

## Use of communication technologies in document exchange for the management of construction projects

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### Abstract

Information and communication technologies represent a set of people, processes, technical and software tools providing collection, transport, storage and processing of data for distribution and presentation of information. Particularly communication systems are the main tool for information exchange. Of the other part, these technologies have a broad focus and use. One of them is the exchange of documents in the management of construction projects. Paper discusses the issue of exploitation level of communication technologies in construction project management. The main objective of this paper is to analyze exploitation level of communication technologies. Another aim of the paper is to compare exploitation level or rate of document exchange by electronic communication devices and face-to-face communication.

**Key words:** information and communication technologies, document exchange, construction project management.

### 1 Introduction

In recent years, the nature of the construction industry recorded a few changes. Change people's minds, as well as their requirements for building structures are different [1]. The pressure on the time of construction is greater than in the past. Young people prefer a different way of life. Demand for materials is different. That's why they make extensive use of new advanced materials. This required a new approach in the construction industry. Responses were modern methods of construction [2]. Modern construction methods and new materials are not the only improvements in the construction industry. Construction project management is also different than in the past. New information and communication technologies (ICTs) are widespread for the management of all projects [3]. New information and communication technologies have contributed to the increased demands on communication technologies and exchange of documents in project management [4]. This was the reason for the implementation of ICTs in construction. The importance and use of information and communication technologies can be measured by the degree of exploitation. The term "Exploitation Level" is set to measure the use of ICTs in every field. Use of

communication technologies for the purpose of the documents exchanged rapidly increases. The reason is the savings in the electronic document exchange.

## **2 Problem statement and theoretical background**

In construction projects and companies exist various types of information and communication technologies (ICT), such as hardware or business software. The basic question is what the communication technology is and what features should include the effective communication technology. Information and communication technologies represent a set of people, processes, technical and software tools providing collection, transfer, storage and processing of data for distribution and presentation of information [5]. Every communication systems (communication technology - CT) are currently based on the use of information and communication technology. Looks at communication technologies are various. In its narrowest perception of communication technologies are hardware and software solution for processing of information for decision support, control and project management [6].

In recent years, our environments are driven by changes in society, fast growth by science, technology and knowledge development [7]. Implementation of communication technologies in enterprises is relatively difficult process. Many studies it appears that management of large projects increasingly using information and communication (ICT) systems in general [8]. According to this study, the level of use (exploitation level) of ICTs is at the level of 4.11. Another survey points directly to the use of communication technologies in management process [9]. Many studies discusses the issue of the use of information and communication technologies. The rate of communication technology use (also known as a exploitation level) is essential for comparing and analyzing the status of use of communication technologies. Exploitation level of CT is also necessary to monitor for the management construction projects. Surveying of this activity is an essential parameter for determining the rate of CT use.

## **3 Methodology, aims and research sample**

### **3.1 Methodology**

Exploitation level of communication technologies is an essential tool for comparing the use of ICT in different areas. Respondent states on a scale from 1 to 5 (Likert scale) "exploitation level" in areas of document exchange. That includes follow areas:

- Collection and transmission of documents
- Document sharing and storage
- Modification and working with documents

The first step was the definition of CT to the process of document exchange. Communication technologies are already determined by previous surveys. On that basis, it was specified following communication technology:

- Personal computer (Desktop)
- Notebook / Laptop

- Smartphone / cell phone
- Tablet
- Fax
- Applications supporting communication (such as Skype, Viber, Hangouts other software applications and platforms for the transmission of documents and communications).

The obtained values were averaged for every area. The result was the final exploitation level for each technology. The result of the whole it was set of final exploitation level for document exchange. Rating scale is as follows:

- 1-2 (very low level of use)
- 2.01-3 (low level of use)
- 3.01 to 4 (high level of use)
- 4.01 to 5 (very high level of use)

These results should be interpreted. Within the descriptive statistics were performed statistical tests. In order to trace the behavior of construction enterprises by size, participating in construction projects, it was necessary to select a test in which can be observed differences between groups. In the research we used nonparametric test (for ordinal variable or Cardinals, if outside the parameters), called Kruskal-Wallis test.

