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EXPERIENCE AND PERSPECTIVE OF USING BIM TECHNOLOGIES IN ARMENIA

With the advancement of BIM technologies in recent years, many countries developed legislations and standards in the field of construction regulating the usage of BIM technologies. Alongside all the advantages that BIM technologies provide to all stakeholders, many professionals do not use them for their design processes. And while many countries try to make BIM as part of their legislations, countries like Armenia, do not take that risk, because of the differences between professionals in the field of construction, particularly between architects and engineers.

This article presents the current situation of BIM software usage in Armenia, the problems and challenges of its implementation in the whole construction process, from design to environmental and sustainability analysis. To understand and analyze the situation and current issues connected with BIM usage in Armenia, dozens of professionals, architects and engineers were interviewed.

Keywords: BIM technologies, design, construction, engineering, information modeling.

In order to create and develop their projects, professionals in the field of architecture and construction try to use all the resources they have. The right soft-

ware helps them design the project successfully. In 1980's architects began using CAD (Computer Aided Design), which helped them wade from pin-bar drafting to layer based CAD systems. However, CAD systems gave only the building's graphical model, as the next development was the building information modeling, giving not only the graphic representation but also information. Besides giving the opportunity to have information, it made the collaboration and management easier. Several decades after this development, the US National Building Information Model Standard Project Committee defined BIM as a digital representation of physical and functional characteristics of a facility. A BIM is a shared knowledge resource for information about a facility forming a reliable basis for decisions during its life-cycle; defined as existing from earliest conception to demolition [1].

After GRAPHISOFT's ArchiCAD launch in 1987, it became the first software that used BIM. However, as we will see in this article, in 2019, BIM files did not become as widely spread as DWG files after CAD formation [2]. Only during the last decade BIM software programs like ArchiCAD, Revit and AllPlan started to compete with widely used CAD programs. We can infer this development with the roll of different Revit products in 2012, which made their competitors to compete and develop BIM technologies. So, architects and engineers who seek faster and more clever ways to create new buildings and structures within tight period and limited resources, started to implement them.

In Armenia, the construction industry is much smaller compared to countries like Netherlands, Belgium, Estonia, and it considerably depends on the import of materials. Thus any development and change depends on other countries, especially Russia and other leading trading nations big trading countries. Despite the usage of BIM technologies in private sector is growing, howbeit to implement it in the country, Armenia needs to rely on others' experience. For better understanding of the situation, we must examine where the professionals come from.

Armenian National University of Architecture and Construction (NUACA) for many years was Armenia's largest and the only architectural school. In 2013, the Franco-German Engineering Institute became the second school of architecture and engineering in the country. For about 90 years NUACA educated highly qualified professionals, yet now architectural students cope to develop study programs including BIM software courses, which will give them the opportunity to match the market needs. Thus, although the BIM technology development in the world and its widespread use in the labor market, the university continues to educate professionals who use CAD and 3D technologies to implement their projects. This results to the wide usage of CAD software by professionals, both architects and engineers of HVAC systems, electricity, plumbing, fire protection systems and other needed specialists. Among the above-mentioned professionals, only architects adapted to BIM software comparatively quickly. Here is where all the problems start. Although architects take courses of CAD software at the university, engineers do not take any software course during their undergraduate program. There is an urgent need to develop programs and include BIM technology software courses for engi-

neering students, so that they can become skilled professionals, ready to enter the labor market immediately after the graduation. There is a demand for professionals to teach students, says Egnatosyan, doctor of engineering at NUACA. While students are curious about inclusion of BIM software programs in their study programs, annually more than 200 professionals graduate. So, from the beginning architecture students are familiar with CAD technologies, while engineers do not have any idea how to use them and it depends on the person, to learn and apply it in practice.

In Armenia, architectural studios use different software programs for their design process. Those are mainly REVIT and ArchiCAD in contrast with mass usage of AutoCAD by engineers and elder generation of architects. Thus, to work with professionals with extensive expertise fresh graduates have to become familiar with BIM programs. Some large and successful architectural studios, where young generation tends to work, are run by young and middle-aged people who foster use of Revit and ArchiCAD, despite the problems they face.

A major problem is to find architects who use company's preferred software, and are qualified enough. In order to solve this, architectural studios establish their own schools, where they train students with their standards, giving them knowledge and skills to use their software. One of the most successful projects is Archangel Architecture Studio's school, which started from ArchiCAD lessons then turned into an architectural school, where they train students and interns teaching them all the required skills to prepare them as their future employees [3]. Other firms, which face the same problem choose outsource method to train their employees. Here some private schools, like SkillShop come to help the companies. The founder and CEO of SkillShop, Areg Kheshishyan mentions that the need of BIM usage in design process forced them to think wider, and they opened the school, where they aim to create BIM community and conduce the technology usage in Armenia. "Unfortunately, only 20 % of our students are engineers, mostly we have architecture students or architects who want to change their working programs from CAD to BIM". Areg Keshishyan states that giving BIM skills to employees do not ensure that companies will go with BIM workflow, because there is deficiency of BIM managers in companies. Architectural offices mostly do not want to create a new vacancy for BIM managers, which is vital for companies, especially in Armenia. Here the government does not take any step to support the usage of BIM and the BIM managers have to take care of all the aspects themselves.

