

# AN EMPIRICAL ANALYSIS OF OVERHEAD COST MANAGEMENT IN THE CZECH CONSTRUCTION INDUSTRY

Lucie HERMANOVÁ, Tomáš HANÁK

**Abstract:** Overhead costs are considered to be an important part of cost management in companies. This research aims to address the ways in which overhead costs are managed in the specific environment of construction. The Czech Republic is selected as the study area in order to give answers to several research questions. Data collected through a web-based survey among 112 respondents are evaluated e.g. in relation to the use of various costing methods, frequency of costing updates or in relation to the companies' competitiveness. The results presented in this paper have an ambition to serve not just as a contribution to the current body of knowledge, but the managerial implications resulting from the analysis performed and the ensuing discussion could be helpful especially for practitioners, i.e. the cost managers responsible for estimating the products/works/services properly, and they could also contribute to maintaining and improving companies' position on the market.

**Keywords:** company; construction; management; overhead costs; survey

## 1 INTRODUCTION

Alongside time and satisfaction, costs are among the principal performance indicators for construction projects [1]. Costs are crucial both for the client and the contractor: the client wishes to get the final output of a construction project at the lowest possible cost, while the contractor is motivated to satisfy the client and get an adequate profit. Therefore, on the one hand, the contractor is motivated to negotiate a reasonable contract price, and on the other hand, he seeks to reduce his own costs in order to maximize profit. The calculation of the unit price of production consists of the direct cost calculation plus the overhead costs (OHC) and profit [2].

The amount of direct costs is dependent on the scope of works, unit prices of materials, wage tariffs and costs of machinery usage, and can be easily planned in a detailed way. However, a proper allocation of overhead costs to individual contracts is a challenging issue. Taking into consideration that OHC can be considered as a factor of the company's competitiveness [3], it is obvious that overhead costs should be managed adequately in order for the company to remain eligible to participate in tenders with acceptable prices.

OHC are defined by Janani et al. [4] as costs that are not a component of the actual construction work but support the main work. Accordingly, administration staff wages, the depreciation of fixed assets or acquisition and operation of IT and mobile devices are among the typical OHC items.

An accurate estimation of OHC should be supported by a detailed cost accounting enabling the required analysis. From a theoretical perspective, different approaches have been presented to support the OHC estimation, e.g. approaches based on neural networks [5, 6], ABC approach [7] or earned value [8]. OHC management should also take account of the fact that some cost items are of a variable or fixed nature, i.e. are or are not, respectively, dependent on the volume of production. This issue was addressed by

Banker et al. [9], who claim that OHC are not driven by production volume but by transactions resulting from production complexity.

Taking into consideration that the construction process is usually accompanied by a high level of uncertainty and complexity, and that a high number of stakeholders are involved [10], the company should also consider whether all the works will be implemented using its own capacity, or if employing subcontractors is more advantageous. Taking into consideration that subcontractors and general contractors have an important influence on the functioning of a construction company [11], the decision to outsource will also influence the extent of overhead costs in a particular contract.

Based on a review of appropriate literature, it can be said that OHC is a focus for many researchers, especially in terms of construction projects. For example, Chan has explored the principal factors affecting construction project overhead expenses [12], Becker et al. addressed the predictability of construction project outcomes through the intentional management of indirect construction costs [13] and Plebankiewicz and Lesniak presented their research on defining and calculating overhead costs and profit by Polish contractors [14].

The issue of OHC management becomes more important especially in the highly competitive environments such as tenders using electronic reverse auctions [15]. At a high price pressure, i.e. where it is no longer possible to reduce direct costs, OHC represent potential additional room for a tender price reduction.

### 1.1 Research aim

Based on the literature, it can be reasonably claimed that OHC management counts among the important managerial tasks in the construction sector companies. Therefore, the present research aims to contribute to the current body of knowledge by performing an investigation

within the Czech construction sector in order to analyse the selected managerial practices relating to OHC management in companies.

## 1.2 Research questions

Following the above-defined research aim, three research questions were formulated.

