Application of knowledge management on project management in construction

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Abstract. The modern Russian labor market dictates new requirements for the qualifications of project management managers in the investment and construction sector. The leading job and staff search site, HeadHunter, requires to have a Project Management Institute certificate in every third qualification condition. Foreign standards are actively supplanting “domestic rules of the game”. The relevance of this study is contained in the answer to the question: is the body of knowledge on project management applicable to the modern construction industry or is it just “a fashion trend” of senior management who wants to have the “Project Management Professional” certificate that is in demand abroad? This paper contains an analysis of significant and “linear” investment and construction projects for the Russian Federation on the structural assessment of key indicators: time, content, and money. This triad of constraints is reflected in the project management body of knowledge as being most susceptible to change during the project life cycle. The main idea of the analysis is to look at and evaluate the deviation of the values contained in the design and estimation documentation at the “input”, i.e. at the pre-investment stage, and at the “output”, i.e. at the stage of putting the object into operation.

1 Introduction

The predominant part of economic activity is concentrated in private hands and is not a subject to direct government control. The main substantive characteristic is specified in certain rights inherent in the owner object: use, possession, disposal, alienation. And as a consequence, there is an emergence of duties, among which the dominant role is the responsibility of managing. Getting the maximum effect from property cannot be achieved without managing it. These prerequisites gave impetus to the emergence of practical management - the owner, by managing his property, has achieved economically beneficial results for him. However, the existing dialectical contradiction, namely that the owner, in fact, was a manager and was not at the same time, persisted until XIX. He was - because he was engaged in management activities and he used methods and tools based on his practical experience. He was not - because for any professional activity the theoretical basis of a profession is needed, which he had not.

Therefore, in its essence, project management is not a new area of knowledge. Throughout the evolution of public consciousness, we are faced with examples of projects

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implementation - the organization and conduction of the Olympic Games, and the construction of the Taj Mahal, the Great Wall of China, as well as the creation of various vaccines against “death diseases” and even the embodiment of the international space station into a really functioning organism. The practical implementation of these projects is nothing more than the embodiment of certain management methods and principles to meet the needs of people or customers - owners. By the middle of the 20th century, management took an active position in systematizing the methods and principles of project management, taking knowledge to a new level of development in recognition of this activity by the professional community. For this, as noted earlier, a theoretical basis is needed. The Project Management Institute (PMI) creates a project management body of knowledge (PMBOK) [1], which contains basic schemes, principles, methods, practices and a glossary. The “theoretical standard” of project management, and which provides the basis for professional activities under the project management.

Projects are the driving force behind changes in the socio-economic life of society. A lot of researches have been carried out in the field of project management, and characteristics are given to the conceptual apparatus. In the classical sense, a project means a series of actions aimed at achieving a specific goal and having a beginning, middle and end. Or is it when you have to deal with an initiative of such complexity in your work that in order to cope with it, special charts are drawn up of what needs to be done. The practice of PMBOK characterizes the project as a temporary enterprise aimed at creating a unique product. According to the body of knowledge, a project is always unique, limited in time, and always involves the creation of a temporary organizational structure. From here follows the main difference between a project and operational activities - if a project team is not created, you are dealing with an ordinary operational activity.

The body of knowledge is a kind of basis on which any organization, of any field of activity, is able to write the methodology necessary for it. Approaching from this point of view, there is nothing wrong with practicing PMBOK - choosing a set of practices, following them and putting the project in the “zone of success”. However, who determines the success of a project? What success indicators does the body of knowledge practice? PMBOK defines the limitations of the project: “money”, “time”, “content”, and “money” and “time” are sufficient components to solve problems of any complexity, and “time”, “money” and “content” are optimal set for the implementation of the project. Therefore, the main objective of the study is the analysis of capital construction projects from the perspective of a body of knowledge on project management. Looking ahead a bit, I will give an example of a large-scale construction of the century - a project called the Crimean Bridge. The facility connecting the Crimean and Taman Peninsulas is a highway consisting of four lanes, nineteen kilometers long, financed by federal funds. The participation of state funds involves a mandatory expertise of project and estimation documentation.

