Organizaciono-tehnološki modeli za formiranje efektivnih skupova mašina i tehnologija pri izvođenju građevinskih radova

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U ovom radu primenjeni su kriterijumu za procenu optimizacije postupka odlučivanja zasnovanog na teoriji prakseologije. Izrađen je algoritam snabdevanja mašina za građevinske radove. Korišćen je klusterski pristup za organizaciju tehnologije građevinskih radova, koji se zasniva na teoriji sistema, kriterijumima donošenja odluka i sinergetičnosti. Svojim sadržajem, prema relevantnoj tehnologiji, omogućio je stvaranje optimalnog skupa potrebnih načina organizacije građevinskih radova u jedinstven sistem. Rezultati istraživanja uključuju: podizanje nivoa svesti i pripremu potencijalnih učesnika za stvaranje klastera kao i definisanje kriterijuma za procenu optimizacije donošenja upravljačkih odluka u cilju povećanja efikasnosti optimizovanog skupa mašina za građevinsko preduzeće.

Ključne reči: kriterijumi evaluacije, optimizacija, snabdevanje mašina, kluster pristup

0. DEFINISANJE PROBLEMA

Transformacioni procesi u modernoj ekonomiji postavljaju složenost gradnje ispred zahteva opstanka na tržištu, što zahteva dosta napora i pažljivo planirana rešenja. Strategija menadžmenta, čiji glavni cilj danas nije toliko profit, postaje sve rasprostranjeniji, jer povećanje investicione vrednosti vlasničkog kapitala pruža budućnost ekonomskog stanja građevinske kompanije. Problem sa skupovima građevinske opreme je taj što imaju povećan stepen fizičkog habanja, dok niska tehnološka produktivnost dovodi do upotrebe velike količine opreme.

Rešenje je u pronalaženju novih organizacionih i tehnoloških modela za formiranje skupova mašina u skladu sa programom izgradnje, modernim zahtevima i tržišnim potrebama. Jedan od takvih metoda je primena klusterskog pristupa, koji se široko koristi u različitim oblastima i zasniva se na teoriji sistema [1], kriterijima odlučivanja [2] i sinergiji [3]. Njegova suština je sposobnost da u jednom sistemu stvore optimalan skup potrebnih, značajnih tehnologija, metoda proizvodnje bilo kojeg proizvoda najvišeg kvaliteta i dostupnost prilagođene kontrole kako bi se osigurali minimalni troškovi energije i maksimalna produktivnost implementacije finalnog projekta.

1. OBRAČUN MATERIJALA

Kriterijumi za efikasnost dejstva su, u izvesnoj meri, kriterijumi koji vrednuju efektivnost univerzalnih i sintetizovanih vrednosti i predstavljaju frazeološke (praktične) procene [4]. Prakseologija je opšta teorija efektivnosti akcija, koja ima za cilj postizanje najšire generalizacije tehnološke prirode [8] (a radi se o tehnologiji efikasnog rada, preporukama i upozorenjima koja su važna za svaku akciju i koja je konačno usmerena

ka maksimalnoj efikasnosti) i uglavnom se bavi efikasnošću delovanja i funkcionisanja.

Efikasnost se identifikuje sa ekspektivnošću, jer su produktivne akcije ili metode delovanja one koje na kraju dovode do željenog rezultata, nazvanog cilj [4]. Označavajući cilj sa M, rezultat sa P, glavni rezultat sa O i trošak sa B, možemo napisati sledeće frazeološke pokazatelje univerzalne efikasnosti [4,5].

Kvalitet rezultata

$$K_p = P/M, \quad (1)$$

je odnos rezultata i cilja delovanja.
Rezultat glavnog cilja

$$K_o = O/M \quad (2)$$

je odnos glavnog rezultat i cilja delovanja..
Nedоследnost rezultata

$$\bar{P} = P - M \quad (3)$$

je razlika između rezultata i svrhe akcije.
Nedоследnost glavnog rezultata

$$\bar{O} = O - M \quad (4)$$

je razlika između glavnog rezultata svrhe akcije delovanja.
Benefit rezultata

$$\chi = P - B \quad (5)$$

je razlika između rezultata i troškova implementacije akcije.

Ekonomija rezultata:

$$\eta = P/B \quad (6)$$

predstavlja odnos rezultata i troškova implementacije akcije.

Kvalitet glavnog rezultata K_0 je inverzan stepenu vrednosti cilja, koji je definisan [3] kao "odnos koji uključuje vrednosti ciljeva (količine vrednosti namene) i vrednosti stvarnih uticaja (zbir vrednosti stvarnih uticaja) akcije usmjerene na postizanje ovog cilja (ciljeva) djelovanja.