### **3.2 Objectives of research**

The topic and the aim of this paper are closely related to the issue of the use of information and communication technology and knowledge technology in the management of construction projects. Just the use of ICT in the management of construction projects and their impact on cost reduction is the issue of my dissertation. Theoretical analysis and detection of exploitation level of the different technologies is one of the objectives of my dissertation. Between these ICT include communication system, such as carrier and comprehensive solution for communication of construction project management. This paper represents partial research and partial results of a large research processed within the dissertation. Also the objectives set for this contribution partial objectives for dissertation. On this basis, the research objectives were set for this part of the research as follows:

- The main objective of this paper is to analyze exploitation level of communication technologies for the purpose of document exchange,
- Analyze these results, depending on the size of the enterprises,
- And analyze and compare exploitation level or rate of document exchange by electronic communication devices and face-to-face communication. Compare these results and statistically verified, depending on the size of the enterprise.

### **3.3 Research sample and data obtaining**

The questionnaire survey featured data collection using the online questionnaire. Link to the online questionnaire was together with an explanatory covering letter sent to respondents in electronic form. The questionnaire titled was created as a system of targeted questions designed for contractor and sub-contractor of construction processes, planners and architects.

In order to verify the questionnaire, mainly to test the formulation of clarity of individual items, it was a sample of 42 companies and projects, realized within pre-research. The pre-research is the basis for verification of selected research sample for research in the realization of a dissertation thesis.

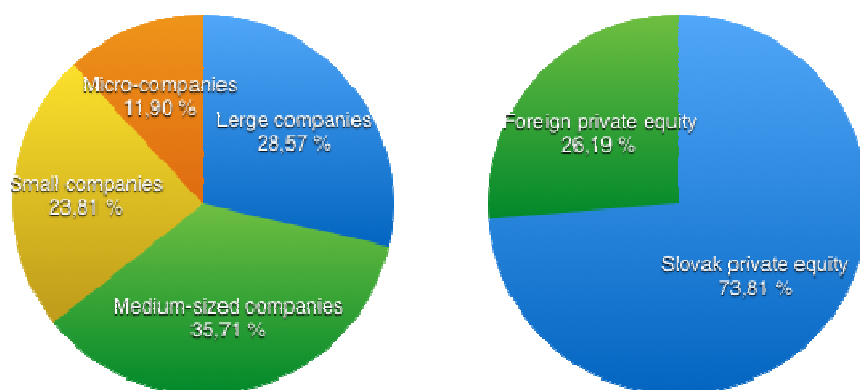


Figure 1, 2: Characteristics of the research sample by size of construction enterprise (1) and by majority owner of construction enterprise (2)

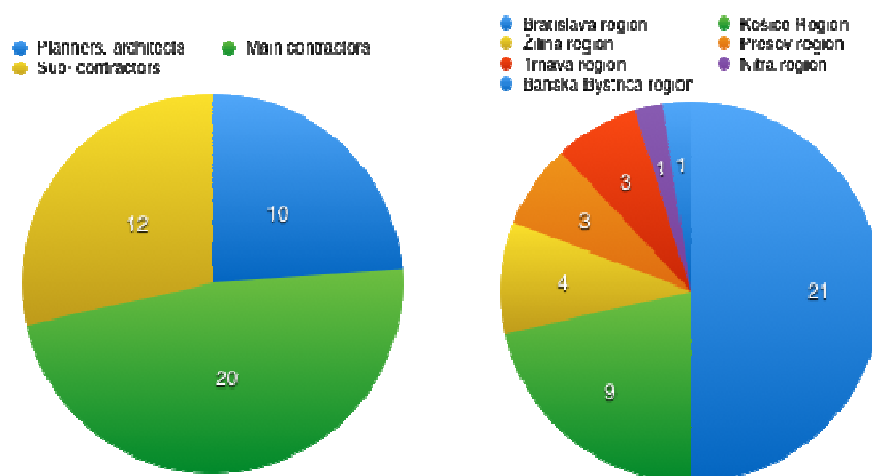


Figure 3,4: Characteristics of the research sample by participants of construction project (3) and by region (4)

Choice of subjects in the research sample was not limited by other criteria such as occupation of the enterprise, region or company size etc. It can be concluded that the fundamental requirement of ensuring representativeness, the survey sample was complied with.