The FAI “Glavgosexpertiza” issued a positive conclusion of the state expertise and confirmed the reliability of the estimated project cost of 211.852 mln. rubles (4th quarter of 2015) [3]. In fact, the “Crimean bridge” cost 227.92 billion rubles, which is 16 billion rubles more than the expert conclusion. Changes were also included in the substantive, constructive part - there was a reduction in the cost of materials with replacement for analogues. However, the construction was completed ahead of schedule by a total of 7 months. So, is the project successful? From a social point of view - perhaps it gives impetus to the development of the Crimea peninsula, tourist flow, commercialization and infrastructure. From an economic point of view, to determine the success of a project, they often use an analogue object, and many mass media found such an analogue in the People's Republic of China. The longest ferry in the world, the Danyang-Kunshan Viaduct, connected the cities of Shanghai and Nanjing. Length - 164.8 km., of which 9 km. were laid over the water. The project cost amounted to 1.46 billion dollars, that is, an average of 8.8

thousand dollars per 1 meter of bridge. Simple translation of the Russian project cost into American dollars will give a figure of 4 billion dollars, which will amount to 209 thousand dollars per 1 meter of the bridge. Instability of factors in the construction industry, the effects of weather conditions, the simultaneous combination of people, machines and mechanisms - is it possible to use the best practices that are responsible for the success of a project in the Russian Federation that meets PMBOK ethics: responsibility, respect, fairness and honesty?

2 Materials and Methods

The hypothesis of this study is that most investment and construction projects have inevitable deviations from the PMBOK “triad”: either the project exceeds the budget, or is late in implementation, or the planned content of the project is cut. In Russian practice, the outside world is guilty of these deviations - external factors. Internal factors, however, are management errors such as “choosing the cheapest supplier”, deliberately underestimated sales terms (high competition) or self-fulfilling predictions in time, underestimated work costs in the case of private investors (price competition) and objective overstatement of work in the case of the state budget (high transaction costs).

The materials of this study are information from open sources on the Internet about implemented projects in the investment and construction sector in the Russian Federation. All projects were considered from three perspectives: the initial maximum contract price (budget), implementation deadlines, and content. The following material was collected and analyzed:

Project Name: “Crimean Bridge”

- Project budget (plan / fact): 211.852 billion rubles. / 227.92 billion rubles (deviation - 16 billion rubles);

- Duration of the project (plan / fact): 44 months / 37 months (deviation: +7 months);

- Project content: transport bridge (road and rail (still underway) through the Kerch Strait);

- Note: the funds of the federal budget of the Russian Federation were used.

Project Name: Opening Arena (Spartak Moscow)

- Project budget (plan / fact): 12 billion rubles. / 14.5 billion rubles (deviation - 2.5 billion rubles);

- Duration of the project (plan / fact): 36 months / 75 months (deviation - 39 months);

- Project content: Opening Arena is a sports complex consisting of a football field with stands with a capacity of 45,360 people (initially it was supposed to be 35,000 people).

- Note: project financing through private investment.

Project Name: Moscow Central Ring (MCC)

- Project budget (plan / fact): 197 billion rubles. / 237 billion rubles (deviation - 40 billion rubles);

- Duration of the project (plan / fact): 36 months / 34 months (deviation +2 months);

- Project content: railway route line along the main turn of the Moscow small ring. Partially integrated with the Moscow metro;

- Note: funds of Russian Railways OJSC, the Government of Moscow, MKZhd OJSC, and a group of investing companies were used.

