Approach, understanding, needs and integration of the BIM concept in the Romanian modern society

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Abstract. The aim of this study is to look at the level of knowledge about BIM (Building Information Modelling) in 3 important constructions sectors: higher education institutions (HEI) - companies – public bodies. In reference to the studies and surveys made in Romania by a team from Transilvania University of Brasov, in the frame of an Erasmus+ research project - UrbanBIM, it is reasonable to hypothesize that most of the people surveyed did not understand what BIM really is, and some were unable to identify the differences between BIM and CAD (Computer-aided design). Making population surveys and analysing the data allow for determining the methodologies for future implementation of BIM technologies and improving the educational training. The concept understating shows the preponderance of using BIM technology in the construction sector, developed on extended levels, starting from urban planning, geographic information system (GIS), architecture, engineering and construction (AEC), building management and leading to life cycle analysis (LCA) and energy efficiency (EE).

1. Introduction

Beyond the basic definition of BIM which is explained in only three words: Building Information Modelling, the concept in itself is an extensive approach to computational work to serve a large scale of purposes. BIM is a technological approach which allows for further efficiency enhancements for economical and sustainable development across major sectors in the modern societies.

Since 1963, when the first CAD program proposed a graphical interface – Sketchpad, continued with GIS technology, further followed in 1982 by 2D CAD, and in 1987 highlighted by ArchiCAD, the software systems have created the foundation for actual BIM. From the beginning the CAD software has been used in projecting mainly for the Building Industry and has continued to develop as a first generation from 2D to 3D modelling [1, 2].

The concept of BIM has collected a history of innovation from the United States, Central and Northern Europe and all the way to Japan [1].

CAD technology used by architects and engineers, inter-connecting the same projects and providing computational-design deliverables for the building sector, is an essential tool which allows for planers, contractors and others stakeholders to get key information delivered in a more easily interpretable form.

The building industry and the software companies, being in a continuous development and economical competition, have continuously worked to build for themselves the framework for disseminating their products. Using and improving the assisted design, software, CAD, construction

planning systems for technological products, they succeed to develop strategies in regard of Industrial-marketing and Building-process management [3].

Each sector of modern society can have its own definition for BIM. The level of understanding is connected with the level of society needs. The building industry sector has a most acute determination for developing methods which are bringing better management – control and faster results with less error in the building process or more efficiency in exploitation during the life cycle assessment.

The companies in the field of architecture, engineering and construction (AEC) which are the first technical participants involved in the construction process have great incentives as users of BIM tools and should be the first to develop and disseminate the progress in the field.

Building Information Modelling is the digital representation of the physical and functional characteristics of a facility - shared knowledge resource for information about it forming a reliable basis for decisions during its life cycle, from earliest conception to demolition. Technology is transforming the way that buildings and infrastructure are designed, constructed and operated [4].

The next important aspect in the BIM implementation is the educational system which can benefit by refining the fields and introducing basic training.

The public sector, government and smaller public administration entities are other users who can greatly benefit from having complete or almost complete information relating to projects or cases stored in one system and housed in one easy to access portal. This provides ease of use, allows for reduced time and resources in finding what one needs to be working on, which in turn allows for significant economic benefits, and easier record keeping.

2. Approach of BIM in Romania

In the last 30 years, Romania has been developed in multiple directions. One of the main problems, which the modern society is actually facing, is the cooperation and collaboration. The essence of BIM technology is to gather together different fields and different actors. The administrative - public sector is in continuous transformation. The EU Regulations are integrated in the public system.

The needs for efficiency required in different parts of the modern world like the United States, Western-Central and Northern Europe developed the concept AECOM (Architectural, Engineering, Construction/Contracting, Operating and Maintenance) which leads to collaborative integrated and centered model with the inclusion of the Life-cycle Analysis for buildings using BIM (Building Information Modelling/Management) and IT technologies [4].

In this regard, the technological systems, like 3D modelling, the collaboration and coordination, whether on-line or off-line, information management, mobility and 4D, 5D ,6D, 7D libraries, have been improved and issued and today BIM + IPDD (Integrated Project Design & Delivery) is available. The only solution to the challenges is collaboration [2]. Following the global expansion of the world construction industry, Romania is also seeking to bring forward global construction projects and the need for effective tools such as (BIM) for information management. At the Romanian Standards Association (ASRO - Romanian national organism for standardization) level, a technical committee CT334-Building Construction, Performance, Building Durability has been set up as a European-level CEN / TC 442 Building Information Modelling (BIM) Technical Committee.

