В дослідженні здійснено розробку рекомендацій щодо підвищення ефективності управління будівельними проектами за рахунок створення нових та розвитку відомих моделей організації офісу управління проектами. Розвинуто концепцію інформаційної системи управління будівельними проектами

Ключові слова: офіс управління будівельними проектами (ОУБП)

В исследовании разработаны рекомендации для повышения эффективности управления строительными проектами за счет создания новых и развития известных моделей организации офиса управления строительными проектами. Развита концепция информационной системы управления строительными проектами

Ключевые слова: офис управления строительными проектами (ОУСП)

The research contains the development of recommendations as to increasing the efficiency of managing construction projects due to establishing new and developing already known models of project management office organization. The work also includes the development of conception of the construction project management information system

Keywords: construction projects management offices (CPMO)

УДК 65.014.1

МОДЕЛИ ОРГАНИЗАЦИИ ОУСП В СИСТЕМЕ УПРАВЛЕНИЯ ПРОГРАММОЙ «ЕВРО-2012»

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At present all leading Ukrainian cities including Kharkov are strenuously preparing to the participation in Euro-2012 football final matches. Most of the tasks of «The Program on Preparation and Carrying out matches of the Euro2012 football finals in Kharkov region» (Program - hereinafter) touch upon the realization of the series of construction projects [1]. Strategic objects of the football infrastructure are being carried out within planned terms. But at so doing, the projects of constructing and reconstructing hotels, architectural and cultural monuments, roads are in so called «risk zone».

Among the factors causing risk to the realization of these projects are the following: financial (joint sources of financing – budget funds, funds of regional and local budgets, private investors, sponsors, etc); limited nature of regional resources in providing specific services (a number of unique projects demand involving organizations capable to work out corresponding projects' documentation and carry out contractual work). Even under «usual» conditions only some of construction projects are completed in time and use up the planned resources. Therefore, according to the international data only 44% projects are completed in time, the duration of projects reaches 222% of the scheduled period, the costs rise to 189% from the initial budget, 30% projects are terminated being non-completed [2].

International character of Program Euro-2012 has an impact on the traditional system of management of construction projects as well as on the regional level, and on the level of a separate object. The very structure of a constructing object becomes complicated not because of technological cycle of construction, but mostly because of preparation-planning work and its commissioning.

The problems of improving of the construction projects management are getting more essential in complicated conditions of organizational environment: the demands of strict maintenance of the terms, of the effective exploitation of the resources (human, financial, material). Adequate management influence on the process of constructing objects is becoming possible under condition of considering all multiple situational variables and cooperation of all functions of the management process. To gain an effective management of the project, as it is foreseen by the international standards of project management, it is necessary to create Project management office, PMO [3]. But organizational and technical possibilities of PMO in Ukrainian practice of constructive projects management are usually used locally.

The development of integrated model of construction projects management offices (CPMO) which would consider a number of criteria and different stage of uncertainty of referential information is the top-priority scientific and practical task.

The purpose of the present research is the backgrounding theoretical and methodological basis of the CPMO organization through modeling of the organizational and technical elements of management system.

The fundamental prior task for the development of models of CPMO organization will be structural decomposition of the Program management system. The system of construction projects management contains three basic elements: subjects, objects and processes of management (Fig. 1).

The subjects of management of the constructive constituent are the main participants of the projects, they are individuals or organizations which either actively participate in the project, or whose interests can be involved while executing or fulfilling the project. The key participants of the Program are UEFA, the state of Ukraine, Kharkov regional state administration (KhRSA), local authorities, investors and contract holders. Each Program participant has a structure which is responsible for the realization of the project of the Program. For example, KhRSA has organized the department for preparation to Euro-2012, and the Executive Committee of the city has the corresponding department. Taking into consideration that the Program is international, its fulfilling is under UEFA control and monitoring. Ukraine as a state is responsible for the level, terms, volume of preparation to Euro conduct.

From the point of projecting management, the Division for preparation to Euro of KhRSA can be regarded as PMO because it is the structure which has the authority of main coordinator of the Program in Kharkov region [4]. But besides, the scheme of management of the program must foresee the establishment of a separate CPMO for realizing each project [5-7].

On the level of management of a separate construction object CPMO is represented by an organizational structure of management of the project (Project Management Team) which is directly involved into project management operations [4]. Project management team must include specialists-candidates from all participants of the project. The staff of the CPMO includes the following positions: Project Manager, capital construction manager, design and engineering manager, production process manager, risk manager, and marketing manager [8]. The investor of the project, all managers of the project management team, and all specialists executing project work are regarded as the Project Team. In the project office «powerful» communications between key participants of the project are gaining special importance. They work in a unified system with unified forms, rules and standards [3].