- The selection of a suitable costing method can be considered an important prerequisite enabling proper OHC evaluation. As there are several methods available, the first research question seeks to establish the most frequently used costing method.

RQ1: Which is the most frequently used costing method?

- Updating OHC calculation is important in relation to providing outputs that reflect the current state of the company. It might be interesting to find out whether the size of the company affects the frequency of OHC calculation updating.

RQ2: Is the size of the company affecting the frequency of OHC calculation updating?

- OHC can be divided into several subcategories to provide more detailed evidence and cost management.

RQ3: Do companies use OHC sub-categories?

## 2 METHODOLOGY

A web-based survey was used to collect the data in the studied area representing companies active in the Czech construction sector. Data was collected from April 2015 to May 2016. The content of the survey is divided into three sections containing 16 questions. The first section concerns the general information about the surveyed companies (e.g. the scope of business, number of employees, place of business and the length of the company's existence on the market). The information provided in Section 1 ensures that the respondents are relevant to the study population. The number of employees has been used as a variable measuring the size of the company.

The second section examined various aspects relating to OHC management (e.g. the relative significance of OHC, costing methods used, distribution of OHC into sub-categories). The content delivered in Section 2 will allow answering the research questions.

The last section focused on the effect OHC have on the company's competitiveness by asking the respondents whether they agreed with the statement that OHC affect companies' competitiveness (estimated on a 5-point Likert scale). An additional question then examined the significance of OHC in comparison to other factors that influence competitiveness.

## 3 RESULTS AND DISCUSSION

### 3.1 Description of the study population

In total, 672 subjects (companies operating on the Czech construction market) were invited by email to

participate in this research. From this number, 112 subjects responded appropriately to the survey questions and submitted their answers to the examined topics, representing a 16.7 % rate of response. The majority of respondents (74.1 %) reported 15 years or more of activity on the market. Taking this result into consideration, it can be claimed that the study population represents a valuable sample. Similarly, an overwhelming majority of respondents reported that construction works belong to their core business.

Based on the Commission Recommendation [16], the number of employees was used to measure the size of the company ( $\leq 50$  a small,  $\leq 250$  medium, and  $> 250$  large company). Small companies were the most frequent category of respondents, followed by mid-size and large companies (63, 37, and 12 respondents respectively). A description of the sample with respect to the company size is given in Table 1.

**Table 1** Distribution of respondents regarding the size of the company

Size of company	Absolute frequency	Relative frequency
Small	63	56.3%
Mid-size	37	33.0%
Large	12	10.7%
Total	112	100.0%

This research faces a similar problem as other studies that take company size into consideration [17]. In particular, this relates to the uneven distribution of respondents within the categories, showing a higher representation of small companies as opposed to large companies.

### 3.2 OHC significance in a company

Respondents reported the significance of OHC to their company. This significance is assessed as a relative share of OHC on the company's total costs (Eq. (1)).

$$OHC \text{ significance} = \frac{\text{amount of OHC}}{\text{total costs}} \quad (1)$$

Outputs are presented at 10 % intervals (see Tab. 2). The total of 99 respondents replied to this question while other respondents did not provide this information.

**Table 2** Relative share of company OHC on total costs

Relative significance	Relative frequency
0 % - 10 %	28.3%
11 % - 20 %	47.5%
21 % - 30 %	12.1%
31 % - 40 %	7.1%
41 % - 50 %	3.0%
51 % - 60 %	1.0%
61 % - 70 %	0.0%
71 % - 80 %	0.0%
81 % - 90 %	1.0%
91 % - 100 %	0.0%

Almost half of the respondents (47.5 %) reported that OHC represented between 11 % and 20 % of the total company costs. Typically, OHC are between 0% and 30 %, and

indicating that OHC are considerably lower than the direct costs. The rate exceeded 50 % only in a couple of cases (2 companies). We attribute this to the fact that these companies focus mostly on delivering services rather than performing works.

