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Barriers to Implementation of Building Information Modeling in Scheduling and Planning Phase in Iran

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ABSTRACT

Building information modelling (BIM) is an example of a systemic process of innovation in the construction industry BIM is a set of interacting policies, processes, and technology to create a methodology to manage the fundamental construction design and project data in digital format during the entire life-cycle of a building BIM was expected to bring substantial improvements in productivity in the construction industry. In this way, the implementation of Building Information Modelling (BIM) in Building practice promises to improve communication and cooperation among participants through greater interoperability of data. However, to implement BIM on construction project, professionals need to set and row BIM based tools, project operations, and the business models of the companies which collaborate on a project. As many researches mentioned there are lots of valuable benefits of using BIM based planning and scheduling 4 dimension (4D) but the slow adoption of this new method is a fundamental problem in developing countries like Iran. The Aim of this study is to identify the state of the art of strategic implementation of using BIM based scheduling in comparison with conventional based scheduling in Iran in the construction industry, hence the related and measurable objectives are to explore the obstacles to the use and implementation of Building Information Modeling in the planning and design stage in Iran and identify strategies that will improve the efficient BIM implementation in the construction industry in developing countries. The scope of this study is limited to the construction phase within Iran. The briefly Identified barriers of using BIM in this country is that Legal/legislative backing by government, subsidizing the price of the software by the government and authors and providing trail software, mobilizing clients on the importance of BIM by service, training and retraining, managing Cultural Change are items which were found in this study.

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INTRODUCTION

Building Information Modeling (BIM) It is a significantly re-shaping the way construction project teams work closely together to increase productivity and improve the final project outcome (cost, time, quality, safety, functionality, maintainability, etc.) for all the stakeholders.The use of BIM on construction projects is growing rapidly. According to statistics from BIM Trends Smart Market Report 2008 (McGraw Hill, 2007), 62% of BIM users reported that they were going to use BIM in more than 30% of the projects in 2009. BIM use is spreading in all construction areas, and the development of best management practices for BIM implementation will differ according to the particular needs and existing practice of the concerned agencies.

BIM is not just a fancy marketing term that some might have originally thought. BIM is real and that are here to stay. Similar to what we have seen 15-20 years ago, when companies were moving from manual drafting to CAD (although CAD has been around for a number of years); the same is occurring todayonly the transition from CAD to BIM. BIM technology has been around for a number of years, but it is not until now that a significant shift is happening a bit aggravated by the recession of 2008-2009. We also experienced a recession 15 years ago when the first change has occurred. Now adays, companies must find new ways of generating income and do it in the most effective manner in order to set themselves apart from their competition. BIM is one of the ways in which the architects and engineers have set themselves apart (Aidin *et al*., 2015).

Building Information Modeling (BIM) may be defined in a variety of ways.The National Institute of

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Building Sciences (NIBS, 2007) stated a definition which "BIM stands for new concepts and practices that are so greatly improved by innovative information technologies and business structure that they will dramatically reduce the multiple form of waste and inefficiency in the building industry". The degree of co-ordination is necessary in the construction industry dramatically in the scheduling and planning. During one project, the collaboration of a number organization is important (Alshawi and Faraj, 2002). The integrating of the construction project network and BIM technologies causes major productivity improvements (Taylor and Bernstein, 2008).

Building Information Modeling (BIM) is referred to as a conceptual approach to the construction and building design including the buildings' three-dimensional (3D) parametric modeling for the design, and for the computer-intelligible exchanges of the building information among the construction, design, and other disciplines. The products and development support the integrated 3D parametric modeling in such a way that it could be used widely as the base technology in the case of the building information development, and also it can be used in managing the major engineering and architectural firms. (Rafael *et al*., 2010). Employing BIM tool for the concept planning enables the operators swiftly to express the isometric and sectional details to end users in a way that the concept on its whole could be developed and experienced before contracting with the design-builder. It is very important in cases where there is coordination between the various areas and spaces renowned as a continual challenge in the process of the projects. The detail that has been developed within the BIM enables the user to focus totally on the additional required details (Manning and Messner, 2008).