The objects of Program management are divided into the following groups:

1. The construction, reconstruction, repair of the objects which are under special control of UEFA

1) the main (strategic) objects: Metallist stadium, international airport and servicing terminal for passengers, the three sporting bases for training and accommodation of the teams – participants of Euro 2012;

2) hotels: existing network and the new 4* and 5*ones;

3) medical establishments;

4) network and constructions of the central water supplying and water drainage in the city of Kharkov;

5) electricity submission lines.

2. The construction, reconstruction and repair of the objects which are being realized on the initiative of KhRSA:

1) along Poltavsky Shlyach and Sumskaya street;

2) cultural monuments (the National museum named after Grigory Skovoroda in Zolochev district, the state historical and archeological recreation area «Upper Saltov» in Volchansky district, and others).

General coordination of the management can be carried out on the level of portfolio. The algorithm of decomposition of the very construction project consists of destructuring elements (processes, procedures, operations) which are less in size, but easier to manage. Decomposition will last

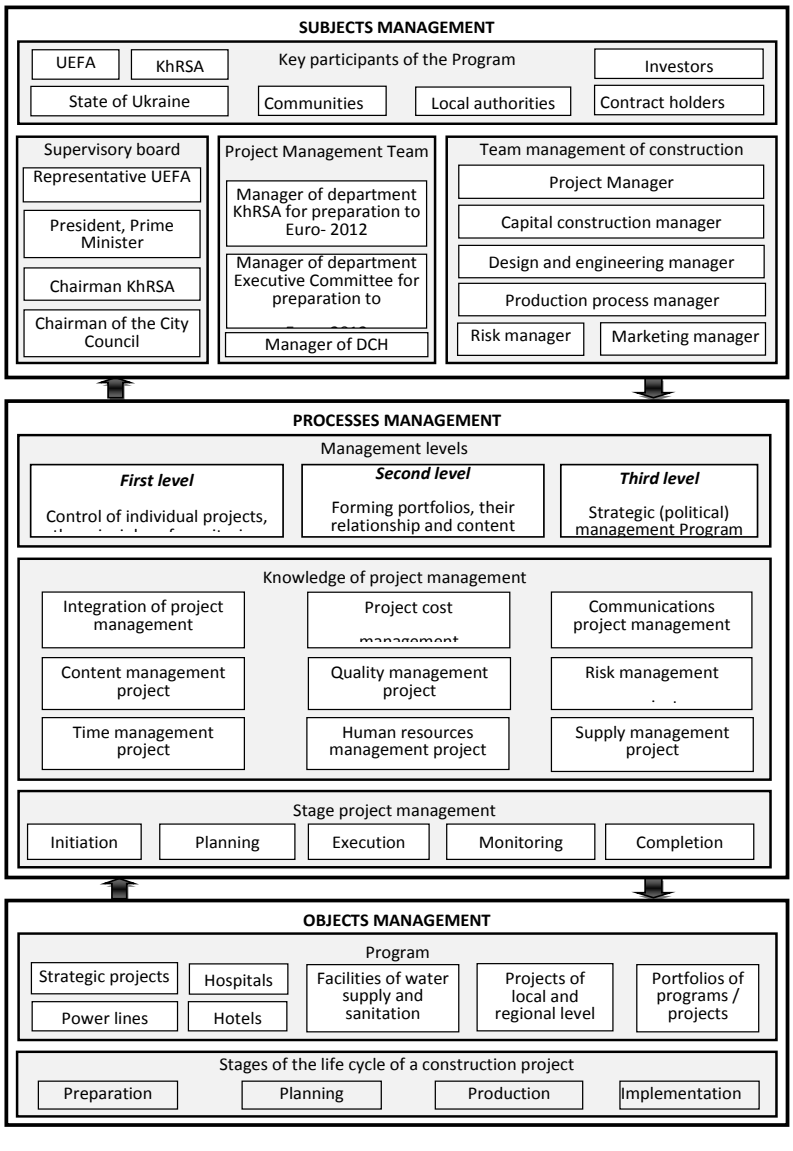

Fig. 1. Structural model of the Program for construction project management system

until the level of detalization of the results (elements) is appropriate for effective preparation, planning, production and implementation of an object.

The living cycle of each construction project is comprised of the following stages: preparation, planning, production, and implementation for any of the constructing projects [9].

The processes of management system are represented by three dimensions: by the level of management, by the spheres of knowledge on project management and be the stages of project management.

On the first level of management the problems connected with definite separate projects and the principles of their monitoring are decided. The second level ofmanagement presupposes the formation of portfolios and their interconnection and rational filling in. The problems of strategic (political) character are decided on the upper – the third- level of management.

On each of the three levels of management specific management processes are realized, they are decomposed according to PMBOK® and to the stages of project management (initiation, planning, execution, monitoring, fulfillment). Nine spheres of knowledge are defined by the PMBOK® international standards, they are integration of management, management of contents, terms, value, quality and of human resources, communications, risks and supplies of the project. The spheres of knowledge of the project management are included into the process of project management is different stages, depending on the stage of the living cycle of the project.