At the beginning of 2019, ASRO published a new set of international standards to permit BIM to develop within projects and across borders, bringing benefits to the entire industry. Providing a framework for information management to collaborate with BIM, ASRO published the first two parts of ISO 19650 - Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM) - Information management using building information modelling (which was developed on the basis of British Standard BS 1192) [4].

3. Surveys and analysis about BIM in Romania

In order to improve BIM implementation to different professional levels and to identify the needs of the modern society, a team from Transilvania University of Brasov, in the frame of an Erasmus+ research project, ”UrbanBIM – Innovative Educational Integration of Urban Planning based on BIM-GIS

technologies and focused on Circular Economy Challenges", has undertaken surveys in different sectors of the Romanian community: educational, public-administrative and professional companies.

The UrbanBIM project has the main goal to develop a collaborative platform based on urban planning BIM and evaluating the challenges related to LCA (Life Cycle Analysis) of urban construction materials, in order to be used as training material for both HEI students and professional sectors.

A set of specific questionnaires has been supplied by all the partners in the UrbanBIM research project: from Romania, Transilvania University of Brasov (UTBv) and Romania Green Building Council Association (RoGBC), from Spain, Universidad de Sevilla (USE) and Asociación Empresarial de Investigación Centro Tecnológico del Mármol, Piedra y Materiales (CTM) and from Poland, Politechnika Warszawska (WUT) and Datacomp sp. z o.o. (Datacomp).

The preponderance of the people questioned is linked with building industry, namely youth and adults under 55 years of age. The survey seeks the input of population regarding future methods for implementation and creating a basis for an advanced BIM curriculum for the construction sector which should be used for higher education institutions in the teaching process.

The gender balance for the respondents in the Building sector is about 65% male and 35% female and the distribution in the fields shows: 44% engineering/building engineering, 10% architecture, 15% public administration, 22% construction work and 9% others.

The BIM concept is more used by the professionals in architecture/urbanism 21%, building engineering 31%, engineering 31%, construction 26%, the administrative sector is closer linked with urbanism.

The survey, in the first part, answers the following questions:

- Have you received BIM training? What kind of training?
- What is the proportion of people in your organization/studies center who use BIM?

All the answers from the three sectors, HEI, private companies and public bodies, indicate that more than 55% didn't receive any type of BIM training, 16% yes, self-taught, 23% yes, induction course, 2% yes, master course and less than 1% yes, expert course. The public bodies received the less BIM information compared with HEI and companies (figure 1).

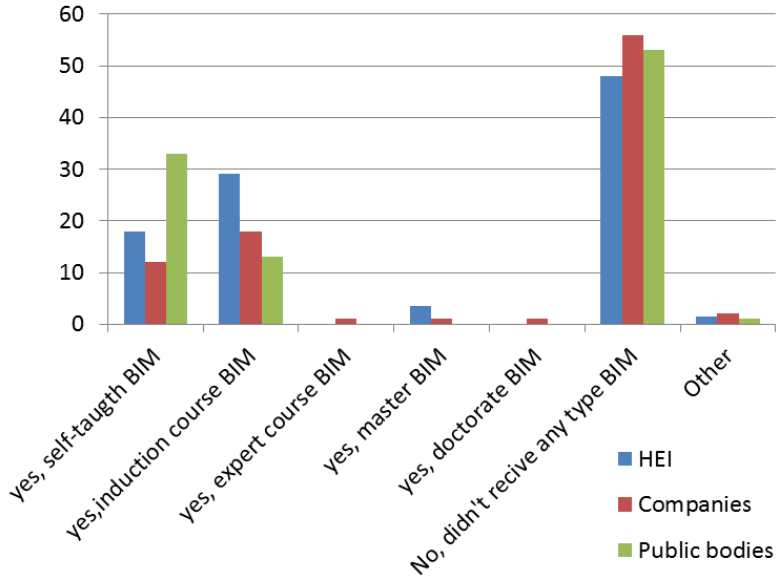

Figure 1. Survey: groups, professions – BIM acknowledgement.

