

Risk Management in Construction Project: Taking Fairness into Account

Jarosław Górecki ¹, Jadwiga Bizon-Górecka ¹

¹ Department of Construction Engineering and Management, Faculty of Civil and Environmental Engineering and Architecture, University of Science and Technology Bydgoszcz, Al. prof. S. Kaliskiego 7, 85-796 Bydgoszcz, Poland

gorecki@utp.edu.pl

Abstract. Risk management requires a comprehensive review of possible hazards, their possible outcomes as well as some recommendations about minimizing the risk. The study emphasises that the project risk management refers to an analysis of the risk factors and a creation of the strategy minimising negative effects of the risk. It was pointed out that a construction project is this kind of projects that can be defined as a unique process of high complexity (design documentation, various stages of creating the building), which has clearly defined time frames and a given financial limit. It is executed as a team work, by qualified or highly qualified specialists of different matters, for example masonry, precast, etc. Additionally, it requires a use of modern equipment and an adequate preparation of the investment. Therefore, the risk management focuses on the problems allowing for troubleshooting. A basis of the risk management is to recognise the fundamentals, which are crucial for the construction project management, i.e. an object perspective, including technological, supporting and management processes as well as an entity perspective – project stakeholders. Construction projects require also an acquaintance with the specificity of the branch. The article refers to the risk management in construction project and, in particular, a phenomenon of participants' fairness in such projects. The problem of fairness of the entities involved in a project should be understood as a fair play, according to the arrangements agreed in a contract and compatible with current formal procedures and social rules. It was indicated that fairness can be treated as an important factor in predicting the success of such projects. Interviews conducted among contractors in Kuyavian-Pomeranian region showed varied fairness requirements put to individual participants of construction projects. The article presents results of the research. It shows a desired attitude of the surveyed enterprises towards a problem of the fair behaviour. These behaviours, relating to individual stakeholders, have been underlined in different phases of the construction projects' life cycle.

1. Introduction

Risk occurs both in the course of routine activities as well as in projects. However, in project management, as an innovative task, risk management takes a more conscious form; it is becoming a significant management process module. The best way to deal with risk is to stay alert and aware of its existence [1].

The complexity of construction investment projects makes reaching the project objectives burdened with a substantial risk, an attribute of probabilistic nature of project-related phenomena. There are



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several threats linked to construction works and problems where construction company and projects the company participates in meet. Project management "is the process involving the development of strategic plans, taking into account the risk factor and then acting based on these plans" [2].

Risk is found everywhere and it must be taken seriously. Project managers, ~~when managing a project~~, must face risk management problems. Risk control implementation constitutes a risk management development cornerstone. Project should be a system capable of predicting the project goal achievement level and potential threats, the analysis of their effects and dynamic control of the scenarios execution level. Risk control involves developing systems of early warning and the project manager provides information to managerial IT decision support systems. Project managers can predict consequences of their decisions only at some probability level. It means that project processes are exposed to risk related to achieving the project goals. Risk management involves managing actions on day to day basis thinking about tomorrow. The idea of risk management covers all the actions which are to identify, estimate, control, finance and monitor risk, which means reducing risk, diversifying and using it as a phenomenon. At present, risk attracts much interest as it is introduced to good practices procedures in construction engineering and project risk management helps achieving project goals.

Risk which is found all around should be perceived as an occasion to introduce a purposeful game of risk. The game is to avoid negative risk effects to be found throughout the project execution. At the decision risk reaction strategy launching phase, it is planned to:

- prevent a possibility of the occurrence of risky project situations or eliminating them,
- combat risk consequences.

Construction production can be considered as a complex biotechnical system with a mixed reliability structure. Thus, biotechnical systems can be viewed as elements of production processes. The analysis of risk and construction production reliability should consider an approach to biotechnical systems reliability.

2. Project risk management stages

Moving away from amateur *ad hoc* response to incidents and implementing an integrated project risk management require changing the approach to risk management. Therefore, a comprehensive continuous approach is proposed instead of selective - focused on details - or passive strategy, focused on avoiding losses and applied temporarily, [3].