As the result of general decomposition of the system of construction management project Program the process of formation of CPMO can be represented by structural logical model of organizational and technical tasks setting up the CPMO (Fig. 2).

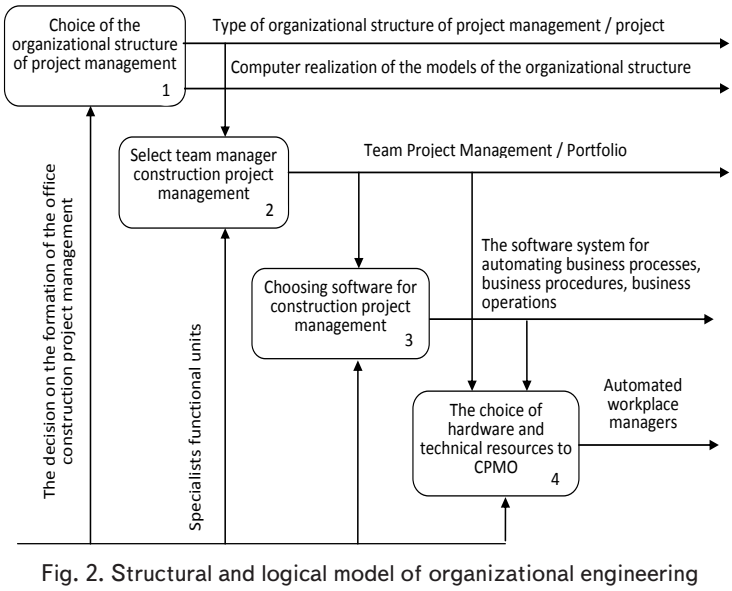

Fig. 2. Structural and logical model of organizational engineering objectives of CPMO setup

The first organizational task of CPMO formation is the choice of organizational structure of project/portfolio of projects management, CPMO can be integrated into any organizational structure of management, the range of which is represented from functional to projective, and alongside, different subtypes of matrix structures (the weak, balanced, and the strong ones) are placed.

It is supposed to realize the choice of the place (role) of the CPMO in the system of project management/portfolio of the projects management, following classical key characteristics of its participation in the project [3].

Next task of the CPMO formation is the choice of managers for construction project management presupposes consideration of the complications (specifics) of management works on the construction project. The specifics of the team's activity are as such as:

- an organizational structure exists during the time of the realization of the project;
- its content is non-stable structure and can be modified during the realization the stages of a project (a part of the personnel can be involved into definite stages of work, other definite work) (Fig. 3).

Resource (staff CPMO)	Of project management processes																			
	Group processes of initiation				Group processes of planning				Group processes of execution				Group monitoring and management processes				Group processes completed			
Project Manager																				
Manager of Capital Construction																				
Project Design Manager																				
Production Technical Manager																				
Risk Manager																				
Marketing Manager																				

Fig. 3. Diagram of construction project management team members' involvement by groups of project management processes

In the mathematical model for selecting the type of project management organizational structure a partial criterion can be represented by maximum managerial powers:

$$P: = \sum_{0=1}^{5} P_0 E_0 \rightarrow \max \qquad (1)$$

where ПМа are managerial project powers in a type of the organizational structure;

xa={0;1}, xa=1 – if a type of the project management organizational structure is selected, otherwise xa=0;

5 is the quantity of project management types: functional, matrix (weak, well-balanced, strong), project.

Similarly, other partial criteria are formed. The feasible region is determined by the assessed criteria limits. Thus, managerial project powers must not exceed the set point ПМset:

$$\sum_{0=1}^{5} P_0 E_0 \leq P_{set} \qquad (2)$$

The developed model (1) – (2) refers to the task of multi-criteria mathematical

programming. The task is solved by bringing to one or a set of single-criterion tasks. In case the decision-maker should take into account all particular criteria, it is necessary to use the following summarized quality function:

$$F(MP,PO,BM,BF,AP)=\alpha_1 \quad P+\alpha_2 \quad O+\alpha_3 B \quad +\alpha_4 BF+\alpha_5 \quad P \quad (3)$$

$$\sum_{i=1}^{5}\alpha_i = 1;\ 0 \le \alpha_i \le 1,$$

where F is an additive function of usefulness, which is considered on numerous characteristics of participation of PMO in the project; αi are weight factors, $i=\overline{1,5}$.

On the whole, the solution of the task (1) – (3) may be carried out in two basic scenarios:

1. When particular criteria (1) may be assessed and determined by limits (2), then the first step to the solution is the search for weight factors αi of the additive function of usefulness (3). Numeric values of weight factors are found by the expert method, e.g. method of analysis hierarchies (MAH). Further task solution is carried out by well-known methods of integer linear programming.