The responses show that the basic level of general BIM knowledge is actually low, but the professions linked directly with the building sector have access to high technologies due to the work contracts, being mainly employees in big companies. The BIM concept is more popular among young

people and seems easier to implement in the higher education institutions. Some employers currently use BIM and seek students capable of managing BIM, but do not ask for software expertise or previous training. The ”social benefits” of BIM are necessary to be gradually implemented, social benefits meaning the sociological, behavioural, collaborative, psychological, and motivational benefits [4].

Educational institutions do not have BIM strategies in their curriculum. The training is more self-taught and once becoming employed in a building company as software user, some will receive training. Choosing BIM in projecting fields leads to efficiency, data analysis, lower management risk, quality control, national coverage.

BIM is more known among younger employees. The majority of people using BIM do not have extra acknowledgement about the advantages and the efficiency of the system in addition to the knowledge that they acquired by using BIM for no more than 5 - 6 years.

The benefits of using BIM are widely shared. The dominant observation was to create projects of better quality and the possibility of minimizing errors - both design and implementation, as it is shown in figure 2.

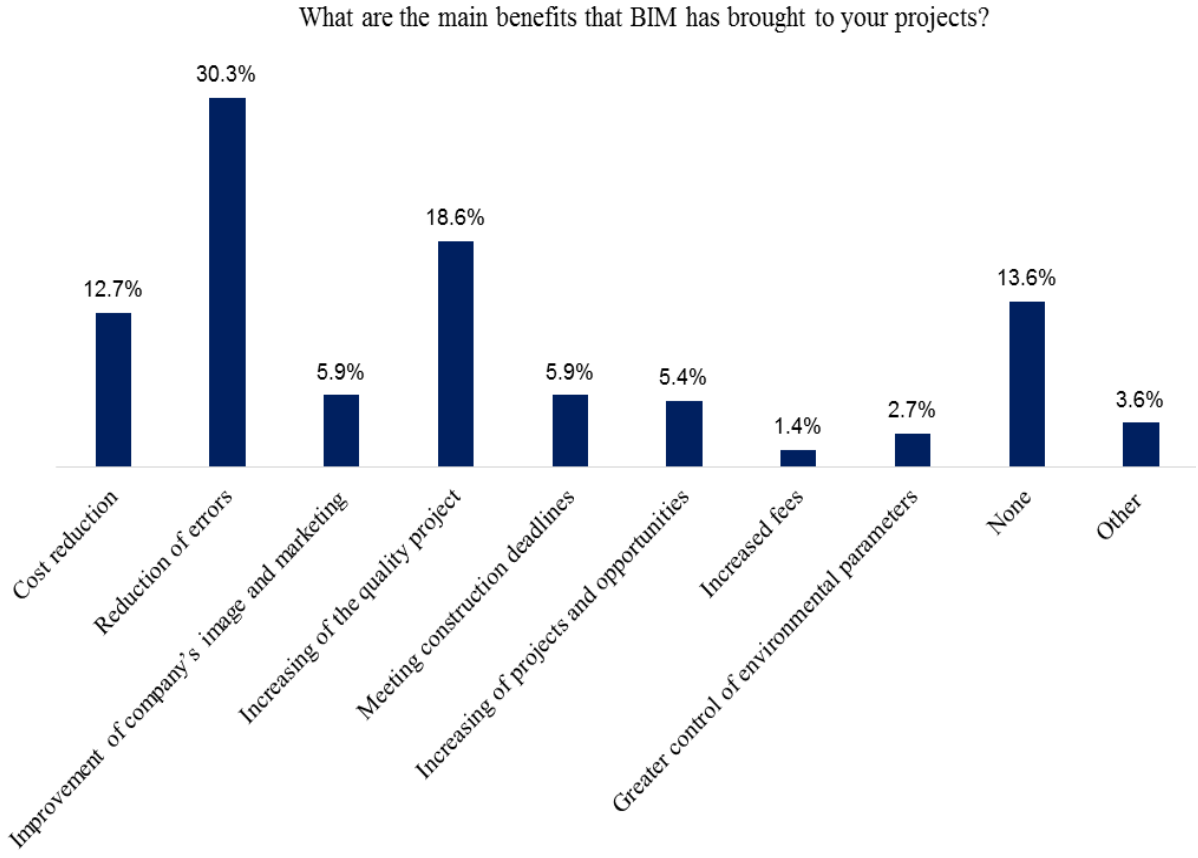

Figure 2. Survey: BIM implementation.