### 3.3 OHC calculation

The next question in Section 2 asked about the companies' approach to OHC calculation. Specifically, companies reported whether they (a) used any specific method for an accurate OHC calculation, (b) used only approximate estimations, or (c) did not use any method or estimation. It was found that half of the population (50.9 %) approached OHC calculation responsibly, 29.5 % at least tried to make an approximate estimation of the costs, while the rest of the population (19.6 %) did not apply any method/estimation to OHC.

The next question inquired about the specific methods used for OHC calculation/estimation based on [18] and [19]. The only respondents who answered "Yes" or "Partially" to the previous question were asked this question. See the details in Fig. 1).

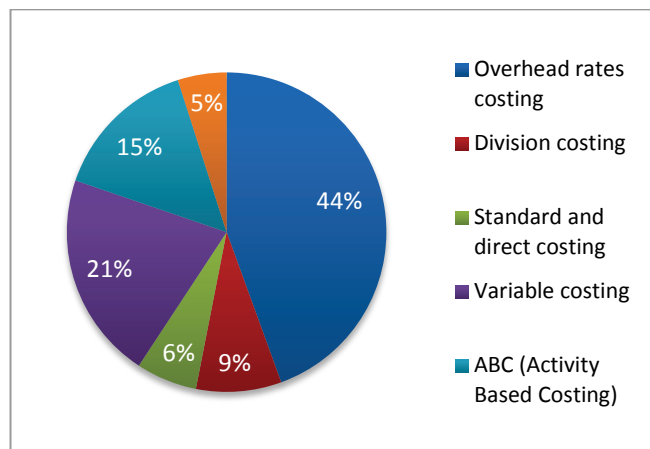


Figure 1 OHC calculation methods usage

Based on the data presented in Fig. 1, RQ1 can be answered as follows: The most frequently used method for OHC calculation in the Czech construction sector is the overhead rates costing method, followed by variable costing and activity based costing (ABC), where almost half of respondents (36 out of 81 respondents answering to this question) use overhead rates costing.

### 3.3 Updating OHC calculation

Having accurate input data for any calculation is crucial if actual outputs are required. Consequently, RQ2 asked how often such updates are made with respect to the company size (see the data in Tab. 3).

The results clearly show that the majority of the respondents (70 out of 112) update the OHC calculation annually; however, the preference to perform more frequent updates (monthly, quarterly or biannually) was reported in

some companies. In total, 14 companies reported that they applied some other approach (no updates or irregular updates performed if some major change in the company occurs). It is very important for companies to apply updates regularly; however, major one-off changes in the company must be taken into account sooner if necessary (e.g. a change of outsourcing policy for the delivery of works by sub-contractors, significant changes in the prices of substantial commodities purchased or a substantial change in the number of employees).

Table 3 Updating OHC calculation

Company size	Updating frequency				
	Monthly	Quarterly	Biannually	Annually	Other
Small	7	5	2	39	10
Mid-size	2	4	5	23	3
Large	1	2	0	8	1

The preference to update annually could be attributed to the fact that at the end of each year, financial statements are prepared and could then serve as an information source for OHC calculation updates.

Concerning RQ2, Table 3 indicates that there is no significant relationship between the OHC updates frequency and the company size. To support this statement, the data were tested using the chi-square test of independence. It should be mentioned that the application of the chi-square test of independence is more suitable if the data are more evenly distributed among the categories. However, the use of chi-square tests is not appropriate if any of the expected frequencies is below 1 or if the expected frequency is less than 5 in more than 20 % of the cells. This is why the categories "monthly", "quarterly" and "biannually" were merged into "more often than once a year" (MOTO) and the category "Other" was omitted. For the adjusted data (the MOTO and Annually categories) taken from Tab. 3, there is just one cell with the expected frequency below 5 (3 in the case of large companies and the MOTO category). From this perspective, the chi-square test of independence can be used. The data were tested with a 5 % significance level. For the chi-square test of independence, the null hypothesis assumes that the examined categorical variables are independent.

For a chi-square value of 0.368 with 2 d.f. (degrees of freedom), the  $p$ -value = 0.832. Because  $p > 0.05$ , there is not enough evidence to reject the null hypothesis concerning the independence of the examined variables. Therefore, the results support the assumption that company size does not affect the frequency of OHC calculation updates.