BIM manager, architect Kasra Hamidi Dastnaei at Storaket Architectural firm mentions that because of lack of regulations and standards from government of Armenia, BIM managers are in a difficult situation, because they have to develop templates not only to provide easy workflow for studios, but also templates for final documentation. In this case it can take up to 400–500 hours for BIM manager to create a new template, which costs too much for architectural companies based in Armenia, and unfortunately this is not solving all the problems related to BIM

workflow. After all the investment the company does to go BIM, at some point they go back to CAD, as engineers, no matter structural, HVAC or plumbing use CAD and somehow they have to adapt their CAD files to the company projects, integrate and insert information in them. This takes too much time and big expenses, increasing the financial burden of the Company.

Here we can see the gap between engineers and architects. Architectural studios use BIM software in design process, but they are not able to integrate engineering system files of buildings to their BIM files, because of CAD files of engineers. Here the BIM workflow intermits and no future BIM actions can be done. As architects work for architectural studios, they have to adapt to the company's requirements and use the same software. And, as mentioned above, younger companies accept the BIM and its advantages, so more and more young architects start using BIM in their workplaces. This is not the same for engineers, because in Armenia architectural companies are not large, with maximum 30 employees and it is not profitable for them to have full time engineers and it is more acceptable to out-source, even if they work with CAD technique and their BIM workflow is interrupted. There are several companies, which perform HVAC and plumbing engineering with BIM technologies, however, they do not spread their knowledge with others, preferring to set high price for their services, taking advantage from the fact that there are not many companies who do engineering with BIM technologies and architectural studios prefer to work with them. As the key players in the market do not want to solve the big, public problem of BIM usage, the only way to solve it, is to train for professionals and students of engineering as Dr. Egnatosyan mentioned above. This will foster propagation of BIM usage in the field of engineering, the university will have qualified professors, who possess BIM technologies and can realize projects with them. In addition, it is important to have the chance to develop literature in Armenian language, related to BIM usage topics. Currently this kind of literature is missing. This collaboration, which started by interviewing professionals to receive information about the usage of BIM technologies in Armenia, can be an excellent beginning of cooperation of professionals from different fields, which will give advantage for all stakeholders such as the state, private companies, individual professionals and construction production businesses.

So, if the software skills can be developed individually or in companies, workplaces, schools, there is another problem that all the interviewed professionals were worried about: regulations and standardization. This is something that has to be ensured by the government in close cooperation with architects, engineers and construction producers. Nowadays, companies try to develop their custom templates by having some kind of regulations as a base, but this is too far from producing full BIM project pack. Armenia, as any other country, has its own standards and regulations of architectural and engineering drawings representation, its particularities like materials and standards used in construction, different configurations and day-to-day developments in this field. Hence, to go BIM, this all have to

move from papers to BIM world firstly. This kind of big changes surely have to be realized in phases. Taking into consideration the international experience can help Armenia integrate BIM technologies much easier compared to other countries that did it without having any experience in this field.

The Armenian economy and construction field is deeply connected with Russia, the Russian experience in this transformation can be most valuable for the country. The Russian government announced about implementation of BIM technologies in the field of construction in December, 2014, and, by that prescript, phase to phase transition will be fully done in 2020 [4]. In case of Russia's successful transition, Armenia can follow the success by having the chance to avoid possible mistakes. Because of the bulk amount of imported goods from Russia, if imported products will have their BIM models, library making process will be easier in Armenia. But this does not mean that Armenia's BIM library problem will be solved. Armenia's uterus is rich with different stones, metals and other materials, which are widely used in the field of construction. So, except for all imported materials, everything produced in Armenia must have its BIM model and description. On the other hand, Russia's transmission will be a forcing power for Armenia to go to BIM too.

All the interviewed professionals agreed that changes must be done with the input of government of Armenia, which manages all the projects. If there are companies that can allow them to develop their BIM standards and make their libraries, there are many other individual architects and firms who cannot afford to create libraries or templates. Usually companies keep their libraries and templates private, and it is not accessible to the public. Mr. Keshishyan believes that successful BIM environment must be open and accessible to all professionals. BIM is not just a technique used by architects or engineers. This transition must be done from higher levels of governance in the field. For example, Professional Unions and Committee of Urban Planning must take the responsibility to gather all stakeholders and design a document, like a national strategy plan, or something like the Estonian Digital Construction Cluster. All the stakeholders have to start the transition steps together to be able to form the BIM strategy for RA.