Main characteristics of research subjects in terms of the size of the company we can see down. Participated in the survey and a questionnaire completed by 11.90% micro-companies, 23.81% small companies, 35.71% medium-sized companies and 28.57% large enterprises (Figure 1).

## 4 Results and discussion

Exploitation level of CT is a measure of the use of selected technologies for the purpose of exchange of documents in the management of construction projects. Use of communication technology is primarily for the purpose of communication and coordination of construction projects. It can therefore be expected that these technologies will be used for document exchange to a lesser extent than for the actual communication. More detailed results can be seen in Figure 5.

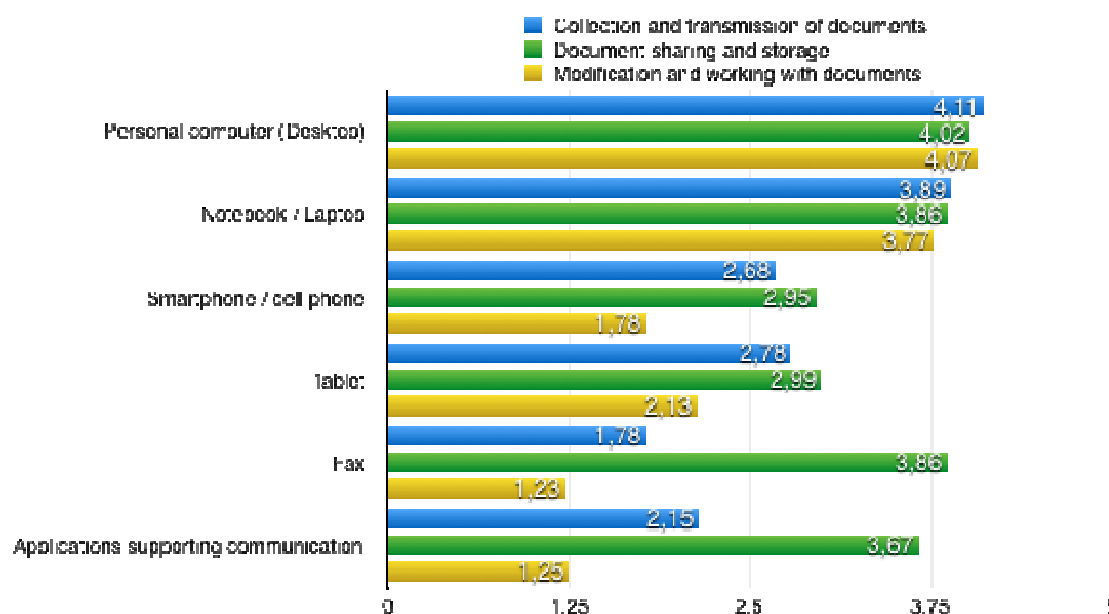


Figure 5: Exploitation level of choose communication technology for document exchange in choose activities

Personal computer (Desktop) is probably the most widely used tool for communication and coordination of all project activities at all. For the purpose of exchanging and working with documents it is one of the basic tools. For the needs of collection and transmission of documents represents a measure of the use value of 4.11. Document sharing and storage represent exploitation level at 4.02.

Very similar results were also recorded in the use of notebooks for that purpose. Collection and transmission of documents on notebooks represent value of 3.89. Similarly, document sharing and storage reaches a value of 3.86. Modification and working with documents on notebook represent value of 3.77. These are relatively high and good results. Therefore, we can conclude that these technologies are heavily used for such purposes.

Other results we have seen with other technologies. For example, exploitation of Smartphone for purposes of document exchange it is relatively low. Document sharing is a relatively good level, but the modification and working with documents and collection and transmission rate is very low for smartphones.

