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Application of Critical Chain Management in Construction Projects Schedules in a Multi-Project Environment: a Case Study

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Abstract

The aim of this paper is to present the results of a comparative analysis of the application of the critical chain project management and traditional scheduling established according to the critical path method for the programme of the construction of several marinas in north-western Poland. Obtained results are of a significant importance as their possible application by building contractors or investors. Besides, they might be useful for further research connected with the effective management of a set of projects.

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Keywords: critical chain; construction project; resource constrained project scheduling; multi-project environment

1. Introduction

The ability to manage multiple projects in the dynamic and competitive modern economic environment becomes a key competence which may have a significant impact on building a company's competitive advantage. Most companies in the construction industry operate in a multi-project environment, generating revenue from projects whose implementation is a result of sales activities and obtaining external orders. The subject of managing multiple projects consists in project programmes and portfolios. Projects which are implemented simultaneously yet independently of each other and share the resources necessary for completion create a project portfolio [1]. Achieving synergy and strategic objectives of an enterprise requires here a skilful overcoming of difficulties with regard to the selection of projects, corresponding company strategies, and optimisation of the use of resources by individual projects. While the distinguishing feature of the programmes is the common objective of the group of projects, the

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achievement of which would not be possible under separate implementation of individual projects. The dominant problems in managing a programme are related to the coordination of individual elements of the schedules with the programme implementation plan [2].

One of the crucial decisions conditioning effective management of multiple projects is to determine an optimisation strategy. The deciding factor as to whether the project portfolio or programme has been designed optimally may be a particular resource, project risk or timeliness. Time is a particular type of resource. It cannot be stored, therefore in the management of individual projects as well as a portfolio of projects a lot of attention is paid to scheduling the undertakings and monitoring their implementation with regard to completion within a specified timeframe [3].

2. Research Objective and Methods

The aim of this article is to present the issue of scheduling construction undertakings implemented in a multi-project environment with the use of the critical chain method. The second objective of the article is to present the results of a comparative analysis of application of the critical chain project management (CCPM) and traditional scheduling established according to the critical path method (CPM) for the programme of the construction of several marinas in the area of north-western Poland. The research questions are: how can the implementation of the theory of constraints through the critical chain method increase the efficiency of scheduling construction undertakings in a multi-project environment.

The adopted research methods included a review of literature and case study, including analysis of contract documentation. As part of the case study, a comparative analysis of the schedules prepared in the traditional method and in line with the assumptions of the critical chain for an investment programme related to the construction of a network of ports and marinas has been carried out.

Relatively few publications have been devoted to date to the issue of multiple projects management in the construction industry. The analyses and studies in this field are related mainly to high technology industries, in particular to the fields focused on the development of new products [4]. Meanwhile, dynamic changes strengthening the multi-project phenomenon have been taking place in the economic environment of enterprises for a long time now. An individual approach and focus on client's needs as well as the pressure of capital markets on creating the enterprise's values implicate the need to increase operational efficiency, achieved mainly through the reduction of costs and the increase of effectiveness of resources use [5].

3. Background

Multiple projects management is characterized by the complexity of the issues related to planning, organizing, coordinating and controlling a set of projects simultaneously. Thiry [6] defines the management of the project portfolio as a process of analysis and allocation of resources between organizations, projects and programmes, conducted in order to achieve the organization's objectives and maximize value for stakeholders. In this dynamic process of decision-making the set of active projects is constantly reviewed and updated [7]. The three main questions that need constant verification of answers in managing a set of projects can be formulated as follows [8]:

- whether the right projects are implemented in the context of the strategic development vision
- whether the expenditure incurred on projects are strategically justified
- whether the organization has the resources necessary for the implementation of these projects.

A comprehensive multi-project environment is formed mainly by two factors: uncertainty and links between projects. The notion of uncertainty brings another factor crucial for the management of a single project or a set of projects, i.e. risk. The common feature of the management of multiple projects is the necessity to solve the conflict of resources resulting from the links between the projects. Most frequently, the critical resource are people – employees having specific qualifications [9]. The managers focus on the allocation of resources and their ongoing relocation, aiming to solve the problems at the interface of projects on a daily basis. The resource allocation syndrome as a common feature of management in a multi-project environment results primarily from inadequate planning, the indication of which is among others giving priority to projects post factum (*after-the-fact prioritisation*). Also, the