2. When there is full information about particular criteria (1) and exogenous limits parameters are unavailable (2), then the task can be fully solved by the expert method of MAH.

The shown model (1) – (3) for selecting the organizational project management/project portfolio structure enables to determine the role of CPMO in the construction project management system considering the project key features.

The methods of choice of the project management team should be based on the concept of PMBOK ® on expert

knowledge. According to PMBOK® the competence of project management team embraces knowledge and skills in five expert spheres: 1) the body of knowledge on project management; 2) knowledge, standards and normative acts referent to the definite sphere of application; 3) understanding of the project environment; 4) knowledge and skills in the sphere of general management; 5) skills in interpersonal relations [3].

Right personnel decisions can be found only when the demands to the positions will be strictly formulated and corresponded to each candidate to the position. That's why the process of the choice of specialists should be backgrounded on the principles of maximum corresponding to definite position in of construction projects management team. The development of the models of the choice of managers for the construction projects management should consider the demands to the definite position (level of competence) for the realization of the processes, procedures and operations of a definite project/or portfolio of projects. By now national scientific –research recommendations to the choice of construction projects managers, considering the demands of PMBOK® are not actually developed. The methods of the choice of CPMO managers are offered to realize by the way evaluation of the contestants according to the following characteristics:

- qualification demands;
- knowledge and skills in project management;
- knowledge of the processes, procedures and operations of a
- construction project;
- skills in interpersonal relations;
- value.

A part of these indices is objective, i.e. found in the result of absolute measurements (qualification and cost requirements). Other indices, found in the result of relative measurements (knowledge and skills of project management; knowledge of processes, procedures, construction project operations; skills of interpersonal communications), may be evaluated by the existing or specially developed tests, reference letters from the previous employer etc. As a result, qualification features (competence) show that the source information for the task of CPMO managers, selection has different levels of uncertainty. To overcome the uncertainty conditions it is suggested to apply the MAH [10]. The general hierarchy of the criteria for selecting construction project management team members was developed (Fig. 4).

In the mathematical model of selecting construction project management team members particular criteria are maximum requirements to the competence (4) and minimal cost indices (5):

$$OD_{menegCPMO}: = \sum_{i=1}^{i_p}\sum_{j=1}^{j_i}\sum_{r=1}^{r_{ij}} \sum_{m\in\ {}_{menegCPMO}^{r}} \sum_{k=1}^{k'} OD_k Z_{ijrmk} \to \max \quad (4)$$

where KBk – educational-qualifications competence of an applicant for the position of construction project management team manager, $k=\overline{1,k'}$;

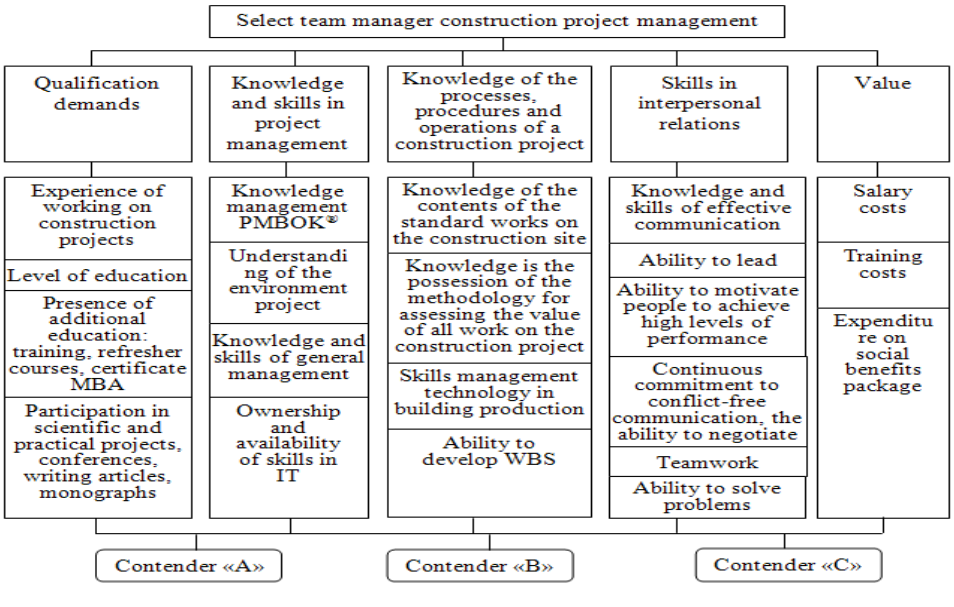

Fig. 4. General hierarchy of criteria for selecting construction project management team managers

Zijrmk={0;1}, Zijrmk=1 – if a k-applicant is chosen, who can perform m-business operation of r-business-procedure of j-business process of i-group, otherwise Zijrmk=0;

k' – number of applicants for position of manager;

$M^{r}_{menegCPMO}$ – a set of business operations of r-business procedure of j-business process i-group, performed by construction project management team manager (CPMT manager);

$$V_{menegCPMO} := \sum_{i=1}^{i_p}\sum_{j=1}^{j_i}\sum_{r=1}^{r_{ij}} \sum_{m\in \atop r_{menegCPMO}} \sum_{k=1}^{k'} V_k T_{ijrmk} Z_{ijrmk} \to \min \quad (5)$$

where Vk – cost index of k-applicant for the position of construction project management team manager;

Tijrmk – time spent by manager on performance of m-business operation of r-business process of j-business process of i-group.

