

Creative Construction Conference 2015 (CCC2015)

Prospects for the use of BIM in Poland and the Czech Republic – Preliminary research results

Michał Juszczak^a, Miloslav Výskala^b, Krzysztof Zima^{a*}^a*Tadeusz Kościuszko Cracow University of Technology, Faculty of Civil Engineering, Warszawska 24, Cracow 31-155, Poland,*^b*Brno University of Technology, Faculty of Civil Engineering, Veveří 331/95, Brno 602 00, Czech Republic*

Abstract

The building information modelling (BIM) has received increased attention in the construction sector. BIM is becoming a widespread and common approach in the design, construction and maintenance of building facilities. BIM is also one of the most widely discussed topics both by the academics and professionals from the construction industry all over the world. The purpose of this article is to present the initial results of studies on the use of BIM in construction projects in Poland and the Czech Republic. The studies cover a widely understood field of management in construction projects. Research concerns the scale of the use of BIM in the construction project management, the awareness of the BIM possibilities and a potential for the participants of construction projects. In the paper the authors discuss the results of the studies and compare the situation in Poland and the Czech Republic.

© 2015 The Authors. Published by Elsevier Ltd. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Peer-review under responsibility of the organizing committee of the Creative Construction Conference 2015

Keywords: Building Information Modelling, BIM software, BIM tools, construction management.

1. Introduction

Building Information Modeling (BIM) is one of the most attention gaining issues for the construction sector. The development of BIM and its impact on the construction projects and the construction companies is widely discussed both by academics and professionals. Evolution of BIM can be seen in different aspects:

* Corresponding author. Tel.: +48-12-628-23-30; fax: +48-12-628-23-29.

E-mail address: kzima@izwbit.pk.edu.pl

- BIM software tools development,
- development of information exchange format for BIM software tools,
- development of standards, rules and guidelines for modeling,
- development of new approaches to construction projects delivery,
- implementation of BIM in the construction projects,
- implementation of BIM in construction companies.

This paper aims to present the initial research results on BIM understanding and its adoption in Poland and the Czech Republic. The objective of the research, (carried out parallelly in the two countries), is to determine the awareness of BIM among the broad group of the professionals that participate in the construction projects from the client's side and contractor's side as well. (The research is conducted with use of an online, web-based questionnaire).

The first part of the paper presents basic information about a global adoption of BIM. The following sections present initial research results mentioned previously. In the final section the authors compare the results obtained for surveys in Poland and the Czech Republic; subsequently, a short summary and conclusions are presented.

2. Basic information about the BIM in the world

This section includes some basic information about the development of BIM in the world. The authors' intention was to provide the background to the presentation and discussion on the research carried out in Poland and the Czech Republic. In accordance to the reports available and analyses, the fastest pace of BIM development is seen in North America. The USA and Canada are world leaders in the implementation of BIM in construction projects. McGraw-Hill report [7], dated 2012, states that a rate of an overall BIM adoption reached 71% in 2012 in North America. The dynamics of change between years 2007 and 2012 for North America (including USA and Canada) is presented in Table 1. It is noteworthy that there is a variation in the overall rate of BIM adoption between the major regions of North America, however – according to the McGraw-Hill report [7] – the differences found in 2009 “have lessened dramatically” in 2012. Differences between major regions in 2009 and 2012 are also reported in

Table 1. Level of an overall BIM adoption in North America in years 2007-2012.

North America	2007	2009	2012
USA and Canada (average)	28%	56%	72%
Major regions of North America (variations):			
USA – West		56%	77%
USA – Midwest		52%	73%
USA – Northeast		38%	66%
USA – South		45%	68%
Canada		49%	72%

In other reports and analyses that McGraw-Hill published in 2012 [8] it is evident that the adoption of BIM rates at 58% in South Korea. According to the RICS School of Build Environment at Amity University report [10], adoption of BIM in India rates at 22%, whilst in the Middle East 25%. Report by Masterspec [4] issued in 2012 states that the rates for New Zealand and Australia are at 34% and 19% respectively. Finally the research carried out for Western Europe in 2010 by McGraw-Hill [9] revealed that the level of BIM adoption is 36%. The comparison of rates for the countries and regions all over the world is presented in Table 2.