Risk management comes down to two components: risk assessment and development of response and its implementation. Risk assessment involves identification and analysis. As an example of risk management in a construction company, one can consider providing temporary detours for the time of construction works. When a risk of traffic inconvenience was identified, a risk analysis was launched by searching for providing alternative roads or detours. A response can involve a total risk elimination or transferring the responsibility for risk consequences to other entities. It is feasible thanks to e.g. provisions in master service agreement and side agreements (transferring the risk to subcontractors), [4].

Risk management, as the art of making rational decisions, in general, follows the (basic) stages [5]:

- risk identification,
- risk estimation,
- risk control,
- risk financing,
- actions monitoring.

2.1. Risk identification

Risk identification involves determining what kinds of risks, and to what extent, the project is threatened with. An analysis of respective processes is required from the point of view of threat and process classification. A detailed analysis covers external events which threaten the project from the outside and those which can emerge as part of the project and which pose a threat to others.

2.2. Risk estimation

Risk estimation involves determining a possibility of damage occurrence (probability and loss size). An adequately performed risk estimation allows for taking actions to reduce the threat posed to the company which could result in a loss of company's assets.

2.3. Risk control

The primary aim of risk control is to determine the means of prevention eliminating or limiting the risk estimated. A list of adequate responses is a result of a detailed analysis of effectiveness and their implementation costs. Risk reducing costs cannot exceed the value of a potential damage value (tangible and intangible damage).

Risk control involves taking actions limiting risk to the assumed admissible size. Reducing risk often becomes contrary to the other project goals, mostly achieving the desired project effectiveness parameters.

Economic organizations usually aim at maximizing profit. Profit increase is often possible by increasing the size of risk related to construction project execution. Most often, risky projects are related to high income. However, over a certain level the profit can be threatened.

Similarly, enhanced profitability is contrary to maintaining liquidity. Reducing risk is also connected with additional costs. Defining an acceptable risk level is necessary.

In risk controlling, two types of actions can be taken:

- those influencing the reasons of risk, taken in order to lower risk; they are referred to as active risk counteraction strategy,
- those affecting the effects of risk, taken to decrease a negative result of unexpected losses on the project goal achievement level; they are referred to as passive risk counteraction strategy.

The company avoids risk by avoiding risky projects and by qualifying limits of risky project engagement.

2.4. Risk financing

All risks which are not eliminated with preventive measures must be financed. Basic risk financing forms include:

- keeping own share risk:
 - without any preventive actions,
 - with preventive actions;
- transferring risk to other entities (for example suppliers, clients, subcontractors, insurance companies):
 - total,
 - partial (franchising, liability limit, insurance subject and scope disclaimer, etc.).

2.5. Monitoring of actions

The last stage of risk management is action monitoring which is to investigate the effectiveness of actions aiming at risk reduction. Internal monitoring procedures play a big role in risk monitoring and limiting.

A rational risk management facilitates finding optimal solutions which are a compromise between insurance and sharing the risk. Such a compromise is an insurance program. Risk management is also a professional approach to insurance.

3. Risk management and project safety

Formulating project risk policy, one should note that it should lead to achieving project goals in a manner which would be safe for all the stakeholders. Such approach confirms an assumption that all the conflicts, apparently authentic, can be solved in a way enabling to create a common roadmap of the actions taken as part of project operation.

The state of safety of the project goal achievement (P) at time t (S_t^P), exposed to a number of risks (R_i), which behave in a dynamic way (depends on time t), describes a set of safety states of distinguishable elements e (processes) of the project:

$$S_t^P = \{ S_{t,R_i}^e : e \in P, t \in T, R_i \in R^e \} \quad (1)$$

Project, or its respective elements, safety states, expressed as requirements satisfaction (goals achievement) probability stand for their operation reliability. Thus, the level of achieving goals is a measure of reliability of the process operation and the entire project ($\bar{R}$) whereas risk (R), in terms of probability, standing for not achieving the goals, remains in the following relation with reliability:

$$R = 1 - \bar{R} \quad (2)$$

Project systems, as reliability-structured sets of a series of engineering (biotechnical) sub-systems and the subsystems with managerial functions require a simultaneous consideration of biotechnical systems reliability (and thus the operation risk) as well as activity risk (and thus activity reliability).

To determine the level of reliability at time $t \in T$, it is necessary to determine a set of goal achievement measures at a given level (process, project) at a given moment.

In the project, a set of measures is presented with the values of measures for respective elements:

$$M_t^{aP} = \{ M_t^{a,e} : e \in P, t \in T \} \quad (3)$$

One should also note the necessity of maintaining a unity of goals of single processes and the entire project.