Region of feasibility is determined by restriction on criteria that are being valued and are formed similarly to (2). There are formalized restrictions on an applicant's possession of knowledge and skills necessary for project management (KMijrmk=1) or their absence (KMijrmk=0):

$$\sum_{k=1}^{k'} KM_{ijrmk} Z_{ijrmk} = 1 ;\ i=\overline{1,i_p}; j=\overline{1,j_i}; r=\overline{1,r_{ij}}; m=\overline{1,m_{ijr}} . \quad (6)$$

Similarly to (6) restrictions on other criteria are formulated: knowledge of construction project business procedures and operations, experience of interpersonal relations, etc. In case a decision-maker needs to consider all particular criteria, it is necessary to use the following summarized quality functional:

$$F(OD,KM,KB,IB,V)=a_1OD+a_2KM+a_3KB+a_4IR- a_5V; \quad (7)$$

$$\sum_{i=1}^{5}\alpha_i = 1 \ ; \quad 0 \le \alpha_i \le 1 ,$$

where F is additive function of usefulness considered in many characteristics of applicants. The following technique of solving task (4) – (7) was developed:

1. Determining exogenous parameters of task (4) – (7).

2. Determining vacant position of project manager: iÎ{1,2,...,Ip}.

3. Solving the task of selecting among set Mk of applicants who are the most suitable for the position of CPMO manager, as a multi-criteria task without restrictions. Additional result of the first stage is ordering the set Mk by criterion (7).

4. Testing the best task solution obtained at the previous stage for compliance of feasibility region distinguished by restrictions (4) - (5).

5. If the obtained result satisfies restrictions (6), selection of applicant for the next position of construction project management team manager is further carried out. If it doesn't – the next specialist is being selected among the ordered set by criterion (7) Mk.

It should be admitted that team work in CPMO can considerably be straightened by using of the information technologies.

As modern standards of construction projects management presuppose CPMO formation as an element of infrastructure of a project management, it is essential to make a model of effective project mechanism which will unite al spheres of organizational – productive activity. Special attention is paid to the information space of a project, which is constantly becoming dominating and is regarded as information-analytical subsystem of the management macro system. Right now the condition of information processes and their security can make the threats to the business-processes management local.

Today construction-project companies use the equipment for storing and processing the information, copying and printing documents, and program devices for partial automatization of the business processes. Software in construction projects is applied in three directions:

1) development of design and estimate (any engineering) documentation (AutoCAD 2000, AutoCAD 200i, CoreDraw 9, CoreDraw 10, ArhiCAD, Photoshop, "Estimate technologies", ABK and other);

2) establishing databases (electronic worksheets Exel, MS Accessxp, MS Office and other);

3) for business management and decision support – automated control systems (MS Project, Sure Trak Project Manager, Primavera Project Planner, Open Plan, Spider Project, 1C: Project management tool, Building Manager, Startup System and other).

However, computer technologies in the construction industry are used locally and not in the full volume.

Realization of information-technological provision of the projects should be optimally organized, that which provides the demands to the formation of CPMO: information maintenance of a project is oriented to the optimization of time and expenses on its execution; exclusion of business processes doubling; effective communication of managers acting within one business process.

Software (SW) for project management is characterized with the possibilities of the detalization of the resources, with the demands to forming information and with accessible communications between participants. All SW users should have an access to the local net or to the Internet in order to have an opportunity to gather regularly operation data, to approve them after some time, to receive the content of work to realize, and to respond on them in the regime of local time. Additional modules of SW create necessary conditions for management of the work on the territorially remote objects [11].

It is suggested to choose SW for CPMO for the projects management which would be maximally adopted to construction industry. Functional demands of a user (a stage of orientation of the software on the construction projects management, import/export of the data from one systems to another, creation of the digital model of construction, etc.), the demands to the apparatus part, value terms have been defined as basic functional-technical characteristics.

Particular criteria in mathematical model of selecting software for construction project management may be: maximum focus of software product on construction project management (8), minimum requisite main memory size (9), minimum reduced cost.

$$FB_{SV} := \sum_{q=1}^{Q} FB_q X_{ijrmq} \to \max \quad (8)$$

$$RAM_{SV} := \sum_{q=1}^{q_{ijrm}} RAM_q X_{ijrmq} \to \min \quad (9)$$

where FBq – focus of q-software on construction project management;

RAMq – main memory size of q-software;

Xijrmq={0;1}, Xijrmq=1 – if q-software is selected, otherwise Xijrmq=0;

$q=\overline{1,q_{ijrm}}$, q_{ijrm} – number of software devices that may

automate m-business operation of r-business procedure of j-business process of i-group.

