

THE SURVEY ON RISK AWARENESS DURING THE IMPLEMENTATION PROCESS OF BUILDING INFORMATION MODELING (BIM) IN THE CZECH CONSTRUCTION MARKET

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Abstract

The research presented in this paper deals with the survey, aimed at young civil engineers in Czech Republic and their awareness concerning Building Information Modeling (BIM) and risk management related topics. The survey questionnaire was created and presented to large amount of respondents. They answered few basic questions about possible connection of BIM with risk management in a construction company and they helped to identify some of the most important impacts of BIM implementation on hazards and chances (threads and opportunities) in construction business. Paper presents the first results of this research, which shows the importance of BIM for risk management and the importance of risk analysis of BIM processes during the implementation of BIM in the Czech construction market.

Keywords

BIM; Building Information Modeling; risk; risk management; survey

Introduction

The main goal of the research is to create information database, aimed at the risk awareness of construction engineers during the Building Information Modeling (BIM) implementation process. The research focuses on gathering data from young civil engineers and it examines their knowledge and awareness about risk management with regard to BIM.

The research deals with the Czech construction market, where BIM implementation process is in its beginning. The awareness is basically not very good [1], therefore it may become a duty for young engineers to promote and use BIM tools in their practice. It is also worth mentioning that BIM is often mentioned with regard of possibilities during its actual use (and there are only a few opportunities during its implementation phase). The branch of threats is much more overlooked, therefore the main aim of the research presented in this paper is focused on threats during BIM implementation and BIM use.

Simple questionnaires were created during the research and they were given to finishing master program students at Czech Technical University in Prague. Their responses were then used to examine awareness of these young engineers about BIM and risk management and to create simple quantified database of risks (threats and opportunities [2]) connected with the process of BIM implementation in a construction company.

Methodology

There were two parts of the methods used. The first part dealt with questionnaires creation and data gathering. The second part dealt with the data processing and their interpretation.

Questionnaires

To achieve defined goal, simple questionnaires were created. There were four basic questions with predefined answers to choose from and one optional supplement question for further explanation of BIM related risks.

BIM question

The general BIM question examined the opinion of respondents on the topic of risk implementation. The question was as follows:

- Do you think that the implementation of BIM in a construction company would pay off?

The question did not specify more details intentionally. For some, the question may be confusing, because it may depend on specific implementation conditions (i.e. What exactly is BIM - is it a specific tool or is it a whole process? Or what is a business field of a construction company that we are dealing with? etc.) The main aim was to get general opinion of respondents to BIM related topics, to see how they are BIM-friendly, whether they are supportive of BIM technology or they are neglecting it.

Respondents were presented with three possible answers:

- Yes
- No
- I don't know

Risk question 1

The first risk-related question was as follows:

- What is the correlation between implementation of BIM and threats in a construction company?

This question examined the opinion of respondents on whether the implementation of BIM has negative impact on risk management in a construction company. It presented respondents with four possible answers:

- The process of BIM implementation carries many problems (the threat level is high)
- The process of BIM implementation carries rather problems (the threat level is considerable)
- The process of BIM implementation carries only minor complications (the threat level is easily manageable)
- The process of BIM implementation is without any issues whatsoever

The questionnaire didn't really allow respondents to assess risks as opportunities, because these are consequences of a BIM use, not of a BIM implementation.

Risk question 2

The second risk-related question was as follows:

- What is the impact of using BIM on increasing the threat level of activities of a standard construction company?

This question examined the opinion of respondents on the topic of possible drawbacks of using BIM in a construction company, i.e. whether the effects of using BIM have any negative impact on risks (increasing the threat level) and if so, how big this impact is. Respondents were presented with following possible answers:

- The use of BIM brings problems (increases threat level) during majority of activities in a construction company
- The use of BIM brings problems (increases threat level) during some of activities in a construction company
- The use of BIM does not increase threat level of activities in a construction company

Again, respondents were not allowed to assess risks as opportunities, due to the nature of the research. It would be very complicated to weight those pros and cons to formulate empiric answer, which would also be unbiased and balanced in the manner of risk level.

Risk question 3

The last risk-related question was as follows:

- What is the impact of using BIM on threat mitigation of activities of a standard construction company?