To summarize the numbers given in the table 2, it is clear that BIM is constantly finding increased attention from the construction sector. However, the level of BIM adoption varies in different regions.

Table 2. Current overall global BIM adoption.

Regions / Countries	Year	Rate of overall BIM adoption
North America (including the USA and Canada)	2012	72%
South Korea	2012	58%
India	2014	22%
The Middle East	2011	25%
Australia	2012	19%
New Zealand	2012	34%
Western Europe (average)	2010	36%
Countries of Western Europe (variations):		
France	2010	38%
Germany	2010	36%
The United Kingdom	2010	35%

One of the key factors for the BIM adoption and implementation is an introduction of national policies and mandates. Requirements of BIM for the public projects is becoming a trend all over the world. A concise summary, based on McGraw-Hill report issued in 2014 [6], is presented in Table 3.

Table 3. Summary of BIM National Policies.

Country	Name of Mandate / Policy	BIM data required	Projects requiring BIM
USA	National 3D-4D-BIM Program	Architecture and design	All national public projects (from 2007 onwards)
South Korea	BIM Guide Version 1.2	Architecture and property data	All public buildings costing over \$27.6M (from 2010 onwards)
Singapore	BIM Road map and e-submission requirements	Architecture and engineering data	All new buildings over 20,000 sq. m. (from 2012 onwards)
Denmark	Executive Order No. 118	Project lifecycle (architecture through O&M)	5M kroner and higher for national projects 20M kroner and higher for regional and municipal projects (from 2007 onwards)
Norway	Statsbygg BIM Manual 1.2.1	Architecture and handover data	All national public projects (from 2005 onwards)
Finland	Common BIM Requirement 2012	Project lifecycle (architecture through O&M)	All national public projects (from 2007 onwards)
United Kingdom	Government Construction Strategy	Project lifecycle (architecture through O&M, defined in the U.K. as Level 2)	All national public projects (from 2011 onwards)

According to the McGraw-Hill report [6] dated 2014, the reasons for establishing national policies or mandates for BIM implementation in different countries and regions can be summarized as follows:

- to reduce and control the costs of construction projects (primarily, in 2000s, attention was focused on design and construction costs, currently there is shift towards lowering the total lifecycle costs),

- to achieve energy efficiency and lower long-term operational costs, reduce energy consumption in buildings, meet carbon reduction requirements for buildings,
- to support making the design and construction lifecycle process compliant with sustainable development,
- to increase project quality, productivity and efficiency throughout project lifecycles, to improve productivity, coordination and communication among team members,
- to standardize data processes and data formatting for facility lifecycle sustainment,
- to reduce errors and omissions and to shorten project delivery timeframe,
- to utilize models for facility management,
- to make national design and construction industries more competitive globally.

3. BIM in Poland – state of the art

A web-based survey was carried out to analyze the construction industry's use of Building Information Modeling in Poland. The survey was conducted to assess the knowledge of the BIM concept, academic research included. The study involved 43 respondents. The survey was completed by individuals in a variety of positions within the construction industry, including owners (2%), designers (21%), designer assistants (28%), site managers (9%), work managers (5%) and others (35%), such as engineers, and estimators. Sixteen percent of the respondents worked as a building contractor, twenty five percent as a structure engineer, nineteen percent as a sanitary installation engineer, twelve percent as an architect, seven percent in the road sector and twenty eight in other kinds of construction profession. The participants in this survey worked mainly in micro companies (39%) and in average companies (26%), small (23%) and large companies (12%). Work experience of the respondents was for 32% below 2 years, for 26% between 2 and 5 years, for 21% between 5 and 10 years and for 21% above ten years.

The knowledge of the idea of BIM was high, since as many as 81 percent of respondents admitted that they had heard about this concept (Fig. 1).

