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REDUCTION OF THE RISK IN PUBLIC PROCUREMENT BY USING DESIGN-BUILD AS A MEANS FOR SUITABLE CONSTRUCTING

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ABSTRACT

Suitable and sustainable buildings have increased demands for design and for the transfer of design requirements to realization. That causes an increase of risk connected with the differences between planned and real parameters of the buildings. This article will outline the main theme comparison between DBB and DB projects concerning contractor's risk management level. This comparative analysis explains, using the RIPRAN method, the hidden risks in each type of delivery method. The comparison identifies numerous contractual topics and risks included in both and gives deeper insight into risk management, both for the contracting party and also for public procurement. Applying risk analysis strategies and tools to the process will help decision-makers evaluate and select the suitable delivery method consistently and defensibly. This paper gives generic risk factors related to both project types. The results indicate risk factors with influence on the price, probability of occurrence and unfavourable impact on the project and help allocate risk level more properly in accordance with its high, middle or low probable impact. Public investment is a significant part of the public budget, the application of design-build can help with the reduction of corruption, and the public sector can benefit from the usage of DB projects to help eliminate the mistakes made by contracting authorities.

KEYWORDS

design-build, public procurement, RIPRAN, design-build risks

INTRODUCTION

In every human activity, some risks can be found, civil engineering is not an exception. The space for risk is even bigger than in other areas of human activity. Undesirable events can be estimated with certain probability, which are not included in the planning, the construction or the delivery of final building construction. The consequences of non-expected events incur damage. It is very important to be secure in these cases. Typical risks of a design-bid-build (hereafter referred to as DBB) project are different from a design-build (hereafter DB) project [1]. Even if DBB is the classic way of construction, it brings higher costs related to the project realization. This is caused by a delay between the project inception and the choice of the contractor. By the usage of DB, this delay can be eliminated. Thus the discrepancies are modified and the transactional costs related to finding a suitable contractor are lower. Nevertheless, both methods contain some hidden threats. Traditional construction procurement approaches try to find adequate construction and building

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methods, which consider risk level in comparison with demands, challenges and alternative procurement routes to have the best “value for money” [2]. For this purpose, it is critical to make a comparative overview to identify the core aspects of risk management analysis, using adequate methods [3,4].

The main aim of this article is to show one of the function methods to analyse risk level and compare DBB and DB views so that the contractor can have a clear overview of the whole situation and its own needed risk level.

RISK EVALUATION IN DESIGN-BUILD PROJECTS

Design-Build projects can be risky for both the ordering (public procurement) and the contracting party. It is desirable to evaluate the risk by analysis [5]. The risk strategy is the key part of each project. The goal of the research is to confirm that there is a real reduction of risk for the public sector and quantify the risk reduction. The parts of the project where the public sector is able to reach the greatest amount of reduction and the part with no influence by the usage of the design-build scheme are also shown in the research. This can be very useful for authorities who are planning a new project, because they will know where they need to be careful so they can achieve the largest net income. All the research has been done in the area of the Czech Republic. In this case the Czech Republic is characteristic in that there is almost no usage of design-build in the public sector, even though the private sector is familiar with this scheme. The motivation is to show the advantages of design-build to public authorities [6].

Risk management methods

It is very important to understand the main characteristic of risk management to be able to decrease the risk level. Risk management is the process where the managing subject makes an effort to eliminate the influence of existing and future risks and designs arrangements to remove the non-desirable influences where possible. Simultaneously, the positive influence is used – the analysis of non-desirable influence and the risk monitoring belong among risk management processes. By using risk analysis, every risk can be identified and also the probability of expecting damages and risk responses can be considered. Risk monitoring means continual discovery to see if the risk level is invariable and the prospective arrangement does not need to be realised – as a response to the risk expectation.

Potential threats can be found and, above all, suitable reactions and arrangements can be arranged to reduce them thanks to risk analysis. Probability and possible damage must be defined. The risk identification techniques can be categorized, for example, by the documentation review, brainstorming, Delphi, the method of nominal group, interview with an expert and other methods. As the risk is identified and considered, the estimation of probability to the risk occurrence and its negative influence to the whole project is done. The evaluation can be qualitative (verbal value) or quantitative (number value). The target is to create an arrangement to decrease the probability of risk occurrence to an acceptable level. To be able to change the effectiveness of the arrangements it is fundamental to follow construction rules.

Different methods can be used to create the risk analysis. The methods are divided into two groups:

- The methods of risk analysis concerning the project product
- The methods of risk analysis concerning the project management

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This article is focused on the second group, as it is important to pay attention to the risks which arise from the basis of project management (there is also technical risk). These methods are, for example: FRAP, the susceptibility analysis, the method of scenario planning, the decision trees or RIPRAN. The last method is described in detail in the following part.