This question seems to be similar to the previous one (in a manner of being opposite of the previous one), but one should note that it aims at the topic of existent threats mitigation, it is not an opposite of the previous one and it is not asking respondents about their opinions of opportunity level. The question is whether using BIM has positive impact on lowering threat level. Respondents were presented with following answers:

- The use of BIM helps to solve problems (reduces threat level) during majority of activities in a construction company
- The use of BIM helps to solve problems (reduces threat level) during some of activities in a construction company
- The use of BIM does not help to decrease threat level of activities in a construction company

Please note that using BIM may have a high impact on raising a thread level as well as a high level on lowering it at the same time. This situation results in the higher requirements on expertise than the opposite one, resulting in the lower level of expertise (i.e. less things can go wrong when someone messes up).

Explanation question

The last question had character of explanation, where respondents explained why they choose the way they did. The main task in following question was to formulate notable advantages and disadvantages (i.e. threats and opportunities) of using BIM. These written responses were examined and results were categorized. This resulted in hazards and chances of BIM related risks database.

Interpretation

When all relevant data was gathered, their interpretation was needed. The results of each respondent's questionnaire were transformed into a database and results have been presented. If questionnaire wasn't complete, it was not used. In case of *Explanation question*, all responses were examined and analyzed. The analyzed data were used to create various categories, describing advantages and problems of using and implementing BIM in a construction company. All data were then assigned to their categories.

In the end, all results were summarized and described. Key oddities were addressed and explained more thoroughly.

Results

The survey was conducted in the period of 6 months from December 2013 to May 2014. All responders were young civil engineers or students of construction management study program in their late masters. From total of 104 questionnaires, 78 was returned in a correct state and could be processed. 4 questionnaires had to be removed due to insufficient fill out.

BIM question

The following figure 1 shows results of the first question (BIM question). In total, 64% of respondents think the BIM would pay off when implemented into a construction company.

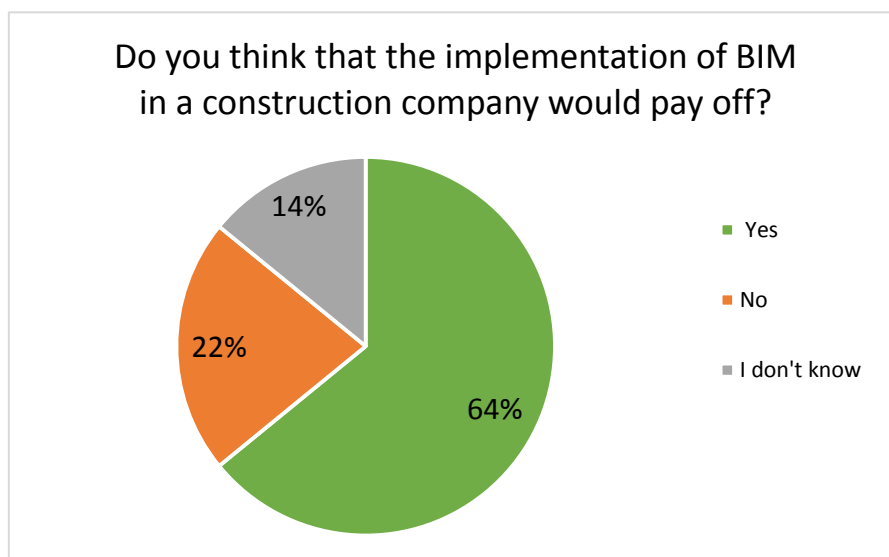


Figure 1: Pie chart results of BIM question (source: authors)

Risk question 1

The following figure 2 shows results of the second question (Risk question 1). In total, 76% of respondents believe that BIM implementation process carries minor complications. They believe the threat level is manageable.

