EDUCATE THE PUBLIC ADMINISTRATION IN THE USE OF NEW METHODOLOGIES

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Abstract

In the context of Real Estate management, the importance of education in new working and collaborating method is crucial as it has an impact on the entire value chain of the construction industry. The main purpose of this paper is to promote a training method for the public administration aimed at providing the toolkit to achieve system optimisation by making the best use of Building Information Modelling methodology and new technologies. The idea is to invest in human capital to activate virtuous processes that can improve the quality of works and services, leading the market towards increasingly integrated and interdisciplinary procedures. A knowledge society can generate savings that can be re-invested in social, economic and environmental development.

Keywords: knowledge society, building information modelling, technology, public administration, vision.

1 INTRODUCTION

Technology is the paradigm of this millennium. Nowadays society is dominated by digital processes and new forms of communication that are applied in all contexts, from culture to production. Technological innovation produces qualitative progress, which leads to evolution from the “information society” [1], characterized by the unidirectional distribution of predefined data, to the “knowledge society” [2], which encourages the cognitive participation of each individual with increasingly qualified skills. However, while people are constantly attracted in their daily lives by the possibility of experimenting with cutting-edge solutions and products, there is a strong resistance to change in professional activities. In the Industry 4.0 era, the construction industry is going through a period of structural change to keep pace with the speed of innovation process. In this direction, the use of electronic tools such as building information electronic modelling has been encouraged by the European Parliament for public works contracts and design contests through the adoption of the 2014 European Union Public Procurement Directive [3]. In line with these European policies and with the dematerialization and digitalization actions, the Italian New Procurement Code [4] was the first legislation including this subject. This provides for the progressive obligatory adoption of these practices for public works from 01/01/2019.

The introduction of methodologies such as BIM (Building Information Modelling) [5] is an essential aspect to improve collaboration, efficiency, and productivity in the entire construction value chain. Against this background, it is essential that officials of the public administration, as clients of the works and managers of the public Real Estate, receive appropriate training that can help them to govern the change taking place. Software is only a means to achieve the goals, it is on the methodology that it is necessary to focus attention. In this the University plays a critical role in providing the right interpretative keys and supporting the public administration in dealing with an increasingly accelerated and complex society where digital technologies, but also globalization, introduce new challenges and needs. The paper refers to the training experience of a group of Piedmont Region officials on the use of BIM and new technologies to improve the usability of the built heritage data.

2 METHODOLOGY

In relation to the context outlined, there is an increasing demand for training courses to respond to the crisis and face the changing working world. Currently, the challenge of BIM is addressed with the support of Universities through Bachelor and Master programs, by accredited training institutions and specialized consultants. The Politecnico di Torino, on the basis of an interest initially expressed by the Piedmont Region, has decided to promote a training course on the BIM methodology for the public administration officials. The educational activity combines the need for advanced training on innovative and multidisciplinary issues, achieved through the provision of theoretical lessons, with moments of participatory learning that enhance the effectiveness of the teaching.
Considering the general value of the activity, the BIM and Interoperability for a Public Administration course has been designed as part of the permanent training offer of the University. The course consists of 40 hours of lessons, distributed in 10 sessions. As mentioned above, the first experience was reserved for Piedmont Region that involved 50 officials from different areas of the institution. The approach to the topics is addressed from the point of view of the organizational processes, the operational tools and the cultural change they require. These aspects match with the three dimensions of system interoperability: technological, procedural and organizational. The aim is therefore to share a vision for a real implementation of a knowledge-based system overcoming the simple transfer of specific notions. Once the potential of the framework is understood and the possible applications are known, it will be easier to apply the concepts to professional activities in a responsible way.

