Analysis of Information Technology Used in Construction Enterprises

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Abstract. Information technology represents an increase in use in every sector. The construction industry is a sector that produces large volumes of data. Their processing requires automation and systematization. Information technology is an essential tool for data processing. Relevant information is an important advantage in the digital economy. However, working with data and information is time-consuming, economically demanding. Based on this, the use of information technology is critical to implement in construction. This paper addresses the issue of using information technology in smelting companies. The research aims to analyse the use of information technology in construction companies. Information technology can save information processing time. They also have a positive impact on reducing costs in the long run. They also have a positive effect on productivity. The research seeks to quantify the use of information technology and to look for dependencies between research groups. The research works on the assumption that the use of information technology will be different between research groups. The size of the construction company, the use of foreign know-how and capital, and the construction activity, or the definition of the participant in the construction project, can be important in the results and determine differences in use. Differences and identify potential differences between individual research samples are based on the use of statistical tests. The Kruskal-Wallis test verifies the significance of the findings. The research sample includes 55 construction companies operating in Slovakia. These are mostly contractors, developers, designers and sub-constructors. The research involved large construction companies, as well as SMEs and micro-enterprises.

1. Introduction

The present time is based on a large amount of data [1]. Every day, a large amount of data is generated, which is the basis for the information period [2]. The volume of data grows geometrically every day [1,3]. All this, on the one hand, significantly increases the scope for better information. On the other hand, it requires higher demands on data processing [4]. This results in pressure to implement and use data processing technologies [5].

Data processing is a combination of data collection activities, storage, processing, data transfer to the use and sharing of data [1]. Data processing requires the implementation and use of information technology, which aims to automate and systematize processes. Several studies point to the benefits of using information technology [6]. These include saving time, reducing administrative costs in the long term, increasing employee productivity, and improving business management processes. Information technologies are devices that ensure the transfer of information and work with them [7]. These are
enterprise information systems, BIM technologies, controlling tools, and communication technologies that ensure the exchange of data and information [8].

Information technology is one of the critical tools for the administration and management of construction projects [9]. These information technologies can present an opportunity to increase the performance of businesses [10]. The field of construction is characterized by a large amount of data, complicated business and contractual relationships, many participants, and the uniqueness of projects [11]. Based on the established uniqueness and specifics, it can be stated that effective management is key to the success of not only projects but also construction companies. The implementation and use of information technology are one of the tools to ensure continuous performance and quality results [12].

This is based on some factors that may affect the degree of implementation and use of information technology. Based on the analysis and communication with experts and project managers, a narrow range of factors has emerged that may be related to information technology in construction companies. The size of the company is often debated. In our opinion, this first researched factor may influence the level of use of information technologies in construction companies. This consideration is based on the assumption that a larger company has more financial resources and can afford more investment in information technology.

Another assumed factor is the use of foreign capital. A company that has ties to foreign countries by using know-how or foreign financial capital is probably more inclined to innovation and implementation and thus also to the use of information technologies. Specific differences are also expected from the diversity of participants in construction projects. Therefore, this is another factor in question that is believed to have differences. The aim of this research is to analyse the use of information technology in construction companies and analyze these factors.

2. Methods and Research Sample
The research focused on analysing the use of information technologies was carried out on a sample of Slovak construction companies. Data collection was ensured through an online questionnaire. A total of 1276 respondents (participants in construction projects) were contacted. 125 respondents participated in the questionnaire survey, but only 55 companies filled in a complete questionnaire, usable in our research, representing a return of 4.31%. Given the scope of the examined areas in the questionnaire survey, the return at the level of 4.31% can be considered good. The research involved construction companies operating on the Slovak construction market. It was a group of developers, contractors, subcontractors and designers.

Figure 1. The research involved construction companies operating on Slovak construction market.
The data processing was based on the analysis of research data and the identification of factors that are expected to be related to the use of information technology. Based on the distribution of the research sample, a Kruskal-Wallis test was determined to verify the statistical significance of the research results.

Before that, however, statistical averages for individual groups and contingency tables and abundances were made. Based on these data, selected factors were monitored. Based on a thorough theoretical analysis, hypotheses were built, and three research factors were selected, based on which it was possible to divide the research sample.

| Table 1. Hypotheses |
|---------------------|
| Factor | Kruskal-Wallis anova | $p$ |
| H$_1$: The size of the enterprise has an impact on the use of information technology in the management of construction enterprises |
| H$_0$: The size of the enterprise does not affect the use of information technology in the management of construction enterprises |
| Enterprise size | |
| H$_1$: The use of foreign capital in the company impacts the use of information technology in the management of construction enterprises |
| H$_0$: The use of foreign capital in the company does not impact the use of information technology in the management of construction enterprises |
| The use of foreign capital | |
| H$_1$: Participant status in a construction project impacts the use of information technology in the management of construction enterprises |
| H$_0$: Participant status in a construction project does not impact the use of information technology in the management of construction enterprises |
| Participant of CP | |

3. Results and Discussion
The level of use of information technology differs in the individual phases of a construction project. To summarize the results, it is appropriate to consider the factors that were also monitored at individual stages. There was a presumption of impact or a certain degree of dependence on the use of the selected type of technology. Based on the established hypotheses in using selected groups of technologies, statistical significance tests were performed.