Upotreba dobijenih kriterijuma (1-6) bila je preduslov za izradu sheme za formalizaciju snabdevanja mašina (slika 1).

Koncept klastera prevazilazi jednostavne horizontalne veze, u kojima firme koje posluju na opštem tržištu gotovih proizvoda pripadaju istoj industrijskoj grupi, sarađuju u oblastima istraživanja i razvoja, demonstracionim programima, zajedničkom marketingu ili aktivnosti nabavke.

Klasteri u velikoj meri deluju kao mrežne strukture kombinovanih područja, osoblja sa heterogenim i komplementarnim firmama koje su specijalizovane za stvaranje bilo kog materijalnog ili specifičnog inovativnog proizvoda.

Sl. 1: Algoritam adekvatnog izbora i proračuna skupa mašina

U okviru implementacije ovog algoritma (Slika 1), izvršeno je odgovarajuće istraživanje u razvoju i implementaciji klasterkog pristupa.

Koncept klastera se fokusira na veze i međusobne zavisnosti između kompanija integrisanih u mrežnu strukturu za proizvodnju proizvoda, usluge i inovacije.

Klasteri se razlikuju od drugih oblika saradnje kompanija zbog činjenice da kompanije koje učestvuju u njemu formiraju proizvodnu i trgovačku mrežu.

Prilikom utvrđivanja striktnih granica za sektore i industrije, tradicionalni pristup istraživanja ne uzima u obzir značaj uspostavljanja međusobnih veza i razmene znanja unutar mrežne strukture.

Koncept klastera služi kao alternativa tradicionalnom sektorskom pristupu istraživanja ekonomskog tržišta (Tabela 1).

Tabela 1: Razlike između klaster i sektorskih protupa

№	Klaster pristup	Tradicionalni sektorski pristup
1	Strateške grupe sa heterogenim, komplementarnim firmama u mrežnim strukturama	Grupe kompanija sa sličnim mrežnim strukturama
2	Uključiti dobavljače, potrošače, proizvođače roba i usluga, specijalizovane ustanove	Fokusiranje na proizvođače gotovih proizvoda
3	Kombinovanje niza međusobno povezanih industrija koje koriste zajedničke tehnologije, obrazovanje, informacije, resurse, kanale i klijentele.	Fokusirajte se na direktne i indirektno učesnike
4	Većina učesnika nije direktni konkurent, već imaju uobičajene probleme i izazove	Sumnja u organizaciji saradnje sa konkurentima
5	Rasprostranjena poboljšanja u oblasti od opšteg interesa koja poboljšavaju produktivnost i povećavaju konkurenciju.	Pristup uskog opsega
6	Forumi za konstruktivniji i efikasniji dijalog između vlade i poslovne zajednice	Dijalog sa vladom obično ima za cilj dobijanje subvencija, protekcionizma i ograničavanja konkurencije
7	Потражите синергију нових синдиката и удружења	Traženje u pravcu napora da se diverzifikuju korporacije u postojećim uslovima

Mnogi učesnici su uključeni u značajnu oblast inovativne aktivnosti, a njegov uspeh određuje njihova komplementarnost, dostupnost njihovog specijalizovanog znanja;

- efekat sinergije koji proizlazi iz kombinacije znanja različitih firmi i organizacija koje se međusobno dopunjuju, a potreba za preduzećima u borbi protiv sve veće zavisnosti od uslova životne sredine je pokretački faktor u formiranju klastera i zaključivanja sporazuma od strane firmi o zajedničkim inovativnim aktivnostima;

- inicijalna teorijska pozicija je zaključena u interakcijski zasnovanoj teoriji inovacija, u kojoj se inovacije definišu kao interaktivni proces učenja zasnovanog na razmeni znanja i zajedničkim aktivnostima različitih učesnika i proizvodnih mrežnih struktura;

- značajne inovacije nastaju iz novih kombinacija komplementarnosti, različitih znanja i kompetencija;

- različite vrste mrežnih struktura i tržišta zahtevaju različite stilove inovacija;

Sl. 2: Inovativni sinergijski klaster

Izlazne pozicije prednosti klaster pristupa (Slika 2):

- firme retko uvode inovacije u izolaciju. Mnogo je intenzivnija u mrežnim naukama i proizvodnim sistemima.