The lowest values were recorded in the use of the fax. At the time the Internet is a relatively outdated solutions. Obviously, for this purpose there are used modern technologies more. Exploitation level for tablet is greater. Similar results recorded applications for supporting

communication (for example Skype, Hangouts and so on). These tools also are not primarily intended for the exchange of documents. A very interesting phenomenon represents sharing of documents, which is significantly higher compared to other activities.

The total exploitation level for each technology is as follows (Figure 6). The total exploitation level for the personal computer was determined to be 4.07. This represents the highest value. The high utilization rates were also recorded in notebooks. Fax recorded the lowest value, only 2.3. The final exploitation level was set at 2.94. This indicator is in the range from 2.01 to 3, it represents a "low level of use". It must be said that it is near the border with the use of good quality.

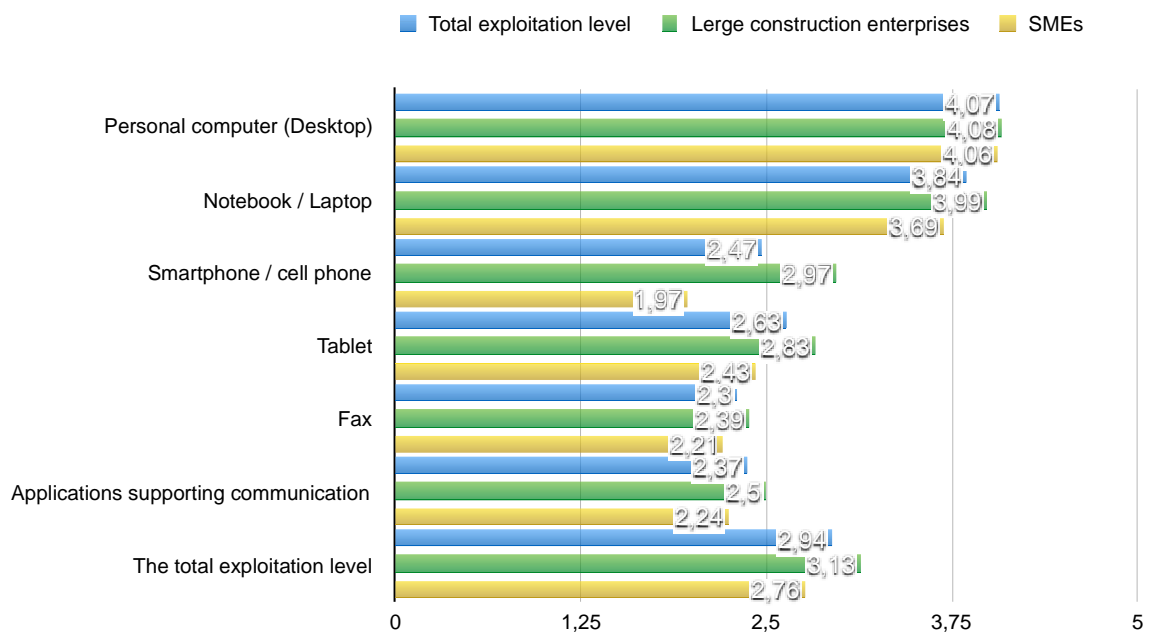


Figure 6: Comparison of final exploitation level and exploitation level of choose communication technology for document exchange according size of enterprises

Table 1: Kruskal - Wallis test (Communication technologies) - by size of enterprises

<i>Depend: Communication technologies</i>	<i>Kruskal- Wallis ANOVA based on order: Communication technologies</i>	
	<i>Indepedent variable: Size of enterprises</i>	
	<i>Kruskal - Wallis test: <math>H(3, N=42) = 9,367283</math> <math>p = 0,246</math></i>	
	Code	The average order
<b>Large construction enterprises</b>	1	24,06250
<b>Medium-sized construction enterprises</b>	2	32,02635
<b>Small enterprises</b>	3	29,59999

Based on the Kruskal Wallis test, it can be stated that on the significance level of  $\alpha = 0.05$ , use of communication technologies for different activities depends on the size of the enterprise.