In the architecture, engineering, and construction (AEC) industry, various people, processes and materials are brought together in shaping projects that are becoming increasingly complex. Stringent codes, sustainable design and equipment, high-tech communication systems, and environmental control systems installed in confined spaces under increasingly aggressive schedules make it necessary for each team member to have ability of visual translation, written, and oral expressions and understanding the nuances for effective communication Recent advances in Building Information Modeling (BIM) have disseminated the utilization of multidimensional (ND) CAD information in the construction industry specially in the field of 4D or 5D models (Youngsoo and Mihee, 2011). BIM has various benefits and advantages that can be extended from the conceptual documentation and design, throughout the whole construction process to the building occupancy. Since using BIM gains momentum, these ideas have gotten realized more and more, and it can be simply integrated into the process of construction and design (Krygied and Nies, 2008).

Building Information Modeling (BIM) based tools to support the work of construction management issues practically is still a problematic task. Because of these technical issues many researchers are trying to find the problems and barriers to successful and unsuccessful implementation of BIM and explain about the process of it (Hartmann Timo *et al*., 2012). As a solution the project teams & members need to align their task processes to the new "Collaborative and integrated ways of working" that BIM based tools require (Arayici *et al*., 2011). We are no longer trading three dimensional ideas and concepts on paper and Pcs with our owners, consultants, or Contractors we're trading at four (or five) - dimensional virtualized buildings that contain a vast amount of useful information. This virtualized world (4D or 5D) allows us an extraordinary amount of control and information and familiarity over the building before we even put a shovel in the ground. One of the most important elements of BIM based scheduling is 4D modeling or 5D modeling. For creating 4D models we integrate and link the 3D models which come from BIM based design phase to schedule of the project come from any management software, moreover our 3D model can show all the sequence of construction and other specifications of 4D model.

BIM is being increasingly used as a new technology to help in the conception, design, construction and operation of buildings in many countries, particularly in the United States. According to a survey in 2008, such participation had been estimated to vary between 20% and 40% of the number of companies implementing BIM. Outside of the USA, the Scandinavian region is considered as the most active in BIM implementation whereas Singapore and Hong Kong are two of the few countries in Asia who have implemented BIM in the public and private sector. Therefore, a review of the initiatives taken in the selected Scandinavian Countries including Finland, Norway, Denmark and the Asian Country Singapore to implement BIM at the public and private sectors is presented to highlight the successful practices in this field (Andy *et al*., 2009).The slow adoption of the BIM in the field of planning and scheduling as the BIM in the developing countries were caused by a number of technical and human barriers, these obstacles can be classified as internal or outside. The main obstacles are the cost and human issues, primarily the learning of new tools and processes.

The study is limited to the implementation of Building Information Modeling (BIM) in the planning and scheduling phase, data was collected from Building managers and Construction companies in Iran only. Moreover, the study is limited to a sample of selected customers, consultants, contractors located

in the country just. This research focuses on Building Information Modeling (BIM) in developing Countries (Iran) the study aims to identify the reasons behind the slow pace of implementation of this method in the construction sector in the stage of planning and scheduling.

Research Methodology:

The methodology of this research started from identifying and exploring the problem statement, a survey of literature, questionnaire survey, collecting data, analysis of results, discussion of results and conclusions.

This study was carried out essentially with the use of a survey questionnaire which was formulated based on factors related to the implementation of BIM based planning and scheduling which were gathered from the literature research. Prior to sending out the questionnaires, a research was conducted to determine its practicality, in which comments from the study was incorporated to refine the said questionnaire. The retrieved questionnaires were then compiled and analyzed with the frequencies are represented in the form of tables and charts. In order to generate the results, in the use of Statistics for Social Science (SPSS software) and also the average index computation as shown bellow(Abd. Majid and Mc Caffer (1997)) as shown below:

$$\text{Average Index} = \frac{\Sigma\, aixi}{\Sigma\, xi}$$

Whereas,

ai = constant which represent the weight for I,

xi = variable that represents the frequency of respondents to the I (I = 1,2,3,4,5).