Region of feasibility is determined by restrictions on criteria, which were measured and are formulated similarly to (2). Restrictions on presence or absence of function of data import/export from one system to another, possibility to create construction digital model and other characteristics are also formalized similarly to (6). In case a decision maker has to consider all criteria, the following summarized quality functional is applied:

$$F(FB,RAM,HD,V)=\alpha_1 FB-\alpha_2 RAM-\alpha_3 HD-\alpha_4 V \quad (10)$$

$$\sum_{i=1}^{4}\alpha_i=1;0\le\alpha_i\le 1,$$

where F is additive function of usefulness considered in many software characteristics. Solution of task (8) – (10) is considered similarly to (1) – (3).

The task of technical provision of CPMO can be regarded through the choice of office equipment. Besides, CPMO should be equipped with specific technical devices (TD): web-camera, multi-media installation, interactive white board. It can be explained by the special role of CPMO – which is different from traditional office- to coordinate all works on construction project in the regime of real time. That is why the necessary constituent of the modern CPMO is a virtual office – dispositive computer system based on telecommunication network, which will allow to use unified program devices, unified data bases and knowledge, to realize the unified control account, monitoring of the project works, to conduct videoconferences, telecommunication meetings in the regime of real time.

Realization of any constructing project demands a strict control system of the execution of construction and assembly works. Thus, the monitoring of works on the object foresees the realization of technical, authorial and production supervision. The specifics of the system of construction project management is connected with involving considerable number of labour resources, that are a construction site supervisor, a technical supervision engineer, and Engineer General of the project (Designer General of the project). During all operation meetings on the construction site the heads of the construction organizations (of the upper and middle level), experts on project and fulfillment of specialized kinds of work in a project, the representatives of state control (fire-guard service, energy efficiency, sanitary inspection, labour protection, architecture-construction control, etc.) also will participate.

For making constructive decisions the participants of such meetings will need full production-organizational information about the volume of construction. But besides, the traditional problem is still the difficulty in acquiring f

ull and exact information, because it is connected with 'human factor' – absence of responsibility of the principals, corruption, etc. Because all key principals can not be present at the construction site all 24 hours a day, considering the character of their work, the problem of improvement not only the system of control over construction-assembly works, but the management of the whole project is still essential.

One of the innovative instruments in the organization of construction-production process management is web-watches which is digital web-camera installment and the organization of video transmission into the Internet. Camera can be installed as well as both inside and outside (in a special geometrical heated boot).

In modern literature the technical-organization possibilities of web-camera, connected with improvement of the system of control, are studied. But the development of the conception of system usage of web-cameras in the project management - its introduction into all business processes (according to the living cycle and spheres of knowledge on project management) is still an essential need.

In practice all leading construction companies have already installed the systems of watch on the construction sites and watch over the object for 24 hours a day in on-line regime, for example, on the objects, which are included into the program of preparation to Euro-2012 (the stadiums in Donetsk, Kharkov, Lvov, Kiev and other objects). But nevertheless web-camera in modern construction project is still a novice and is not widely used.

Possible options of using web-camera in the process of construction project management are suggested (Table 1).

Table 1

Part of web-camera in construction project management and its performance capability

Groups of project management processes	Application of web-camera in construction project management processes
Initiation	*Project Charter development.* Investors and co-investors obtain visualized information on availability of future object land parcel parameters (reconstruction object): place of location, neighboring objects, overall views, bordering land parcels, etc.
Planning	*Project management plan development.* In the process of collecting initial data for design and estimate documentation it is necessary that representatives of state, municipal and engineering services visit the site for general visual inspection. If there is a notebook connected to the Internet, the procedure may be carried out in the form of on-line viewing.

Continuation of table 1

Implementation	*Direction and management of project implementation.* Holding video-conferences, video-meetings for prompt data exchange, prompt approval and decision of current managerial and engineering questions. *Quality assurance process.* Web-monitoring systems allow supervising construction of immovable property items. One or more web-cameras can be installed, for instance, on a tower crane, and construction company executives as well as clients can control construction process from their office. 24-hour live video-broadcasting of work performed on construction sites allows managers to efficiently control contractors' and subcontractors' execution of their obligations under contracts. Access to ip-address of each camera can be restricted to provide data security.
Monitoring and management	*Monitoring and management of project work.* Organizing video-monitoring of construction site. *General change management.* It is possible not only to see and hear, what is happening on construction site, but also to warn of danger (for instance, alarm signal from built-in movement detector). *Project team management.* Management of remote subdivisions by holding video-meetings. *Implementation reporting.* Making photo-report on construction process.
Close-out	*Project close-out.* Presentation of completing work on an object, and commissioning to state commission. Video-archive of construction stages.