Project Name: Pokrova Presvyatoy Bogoroditsy Church, Stavropol Region, Georgievsky District, st. Urukhs kaya

- Project budget (plan / fact): 950.169 thousand rubles. / 960.927 thousand rubles (deviation -107.58 thousand rubles);

- Duration of the project (plan / fact): 28 months / 30.5 months (deviation of 2.5 months);
- Project content: Orthodox church;
- Note: the sources of financing were donations from pilgrims.
Project Name: “Zaryadye” Park”
- Project budget (plan / fact): 5.08 billion rubles / 27 billion rubles. (deviation - 21.92 billion rubles);
- Duration of the project (plan / fact): 30 months / 30 months;
- Project content: innovative public on the site of the demolished "Rossiya" hotel. Four natural zones are organized, and architectural structures for various purposes. In fact, there was a deviation in the content of the project: the appearance of a “floating bridge”, organized parking for 500 cars, laying of new communications, the demolition of the stylobate part of the "Rossiya" Hotel;
- Note: the funds of the federal budget of the Russian Federation were used.
Project Name: “Gazprom Arena”
- Project budget (plan / fact): 6.7 billion rubles / 43 billion rubles (deviation -36.3 billion rubles);
- Duration of the project (plan / fact): 26 months / 120 months (deviation -94 months);
- Project content: football stadium with a capacity of 68,000 seats;
- Note: the source of financing - the budget funds of St. Petersburg.
Project Name: Construction of the Northern alternate for Kutuzovsky Prospekt
- Project budget (plan / fact): 40 million rubles / 70 million rubles (deviation - 30 million rubles);
- Duration of the project (plan / fact): 36 months / 48 months (deviation -12 months);
- Project content: Creation of a toll highway with a length of 10.3 km from MIBC "Moscow City" to the Molodogvardeisky traffic intersection in order to reduce the transport load on Kutuzovsky Prospekt;
- Note: project financing through private investment.
Project Name: “VTB Arena - Dynamo Central Stadium”
- Project budget (plan / fact): 35.4 / 40 billion rubles. (deviation - 4.6 billion rubles);
- Duration of the project (plan / fact) 84 months / 132 months (deviation -48 months);
- Project content: multifunctional sports complex, which includes a hockey and football arena for 25 716 people (initially the capacity of the football stadium was 45,000);
- Note: financed by private investments of VTB PJSC and CSO VFSO Dynamo.
Project Name: “Kaliningrad Arena”
- Project budget (plan / fact): 11 billion rubles. / 17.75 billion rubles (deviation - 6.75 billion rubles);
- Duration of the project (plan / fact): 28 months / 39 months (deviation - 11 months);
- Project content: football stadium with a capacity of 35,000 people (the initial design number was 45,015 people);
- Note: the funds of the federal budget of the Russian Federation were used.

3 Results

An analysis of the data presented on investment and construction projects shows that there are deviations in terms of indicators: project budget, implementation timeline and content. To a lesser extent, adjustments were made to the “content” indicator and to the side of increase in construction and installation works, which, of course, entailed an increase in terms and initial cost.

Fig. 1. Graphical interpretation of the studied objects in terms of the "budget" indicator

The graphical interpretation demonstrates that each investigated capital construction object exceeded the originally budgeted budget.

Fig. 2. Graphical interpretation of the studied objects in terms of the "implementation time" indicator

The graphical interpretation demonstrates that each of the studied capital construction objects exceeded the initial implementation period, except for the objects specially controlled by the state: these are the "Krymsky Bridge", "MCR" and "Zaryadye" Park".

The causes of deviations of the identified values can be considered:

1. The project "Crimean bridge":

- the project is state-owned, compliance, and in this case, advancing deadlines is tightly controlled, accordingly, the construction cost increases;
- in comparison with foreign analogues, the initial cost of this building is overestimated and takes into account the risks of weather and climate conditions;
- implementation "at any cost" - a reputational state project.

2. The project "Otkrytiye Arena (Spartak Moscow)":

- world financial crisis;
- location of the facility (tunnel of the Tagansko-Krasnopresnenskaya metro line);
- bureaucratic procedures;

- changing the content structure of the object - increasing the tribunes from 35,000 to 45,360 people)

- transaction costs.