Another aim of the paper was to compare the rate of exchange of documents electronically and face to face. Respondents were asked to state what use to a greater extent in the exchange of documents. The results further described in the figure 7.

In the picture 8 you can see that the use of electronic document exchange and face-to-face exchange is very similar. On the one hand, face-to-face document exchange represents the value of 3.26. Electronic document exchange represents value only 2.7. On the other hand, electronic document exchange was the most common value 4, face to face only the 3.

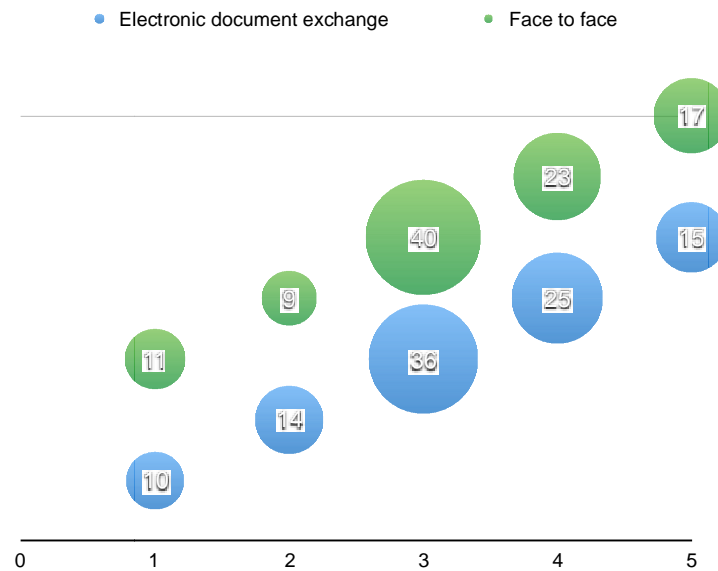


Figure 7: Use of electronic document exchange and face to face on Likert scale

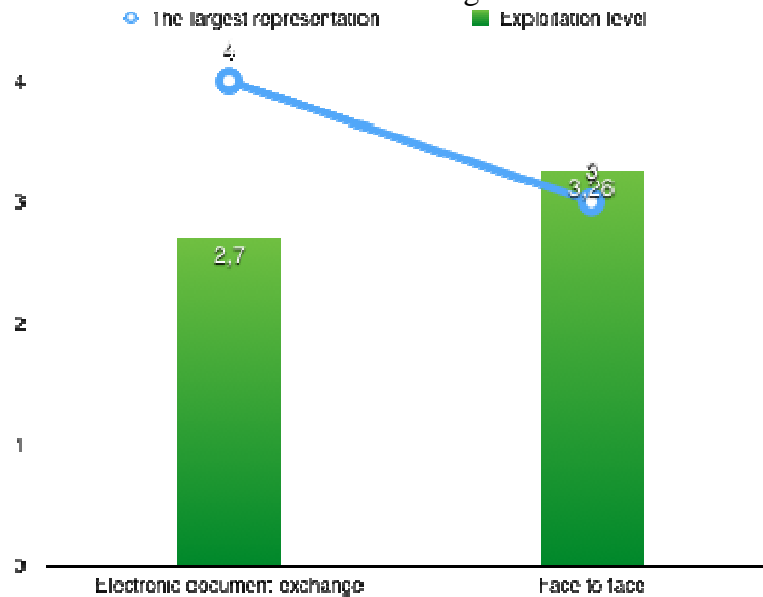


Figure 8: Use of electronic document exchange and face to face

## 5 Conclusion

Use of communication technologies for the purpose of exchanging documents can be analyzed from several perspectives. The main aim of this paper was to determine the final exploitation level of communication technologies. Based on the research results and the selected methodology, we can say that the use of such systems for the purpose is not high. On the other hand, the value of 2.94 is close intervals 3 and more. The value of 3 or more represents already a relatively good utilization rate of selected technologies. In any event, it can be stated that in this area include reserves. Despite of technology progress, document exchange largely takes place face to face. Within the research it must be said that the use of communications technology depending on the size of enterprises and it is statistically significant.

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