Following the stated above, it can be asserted that web-camera realizes not only technical support in the realization of the processes of management of construction project, but changes the meaning of the very management process – leads to the level of systematical, projective approach. That is why it is necessary to use web-camera more actively, as an element of technical provision of construction project management. But web-camera can not replace a human specialist. So called «exact» works will be left in the sphere of personal (supervisible) monitoring: supervision over production and erection of basic construction (metal framework, the process of concreting, etc,), check of the marks in the load-bearing framework, quality of finishing, sanitarian, specialized works, etc.

Hardware selection must be based on distinguishing functional specifications for each hardware type and its suitability (automation of relevant management processes) at each stage of project life cycle.

Particular criteria in mathematical model of selecting hardware are maximum/minimum functional specifications (11), (12) and minimum cost. $v = \theta_{max+1},...,\theta;$

$$FS = \{FS_1, FS_2, ...FS_q\} \qquad (11)$$

where $FS_v \to \max$; $v = 1,2...\theta_{max}$;

$FS_v \to \min$; $v = \theta_{max+1},...,\theta;$

FSv – functional specifications of v-configuration of peripheral equipment and communication devices;

$$FS := \sum_{i=1}^{5}\sum_{j=1}^{j_i}\sum_{r=1}^{r_{ij}}\sum_{m\in M_r}\sum_{h=1}^{h'} FS_h \overline{Y_{ijrmh}} \to \max \qquad (12)$$

where FSh – maximum (FSh) / minimum (–FSh) functional specifications of h-configuration of multimedia system;

$\overline{Y}_h = \{0;1\}$, where $\overline{Y}_h = 1$, if

h-configuration of multimedia system hardware is selected, otherwise $\overline{Y}_h = 0$.

Region of feasibility is determined by restrictions on criteria being measured, availability or lack of necessary functions:

$$\sum_{h=1}^{h'} F_h \overline{Y}_h = 1 \quad \exists h = \overline{1,h'} \qquad (13)$$

where Fh – necessary additional functions of h-configuration of multimedia system hardware.

Summarized quality functional is as follows:

$$F(FS,V) = \sum_{g=1}^{G} \alpha_{1g} FS_h + \alpha_2 V; \qquad (14)$$

$$\sum_{g=1}^{G} a_{1g} + a_2 = 1 \quad \alpha_{1g}, \alpha_2 \in (0,1)$$

where F is additive function of usefulness considered in many characteristics of multimedia system hardware; G is a number of functional specifications of multimedia system hardware.

Developed mathematical models of hardware selection for CPMO refer to tasks of multi-criteria mathematical programming. Task (11) – (14) is solved similarly to (1) – (3).

Modern IT-technologies let automate decision-making process on CPMO organization on the basis of software systems realized in the form of software modules: selecting project management organization structure, selecting managers of construction project/project portfolio management team, selecting software for construction project management, hardware to automate managerial processes implemented by CPMO managers. Computer technology structure for CPMO organization is developed

taking into account enterprise management system and is shown on Fig. 5.

