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ScienceDirect

Procedia Engineering 196 (2017) 746 – 753

Procedia Engineering

www.elsevier.com/locate/procedia

Creative Construction Conference 2017, CCC 2017, 19-22 June 2017, Primosten, Croatia

# A Predictive Model of Contractor Financial Effort in Transport Infrastructure Projects

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**Abstract**

With high complexity, duration and size, the transport infrastructure projects are very often delayed and over budget. One of the frequent reason these type of construction projects behave in such way is the lack of liquidity at the construction company level. On one hand, due to the aggressive competition, the contractors participate in tenders with smaller prices, on the other hand, they confront with a large number of risk events in the execution. All of these have tremendous effects on the company cash flow, leading to delays in project execution, over budget, penalties and loss of opportunities.

Different type of transport infrastructure projects are characterized by certain shapes of contract value distribution in time, determined by their complexity, technical and organizational aspects. The paper propose a simplified model to quantify the contractor financial effort using a linear functions for several types of transport infrastructure projects. Six real projects implemented in Romania are analyzed considering different criteria which affects the contractors' financial effort and help to validate the model.

The goal of the research is to establish a relationship between the contractor financial effort and project technical, organizational and contractual aspects, leading to a decision making tool both in the biding phase and in the execution phase.



Peer-review under responsibility of the scientific committee of the Creative Construction Conference 2017

*Keywords:* construction projects cash flow; financial management; project scheduling; regression model.

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Peer-review under responsibility of the scientific committee of the Creative Construction Conference 2017
doi:10.1016/j.proeng.2017.08.003

## 1. Introduction

Due to their complexity and long duration, the transport infrastructure projects are often delayed. In addition, the aggressive competition in construction sector leads the contractors to participate in tenders with smaller prices, increasing risk of exceeding the project budget. The difficulties in project financial management have negative impact over across the entire company. The failure of a construction company is often perceived as being a consequence of the failure of one or more of its important projects.

Insolvencies are more frequent in the construction sector than other industries [1,2]. Altman [3] presents the failure rate in the UK, from 1971 to 1980. The comparisons with USA, Japan, West Germany and Australia indicate that United Kingdom had one of the highest failure rates in the world in 70s and early 80s. Based on data collected for the first six months of 2016, Coface performed a sector risks assessment [4], taking into account five financial indicators: turnover, profitability, the net debt ratio, cash flow and claims. The risks in construction sector in North America and Central Europe were assessed as moderate, in Latin America as very high, while in Western Europe, Middle East and emerging Asia the risks were evaluated as high. A study made for Romania [5] show that in 2011-2015, in Romania, there were registered 105.545 insolvent companies, in average 20,000 new insolvent companies per year. In Romania, the number of insolvencies at 1000 active companies is 40, which is nearly four times bigger than in Central and Eastern Europe. Only 2% - 3% of the Romanian insolvent companies were reorganized, which represents ten times less than European average for developed countries. The sectors that are most affected by the insolvency phenomenon, in relation with the number of active companies, are manufacture of textile products and constructions.

Several studies investigate the factors of the financial failure of construction companies. [6,7,8,9,10]. Usually, there are many causes, acting simultaneous, which are leading to financial failure of construction companies. Among these causes, the inadequate financial management, especially a poor cash flow management is considered as one of the most important [7,11,12]. Argenti [6] identified four main characteristics of insolvent companies: the lack of cash flow forecasts, no costing system in place, no budgetary control, and no asset valuation. It is also possible that a firm is pulled into insolvency by the failure of another firm. This “domino theory” [8] is applicable when the contract clauses and payment systems allows significant payment delays. Using a multiple regression model for explaining the construction insolvency in the United Kingdom, Lowe tested the following insolvency factors: profitability (return on capital invested); cash flow (working capital requirements, borrowing, domino theory); credit (cost of credit, availability of credit); fluctuating demand (changes in demand). Another two factors, meaning competitive tendering (tendering and pricing strategies) and management problems could not be tested using the available data. It was found that the cash flow related variables have a big contribution for explaining construction company insolvency. Arditi, Koksal and Kale investigated the factors of construction company failure, in USA, for the period from 1989 to 1993 [13]. They identified budgetary and macroeconomic contextual issues as being responsible for 83% of the construction company failures. Based on these findings, several failure prediction models were defined, mainly based on the cash flow forecasts.

The determination in advance of the inward and outward cash flows, together with their combined effect on the project cash balance represents the cash flow forecast. The cash flow forecasting models should take into account the specific features of the activity in construction sector. The characteristics of construction projects are presented in table 1.

Table 1. Characteristics of construction projects

| Characteristic | Description |
|---|---|
| Project orientation of the construction project | The construction company activities are performed in projects. For this reason, usually the cash flow management starts at project level and it is completed at company level, in a multi-project environment, by integrating all/some of the most important project cash flow data [14]. Sometimes, the cash flow forecasting is performed only at the company level, by using variables defined at this level, such as: market-related variables, credit conditions variables etc. The forecasts of individual project cash flows derived from cumulative cash flow profiles at company level are usually invalid [15]. |
| Significant payment delays | Construction companies experience significant payment delays during project implementation. Sielewicz [16] shows that Polish companies are experiencing in our days an average payment delays of 51.5 days, |