Ekonomska efikasnost preduzeća (Slika 3) na osnovu upotrebe klastera smanjuje do 40% nominalnih troškova proizvodnje, uključujući: DC - zbir direktnih troškova: troškovi sirovina, direktne zarade, rad mašina i mehanizama, energija (raspon strukturnih troškova 40-

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50%); FC je zbir konstantnih opštih ekonomskih, opštih, administrativnih i socijalnih troškova (smanjenje strukturnih troškova za 10-20%); LMA - transportna logistika, troškovi aktivnosti spoljnih organizacija, marketinške i reklamne aktivnosti u cilju prikupljanja i održavanja roba (usluga) na tržištu (raspon strukturnih troškova 0-10%); Povećanje obima prodaje; Poboljšanje statusa kompanije kao člana klastera.

Sl. 3: Ekonomska efikasnost preduzeća zasnovana na korišćenju klastera

2. ZAKLJUČAK

1. Predloženi kriterijumi određuju racionalan skup mašina za građevinsku kompaniju, njihov izbor za poređenje različitih opcija u eksplicitnom i sintetizovanom obliku.

2. Utvrđeno je da u savremenim uslovima kontrole procesa izbora građevinske kompanije skup mašina zasnovanih na upotrebi klastera, koji se zasniva na teoriji sistema, kriterijumima donošenja odluka i sinergičnosti.

3. Primena metode klastera ima sposobnost da u jedinstvenom sistemu stvori optimizovan skup potrebnih, prema relevantnoj tehnologiji, metoda proizvodnje bilo kojeg proizvoda najvišeg kvaliteta i dostupnosti prilagođene kontrole kako bi se osigurala minimalna troškovi energije i maksimalna produktivnost implementacije završnog projekta.

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Organizational-Technological Models for the Formation of Effective Sets of Machines and Technologies in the Performance of Construction Works

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The criteria used to evaluate the optimization of decision making on the basis of the theory of praxeology have been applied in this work. The algorithm of supply of machines for construction works is made. The cluster approach for the organization of construction work technology, which is based on the theory of systems, criteria of decision-making and synergetic, is used. Its content essence has made it possible to create an optimized set of necessary, according to the relevant technology, method of organization of construction work in a single system. The results of the research include: raising the level of awareness and preparing potential participants for the creation of clusters. Development of criteria for evaluating the optimization of making managerial decisions in order to increase the efficiency of an optimized set of machines for a construction company.

Keywords: *evaluation criteria, optimization, supply of machines, cluster approach*

0. FORMULATION THE PROBLEM

Transformation processes in the modern economy place the building complex in front of the requirement to stay in the market, which requires a lot of effort and carefully thought out solutions. The strategy of management, whose main goal is not so much profit making today, is becoming more widespread, as the increase in the investment value of equity capital provides the future of the economic condition of the construction company. The problem with construction equipment kits is that they have an increased degree of physical wear and tear, and low technological productivity leads to the use of a large amount of equipment.

The solution lies in finding new organizational and technological models for forming sets of machines in accordance with the program of the construction project, modern requirements and market needs. One such method is the application of the cluster approach, which is widely used in various fields and is based on the theory of systems [1], decision making criteria [2] and synergetic [3]. Its essence is due to the ability to create in a single system an optimized set of necessary, significant technology, methods of manufacturing any product of the highest quality, and the availability of adapted control to ensure minimum energy costs and the maximum productivity of the implementation of the final project.

1. STATEMENT OF THE MATERIAL

The criteria for the effectiveness of action are, to a certain extent, the criteria that evaluate the effectiveness of the universal and synthesized values, and are

phraseological (practical) estimates [4]. Praxeology is a general theory of the effectiveness of actions, which aims to achieve the broadest generalizations of a technological nature [8] (and it is about the technology of effective work, the recommendations and warnings that are important for each action and ultimately aimed at maximum efficiency), and mainly deals with the effectiveness of action and functioning.

Efficiency is identified with expediency, because productive actions or methods of action are those that ultimately lead to the desired result, called goal [4]. Marking the goal M, the result P, the main result - O and the cost - B, we can write the following phraseological indicators of universal efficiency [4,5].

The quality of the result

$$K_p = P/M, \quad (1)$$

is the relation of the result to the goal of action.

The quality of the main result

$$K_o = O/M \quad (2)$$

is the relation of the main result to the goal of action.

Inconsistency of the result

$$\bar{P} = P - M \quad (3)$$

is the difference between the result and the purpose of action.

Inconsistency of the main result

$$\bar{O} = O - M \quad (4)$$

is the difference between the main result and the purpose of action.