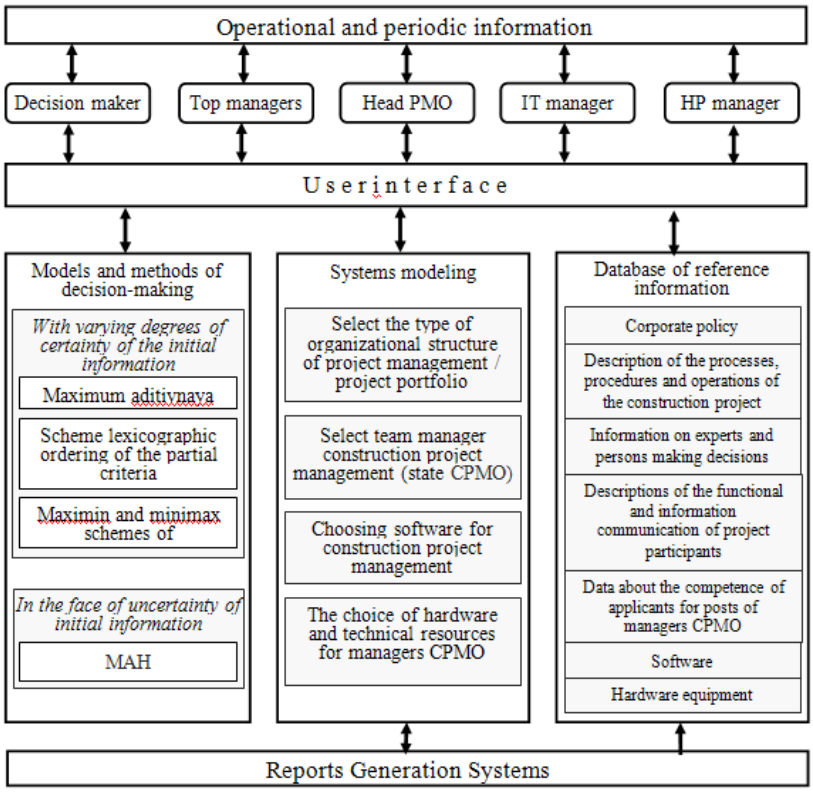

Fig. 5. Structural diagram of decision support on CPMO organization

Thus, understanding of the problem of CPMO organization led the Program coordinators to the formation of the project-oriented environment for the management of all construction projects. The creation of the project office presupposes straightening of the organization-settled relations and ties between the elements and levels of construction projects management.

There was developed a construction project management system structural model of the Program through multi-level description of management system structural model (management subjects, objects, processes). The task of establishing CPMO is presented by structural-logical model of managerial and engineering tasks.

It is suggested to take scientifically-grounded and efficient decisions on selecting the purpose of CPMO in construction project management system on the basis of key project characteristics: project manager powers; powers of resource management office; project budget control by office (project manager); project budget control by functional executive; engagement of active participants in project management.

The group of main participants in construction project management team was formed: project manager, capital construction manager, design and engineering manager, production process manager, risk manager, and marketing manager. Suggested selection principles take into account both, process particularity, and requisite qualifications characteristics of applicants for corresponding positions (qualifications requirements, knowledge, and skills of project management, knowledge of construction project processes, procedures and operations, experience of interpersonal relations, cost indices). This technique is based on multi-criteria evaluation and allows forming a construction project management team on scientific grounds, so that such team was able to increase both, the level of team work and quality of the construction project itself.

There was developed a model of selecting CPMO software system taking into account user's functional requirements, hardware requirements; cost indices. Such models are based on multi-criteria evaluation and allow establishing technical support for construction project management on scientific grounds. Applying information technologies in CPMO will allow manage construction projects in real-time mode and create a virtual office.

Functional and technical abilities of web-camera are considered not only as a spyglass, which several times magnifies an image, but also as a device able to change construction project management in the direction of system project management. Web-camera becomes an important source of on-line information and a ground for taking balanced realistic managerial decisions in construction sphere. On the whole, web-camera allows using the newest project management techniques: holding video-meetings and video-conferences, conducting video-monitoring, managing geographically-distributed subdivisions, making video-reports and video-archives, etc.

Developed mathematical models (on selecting project management organizations structure, construction project management team managers, software and hardware system) are basic. They may be added, extended according to characteristics of a separate project (organization system specifications, project scope and description, improving existing and appearing new technical feasibility for managerial process support). Such models allow taking decisions on various criteria depending on degree of uncertainty, and also with account of construction brunch specificity.

Suggested methods of CPMO formation in the framework of the realization of the Program will allow modeling the variants of the most appropriate management structures, capable to reduce risks in the realization of a project, and to increase flexibility (to react quickly to the current changes), and thus, to influence positively to the qualitative characteristics of the project.

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УДК 51-74

ОСОБЛИВОСТІ РОЗГОРТАННЯ ФУНКЦІЇ ЯКОСТІ НА БАГАТОАСОРТИМЕНТНИХ ВИРОБНИЦТВАХ БУДІВЕЛЬНОЇ ГАЛУЗІ

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В роботі розглянуто особливості розгортання функції якості для пошуку оптимального складу будівельних сумішей та побудови стратегії керування якістю продукції. Запропоновано застосувати QFD-методологію для прийняття рішень у будівельній галузі

Ключові слова: QFD-методологія, клей, будинок якості

В работе рассмотрены особенности разворачивания функции качества для поиска оптимального состава строительных смесей и построения стратегии управления качеством продукции. Предложено использовать QFD-методологию для принятия решений в строительной отрасли

Ключевые слова: QFD-методология, клей, дом качества

There are quality function development (QFD) for the optimal composition of the construction material and the strategy of the quality control formation considered at the article. The QFD-methodology for making decision in a build industry have been proposed to use

Key words: QFD-methodology, glue, home's quality

1. Вступ

Декоративні матеріали, лакофарбова продукція для фасадів та інтер'єрів, клеї, різноманітні засоби для деревини, паркету, металу, засоби біозахисту, тощо є типовою продукцією багатоасортиментних виробництв у будівельній галузі. Відомо, що конкуренція на ринку багатокомпонентних гетерогенних матеріалів є жорсткою [5]. Впровадження концепції загального керування якістю та вдосконалення систем керування якістю забезпечують стійкий розвиток підприємства. В умовах сучасного ринку на виробництвах багатокомпонентних гетерогенних матеріалів актуальність