The organizational order of the project can reflect a process relations map. Developing such map leads to reflecting the project reliability structure. Applying the reliability theory principles facilitates a development of organizational structures with a high level of reliability (a possibility of building reliable structures with unreliable elements). Thus, due to the dependence expressed with Formula 2, one must note that the reliability theory can be a perfect tool for project risk management. Interestingly, next to unfavourable situations probability, their effects, determined with the measures assumed, are also essential.

The size of risk is shown with risk value $Var(t)$, calculated as a product of risk probability $R(t)$ and value exposed to risk Va . One must note that each action implies risks in many areas. The total risk value is a sum of products of risk probability in a given area „i” ($R_i(t)$) and the value exposed to risk in that risk area (Va_i):

$$Var(t) = \sum_1^n R_i(t) \cdot Va_i \quad (4)$$

4. Fairness of construction project participants as a marker of Stakeholders Project Responsibility (SPR)

Risk management starts playing the key role in terms of project management methodology. For that reason, one should consider specific project risk factors and entities responsible for project success. Defining the role of construction project participants, one can introduce the term of Stakeholders Project Responsibility (SPR) and consider fairness of their actions.

To verify a construction engineering community's opinion related to stakeholders' project management fairness, construction companies were involved in a survey. Empirical studies of 29 Polish companies, conducted in the first quarter of 2017, demonstrated that 93% of the respondents claimed that fairness of all the construction project participants, determines project success. An importance of fairness of particular stakeholders, influencing a success of the construction project, was presented in the figure 1.

The respondents pointed to an important role of contractor - 90% responses, subcontractor - 55% responses, material supplier - 55% responses, investor - 45% responses and building designer - 39% responses. These results reveal that project participants affect the project risk level at various project life stages. The stakeholders have a dominant effect on the course of construction project at its early life stages. Thus, their fairness and reliability concern mostly the course of preparatory and execution stages of the project.

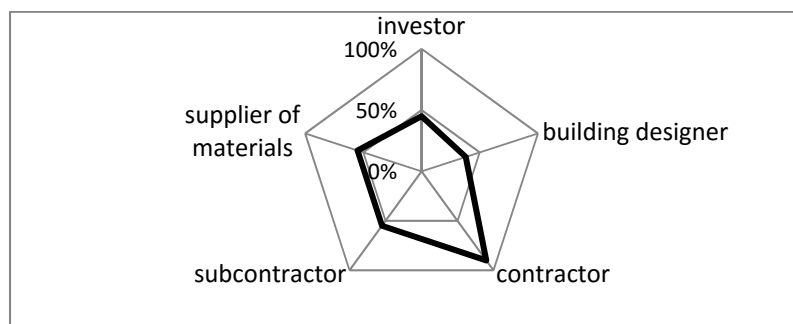


Figure 1. Importance of stakeholders' fairness to project success

5. Conclusions

Risk analysis should cover operational goals, resulting from strategic goals and risk estimation can be made both with financial and non-financial means. Risk management can be included in the general concept of the art of taking rational decisions. In a search of an effective project management, managers use risk-management tools. Construction production management requires identifying places of threat, its properties and factors which generate threat. It is necessary to take measures referring to project risk itself and achieving its goals. One must also determine the size of potential project losses resulting from independent risk areas. Independent risk is a risk which does not depend on project manager's decisions. Project risk factors analysis allows for defining and accounting for events which can heal the project. It also helps to define some possible strategies of counteracting such situations. The system-oriented approach to risk management stands for a global view on the project through a role of each element as a whole, especially future effects of the decisions. Risk management is mostly a series of actions to reduce risk consequences. Therefore, it seems that respective risk areas affect achieving project goals to a different extent and some risk factors come from its environment. Risk management effectiveness is guaranteed by system-oriented approach fully integrated with all the project processes. Practical project risk management appears mostly in a form of risk diversification. Another essential risk management function is launching measures to reduce the production system risk, compliant with the theory of reliability. Due to high costs of preventive measures, prioritizing is

required. It must factor in the effect of such measures on general project goals. The stakeholders whose activity is affected by a given project are interested in project safety. One should note that for project risk, fairness of stakeholders is also essential, especially at the construction project preparation and execution phase.

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