Construction programs seek to integrate BIM depending on the size of the company. However, small companies which have been using CAD 2D and 3D modelling, mostly in civil engineering and architecture, declare that they had contact with BIM. Over 60% of the respondents think that BIM will replace CAD in a long or medium term, but at the same time, about 27% assume that BIM will not replace CAD (figure 3).

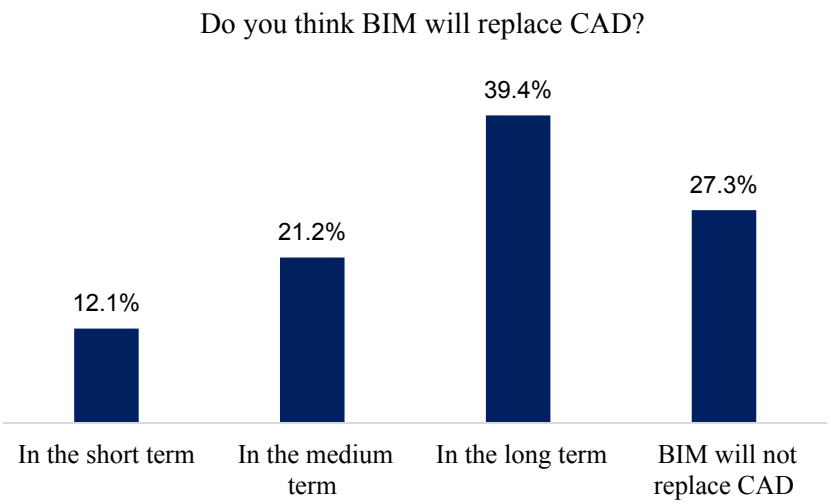

Figure 3. Survey about BIM / CAD.

The specialists in the architectural and construction industry are involved in the preparation of projects using modelling information 3D, 4D, 5D, 6D connected with the BIM, but BIM is more often used by larger companies [5].

Just about every source, including industry leaders, has its own definition of BIM, which can leave users with a few misconceptions: BIM is just for architects, BIM is just a design tool or BIM comes in a box [1].

The lack of standardized BIM will be covered in the coming years. The actual survey shows that in addition to the lack of information, training and the high costs of licences, there is a limited demand for BIM technologies in the Romanian construction market. This is not encouraged by the existing requirements of the administrative system for urban planning (figure 4).

The fact that Romania is an EU country and it is part of the Smart City – map Projects (there are over 300 projects) leads to intelligent development for the future urban planning [6].

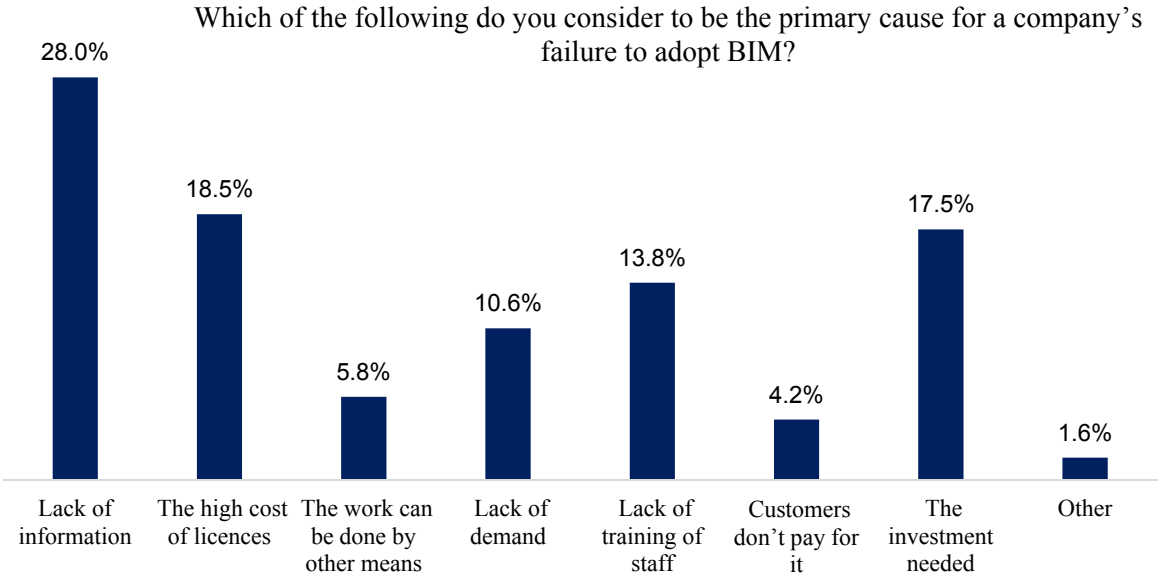

Figure 4. Survey: BIM - failures in implementing.