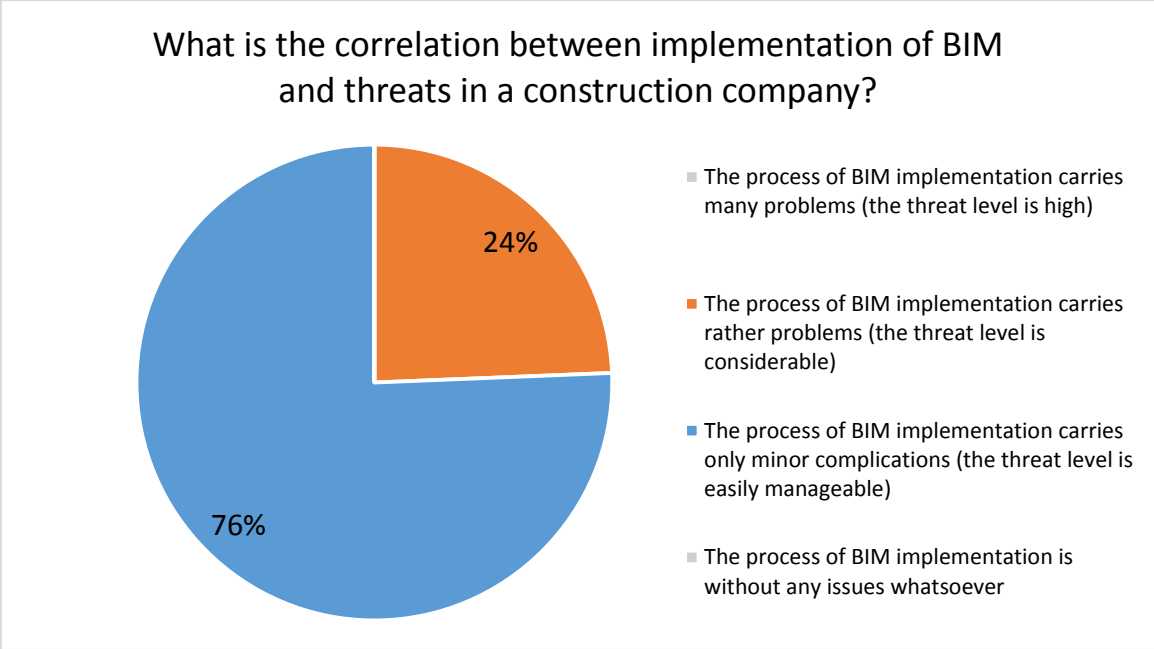


Figure 2: Pie chart results of Risk question 1 (source: authors)

Risk question 2

The following figure 3 shows results of the third question (Risk question 2). In general, respondents see using BIM as not increasing threat level dramatically. Some of them (32%) believe there is a threat level increase during some activities, the rest of them believe the threat level does not increase. This is rather optimistic result.