Research method

A research method called RIPRAN has been used to modify the method for evaluation of the risks [7]. This method is designed for evaluation and reduction of the project risk in various sectors. The RIPRAN method is excellent for every phase of the ongoing project [8]. The basic phases of this method can be taken as the process where each phase is connected to the other phase. Found among the basic phase are: the preparation of risk analysis – the identification of project hazard – the quantification of project risks – the reaction the risks – the overall risk evaluation. The manner of its composition is found among the advantages of this method, created from the international standards. The benefit is simple usage in practice which enables analysis of risk in incorrectly structured projects. This method can seem more complicated than in reality, but it is not complicated to get the recommendations and proposals to eliminate the potential risks.

The basic phases of the RIPRAN method:

The preparation of risk analysis – the projection of the time frame creates the source of needed documentation; the output is a plan to execute the risk analysis.

The identification of project danger – the target is to find all possible threats and scenarios, the statistical data and prognoses are used; the output is a list of the threat – scenario pairs.

The quantification of project risks – the effort to evaluate the probability of listed scenarios and size of damages; the output is a chart with listed threats and scenarios and also probability, impact and risk value.

The reaction to project risks – to use the data from the prepared chart; the output is a chart complemented by columns with the proposal to arrangements, the new risk value and also the cost of the arrangements.

The overall risk evaluation – to evaluate the analysed project; the output is an overall evaluation of risk levels [9].

An author of the method is Doc. Ing. Branislav Lacko, CSc. The method was established for the analysis of risk in automation projects in pursuance of scientific research at VUT Brno. The praxis showed that after a few modifications, the method is applicable for analysis of various risks in many projects. RIPRAN™ is a trademark registered by the office of industry ownership in Prague [9].

Research process

For our research, part of the RIPRAN method was used for evaluation of the typical risks of a design-bid-build (DBB) project and separately for a design-build (DB) project.

The research has been done in four steps:

- Identification of the risks
- Inspection of the risk matrix
- Evaluation of the risks
- Appraisal of the results

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Identification of the risks

In this step, an economic survey was carried out to find as many risks for construction projects as possible. The survey was done by questioning 12 construction managers [10]. Each respondent had to write down a list of risks which he or she thinks is relevant to the comparison of DBB and DB. The final list was discussed with the respondent to get the right projection of what he or she had meant by each risk. Finally, all the lists were matched and the duplicated data was deleted [1]. Because the final list has almost 150 records, it was necessary to determine groups and sub-groups of risks. Each of the risks was described as a part of a pair: threat and scenario. For example, the threat could be an actual danger (e.g. a lightning strike) and the scenario would be the result which is caused by the threat (e.g. a fire). In this phase, 149 pairs of risks were identified, which were split into 9 chapters.

Tab. 1. - Risk chapters

Security area
Ecological area
Economical area
Management and decision making
Political
Law and regulatory area
Social and personal area
Technological area
Other

Source: author

It was necessary to look at the risks from the public authority's point of view, and also in the same manner, to make an evaluation of the risks [11]. The main criteria for the evaluation was the level of the influence on public procurement.

Tab. 2. - Example of the risk matrix

Technological area	Planning quality	**R110**	Bad estimate of area requirements for the building site	Not possible to continue
	Planning quality	**R111**	Contradiction between bills of quantities and planning	Increase of cost
	Planning quality	**R112**	Contradiction between bills of quantities and planning	Prolongation of time schedule due to solution finding
	Planning quality	**R113**	Contradiction between parts of planning	Increase of cost

	Planning quality	**R114**	Contradiction between parts of planning	Prolongation of time schedule due to solution finding
	Planning quality	**R115**	Contradiction between parts of planning	Difficult setup of responsibility

Source: author

Checking of the risk matrix

In this step, the final risk matrix was checked with the respondents from the first step. This ensured that the basis for the future research respected the reality of the market. Of course, the meaning of each risk and the correctness of the threat and scenario pair were also discussed [12]. The goal of this step was to finalize the list of risks and clarify the meaning of each risk.

Final risk evaluation

Concrete threats and scenarios were judged by their probability and influence on the project. This was done for DB and DBB separately. The chart n. 3 shows the level of risk probability and the possibility of overall impact by using three probability values – low, middle and high. In DB projects, some risks are transferred into the contracting side from the public procurement side, so that the probability or influence could be lowered, as can be seen from the example in Table 3.