The classifications for the rating scale based on Abd. Majid and Mc Caffer (1997) are:

1= 0.00 ≤ Average Index < 1.50 (not important or strongly disagree)

2= 1.50 ≤ Average Index < 2.50 (less important or disagree)

3= 2.50 ≤ Average Index < 3.50 (neutral or moderately agree)

4= 3.50 ≤ Average Index < 4.50 (important or agree)

5= 4.50 ≤ Average Index ≤ 5.00 (very important or strongly agree)

RESULT AND DISCUSSION

In this research 100 questionnaires distributed among construction professionals and firms in IRAN. Finally 32 questionnaires were collected successfully and were analyzed with SPSS and Average Index method. The Figure 1 shows the means of agreement on barriers to implementation of BIM in the phase of planning and scheduling within Iran.

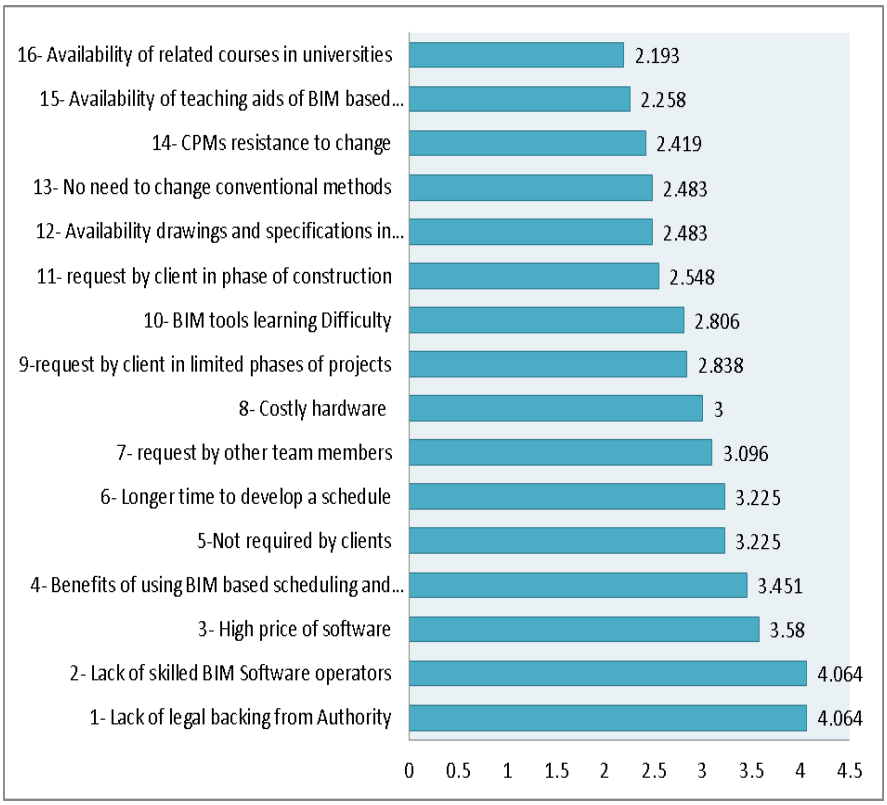

Fig. 1: Means of agreements on barriers to implementation of BIM in the phase of planning and scheduling in Iran

The result has shown that the Lack of skilled BIM Software operators and Lack of legal backing from Authority have the highest means index of 4.064 indicating that are the main barriers of implementing of BIM in the phase of planning and scheduling. It can be said that the power of government can enhance the usage of new technology among the country and the other hand one of the main barriers to implementing the BIM in the phase of planning and scheduling is a lack of competent users in this field. Figure 2 & 3 shows the level of agreement of these statements among respondents.