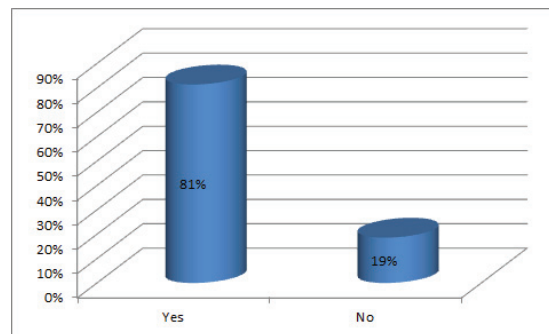


Fig. 1. Knowledge of the BIM concept in Poland.

Some of them (23%) use BIM in their work. Respondents derive their knowledge of BIM (Fig. 2) from training and courses (27%), the Internet (23%), construction press (19%), their work (19%) and other sources like higher education or postgraduate studies (12%).

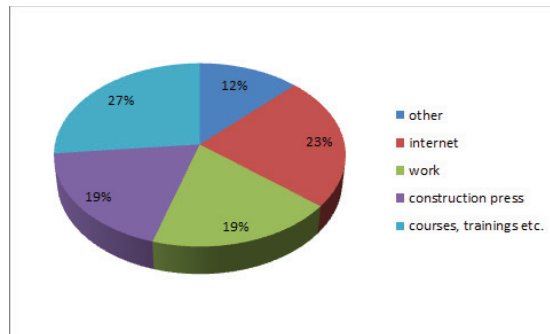


Fig. 2. Sources of information about BIM..

The majority of the respondents did not know about any plans to introduce BIM in their companies within the following 2 years, 17% said that there were no such plans, and only 9% stated that BIM would be introduced in their company soon (Fig. 3).

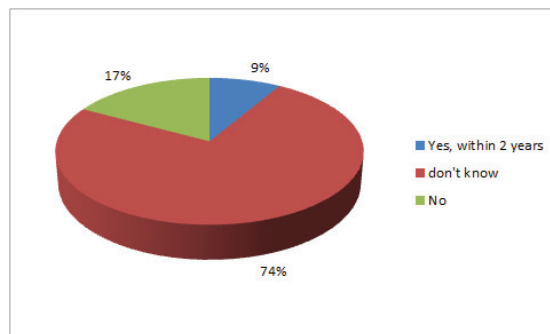


Fig. 3. Plans for the implementation of BIM in the company – Poland.

The main reasons for not using BIM at work included the lack of knowledge and lack of requirements from owners (Fig. 4).

As far as software is concerned, the one most frequently used was AutoCAD (50% of respondents), but only in 10% of cases the respondents used software based on BIM technology. Other software using BIM included programs common in Poland, namely ArchiCAD, Tekla Structure and Tekla BIM Sight, Bentley Microstation and Bentley Navigator, and Vectorworks. The main reasons for not using BIM at work included the lack of knowledge and lack of requirements from owners (Fig. 4).

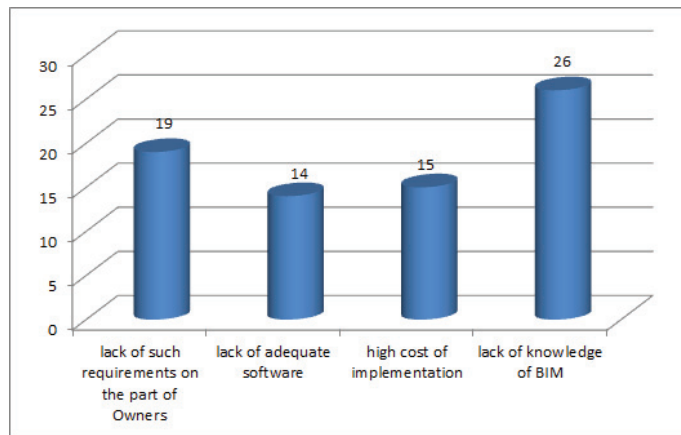


Fig. 4. The reasons for the non-use of BIM in companies (own studies).

93 percent of the respondents understood the necessity to implement BIM in Poland. The main arguments for the introduction of BIM concerned the need to facilitate and accelerate work, to organize information throughout the life cycle of the building, to facilitate communication between designers of different industries working on the same object, to avoid collisions and to speed up the quantity takeoff process.