In accordance with these objectives, the theoretical lessons provide a broad overview of application, embracing issues that affect different stages of the building process. Public officials play a crucial role in the life cycle of buildings, since they have to promote the construction of new buildings, on the one hand, and preserve the conservation of the existing heritage optimizing the management, on the other. In this scenario, the public administration has to be prepared in order to manage part of the activities internally, but above all to govern in the most effective way the tenders for works and services, expressing in the best possible way the needs of the public institution. Given the type of audience that includes the simultaneous presence of staff with different hierarchical roles, from operational to executive, the objective of the course is to transfer a working methodology through high-level conceptual notions and the use of innovative technological tools. Thanks to this approach, all the organizational functions can receive inputs that they can use both within their own activities and to better understand the work of others, internal collaborators or external suppliers. To this end, the course does not examine in detail specialist subjects, but tries as much as possible to create connections of a transversal nature. The modules are divided into theoretical and practical lessons that take place alternately on a weekly basis for a period of about three months. The main themes covered during the theoretical lessons are the following.

**Building Information Modelling definitions**

The main concepts at the basis of the BIM methodology are clearly explained through the different declinations taken from the literature. “Whether used to refer to a product – Building Information Model (a structured dataset describing a building), an activity – Building Information Modelling (the act of creating a Building Information Model), or a system – Building Information Management (business structures of work and communication that increase quality and efficiency), BIM is a critical element in reducing industry waste, adding value to industry products, decreasing environmental damage, and increasing the functional performance of occupants.” [6]. The capability of using data by different users and for various purposes is regulated by the interoperability defined as the possibility of transferring data without loss of information.

**BIM application fields**

Although the acronym BIM refers to buildings, its application has been extending in recent years, including both punctual and horizontal infrastructures (InfraBIM) and the urban scale (District Information Modelling). The level of development, both graphic and informative, of the digital model can therefore take different
forms depending on the object of interest, as well as the users purposes and stage of progress of its implementation. Although there are valid guidelines that define the meaning of LOD (Level of Detail and Development), there are many difficulties in practicing them. The client has to be able to evaluate the level of information required according to the specific needs and the object to be managed, while adopting a vision replicable within a portfolio. It is only from a correct initial setting of the projects that it is possible to obtain useful systems that can be updated over time.

**Energy and Facility Management**

Better information about existing conditions reduces the cost and complexity of building management and maintenance. The key point of exploiting BIM and interoperability for digitalizing heritage lies on being able to differently sort and query the 3D model according to specific purposes, from Facility Management to energy refurbishment or simulations. The speed of BIM visualizations and computations allows us to perform accurate simulation scenarios and achieve the best design or management solutions. In this way, it is possible to obtain a powerful balance between costs and efficiency and optimize the building performance.

**System integration and data visualization**

The BIM model is first of all a database of information. The potential of the methodology lies in the possibility of interacting with other domains, providing a cross-scale dynamics vision to analyze the city heritage. Manager can access real-time information about the service installed, making accurate assessments of the asset operating condition, enabling its better usage and utilization. In this context, only a good data organization at the beginning of the process with specific characteristics in terms of exchange formats, ontology, uniqueness and reliability of information allows the BIM model to be used in contexts and for very different purposes with each other. Direct use of BIM data, as well as systems integration across CAFM and CMMS platforms or simulations software, are illustrated to ensure connection with facility activities. In addition to a tool for knowledge and for managing, BIM supports all levels of the communication process, exploiting new ways for data visualization and dissemination. Thanks to the three-dimensionality of space and the interaction with new technologies(e.g. Augmented and Virtual Reality, 3D printing), designers, public administrations as well as citizens can better understand design solutions and implement knowledge about the heritage.

**Public contracts requirements definition**

The area in which the BIM methodology has the greatest impact for this target user is public contracts, through which the public institution requires services. Through the Employer's Information Requirements (EIR) document the public client can defined in the initial stages of a BIM project the minimum information in technical, management and commercial areas with respect to the BIM model development. Despite EIR is a tool that allows the client to make specific requests, the inclusion of it in the tender documents is not currently widespread as it requires a proper knowledge of the topic to produce it. The course aims to provide the public administration with the methodological knowledge to activate projects aimed at optimizing resources and management. The operative declination is delegated to the works and services contractors who are more familiar with tools and technologies as specialists in their fields of application. More the client is educated on the use of methodologies through the consolidation of the training process, more can go into detail to request technical solutions more suitable to meet its needs. This lesson module is deliberately made at the end of the course in order to have acquired all the preparatory knowledge to deal with the subject in an effective and conscious manner.
The lessons deal with the listed themes through the sharing of theoretical notions supported by the presentation of case studies. The course aims to overcome the building scale highlighting the strong connections with the concepts of smart city. The wider the overview users access, the more applications they will be able to generate. As the theoretical modules shows, BIM represent a powerful methodology for smart data management. For this reason, the debate is stimulated with the audience at the end of each session to frame the themes towards the specific needs of the participants and to activate a discussion on the ways to deal with this cultural change.