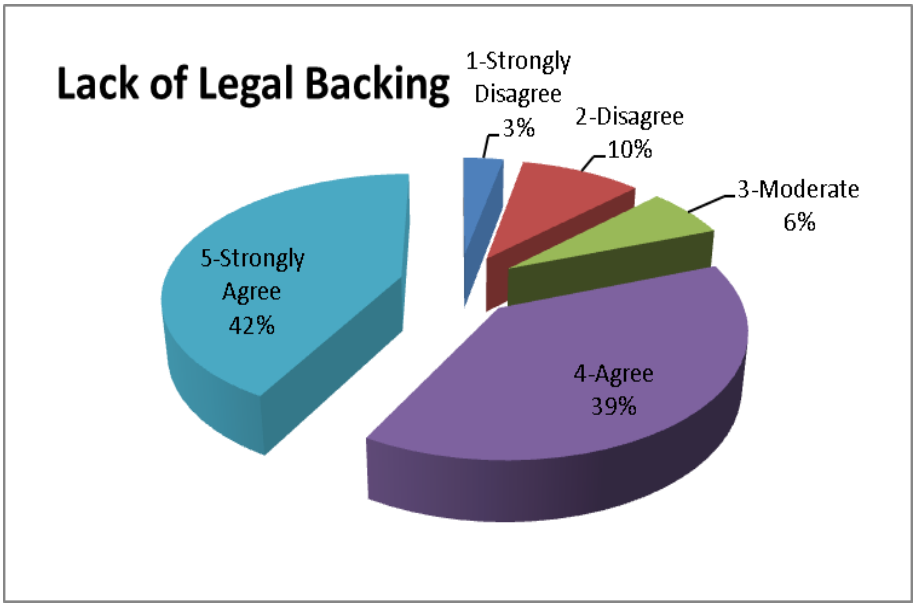

Fig. 2: Level of agreement of respondents

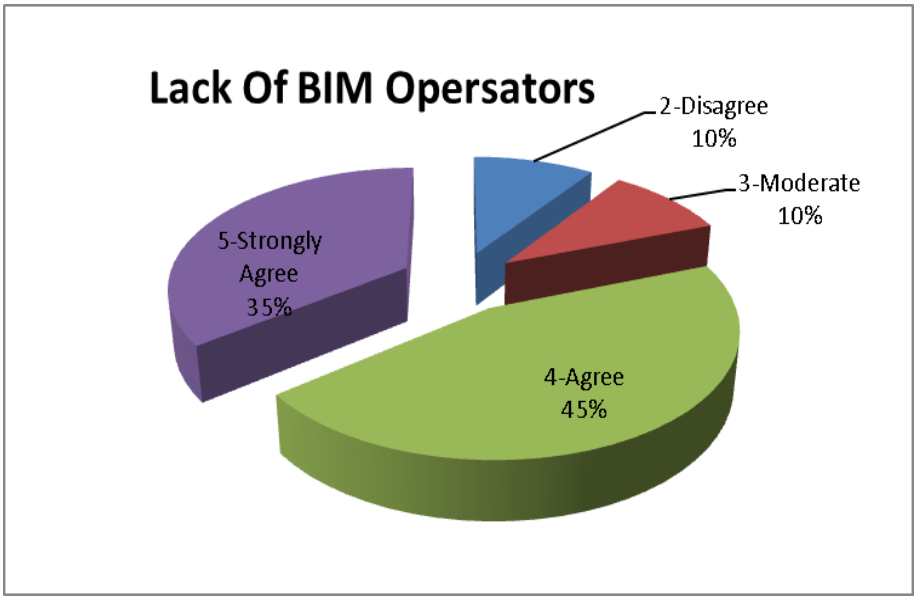

Fig. 3: Level of agreement of respondents

Equally, the results have shown a significant level of agreement (3.58) that, High price of BIM software is another overwhelming problem; this may not be unconnected with the fact that BIM based planning and scheduling is a new concept that has not spread across developing countries and Iran inclusive.

Other major problems that have been identified by respondents in the field of BIM based planning and scheduling, are "Benefits of using BIM based scheduling and planning are not tangible" (3.45), "Not required by clients" (3.22) and "Longer time to develop a schedule in this method" (3.22). It can be said that the respondents think the process and

benefits of BIM based planning and scheduling is not transparent and tangible enough for them. On the other hand the clients don't interested in using BIM based applications and software in the field of planning and scheduling. Moreover the respondents think that developing a BIM based schedule takes longer time in comparison with conventional methods.

According to the results of this research "Costly hardware" (3), "request by client in limited phases of projects" (2.83), "BIM tools learning Difficulty" (2.8), "request by client in phase of construction" (2.55) respectively are the major problems for implementation of BIM in the phase of planning and scheduling in Iran.