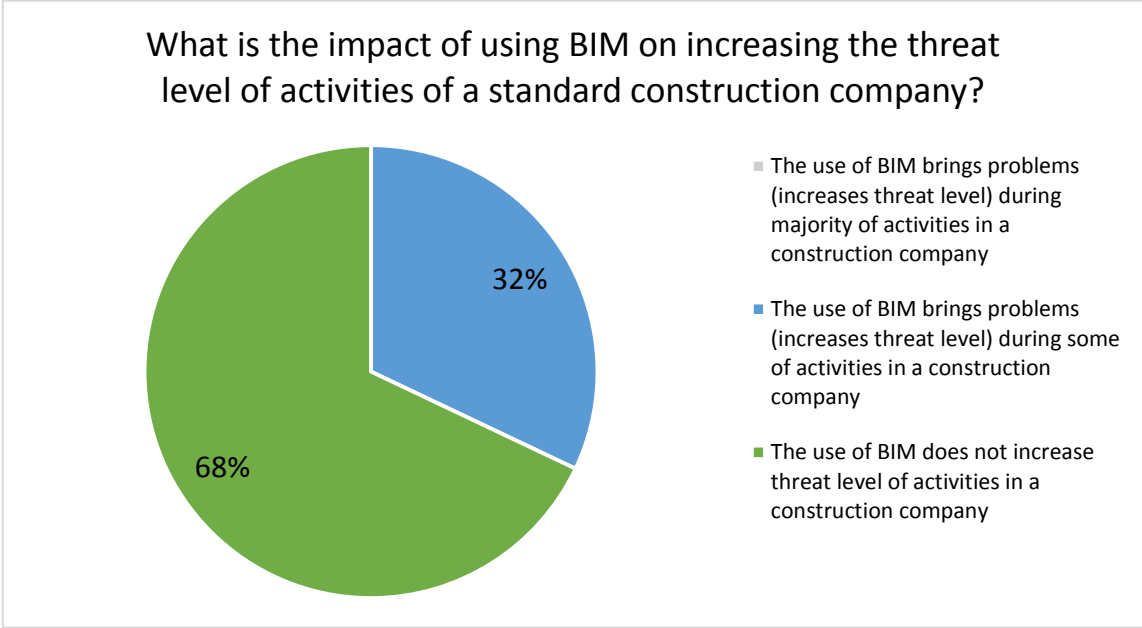


Figure 3: Pie chart results of Risk question 2 (source: authors)

Risk question 3

The following figure 4 shows results of the fourth question (Risk question 3). Majority of respondents (62%) believe that use of BIM have positive impact on reducing a threat level. This means, together with the previous results (figure 3), that using of BIM technology have positive effect on threats in a construction company. There should not be more threats created and there is a risk mitigation factor of BIM for threats, which are already present.

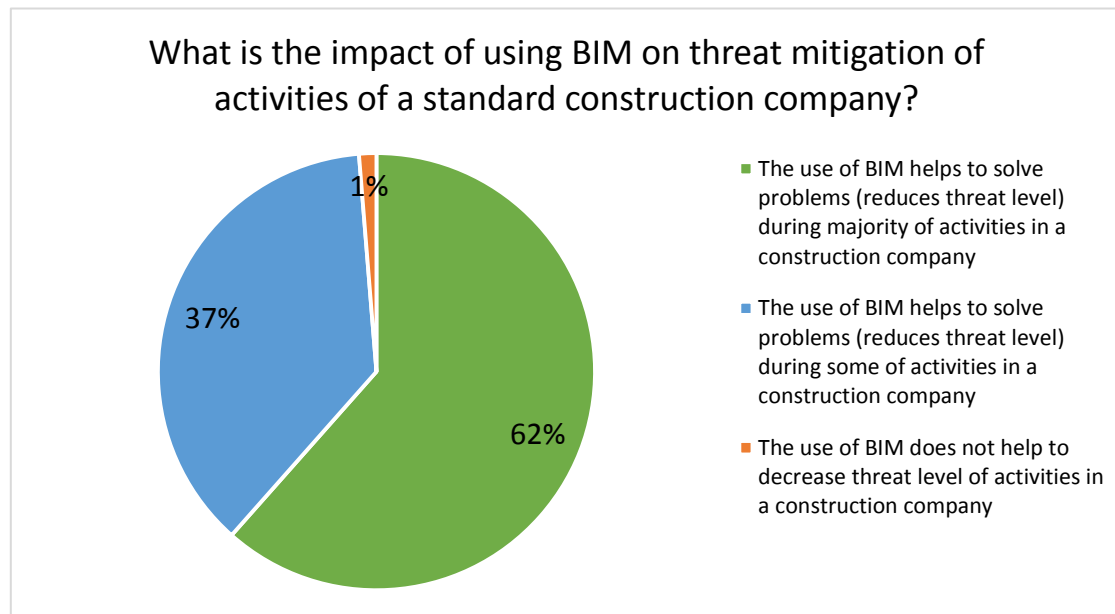


Figure 4: Pie chart results of Risk question 3 (source: authors)

Explanation question

The most difficult question to analyze was the fifth question. All respondents explained all previous answers. The result was analyzed and used to describe various advantages and disadvantages of using BIM in a construction company. These advantages were categorized with the aim to create such categories, which can be used for direct comparison. This resulted in advantages, which are listed below:

- More efficient processes in general
- Better risk management
- Lower costs
- Less errors
- Better audit tools
- It is a future
- It is competitive advantage

The specific role is played by the first category (More efficient processes in general), which may be broken into more detailed sub-categories. These subcategories are:

- Higher efficiency
- Better quality
- Better planning
- Better change management
- Higher transparency

- Better time management
- Better communication and collaboration
- More efficient processes in general

Answers analysis also resulted in following disadvantages.