### 3.4 Details of OHC calculation

RQ3 aimed to establish the level of detail concerning OHC in terms of dividing OHC into sub-categories. Results show that the most frequent approach is to use a general OHC category without any subdivision (54 respondents), followed by the use of two sub-categories (47 respondents) and the use of three sub-categories (5 respondents).

This result is surprising because the two most common software solutions used in the Czech Republic for estimating the price of construction works commonly work with the subdivision of OHC into production OHC and administration OHC (i.e. two sub-categories). It appears that about half of the companies use a more detailed approach to OHC management with two or three sub-categories, while the rest only use one general OHC category. The remaining 6 companies in the sample do not keep track of OHC for calculation purposes.

Few companies reported the use of different OHC rates according to the subject of the contract. This is important because the structure of production OHC in particular can differ significantly, e.g. with regard to water supply systems, buildings or transport infrastructure projects. Therefore, it can be recommended that companies with a diverse portfolio of work/activities apply this approach.

None of the respondents mentioned that the value of the contract was taken into account for OHC management purposes. They do not seem to be concerned with the fact that for small contracts, the relative amount of OHC is higher than for large contracts due to the fixed and variable nature of the individual OHC items. Companies dealing with both large and small contracts (in financial terms) should therefore take this aspect into account in order to implement a corresponding calculation of contract prices.

### 3.5 OHC and competitiveness

In the final section of the survey, respondents were asked to give their opinion on the statement that OHC affects the company's competitiveness on a 5-point Likert scale where 1 indicates strong agreement and 5 indicates strong disagreement (see Tab. 4).

**Table 4** Relation of OHC and competitiveness

Response	Relative frequency
Strongly agree	55.3%
Rather agree	36.6%
Nor agree nor disagree	4.5%
Rather disagree	3.6%
Strongly disagree	0.0%

The data clearly show that an overwhelming majority of respondents (92.0 %) agree with the statement that OHC affect the company's competitiveness. If compared with the data in the Section 3.4, it appears that companies are aware of OHC significance but, simultaneously, they assume that OHC management on a general level (i.e. without the distribution into sub-categories) is sufficient for their purposes.

Finally, respondents were also asked to give their opinion on various competitiveness factors in order to get an idea of the significance they assigned to OHC. The overall management of the company was the most frequently mentioned competitiveness factor, followed by direct costs, manufacturing processes and techniques, with OHC being fourth.

These results confirm that OHC management is one of the key areas for construction companies to pay attention to.

## 4 CONCLUSIONS

The present research dealt with the issue of OHC management in the construction sector. By using a web-based survey, data from Czech companies were collected and evaluated in order to provide the experts and the professional community with a deeper understanding of various aspects relating to OHC management. In particular, the results revealed the significance of OHC within companies, the companies' approach to OHC calculation, the details thereof and the calculation update frequency. The results confirmed that OHC cannot be omitted as they affect the company's competitiveness on the market and, consequently, its ability to win contracts.

The research also faced several limitations. Firstly, although the study population provided insight into the opinions and practices of 112 private companies, its distribution in terms of company size was not well-balanced. Therefore, an extension of the dataset, especially in the category of mid-size and large companies, could enable a follow-up analysis which could potentially lead to additional interesting findings.

Furthermore, addressing OHC values in greater detail could be of interest. Such approach has the potential to assess the level of the companies' competitiveness in a quantitative way. This is one of the possible future research directions that could contribute to the current state of knowledge in the area of corporate OHC management.

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**Authors' contacts:****Lucie HERMANOVÁ, MSc.**

Brno University of Technology, Faculty of Civil Engineering  
Veveří 95, 602 00 Brno, Czech Republic  
hermanova.lu@seznam.cz

**Tomáš HANÁK, Associate Professor, PhD**

Brno University of Technology, Faculty of Civil Engineering,  
Institute of Structural Economics and Management  
Veveří 95, 602 00 Brno, Czech Republic  
Hanak.t@fce.vutbr.cz