Software which uses the BIM concept allows, for example, the user to prepare bills of quantities or to calculate the required amount of materials without the need to carry out manual and arduous calculations of the necessary works or materials required [11]. The recently created polish application BIMestiMate is used for cost estimation on the basis of a bill of quantities and gives an advantage over the Czech Republic in terms of the development own BIM software in Poland.

4. BIM in the Czech Republic – state of the art

With regards to the development of the issue described here, the Czech Republic just begins to use BIM technologies and to develop information modelling [2, 5]. Architectural studios have already used 3D modelling for visualisation of their concepts. However, in most areas of the construction process, a 2D design documentation is still the preferred one. The reason for this situation is, especially, the absence of standards and legislative regulations for BIM application and disagreement about the level BIM should be implemented, even if the BIM methodology can be used in relation to awarding and evaluating public procurement, especially in terms of [3].

An organization that is dedicated to systematic and long-term issues of building information model not only in terms of application in the world, but also with regard to the specifics of the Czech environment (standards, legislation, etc.), in practice is the "Expert Council for BIM" (www.czbim.org). This organization initiates scientific research cooperation among faculties in the academic level and also organizes cooperation with professional associations and professional associations. Since 2012, the Expert Council for BIM operates a program called pilot projects. The aim of this program is to offer a methodology BIM tools, but also the know-how to try a BIM methodology on a real project. In April 2013 the Czech Republic was historically the first working group focused on BIM, standards and legislation. Research into the area of prerequisites of BIM usage was performed in the Czech Republic in a similar way as the research in Poland, as described above. 32 respondents were interviewed. Employees across the construction industry took part in the survey. The highest number was represented by employees from the domain of architecture (47%) and civil engineering (32%), others were represented by construction department staff (15%). Professional distribution of respondents was spread among authorized engineers and independent designers (4,5% and 33% respectively), owners of construction companies (7%) and employees of engineering offices (assistants to architects 51%).

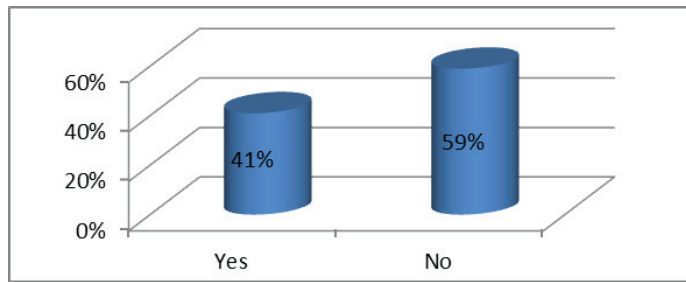


Fig. 5. Knowledge about the concept of BIM in Czech Republic.

The respondents were employed mainly in smaller companies with fewer than 9 members (50%), middle companies (38%), and big ones (16%). Professional experience of the respondents ranged between two (63%) to nine years (37%). The awareness of the BIM method proved relatively low in professional public and only 41% had already seen a project implemented by means of the BIM method (Fig. 5).

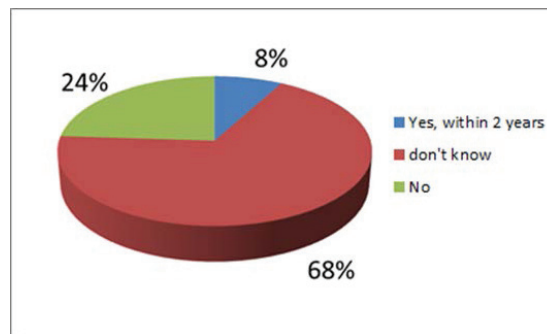


Fig. 6. Plans for the implementation of BIM in the company – Czech Republic.

42% of respondents met the BIM method at work (especially architects, designers and their assistants). Another important source of information about this method was, according to the respondents' answers, training courses (42%). The same number (8%) learned about this issue from scientific literature and at scientific conferences.

BIM modelling was currently used at work by 19% of respondents, especially architects, designers and their assistants with foreign experience (Fig. 6). 19% of respondents used the BIM method in their company. The introduction of BIM was expected by 8% of the respondents, while 24% of them did not expect its introduction and 68% did not know (Fig. 7).

