Influence of the economy crisis on project cost management

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Abstract. Economy crisis significantly affects primarily the project cost management. The article considers the problems of project management in the field of housing under conditions of economy crisis. Project budgets are reduced, their mutual interference grows and framework of risks changes. Apparently, specific approaches are required to be developed to optimize the expenses and guarantee the project implementation within the approved budget. There is considered domestic and foreign experience in terms of project cost management with involvement of BIM technologies.

1. Introduction

Immediacy of the problem of qualitative and affordable housing for people is not in doubt. However, Russian development companies faced significant obstacles not only in the aspect of growth but in the current situation under conditions of global financial crisis, drop of prices for a number of russian export production. Question of import substitution, transport accessibility, sufficient number of facilities of social and commercial infrastructure as well as competent staff resources continue to be relevant. Moreover, there is no collaboration mechanism neither between construction companies and authorities, nor design companies and contractors. In the context of economic crisis and rivalry growth in construction field all the drawbacks in construction process from design documentation to implantation stage of the project show up. In order to tackle the arising problems an integrated approach is required in the organization of interaction between all participants in the construction industry, as well as a set of measures to optimize the project and a competent approach in the implementation of construction production, i.e. it is necessary to develop special approaches to the management of construction projects. Management of projects as a must for success of a today project was discussed by Russian [3-9] and foreign authors [1,2].

A number of authors point out in their studies, that crisis causes framework of risks to be changed [4, 5]. Risks of payment failure, budget freeze and high volatility of prices step forward [2]. Under certain conditions special approaches should be developed, which would minimize the risks of...
implementation of construction projects. There are suggested various ways to solve this objection according to the current situation in construction.

I.V. Azarova [3] suggests to shift the emphasis from pursuit of the maximal profit from housing construction to satisfaction increase of the interested parties with the results of the project. Mechanism for assessment, balancing and management of project social cost is suggested.

G.I. Abdulaev [4] draws attention to the fact, that implementation reliability of the entire construction plan is essentially defined with meeting the deadlines of particular objects and the whole project in general, the volumes of investments under construction quarters, the volumes of necessary production and technological capacity under construction quarters, construction of facilities in accordance with established priorities. All of the points depend on the efficiency of the project management, which goal is to come up with organizational and technological solutions that allow minimizing the deviations from the designed parameters.

Under conditions of economic crisis developers are forced to pay significant attention to project cost management because of high insolvency of customers and volatility of prices for primary construction resources in order to improve the project efficiency. Analyzing the ways for cost reduction of construction. V.A. Malinina [5] reaches conclusion, that contract tendering creates competitive environment for contractors, that allows customer to choose the most favorable offer for the price and other parameters.

Construction expenses are diversified, therefore, regulations should be elaborated in order to define them. A framework of document support of project cost management processes aimed at efficiency improvement is suggested in the article of O.I. Saltykova and M.P. Bovsunovskaya [6].

Amid the global crisis it is important to correctly assess the investment attractiveness of the project at its initial stage [7]. Financial and economic analysis is an important stage in decision-making and feasibility of investment and determining the attractiveness of the project [8]. In this connection, the methods of economic analysis of the future investment and construction project are of interest. In the study of O.V. Chulgaeva and V.S. Chulgaeva [9] the method based on the simulation model is presented. Dependences of the profitability of the construction project on the transfer of the constructed areas for the acquisition of the project for the central regions and for the commuter districts are found. There are given recommendations for competent schedule.

However, all these recommendations consider only one aspect of project management. In addition, a number of scientists point out the necessity to adjust the general way of classical modeling of objects and to deploy information technologies [12, 13], allowing to model the process at the stage of feasibility study, save and add information on the object as well as provide access for the interested parties to the required data. It is noted that the problem of using information technologies in management of construction projects in Russia is developed insufficiently, in comparison with foreign countries.

One of the promising areas of development in this field is the use of BIM technologies.

The goal of this study is to analyze ways to improve the efficiency of project cost management in times of crisis.

To achieve this goal, it was necessary to solve the following objectives:

1. To analyze the main components that affect the cost of the project.
2. To analyze the main risks of construction and investment projects in a crisis.
3. To identify the benefits of using BIM technologies in project cost management.