- It is a pressure of a market, competition or investor
- Bad legislative support
- Unprepared market
- High costs of implementation or use of BIM
- Bad compatibility
- Tools errors
- Low motivation
- Low demand
- Low awareness and knowledgeableness
- Low qualification
- High laboriousness
- It is a complication

For every category mentioned by any valid respondent, this category received one point. These points were then summed and results are presented in following figure 5. The efficiency category was aggregated (it received one point if it was mentioned only in general or if any of efficiency sub-categories was mentioned).

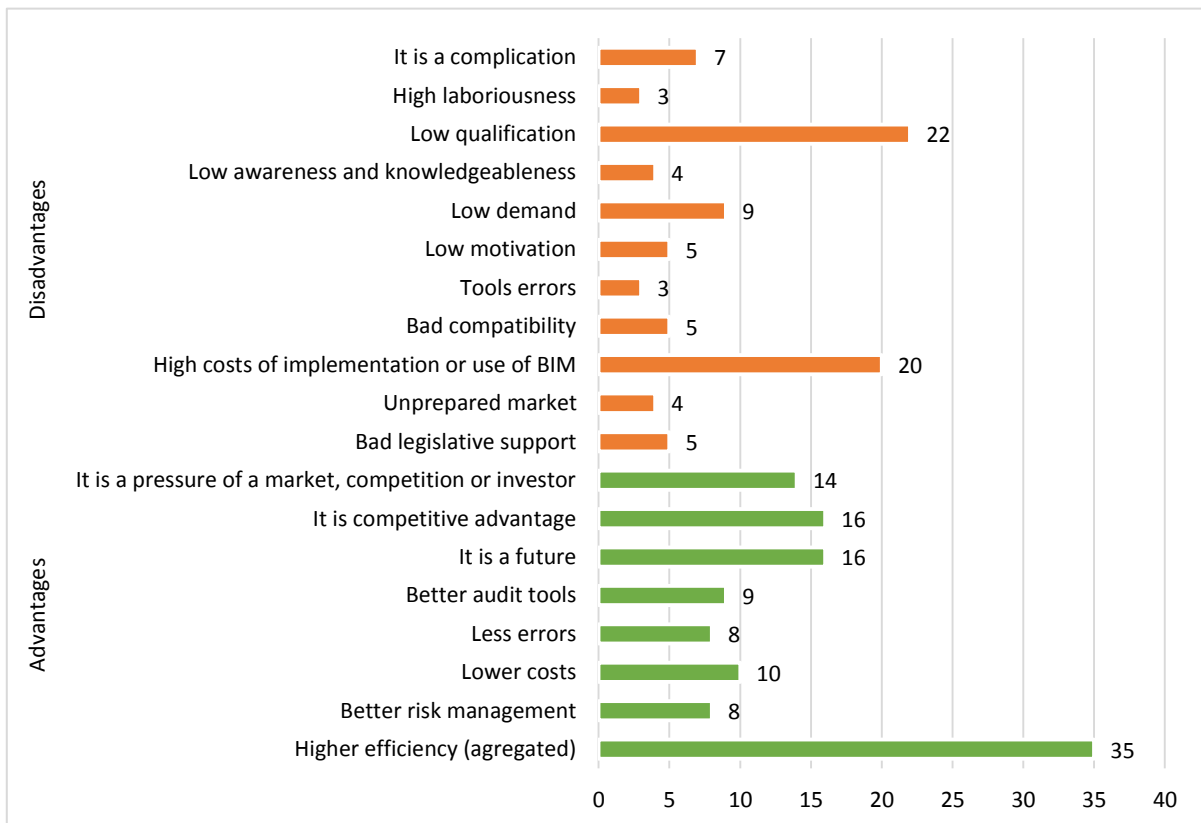


Figure 5: Bar chart results of categorized advantages vs. disadvantages (source: authors)

In the following figure 6, the efficiency category distribution is displayed. In case of need, these sub-categories may be directly compared to main categories as well. The subcategory called *More efficient process in general* stands for responses, mentioning efficiency only in general.



Figure 6: Bar chart results of categorized higher efficiency advantages (source: authors)

The figure 7 shows a pie chart of all found categories without aggregation (i.e. efficiency category is distributed).

