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Time-varying risks of construction projects

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Abstract

Although risk management has become an integral part of project management generally insomuch that its application is required even by standards, it is usually left to project managers to define the required processes in detail and only little relevant methodological literature is available to provide further theoretical content. Known practices can still be developed in many parts, since in current approaches it is especially difficult to reflect on e.g. a phenomenon that individual risks typically decline and then disappear as construction progresses.

This article focuses on declining and disappearing risk changing with time, based on value-based risk monitoring. For providing the mathematical background of time-varying risks, it is important to detect and monitor risks related to the added value of the project. Consequently, if necessary, it is possible to start action plans to avoid losses. In a construction project, in order to maintain a value-based risk management process, a continuous valuation method is necessary which is able to capture the value of the building in its current state.

Our aim is twofold: to develop an evaluation method, which is able to determine the current market value of a project in the construction phase, and to provide a risk monitoring tool, which reflects the phenomenon of time-varying risks.

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1. Introduction

In the construction sector, there is an obvious need for an effective project risk-monitoring and controlling system conducive to the business success of the projects. Reviewing the relevant literature, approaches to risk management with emphasis on enhancing the number of risk criteria can be found, providing a fortified mathematical background and applicability in practice. However, these methods are usually static, and there are hardly any references to the fact that the individual risks in the risk classes may change as time passes. However, some of the risks inevitably get reduced, let us consider risks associated with the individual contractors, simply because the relevant subprocess has been finished. Although it would seem convenient to ignore this issue saying "less risk is better", and do nothing, in fact a reduction in one risk element can have numerous effects on other risks. A reduction in one risk element can

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extend the opportunities considering taking on other risks, but the opposite statement is also true: if a risk is increased, e.g. a contractor is late; it makes the risks of the deadlines of processes based on the work of that contractor higher.

The next problem arises when risks are interpreted in detail. Project management is basically deliverable-oriented, that is, the general goal is that an object to be finished according to the deadline at the defined quality and cost. When an element of risk is considered, we think of the extent the above goals are in danger. This, however is a multi-purpose optimization process, where in addition to the excessively complicated nature of the mathematical methods, sometimes not even the relative importance of the individual goals are clear.

In our study, we present a solution that considers the combined effects of time-varying risks along owner's interests, and puts the interpretation of risk in a context that can be easily handled mathematically. To develop the mathematical background for the project risk monitoring process, we use the value-based financial risk management approach defined by Toth and Sebestyen [15]. In this approach, critical values of the value-driver parameters are specified in the planning phase of the project and the occurrence of those values need to be collected continuously in the subsequent phases. In this article, we focus only on the development phase. The critical values of value-drivers are calculated based on the market value of the project just before its launch. The problem is that on the one hand, as time passes, the value of the project also changes and on the other hand, some plan data turn into fact data, and so the remaining possible deviations from expectations (in other words risks) become characteristically lower and lower. Our mathematical model, therefore, has to consider both the change in value and the change in risks at the same time. The key for a more sophisticated risk monitoring process is to update the project value and the critical value-driver values continuously.

The contribution of this research to the current body of knowledge is that it provides a mathematical background for understanding the time-varying project risks based on continuous monitoring process in an owner's value-based project risk-assessment framework for construction projects. This formalized, integrated risk management model describes the phenomenon of the decrease of risk as time passes, while the applicability of the process is maintained. Our aim is to exploit the developed model to further clarify the concept of value-based business project risks. The proposed model is presented through the planning phase, however it is valid for the development, and the operation and maintenance phases as well.

2. Continuous holistic risk evaluation

In the project management literature, risk is defined as a measure of the probability and consequence of not achieving project goals (see, e.g., [3, 9, 12, 13]), where project goals are typically related to the implementation of construction (time, cost, quality) as a deliverable. Construction project management literature tends to concentrate on specifying risk classes that jeopardize these project goals and focus on how to manage risks based on those classes. For example, Tserng, & al., (2009) recently presented an advanced ontology-based categorization of risk classes [16]. Risk has become increasingly understood conceptually as the likelihood of an event occurring within a project [4, 14], although an 'event' continued to cover a wide range of meanings. The principal methods of risk measurement have spread from other scientific fields to project management applications (for a summary see, e.g., [8]).

Although advanced risk management methods are highly supported by mathematical tools [1, 2, 5, 6, 10, 11], they do not develop the risk monitoring process and methods in detail. Although some of these works include sophisticated mathematical methods for risk management, the ownership approach is still missing from the criteria.

The challenge is not only to provide an integrated, holistic risk management method taking owner's value into consideration supported with proper mathematical models, but also to operate the project risk evaluation system continuously throughout the whole life cycle of the project. Continuous data collection and feedback are key issues for such a monitoring and controlling system. Although a combined evaluation method presented is able to