2. Influence of the economy crisis on project cost management

Considering in detail the problems of this branch of the economy, it is necessary to note such factors as:

1. Property-land relations.
2. Almost completely absent legislative acts regulating professional architectural (construction) activity.
3. The personnel question is one of the most important at the moment, from the requirements for education and accreditation to compliance with the requirements and principles of the Code of Professional Ethics. The decline of professional construction practice can only be prevented by
establishing clear, civilized, understandable in the world rules of conduct for the Russian professional services market, which is the main objective of these standards.

The problem with construction workers is also widely known: the use of low-paid hired labor of migrants without registration, which entails poor-quality construction and/or fines and arrests for violation of legislation [8].

The general problem of the personnel policy remains the appointment of an employee on grounds that are not related to the worker's qualifications, for example, by related signs or by acquaintance.

4. Non-compliance or incomplete compliance with regulations governing construction production. This problem has two aspects: the first is the contradiction between the legislative acts among themselves, the second is the difficulty of observing construction standards in a market economy and increased competitiveness in the construction market.

5. Corruption at governmental level, which is expressed in the following:

1) the cheapest project is chosen, which is used by organizations that later "resell" the won tenders [7];

2) companies sometimes provide incomplete project design, without justification of prices, and without due attention to the specifics of the construction. The results of such a tender are the monetary enrichment of company owners, and the construction itself is delayed.

The change in the provision of housing for the population directly depends on the volume of construction of new housing, physical deterioration of the existing houses and population.

According to sociological research, 60% of Russian families are facing the housing problem, they are not satisfied with current housing conditions to some extent. Moreover, 32% of families are experiencing an acute housing problem that requires solution in the next 3 years. At the same time, every fourth family has a housing that is in poor or in very poor condition. To date the volume of dilapidated and emergency housing in Russia is 99.5 million square meters, which also requires additional volumes of housing to solve this problem.

The total need of the population of Russia in housing is about 1570 million square meters, in order to meet this need, the housing stock has to be increased by 46 percent.

Despite the creation of the foundations for the housing market functioning, the acquisition, construction and renting of housing using market mechanisms in fact are only available to a limited number of families with high incomes. Therefore, Russia is still far behind developed countries in terms of housing provision (the number of square meters of housing per capita). According to the Ministry of Economic Development, housing construction per resident in Russia reached 0.45 square meters. In developed countries, this figure reaches 1 or more square meters per person. At the same time, there are 75 square meters per person in the USA, 74 square meters in Norway, 52 square meters in Sweden, 45 square meters in Germany, 22.8 square meters in Russia. In recent years, Russia has been ranked among the ten most backward countries in the world by the average level of housing provision, along with Angola and Costa Rica.

For the consistent development of the housing market, it is necessary to put in operation at least 1 square meter of living space per person every year, which means that it is required to build 142 million square meters per year. This figure is practically infeasible in the near future (until 2020). The rate of housing construction needs to be tripled, which has not been increasing for the third year. Judging by the pace of construction and adjusted plans, by 2020, it is planned to introduce 90 million sq.m of housing, which, unfortunately, will not allow more free distribution of the area to different layers of the population and, especially, to the poor.

Therefore, the government's plans to construct for the period from 2008 to 2025, at least two billion square meters of housing already now seem problematic.

Despite the fact that a major role in the plans of the Russian government is given to mortgage lending for construction, this type of subsidization is still not available to many Russian citizens due to high mortgage rates.

According to the calculations of economists, if the cost of a mortgage is even 8.5% per annum (and this is the minimum possible rate in the Russian Federation), following the results of 10 years of the
Project cost management includes the following stages:

1. Depending on the natural indicators of the design objects (NGOs) for reference books of basic prices.
2. By calculating the labor costs of the workers performing the design work.
3. Through the indexation.

The cost of construction work types (services) is determined according to the appropriate standards. The order of cost calculation is one-type and provides for the possibility of using three methods:

1. Depending on the natural indicators of the design objects (NGOs) for reference books of basic prices with subsequent indexing.
2. As a percentage of the estimated construction cost in current prices for reference price books.
3. By calculating the labor costs of the workers performing the design work.