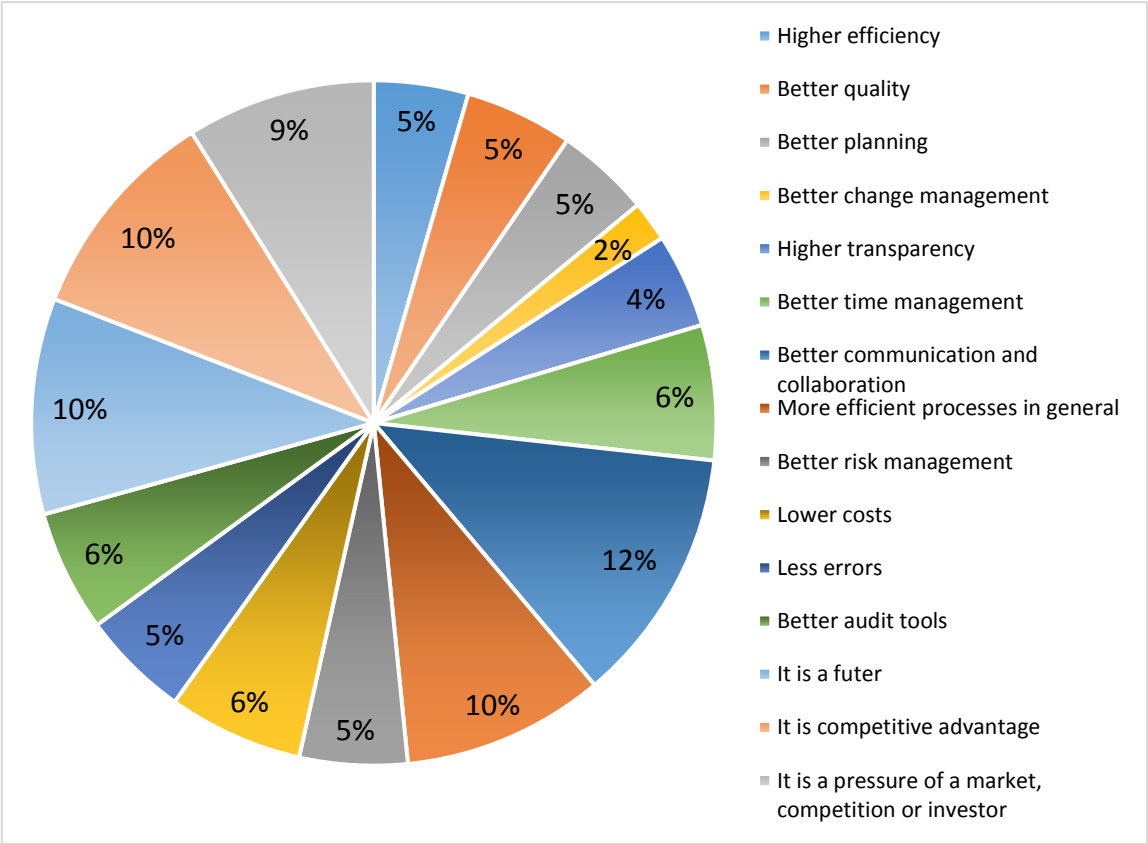


Figure 7: Pie chart results of categorized advantages with detailed efficiency category (source: authors)

Conclusion and discussion

The research shows huge interest of young generation of construction engineers in BIM technology. Around two third of them believe that BIM should be implemented in a construction company. They also believe that BIM has positive impact on risk (thread) mitigation and that there are only minor complication with BIM implementation, which can be managed. The research also helped to formulate and categorize some of the most important advantages and disadvantages of BIM use for a construction company.

The make all these results more valuable, more respondents should be questioned in the long period. It would be very interesting to examine how opinions of the same respondents changes over time when they have more practical experience. It would also be interesting to examine similar young engineers after few years and see the difference in their opinion based on better BIM knowledgeableness. Another interesting follow-up research would be the same questionnaire in practice, especially when respondent would be more experienced and older. It would then be very interesting to examine differences and track their sources. Risk related questions should also be confronted with the reality, but the main issue in this matter is insufficient risk data basis.

References

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