Different learning methods offered. The practical lessons aim at understanding the main functionalities of the BIM tools and become familiar with them. These sessions are carried out in the computer lab to ensure that each participant has access to the technological hardware and software resources. The following aspects are examined in depth.

- **Approach to parametric modelling**
  Unlike traditional CAD drawing, BIM modeling defines building components through parametric objects that allow you to implement information with respect to the definition of the geometry. The fundamentals of this type of modelling are provided, but above all it is explained how to achieve a usable digital model by carefully planning it in terms of general settings, modeling rules, classification and coding systems adoption. A shared and standardized language is required to achieve a unique system within different players or to analyze different buildings. The use of a template is the key to get data and output fully comparable.

- **Structural and MEP modelling**
  Despite the representation of systems and structural elements can be very complex, the course focus on the possibility to simplify the graphic representation and linking the elements to technical details and maintenance procedures. Thanks to the parametric objects it is possible to identify the functional relations between the elements, such as “is contained in”, “is related to”, “is part of” which are essential for the management.

- **Model breakdown and worksharing**
  Communication and collaboration have become a very debated topic within BIM, not only among architects, engineers, and contractors but also with owners and facility managers. In fact, according to several studies [7], construction productivity has decreased significantly over the last forty years due to the lack of communication and collaboration about information. This highlights the need to establish a common collaboration system among all the disciplines and players involved in the construction industry and a proper definition of the virtual model breakdown.

- **Virtual and Augmented Reality Applications**
  To understand the different possibilities offered by the new visualization technologies on the market, a practical demonstration is promoted in which participants can experience different applications that exploit Augmented and Virtual Reality.

- **Information specifications**
  After gaining a greater knowledge of the subject at both a theoretical and operational level, the last theoretical lesson takes up the concepts underlying the drafting of a specification information, declining them operationally.
3 RESULTS

The majority of the participants of the training session had a positive and active response to the various topics covered. This can be seen both from the number of questions and the quality of the debate during the theoretical lessons. Thanks to the method adopted, a proactive participation of all the public employees has been observed during the practical sessions independently of their role within the institution. In addition, the proposal to set up curricular internships and master's theses on various topics identified by the Piedmont Region with specific case studies is an absolutely positive factor. Even before the conclusion of the course, the research group that promoted the course was invited to contribute to the development of the geological model of the areas destined to host the future Health, Research and Innovation Park in Turin, as well as to provide support for the drafting of tender specifications for a minor project. Finally, the Piedmont Region invited the Politecnico di Torino to become part of a working table for the introduction of BIM in the various areas of interest of the institution. These results show that the public employees who took part in the course have understood the potential underlying the methodology and tools and are gradually structuring to adopt and request them. It has been found that people in leadership positions have been the most enterprising in learning, capitalizing on the learning experience.

4 CONCLUSIONS

In order to meet the demands on efficiency and sustainability of smart cities as well as the new technological and social challenges and regulations, overall review of the construction industry needs to be implemented. In this framework, BIM is certainly the key point for the sector digitalization, but a management strategy is required for a constructive contribution. A well-educated public administration makes it possible to introduce into the processes instruments that can foster a powerful balance between efficiency and costs. This can generate an extremely positive framework that would be reflected on all the actors in the construction process, with impacts also on citizens. Education provide a foundation for development. It increases the people’s productivity and intellectual flexibility, promoting entrepreneurship and technological advances. The issue of sustainability is pursued in economic terms: a better management and control of a building allows to obtain considerable savings that can be reinvested in order to generate more benefits for people and for the environment. By adopting this approach, the general objective is to start from the buildings management optimization then enlarge the scale to the district, up to rule the entire city.

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REFERENCES