3. The project “Moscow Central Ring (MCC)”

- project of regional, reputational importance;

- an additional 40 billion rubles were spent for the reconstruction of the road network, overpasses and the clean up the territories around the MCC;

- social effect and infrastructure development around the MCC.

4. Project Name: Pokrova Presvyatoy Bogoroditsy Church, Stavropol Region, Georgievsky District, st. Urukhsкая

- local project;

- lack of a professional project management team;

- implementation of construction and installation works depending on the availability of donations (the money ran out - construction has stopped).

5. Project Name: “Zaryadye” Park”

- the need to build new communications;

- demolition of the stylobate part of “Rossiya” hotel;

- increasing the content filling of the park in the form of a “floating bridge”;

- organized parking for 500 cars;

6. Project Name: “Gazprom Arena”

- The principle of “agreement”. The project was implemented on the basis of agreements, not documents. And every time something changed - the ruble exchange rate, the governor of St. Petersburg or plans to use the stadium - had to “agree” again;

- economic crisis;

- rise in price of work from the position of the general contractor;

- general contractor change;

- repeated passage of state expertise;

- FIFA verification - non-compliance with organization standards - redevelopment of the project;

- protracted deadlines for acceptance of the object by Rostekhnadzor (non-compliance of the facility with the requirements);

- change of customer from the general sponsor of Gazprom PJSC to the municipality of St. Petersburg.

7. Project Name: Construction of the Northern alternate for Kutuzovsky Prospekt

- the protest of local residents about the toll city road (litigation suspends the implementation of the project);

- compensation for demolition of buildings;

- coordination on cutting down plantings;

- relocation of network communications.

8. Project Name: “VTB Arena - Dynamo Central Stadium”

- change in the project and focus (it was planned to use the stadium for matches of the World Cup 2018, however, the “Otkrytie Arena” bypassed the applicant);

- increase in safety standards that were not provided in the initial version of the project;

- economic crisis;

- management error - design and construction lasted a long period, and competition increased significantly (Otkrytie Arena, CSKA Arena, “Luzhniki” Arena);

9. Project Name: “Kaliningrad Arena”

- ruble devaluation;

- imported equipment and fittings;

- new safety requirements not included in the design;
- special geological surveys and soil expertise.

Of the official versions of the reasons for the deviation, environmental factors and errors made by project managers predominate.

4 Discussion

In general, the Project Management Institute project management standard provides tools, methods and approaches for project management in an unstable external environment. However, construction, being a material industry, involves an enormous amount of resources: human, technological, technical and organizational. Calculation of input parameters occurs at the pre-investment stage, and the lack of a “quick response” and the receipt of conclusions of executive authorities makes the management of investment and construction projects unique, requiring the creation of their own management standard, and not existing professional standards and existing knowledge codes.

5 Conclusions

The paper provides an analysis of investment and construction projects implemented in the Russian Federation with the involvement of the state budget and private investments. Significant deviations were recorded in the key indicators of the project: the implementation periods in most cases did not correspond to the declared ones, construction costs were significantly increased, sometimes by 3-4 times, the content of the construction object changed. The question remains unclear about the appearance of a new trend in the Russian market, the requirement for a Project Management Institute project management certificate, when by and large, even if you know by heart the entire body of knowledge on project management, the bureaucratic chain, the legal deadlines for the work, and the so-called “human factor” are impossible to remove from the project in current realities.

Today it is necessary to clarify legislatively: the feasibility study as the justification of investments, the composition and content of the process of investment justification, as well as the requirements for the composition and content of this process, the tasks of state expertise as a mechanism of state control over the efficient use of budget funds. It is also necessary to develop a regulatory database that will create the conditions for transferring the state orders for the construction of a real estate object to automated technologies. In the future, information modeling can become the industry standard for project management [4].

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