The main reason for the companies to fail to introduce BIM was, according to the respondents, the lack of knowledge about the method (58%), insufficient demand from clients (25%) and high cost of purchasing the required software equipment (10%) (Fig. 8). The software commonly used in the Czech Republic, that is AutoCAD and Microstation, only supports 2D design drawings. The software enabling 3D modelling, on the other hand, is ArchCAD, Allplan and Sketchup. Compared to the Polish respondents, none of the Czech ones used software enabling 3D modelling.

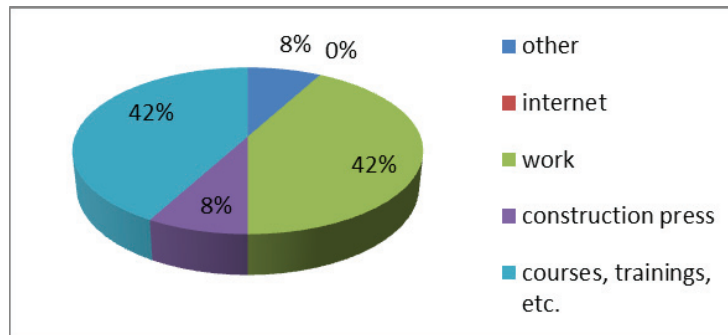


Fig. 7. Sources of information about BIM.

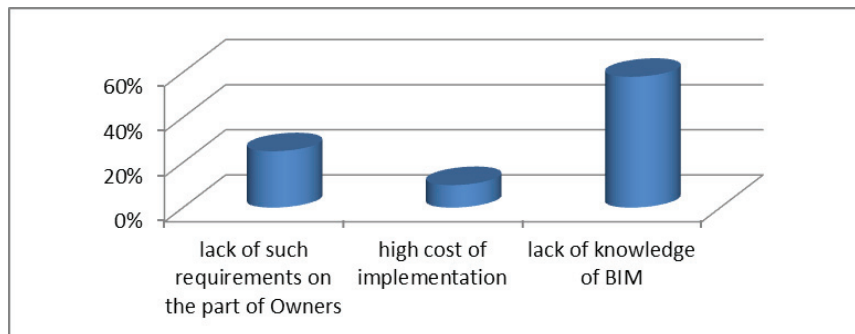


Fig. 8. The reasons for the non-use of BIM in companies.

The respondents' main arguments for the gradual introduction of BIM into the construction industry included possibilities for a simplification of design activities, more comfortable cooperation between individual professions, elimination of errors in design and transparency in compilation of construction costs [according to 1].

In comparison to the Polish results, it can be clearly seen that the Czech Republic is falling behind in the area of BIM. A gradual process of becoming familiar with the relevant information and experience can be observed in those respondents who already had foreign experience from working in such countries as Finland or Denmark, where BIM use is widespread.

5. Comparison of the state of knowledge and prospects for the use of BIM in Poland and The Czech Republic

In the Czech Republic and Poland, both in private and public procurement there is a strong preference for 2D digital documentation. The reasons for this situation include: the lack of legislation or any system solutions and lack of in-depth knowledge about the concept of BIM. While it is true that the knowledge about the concept and basics of the BIM idea increases (in Poland, 81% of respondents declare its knowledge, in Czech Republic about half of it - 41%), still the lack of a practical use of BIM is evident. The situation in Poland seems better than in the Czech Republic in terms of familiarity with the idea, the number of investments undertaken in accordance with BIM and the situation on the local software market (for example, Polish browser BIM Vision, or cost estimation software, BIMestiMate).

Sources of information in the Czech Republic involved mainly work experience and training courses, while in Poland the sources also included trade press and the internet. This may indicate a slightly higher interest in novelty in Poland than in the Czech Republic. 23% of respondents in Poland and 19% in the Czech Republic used BIM software in their work, which proved a similar degree of implementation in both countries. The introduction of BIM

within the following 2 years in their companies was declared by 9% of respondents in Poland and the Czech Republic. Despite the greater interest in the idea of BIM in Poland, the current use of the work and plans for the future look similar. However, it seems that in Poland a more diversified software in both kind of designing is applied: 2D and BIM. In addition, it is noticeable that IT companies actively attempt to introduce Polish software involving BIM into management and cost estimation of construction works.