The benefit of the result

$$\chi = P - B \quad (5)$$

is the difference between the result and the cost of implementing the action.

Economy of the result:

$$\eta = P/B \quad (6)$$

represents the ratio of the result to the cost of the implementation of the action.

The quality of the main result K_0 is the inverse of the degree of value of the goal, which is defined [3] as a "relation involves values that the goals (amounts of values of purpose) to the value of the real effect (the sum of values of real effects) of the action aimed at achieving this goal (goals) of action.

Using the resulted criteria (1-6) was a prerequisite for the development of a scheme for the formalization of supply of machines (Figure 1).

The cluster concept focuses on ties and interdependencies between companies integrated into the network structure for product manufacturing, service and innovation.

Clusters are different from other forms of cooperation of companies by the fact that the participating companies in it form a production and trading network.

The cluster concept goes beyond simple horizontal ties, in which firms operating on the general market of finished products belong to the same industrial group, cooperate in such areas of activity as research and development, demonstration programs, joint marketing or procurement activity.

Clusters in large part act as network structures of combined areas, staffed with heterogeneous and complementary firms specializing in the creation of any material or specific innovative product. When establishing strict boundaries for sectors and industries, the traditional research approach does not take into account the importance of establishing interconnections and sharing knowledge within a network structure.

Fig. 1: The algorithm of the reasonable choice and calculation of the set of machines

Within the framework of the implementation of this algorithm (Figure 1), appropriate research has been carried out in the development and implementation of the cluster approach.

The cluster concept serves as an alternative to the traditional sectoral approach in economic market research (Table 1).

Table 1: Differences between cluster and sectoral approaches

Nº	Cluster approach	Traditional sectoral approach
1	Strategic groups with heterogeneous, complementary firms in network structures	Groups of companies with similar network structures
2	Include suppliers, consumers, manufacturers of goods and services, specialized institutes	Focus on manufacturers of finished products
3	Combine a number of interconnected industries that use common technologies, education, information, resources, channels and clientele.	Focus on direct and indirect competitors
4	Most participants are not direct competitors, they have common problems and challenges	Doubtfulness in the organization of cooperation with competitors
5	Widespread improvements in the field of general interest that improve productivity and enhance competition.	Narrow-band approach
6	Forums for more constructive and effective dialogue between the government and the business community	The dialogue with the government is usually aimed at receiving subsidies, protectionism and limiting competition
7	Search for the synergy of new unions and associations	Search in the direction of efforts to diversify corporations under existing conditions

- firms rarely introduce innovations in isolation. It is much more intense in network science and production systems. Many participants are involved in a significant area of innovation activity, and its success is determined by their complementarity, the availability of their specialized knowledge;
- the effect of synergy that stems from the combination of knowledge of different firms and organizations that complement each other and the need for firms to combat the growing dependence on environmental conditions is a driving factor in the formation of clusters and the conclusion of agreements by firms on joint innovation activities;
- the initial theoretical position is concluded in the interaction-based theory of innovation systems, in which innovation is defined as an interactive learning process based on the exchange of knowledge and the joint activities of various participants and production network structures;
- significant innovations are born from new combinations of complementarity, diverse knowledge and competence;
- different types of network structures and markets require different styles of innovation;

Fig.2: Innovative synergistic cluster

Output positions of the benefits of a cluster approach (Figure 2):

The economic efficiency of the enterprise (Figure 3) on the basis of the use of the cluster reduces up to 40% of the nominal structural cost of production, including: DC - the sum of direct costs: the cost of raw materials, direct wages,

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the work of machines and mechanisms, energy (the range of structural cost 40-50%); FC is the sum of constant general economic, general, administrative and social costs (decreasing the structural cost by 10-20%); LMA - transport logistics, cost of activities of outside organizations, marketing and advertising activity aimed at bringing and maintaining goods (services) in the market (range of structural cost 0-10%); Increase in sales volume; Enhancing company status as a cluster member.

Fig. 3: Economic efficiency of the enterprise based on the use of the cluster

2. CONCLUSIONS

1. The proposed criteria determine the rational set of machines for a construction company, their choice to compare different options in an explicit and synthesized form.

2. It is established that in modern conditions of control of the process of choosing a construction company a set of machines based on the use of a cluster, which is based on the theory of systems, criteria of decision making and synergetic.

3. The application of the cluster method has the ability to create, in a single system, an optimized set of necessary, according to the relevant technology, methods of manufacturing any product of the highest quality and the availability of adapted control to ensure minimum energy costs and maximum productivity of the implementation of the final project.

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