After all the interviews, we have a more complete picture of the level of BIM usage in Armenia. Overall, BIM is used more by architectural organizations and only few engineering companies use it in their projects. More and more architects change their CAD software program to BIM and this is mainly spread among younger generation, a perceptible number of professionals use BIM software for 3D modelling, but creating drawings in CAD software. BIM is also not fully implemented because of lack of material and object libraries. There are no libraries adopted to Armenia's construction and design market. Mr. Dastnaei described this as "half-BIM".

With the new government, formed in 2018, many changes have been taking place in Armenia, including the construction field, where a new licensing method

for professionals is accepted, the Palace of Architects is elaborating new requirements for architects, creating some limitations and making the field law more strict. Except of this there are big urban projects to be built. This can be exact time for some changes to be applied or pilot projects to be tested.

During upcoming years, the BIM usage will grow, nearly all architects will start to use BIM technologies, the percent of engineers who will prefer to use BIM will grow too, this will continue until the government's decision to change all the requirements to be created and presented in BIM environment. To conclude, we have some ways to solve the problems of BIM implementation.

Firstly, universities have to prepare professionals with the skills of BIM technologies, who can transfer their ideas and knowledge to digital world. Then professionals, who use must be trained to transfer from CAD to BIM. As a result of this research, Skillshop and NUACA's chair of Ventilation, Gas and Heat Supply are launching a research project to study BIM for HVAC, plumbing systems, then train students and professionals.

Secondly, there is need of gathering of all stakeholders, which must be done by one of governing bodies. As a result of this, a national strategy must be planned. In this phase some pilot projects can be realized to find defects and disadvantages, after which the strategy should be established.

Finally, all the accepted standards of drawing signs, material representations and symbols must be created in BIM environment and must be publicly accessible. And in addition to this all, the construction materials producers must start production with having BIM model of their products, all the accepted graphic symbols and signs and by this we will have BIM library of Armenia's construction market which can foster the realization of projects accomplished by BIM technologies.

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МЕЖДУНАРОДНЫЙ ОПЫТ ИСПОЛЬЗОВАНИЯ BIM

<i>Biagini C., Ottobri P.</i> BIM Modeling Methods for Seismic Vulnerability Assessment.....	3
<i>Nguyen Minh Ngoc, Tran Thanh Son</i> Advantages, Difficulties and Challenges of Applying BIM in the Design and Construction of Water Supply and Drainage System for High Buildings in Vietnam.....	12
<i>Vardanyan E.</i> Experience and Perspective of Using BIM Technologies in Armenia.....	18
<i>Vedernikova A. A., Guryeva Yu. A., Shiwua A. J.</i> Preparedness of Students of Civil Engineering with the Active Use of Information Technologies in Educational Process.....	24

ТЕОРЕТИЧЕСКИЕ ОСНОВЫ ИНФОРМАЦИОННОГО МОДЕЛИРОВАНИЯ ЗДАНИЙ

<i>Александрова Е. Б.</i> Роль и задачи экономиста при BIM-моделировании в строительстве в условиях цифровой экономики.....	35
<i>Баженев А. А.</i> Перспективы применения BIM-технологий в современной строительной отрасли.....	40
<i>Бахарева О. В., Кордончик Д. М.</i> Внедрение технологических и управленческих инноваций: BIM-модель в архитектуре, проектировании, строительстве и эксплуатации.....	44
<i>Бачурина С. С., Владимирова И. Л., Каллаур Г. Ю.</i> Требования к цифровой модели здания на эксплуатационной фазе жизненного цикла.....	49
<i>Болотин С. А.</i> Формирование графика комплексной застройки территории с использованием Revit и Microsoft Project.....	53
<i>Букунов А. С., Букунова О. В.</i> Обмен информацией в единой системе при создании BIM.....	59
<i>Гайдо А. Н., Погода А. Г.</i> Особенности построения цифровых информационных моделей объектов на стадии строительства нулевого цикла.....	64
<i>Гарибин П. А., Шабанов В. И., Ольховик Е. О.</i> Использование BIM-технологий при эксплуатации арктических портовых гидротехнических сооружений.....	69
<i>Звонов И. А., Нарезная Т. К., Корнилова Д. Л.</i> Принципы применения адаптируемых модульных проектов на базе информационного моделирования в рамках модернизации зданий образовательных учреждений.....	75
<i>Костюнина Т. Н.</i> Технологии искусственного интеллекта в задачах BIM.....	80
<i>Орловская Т. Н.</i> Методология и модели развития умного города: экономическая безопасность и цифровые технологии в инвестиционно-строительной сфере.....	86
<i>Субботина Н. А., Нам Г. Е., Георгиади В. В.</i> BIM-моделирование как инструмент внедрения принципов ОН&S в строительство.....	91
<i>Табакон А. В.</i> Антикriminalогенный эффект внедрения BIM-технологий: повышение контроля и снижение уровня злоупотреблений в сфере строительства...	96
<i>Черетович Д. В.</i> Роль энергетической модели в концепции проектирования и строительства энергоэффективного дома.....	101