The main arguments for the introduction of BIM in the Czech Republic and in Poland are as follows:

- simplification and acceleration of work,
- organization of information throughout the life cycle of the building,
- more comfortable cooperation of individual professions,
- elimination of errors in design and transparency in compilation of construction costs.

In conclusion, it seems that despite the declared use of BIM in the Czech Republic and Poland, the latter revealed a relatively greater knowledge concerning BIM. The dynamics of development also seemed to be at a higher level there.

6. Summary and conclusions

The general conclusion which can be drawn from the actual results of the research is that in general BIM as an idea, approach or technology is known in both countries. However the survey revealed that the knowledge is rather shallow.

Currently the issue of BIM is discussed on conferences, courses and meetings by both the academics and professionals in Poland and the Czech Republic; however it is still far from the actual implementation of BIM in the construction industries of the two countries. In comparison to the worldwide state of BIM adoption, which is regularly surveyed, the rates of adoption in Poland and the Czech Republic are very low. In both countries there are only few projects in which BIM was partially or fully implemented. One of the key factors for the broad adoption of BIM in Poland and the Czech Republic is the understanding by the clients (owners) the advantages coming from BIM usage in construction projects.

It is also probable that BIM implementation by international construction companies in their Eastern Europe divisions will be followed by other construction companies.

A positive aspect, which could be mentioned here, is the development of BIM software tools by a few companies in Poland.

In both countries there exist no public policies or mandates for BIM implementation in public investments (though the authors plan to investigate this issue in the near future). One of the factors driving the change in the approach to BIM in Poland and the Czech Republic, as well as in other Eastern Europe countries, may be the European set of reforms to the public procurement. The clauses included in the Directive of European Parliament from January 2014 [3], encourage adoption of BIM and electronic tools in public works contracts. According to the McGraw-Hill report [6] “It is widely believed that the directive will encourage some EU nations to adopt BIM mandates or incentives.”

References

- [1] Bryde, D., Broquetas, M., Volm, Jm., The project benefits of Building Information Modelling (BIM), *International Journal Of Project Management*, 2013 Oct, Vol.31(7), pp.971-980, ISSN 0263-7863.
- [2] Čermý, M., BIM příručka, Praha, Odborná rada pro BIM, 2013, ISBN 978-80-260-5296-8

- [3] Directive of European Parliament and of the Council 2014/24/EU of public procurement and repealing Directive 2004/18/EC, online: <http://eurlex.europa.eu/legalcontent/en/txt/pdf/?uri=celex:32014l0024&from=en>
- [4] Masterspec, New Zealand National BIM Survey 2012, Auckland, Construction Information Ltd., 2012
- [5] Matějka, P., Anisimova, N., Základy implementace BIM na českém stavebním trhu, FinEco, 2012, ISBN 978-80-86590-10-3
- [6] McGraw-Hill Construction, The business value of BIM for Owners, Smart Market Report, New York, McGraw-Hill, 2014
- [7] McGraw-Hill Construction, The business value of BIM in North America: multi-year trend analysis and user ratings (2007-2012), Smart Market Report, New York, McGraw-Hill, 2012
- [8] McGraw-Hill Construction, The business value of BIM in South Korea: How building information modeling is driving Positive Change in the South Korean Construction Industry, Smart Market Report, New York, McGraw-Hill, 2012
- [9] McGraw-Hill Construction, The business value of BIM in Europe: Getting building information modelling to the bottom line the united kingdom, France and Germany, Smart Market Report, New York, McGraw-Hill, 2010
- [10] RICS School of Build Environment, Amity University, State of BIM Adoption and Outlook in India, RICS School of Build Environment, Amity University 2014
- [11] Zima K., Leśniak A., Limitations of Cost Estimation Using Building Information Modeling in Poland, Journal of Civil Engineering and Architecture, Volume 7, Number 5, May 2013 (Serial Number 66), pp. 545-554.