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Problems in reconstruction projects, BIM uses and decision-making: Lithuanian case studies

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Abstract

The research deals with reconstruction projects investigation by applying statistical analysis and multiple criteria decision-making method, also research on application of Building Information Modelling (BIM) methodology for reconstruction projects. The implementation of reconstruction projects face a lot of problems, and the list of problems is identified when analyzing Lithuanian case studies. The analysis shows that it is necessary to monitor design, construction and maintenance stages both for quality control and information management during the whole project life cycle. According to suggested problem recognition methodology, the list of problems is analyzed in terms of occurrence in the projects and influence to the project. The complex solution is based on estimated problems significance as a result of statistical survey and expert survey by applying Analytic Hierarchy Process (AHP) methodology. Possible BIM uses for reconstruction projects are suggested to prevent the identified problems.

Keywords: Reconstruction projects; Building Information Modelling; BIM uses; Decision-making

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1. Introduction

Reconstruction projects face the same problems as ordinary construction projects and the biggest ones are energy efficiency [1] and information management [2]. Due to rapid grow of application of advanced IT technologies in construction industry, project participants understand the benefits, and Building Information Modelling (BIM) has been increasingly applied in new construction projects [3], but it is still rarely used in building reconstruction projects [4]. While reconstruction project implementation suffers from a set of specific problems [5]. The aim of the research is firstly to identify the most significant technical, organizational and managerial problems of reconstruction projects, then to analyze tools and actions that could help to prevent the problems and to increase the effectiveness of the projects, and finally suggest application of BIM in reconstruction projects of old industrial buildings.

Analyzing the sustainable development of industrial buildings, project participants face the multifaceted problem and they need support in selecting the most effective decision [6, 7]. Therefore, BIM uses in Lithuanian case studies and new techniques are suggested to be applied to support the decision-making process.

Nomenclature

BIM   Building Information Modelling
AHP   Analytic Hierarchy Process

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2. Material and Methods

The Lithuanian case studies of reconstruction projects of industrial buildings, built in a period of 1950-1981 and reconstructed in the last 5 years, have been analyzed.

The research has been done according to the algorithm (see Fig. 1):

- A set of common problems occurring during the reconstruction was identified and analyzed on the ground of 14 case studies.
- The information collection methods: meeting with project managers, contacting by e-mail or by phone. Before comparing and analyzing the data, information about the occurred problems was received by contacting contractor and representatives of designers who participated in these projects.
- The set of 7 main problems was identified: (1) documentation of reconstructed building is out of date or not-existent, (2) due to cost savings a feasibility study work is not fulfilled and technical project is arranged in a careless way, (3) technical staff and project team members are unqualified and incompetent (low skill and knowledge level), (4) long duration of purchasing procedures as every project is being solved involving a number of participants, (5) there is no information continuity which can influence further decisions, (6) project adjustment during construction and warranty period, (7) extension of the project duration and budget increase.
- After detailed analysis of the projects and the gathered information, the frequency of occurrence of problems in the analyzed projects was represented in percentage (Table 1).
- The impact of each problem on the project was defined by using expert evaluation method and applying AHP (Analytic Hierarchy Process) that is one of available decision-making methods [8]. Experts were selected from practitioners and academicians related to project management. They were asked to compare and to evaluate the identified problems by using nine-point scale, shoving the intensity of importance. Survey results were treated according to Saaty's [8] methodology and presented in Table 1.
- After analyzing statistical data and expert evaluation results, significance of problems was estimated. Influence to project scores was normalized and multiplied by frequency of occurrence of problems. Problems significance was expressed in percentage (Table 1).
- Data structuration was performed, then tools and actions that could help to prevent the problems and to increase the effectiveness of the projects were analyzed. As a result, proposals related to BIM uses were introduced to overcome the major problems that are faced while implementing reconstruction projects of old buildings.