Project cost management includes the following stages:

mortgage, the price of the apartment so purchased is equal to the cost of approximately 2.3 apartments, while in Switzerland, this figure is 2.5% per annum, that is, for 10 years only 1.3 apartments are paid.

Approximately 35 million Russians (and this is about 20% of the total population) are not so poor as to get into the queue, and are not so rich that they can pay up to 40,000 rubles a month for a mortgage. All this does not contribute to the development of mortgage construction. Even before the economic crisis in Russia, only about 8% of citizens received free housing under a contract of social hiring, and the rest acquired for the estate. Meanwhile, international practice shows a different picture of development, for example, in Europe, the volume of social housing is between 20 and 50%.

During the work, Russian construction companies face three main problems: deadline breaking, conflicts with designers and “nontransparent” costing.

The first problem is deadline breaking. 80% of companies are willing to take on a project with schedule date only in order to have a contract. Schedules of public construction projects are often unrealistic because of the terms of public funds application. However, constructors have no choice in such situations [6].

The situation with commercial contracts is a little bit easier due to the opportunity to contact with an owner of a contract and amend a project.

Another problem is lack of interrelations between a designer and a constructor. Designers do not provide contractors with all demanded information.

Contractors are not able to analyze a project completely, usually fail to study it in time and have to hope that all presumable problems causing extra cost appearance will be tackled as they come up [8]. As the result, a project can possibly be changed a lot, many construction works have to be replaced by other and expenditure should be reconsidered completely.

The conflict of interests is inevitable, because a designer considers himself deceived, while a constructor starts the works on a site where discovers “nasty surprises”. Moreover, the Russian specifics implies that the project should get approval and pass the government expert review at all costs. It concerns primarily state projects with public funding. It often goes by the following scenario: the project is intentionally prepared for approval, and then amendments and replacements of works are made, while the cost of the project should remain the same. Therefore, a constructor gets concerned again.

The third problem directly relates to the second. A constructor is usually “close” and provides a contract owner with shady under-the-counter cost sheets instead of open and fair ones. Therefore, there is no open cooperation with a customer.

The following decisions can become the solution of these problems:

1. Fair schedule. Firstly, schedule of work should be compiled taking into account the constructor’s opinion. Secondly, the timetable of customer’s activities and duties, which have to be performed during the construction works, should be analyzed. According to the data from the analysis, the time limits should be announced and considered in terms of being realistic or requiring a correction.
2. Thorough analysis. Before taking any project, contactor companies should pass the project documentation, engineering solutions and all other information about an object to designers in order to consider together all pitfalls and decide what corrections will be demanded. Customer should know that all corrections would be implemented after the constructor starts the work. Owing to high-qualified designers, the construction works can be started before all the documentation is approved. While contractor companies work on a site, designers pass the offers to a contract owner. Everything is carried out simultaneously with construction works, so all the deadlines will be met [3].
3. Project cost estimating.

The cost of construction work types (services) is determined according to the appropriate standards. The order of cost calculation is one-type and provides for the possibility of using three methods:

1. Depending on the natural indicators of the design objects (NGOs) for reference books of basic prices with subsequent indexing.
2. As a percentage of the estimated construction cost in current prices for reference price books.
3. By calculating the labor costs of the workers performing the design work.
- preliminary estimation of project cost;
- calculation of the real budget and search of sources of financing;
- phased financing
- control of costs, comparison of actual and planned costs with the aim of developing corrective measures ensuring the implementation of the project within the approved budget.

Drawing up of the summary cost sheet for the project takes place at the stage of development of the working documentation. Calculation of cost sheets in most cases is automated. The most acceptable way of obtaining data (in particular data on the volume of the building material of a building/structure) is also occurred with the use of programs for designing an information model of a building.

4. Proper project management and administration. Increasing rivalry in the construction industry and crisis conditions for economy development lead to the fact that not every developed project proves to be viable [7]. Budgets and time limits of construction projects are increasingly shrinking in order to increase investment attractiveness, therefore it becomes very difficult to meet them. In this regard, project management becomes an integral part of the work of domestic and foreign companies.