Tab. 3. - Example of probability and impact quantification

Threat	**Scenario**	**DBB**		**DB**	
		Probability of occurrence	**Project impact effect**	**Probability of occurrence**	**Project impact effect**
Contradiction between bills of quantities and planning	Increase of cost	High probability	Middle unfavourable impact	Low probability	Middle unfavourable impact
Additional investments not predicted during planning	Increase of cost	Middle probability	Middle unfavourable impact	Middle probability	Low unfavourable impact
Non-complete documentation	Prolongation of construction	Middle probability	Middle unfavourable impact	Low probability	Middle unfavourable impact
Changes caused by the selection of technical equipment	Increase of cost	Middle probability	High unfavourable impact	Low probability	High unfavourable impact
Bad information transfer between	Prolongation of construction	Middle probability	High unfavourable impact	Low probability	Low unfavourable impact

designer and builder					

Source: author

After the identification of risks for every threat and scenario and after adding the possible impact on the project, the risk level was quantified [13]. The risk level was defined separately for each type of project in the construction – Design-Bid-Build (DBB) and Design-Build (DB). The risk level was defined by the mixture of the probability and the impact on the project. The method is shown in Table 4.

Tab. 4. - Risk evaluation

	High unfavourable impact	**Middle unfavourable impact**	**Low unfavourable impact**
High probability	High risk level	High risk level	Middle risk level
Middle probability	High risk level	Middle risk level	Low risk level
Low probability	Middle risk level	Low risk level	Low risk level

Source: author

Finally, all types of risks were considered and judged by numbers (1, 2, 3) as well as by verbal evaluation (high, middle, low risk level) of the overall level of probability connected with the possibility of total impact on the project [14]. For DBB projects, the final average risk level for the public sector is 1,8 and for DB projects the final average risk level is 1,5. It shows that by using design-build, the risk is decreased by 17%. In Table 5 the evaluation of the risks is shown.

Tab. 5. - Example of risk level quantification

Threat	**Scenario**	**DBB**			**DB**		
		Probability of occurrence	**Project impact effect**	**Risk**	**Probability of occurrence**	**Project impact effect**	**Risk**
Contradiction between bills of quantities and planning	Increase of cost	High probability	Middle unfavourable impact	High risk level – 3	Low probability	Middle unfavourable impact	Low risk level – 1
Additional investments not predicted during planning	Increase of cost	Middle probability	Middle unfavourable impact	Middle risk level – 2	Middle probability	Low unfavourable impact	Low risk level – 1

Incomplete documentation	Prologist of construction	Middle probability	Middle unfavourable impact	Middle risk level – 2	Low probability	Middle unfavourable impact	Low risk level – 1
Changes caused by the selection of technical equipment	Increase of cost	Middle probability	High unfavourable impact	High risk level – 3	Low probability	High unfavourable impact	Middle risk level – 1

Source: author

Appraisal of the results

By the comparison of each pair, the parts of the project where the usage of design-build decreased the risk were identified [15]. There are 43 threats which are affected by using design-build. What is really interesting is the amount of decreased risks for each chapter, which can be seen in Table 6.

Tab. 6. - Amount of risk decrease by chapters

Security area	0
Ecological area	2
Economical area	5
Management and decision making	14
Political	0
Law and regulatory area	7
Social and personal area	0
Technological area	15
Other	0

Source: author

It can be seen from the table that the biggest risk decrease is made in the area of “management” and “decision making and in the technological area”. On the other hand, this means that it is imperative for project managers to define precisely these areas in the contract and to focus on risk transfer in those areas [16]. In the next table you can see the average risk for each area of design-bid-build (standard) project.

Tab. 7. - Average risk on design-bid-build projects by chapters

Security area	1,25
Ecological area	1,75
Economical area	1,8
Management and decision making	2,36

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Political	1
Law and regulatory area	2
Social and personal area	1,29
Technological area	2,13
Other	2

Source: author

By a comparison of Table 6 and Table 7, it can be seen that by the usage of design-build, it is possible to decrease most high-risk areas, because the areas “Management and Decision Making” and “Technological Area” have the biggest average risk and the highest amount of decreased risks at the same time.

This directly shows how effective the design-build scheme can be for the public sector [17]. By transferring the risk responsibility to the contractor, they can extend their field of operation and responsibility. The contractor is also responsible for the planning and the building construction during the project realization. Design-build decreases the risks which are the most important for the contractor, and should help the public sector to be more effective.

CONCLUSION

From the given RIPRAN project risk analysis, it can be observed that on the public procurement side (the client) and from the risk level point of view, it is advantageous to use the Design-Build method, and to work on this presumption. The presumption being, with the application of Design-Build projects, there is a lower risk level on the contractor’s side for planning and realization of construction projects.

This analysis also confirms the character of DB projects where is a higher risk level on the contractee’s side (i.e. on the side of the builder). This side has a significantly higher operation effect in both parts of the project, design and construction, so consequently, this side has a higher level of responsibility and risk as well.

So, for the contractor (client), it is useful to use Design-Build projects for public procurement in construction when realizing public contracts because of the lower risk level as compared to DBB projects.

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