Мета**: розробка інструменту впровадження ключової компетенції у роботу організації за допомогою вирішення двоїстої задачі лінійної оптимізації. **Завдання**: проаналізувати чинники, що впливають на результати та можливості впровадження ключової компетенції у діяльність організації, отримати загальний алгоритм переходу від прямої до двоїстої компетенції. **Методи** дослідження: логічне узагальнення, аналіз та синтез, структурний аналіз. **Результати**: В статті розглянуто ключову компетенцію підприємства, як основну складову управління інноваційними проектами, що це підприємство реалізує. Показано її місце та роль, що вона відіграє. Розроблено модель опису проектів, що описує процеси, які враховують вплив виробничо-економічної системи на реалізацію проектів. В статті запропоновано загальний алгоритм побудови пар двоїстих задач в лінійній оптимізації. Існуючі схеми переходу від прямої задачі до двоїстої носить змістовний характер. З огляду на цей факт запропонований та строго доведений алгоритм загального підходу до складання пар спряжених задач. Формалізація розробленої схеми дозволяє легко отримати правильні пари двоїстих задач. Показано, що аналіз ключової компетенції підприємства надає можливість запропонувати нову базу для формування стратегічного плану, виконання якого вестиме до появи (підтримки) стійкої конкурентної переваги, а також оцінити його потенціал з позиції фінансового плану і можливостей підприємства або бізнес-системи в цілому. **Висновки**: Розроблено інструменти аналізу та впровадження ключової компетенції в діяльності організації. Отримані в ході дослідження результати дозволяють констатувати, що запропоновано нову базу для формування стратегічного плану розвитку підприємства, використання якої приведе до стійкої конкурентної переваги, що стане можливим при втіленні ключової компетенції в зміни структури управління. Враховуючи, що організація може мати більш ніж одну ключову компетенцію, друга компетенція є двоїстою до вихідної, що дозволяє отримати загальний перехід від прямої до двоїстої компетенції.

Ключові слова: інноваційний проект; ієрархія управління; показники ефективності; вимірні ефекти; лінійна оптимізація; пряма задача; двоїста задача; спряжені задачі; цільова функція; система обмежень.

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КЛЮЧЕВАЯ КОМПЕТЕНЦИЯ КАК ОСНОВА УПРАВЛЕНИЯ ИННОВАЦИОННЫМИ ПРОЕКТАМИ

При реализации программы развития предприятия существующая ключевая компетенция организации может подвергаться значительным изменениям. Кроме того, при внедрении инноваций можно получить не только преимущества, но и дополнительные проблемы и даже риски. Следует заметить, что организация может иметь более чем одну ключевую компетенцию, особенно, если речь идет о внедрении изменения в структуре управления или выхода на новые рынки. Для такого класса задач классическая задача линейной оптимизации не подходит, так как не учитывает дополнительных условий, которые возникают при переходе организации из одного состояния в другое, именно за счет реализации программы развития. Поэтому для решения этой проблемы понадобится двойственная задача. **Предметом** исследования в данной статье является процесс внедрения ключевой компетенции, как основной составляющей управления инновационными проектами в деятельности организации. **Цель**: разработка инструмента внедрения ключевой компетенции в работу организации с помощью решения двойственной задачи линейной оптимизации. **Задачи**: проанализировать факторы, влияющие на результаты и возможности внедрения ключевой компетенции в деятельность организации, получить общий алгоритм перехода от прямой к двойственной компетенции. **Методы** исследования: логическое обобщение, анализ и синтез, структурный анализ. **Результаты**: В статье рассмотрена ключевая компетенция предприятия как основная составляющая управления инновационными проектами, которую предприятие реализует. Показано ее место и роль, которую она играет. Разработана модель описания проектов, которая описывает процессы, учитывающие влияние производственно-экономической системы на реализацию проектов. В статье предложен общий алгоритм построения пар двойственных задач линейной оптимизации. Существующие схемы перехода от прямой задачи к двойственной носят содержательный характер. Учитывая этот факт предложен и строго доказан обобщенный алгоритм составления пар сопряженных задач. Формализация разработанной схемы позволяет легко получить правильные пары двойственных задач. Показано, что анализ ключевой компетенции предприятия дает возможность предложить новую базу для формирования стратегического плана, выполнение которого приведет к появлению (поддержки) устойчивого конкурентного преимущества, а также оценить его потенциал с точки зрения финансового плана и возможностей предприятия или бизнес-системы в целом. **Выводы**: Разработаны инструменты анализа и внедрения ключевой компетенции в деятельность организации. Полученные в ходе исследования результаты позволяют констатировать, что предложена новая база для формирования стратегического плана развития предприятия, использование которого приведет к устойчивому конкурентному преимуществу, что станет возможным при воплощении ключевой компетенции в изменении структуры управления. Учитывая, что организация может иметь более чем одну ключевую компетенцию, вторая компетенция является двойственной к исходной, что позволяет получить общий переход от прямой к двойственной компетенции.

Ключевые слова: инновационный проект; иерархия управления; показатели эффективности; измеримые эффекты; линейная оптимизация; прямая задача; двойственная задача; сопряженные задачи; целевая функция; система ограничений.