**Verification of hypothesis:** The size of the company has an impact on the use of information technology in the management of construction enterprises.
H₁: The size of the enterprise has an impact on the use of information technology in the management of construction enterprises

H₀: The size of the enterprise does not affect the use of information technology in the management of construction enterprises

One of the factors that are assumed to affect the level of use of information technology in managing construction projects is the size of the construction company. Large companies have stronger financial security, and the survey shows that they invest more in information technology. Medium-sized enterprises use information technology to a lesser extent than large enterprises. Large companies have made extensive use of new, progressive technologies such as smartphones and tablets to communicate. On the contrary, SMEs have used traditional and long-available technologies, such as mobile phones, PCs and laptops. There was also a difference in the use of software applications that allow communication itself. Large companies used them to a greater extent than medium and small construction companies. The use of IT was higher in large enterprises (3.71). The level of use of IT in other companies was very similar. It oscillated at 3.32. Large companies have widely used ERP systems mainly connected with the economic management of construction projects and Controlling systems for tracking and drawing costs. Business Intelligence tools have been widely used to support decision-making. When designing and implementing construction projects, SMEs used ERP systems, Business Intelligence tools and BIM to a minimal extent. The use of budgeting and costing software as well as scheduling programs was similar in all companies.

![Figure 2. The use of information technology by enterprise size](image)

**Verification of hypothesis:** The use of foreign capital in the company impacts the use of information technology in the management of construction enterprises

H₁: The use of foreign capital in the company impacts the use of information technology in the management of construction enterprises

H₀: The use of foreign capital in the company does not impact the use of information technology in the management of construction enterprises
Another factor that is assumed to affect the level of use of information technology in managing construction companies is the majority owner of the company. In other words, whether the company uses Slovak private capital or foreign capital primarily. Based on several types of research abroad, mapping the current situation in Slovakia, the assumption was made that construction companies that use foreign private capital make greater use of information technology than companies with Slovak private capital.

The level of use of information technologies confirms the established trend that construction companies with Slovak private capital use selected technologies for construction project management at all times to a lesser extent than construction companies with foreign capital. Enterprises with foreign capital at the rate of 3.43, enterprises with Slovak capital achieve a utilization rate of 3.17.

This can be associated with several factors. One of them is better financial security from abroad, the effort and pressure of a foreign parent company to minimize costs and automate processes, as well as corporate culture. Furthermore, it is the pressure of the parent company abroad to communicate in a selected form. These companies make extensive use of applications and other software solutions for communication using an Internet connection. The priority is to reduce the cost of communication, which is cheaper than by calling abroad. Enterprises with foreign private capital make greater use of DMS systems and cloud tools for exchanging and storing documents. On the contrary, companies with Slovak capital are more conservative and have often expressed concerns about data and documents' security, especially when using cloud services. Corporate servers are used to a greater extent.

**Figure 3.** The use of information technology by use of foreign capital

**Verification of hypothesis:** Participant status in a construction project impacts the use of information technology in the management of construction enterprises

\[ H_1: \] Participant status in a construction project impacts the use of information technology in the management of construction enterprises

\[ H_0: \] Participant status in a construction project does not impact the use of information technology in the management of construction enterprises
Another of the examined factors is the influence of the construction project participant on the level of use of information technologies. This factor is critical when analysing the results for individual phases of construction projects. Based on the fact that different participants in a construction project have different activities and tasks and different interests, it is likely that their behaviour and use of information technology are similar.

More critical or more excellent informative value is ITs partial results during the construction project's phases. From a contextual point of view, it is possible to specify greater use of CAD software by designers and architects. It is similar in the use of BIM. Investors and developers make greater use of complex ERP systems and tools to support Business Intelligence decisions. Major suppliers and subcontractors make extensive use of Controlling systems for tracking, planning and pumping costs. Differences are also noted in the use of specific technologies. Implementing companies (main contractor and sub-contractor) mainly use the telephone and classic tools for communication. In most cases, investors and designers use more advanced software tools.

Designers make extensive use of cloud solutions, and on the contrary, suppliers are more conservative in this. When it comes to financial documents or information, all participants are conscientious and use cloud solutions to a minimum.

Table 2 describes the Kruskal - Wallis test to examine the statistical significance of the influence of selected factors on the use of information technology. When examining the impact of business size, information systems reached $p = 0.0499$. It follows that: $H_0$ The size of the enterprise does not affect the use of information technology in the management of construction enterprises was rejected at the level of significance $\alpha = 0.05$. Therefore, it can be stated that: The size of the company has an impact on the use of information technology in the management of construction companies.

When examining the connection between the use of foreign capital and the use of information systems ($p = 0.0489$), it follows that at the level of significance $\alpha = 0.05$ it is possible to reject $H_0$: The use of foreign capital in the company impacts the use of information technology in the management of
construction enterprises and state that: Participation of foreign capital in company has an impact on the use of information technology in the management of construction companies.

When monitoring the relationship between the definition of the participant in the construction project and the use of information technology, $p$ reached the value of 0.2346, which cannot be reached unambiguously based on the set level of significance $\alpha = 0.05$. The trend also shows the relationship of this factor with the results, but this hypothesis cannot be concluded. Thus, it can be stated that this factor has an impact on the use of information technologies.

Table 2. Kruskal-Wallis anova

| Factor                  | Kruskal-Wallis anova. $(N)$ | Kruskal-Wallis anova $p$ |
|------------------------|-----------------------------|--------------------------|
| Enterprise size        | 55                          | 0.0499                   |
| The use of foreign capital | 55                        | 0.0489                   |
| Participant of CP      | 55                          | 0.2346                   |

4. Conclusions

The use of information technology can have an impact on the success of construction companies. Several studies confirm the link between the use of information technology and success. It is also considered one way to ensure and set up efficient processes and systematics when working with information and data. This research examined the factors that are thought to influence the use of information technology. The analysis of the use of information technologies in construction companies brought a view and conclusions mainly on the three examined factors, namely the size of the company, the use of foreign capital, and the participant of the construction project. Based on research data and statistical processing and tests, the following research conclusions can be drawn. The research confirmed that the size of the company and the use of foreign capital influence the rate of use of information technologies in construction companies. On the contrary, the third factor examined did not confirm this assumption.

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