Project management is intended to ensure the interaction of the customer, contractors, investors and other stakeholders in the process, their smooth operation. This is a complex set of activities aimed at optimizing the use of temporary, material and monetary resources at all stages of the life cycle of the facility from initiation to commissioning, minimizing project risks, exceeding planned times and costs. It should be noted that within the project management, much attention is paid to the interdependence of time limits, budget and project quality [8]. Changing each of these factors leads to a change in the others.

It is obvious that the effectiveness of all these activities depends a lot on the completeness, reliability and timeliness of the information. Unfortunately, traditional methods of project cost management cannot always provide the required mobility in decision-making and wide availability of necessary information for all stakeholders of the project.

Project management in construction has a number of specific features. First of all, this is due to stringent requirements for the timing of completing of facilities, a significant dependence on the timing of work performance on timeliness and quality of supply, on the coherence of the work of contractors [4]. It necessitates constant monitoring of the project implementation process. The efficiency of making informed decisions is especially important in it [3].

BIM technologies have become one of the ways to improve the efficiency of the project management process.

5. Implementation of BIM technologies in construction (Building Information Modeling or Building Information Model).

Information modeling of the building is an approach to the erection, equipping, maintenance and repair of the building (to the management of life cycle of the structure), which involves the collection and integrated processing in the design process of all architectural, engineering, technological, economic and other information about the building with all its interrelations and dependencies, when the building and everything that has to do with it, are treated as a single object [12,13].

The basis of BIM technology implies the ways of cooperative work with information about the construction site. Processes regulate the work with the BIM model, which consists of intelligent objects and parametric interconnections. For each stage of work on the project, the degree of specification of the BIM-model is prescribed. This allows making management decisions, having all the necessary information without overloading the model.

BIM-technologies cover all stages of the life cycle of a structure: planning, drafting of technical specifications, design and analysis, issuing of working documentation, production, construction, operation, repair and dismantling.

The effectiveness of this modeling system has been recognized all over the world. The UK is the leader in BIM implementation, where reducing the cost of construction by 33% with the help of BIM-technologies is a task stated by the government. This problem is being successfully solved and the indicators are steadily growing.
The first step to introduce BIM technologies in Russia was taken only on December 29, 2014, by the order № 926 of the Ministry of Construction of Russia. Then, on June 11, 2016, a list of instructions was approved to ensure the creation of a legal framework for the use of information modeling of buildings in construction, primarily in the state contracts.

During this short period, the advantages of using this technology were determined (Table 1).

**Table 1 Advantages of BIM technologies**

| Parameters                          | Improvement, % |
|-------------------------------------|----------------|
| **short-term**                      |                |
| Error reduction                     | 52             |
| Expansion into new markets          | 51             |
| Additional work reduction           | 48             |
| New services for customers          | 46             |
| Reduction of construction terms     | 39             |
| **long-term**                       |                |
| Customer retention                  | 49             |
| Reduction of implantation terms     | 37             |
| Increase in profits                 | 36             |
| Cost reduction                      | 32             |
| Reduction of disputes               | 28             |

In addition, with the help of this technology, it is possible to view construction costs at the design stage, and understand whether the building fits into this housing site, make corrections to improve the project and increase its economic attractiveness.

3. Conclusions

If sum up everything above, cost management of projects directly depends on the range of certain measures. The approach to construction operations should be changed at all stages from designing and drawing up project documentation to monitoring and field supervision within the project implementation process. The BIM-technologies should be introduced in the wide-scale practice because of numerous advantages of this solution over alternatives [12, 13].

Ratio of consummation of resources and time to the cost of designing, which outmatches other solutions with the use of BIM technologies, should become the main criterion of selection. After creating a basis of the leading specialists, BIM technologies can be considered to be introduced in all construction activities, which will positively affect the result of work due to competency of all specialists related to all stages of designing. Ubiquitous implementation of BIM technologies in construction will provide common work regulations according to uniform standards in common information space, the increase in communicative capacity and quality of documentation, the rise of expert review quality due to veracity, productivity and informational capacity. All these improvements will result in significant reduce of construction costs.

However, it is worth mentioning that besides obvious advantages there are several weaknesses about using BIM technologies, which first refer to the high cost of the software and necessity of personnel training. The recovery of these expenses depends on the amount of contracts and company activity effectiveness [14, 15].

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