The Romanian Association for Smart City and Mobility has launched with the strategic support of DELL EMC, Smart City projects in several counties in Romania, which involve new technologies in intelligent development with relevant directions in monitoring the environment, the air quality, analysing the urban traffic, public lighting control, also creating communities connections [7].

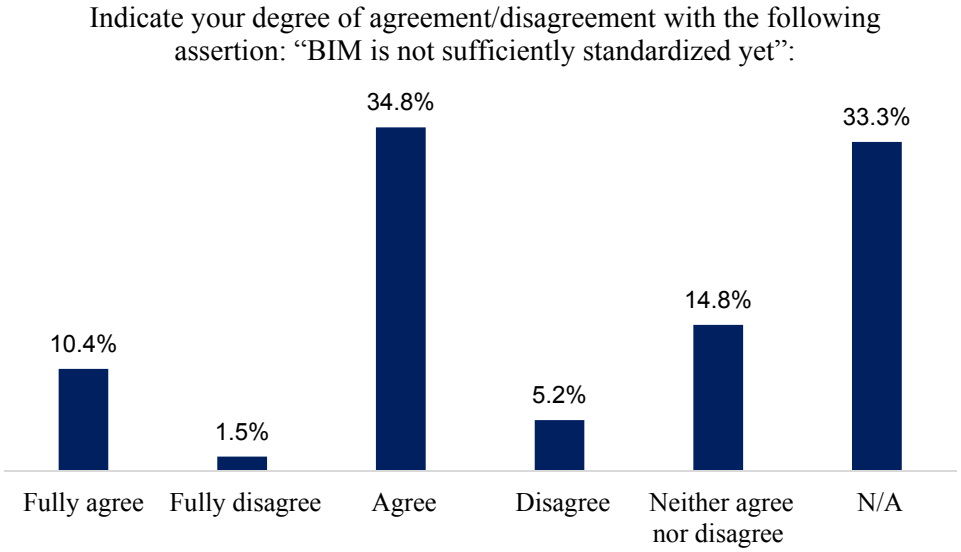

Figure 5. Survey: BIM –standardization

On the Smart City map are Romanian counties like Alba, Timisoara, Sibiu, Cluj, counties whose cities or communes start to develop a sustainable ecosystem with community inclusion, and where the public administrations understood that BIM could generate growth and efficiency in urban planning. The community needs, the big companies' requirements and, more importantly, universities should all contribute by making new curricula, training programmes regarding LCA of construction materials by means of BIM technologies.

4. Conclusions

For higher education organizations, UrbanBIM will contribute by giving them new curricula and material for study and training BIM programs including the LCA and EE of construction materials. Professors will provide new courses for their students and high-technological education in BIM systems and working methods.

The construction sector enterprises need employees with high technological skills and a starting point is UrbanBIM – project grounded on EU Directives and EU communication, p.m. 2015/C 195/06) Resource efficiency opportunities in the building.

The Romanian construction sector has continued a classic design being in the maturity level 2D up to levels 3D and 4D, BIM awareness depending on the size of the company.

The study shows that Romania is at the beginning of establishing rules for the BIM implementation.

The National Strategy for Research, Development and Innovation for 2014 -2020 (*Strategia natională de cercetare, dezvoltare şi inovare 2014-2020*) - supports the construction of new infrastructure and the development of the existing infrastructure as a key priority area, but there is no clear reference to BIM.

The Directive 2014/24/Eu, article 22, para. 4, allows the requirement for the use of BIM provided it does not create discrimination and that alternative means of access are offered to those that do not have access to such technology (this includes free access via a token for instance the day of the publication of the notice to tender).

Governments and public sector organizations can provide leadership to encourage the sector towards the untapped opportunity of digital, and in turn provide better public services and better value for public money. However, governments cannot do this alone: working together with industry at European and national levels is essential to achieve this digital transformation with due consideration given to commercial models, education, skills development and changes to current practices.

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