The findings of the study indicate clearly, that Availability of teaching aids of BIM based scheduling is one of the reasons for the slow implementation of Building Information Modeling based planning and scheduling. Beside it the respondents agree that the lack of proper coursed and education material in universities is one of the obstacles. Therefore, the respondents are ready for change their organizational structure to implement BIM based Planning and scheduling. This Figure 4 shows the means of agreement on strategies for implementation of BIM in the phase of planning and scheduling in Iran.

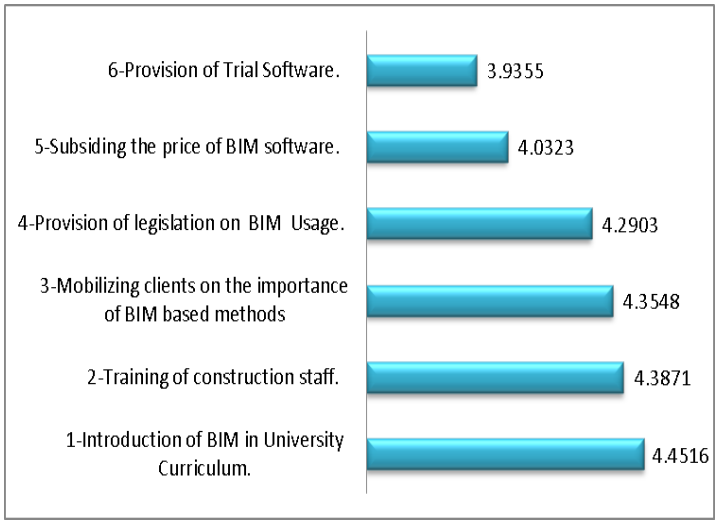

Fig. 4: Means of agreements on strategies to implementation of BIM in the phase of planning and scheduling in Iran

Full implementing Building Information Modeling (BIM) in the stage of planning and scheduling would have needed the extensive interruption of existing business practices, processes, organizational structures, contractual relationships, and even separate job habit. Any technology that offers such a complete break with the status quo has a high probability of failure, regardless of its benefits.

One of the more significant findings to emerge from this study is that Government, Software providers & authors and Training centers & universities have the key role in the implementation of BIM in the phase of planning and scheduling. This result has come from analyzing of answers of questionnaires spread among firms and professionals within IRAN. The identified strategies are as follows:

i. Legal/Legislative backing by government.
ii. Subsiding the price of the software
iii. Mobilizing clients on the importance of BIM.
iv. Training and Retraining.
v. Managing Cultural Change.

Conclusion:

Identified obstacles to the implementation of Building Information Modeling (BIM) in the stage of planning and programming within Iran include:

i. Lack of legal backing from Authority
ii. Lack of skilled BIM Software operators
iii. High price of software
iv. Benefits of using BIM based scheduling and planning are not tangible
v. Not required by clients
vi. Longer time to develop a schedule
vii. Request by other team members
viii. Costly hardware
ix. Request by client in limited phases of projects
x. BIM tools learning Difficulty
xi. Request by client in phase of construction
xii. Availability drawings and specifications in design phase
xiii. No need to change conventional methods
xiv. CPMs resistance to change
xv. Availability of teaching aids of BIM based scheduling

xvi. Availability of related courses in universities

The results indicate that the society of professionals in the construction industry is ready to change their planning and scheduling methods to BIM but their opinions are differed among clients, consultants and contractors.

The study identified strategies for implementing BIM based planning and scheduling in the construction industry within IRAN. Legal/legislative backing by government, subsidizing the price of the software by the government and authors and providing trail software, mobilizing clients on the importance of BIM by service, training and retraining, managing Cultural Change are items which were found in this study. It can be said that the government and software providers have a vital role in the implementation of BIM based planning and scheduling within Iran. On the other hand universities and training center can spread this technology among students and professionals while the companies and firms can train their staffs. One of the more significant findings to emerge from this study is that Government, Software providers & authors and Training centers & universities have the key roles in the implementation of BIM in the phase of planning and scheduling.

The model describes below (Figure 5) presents a logical arrangement of strategies for implementation of Building Information Modeling in the phase of planning and scheduling based on priority. This result has come from analyzing of answers of questionnaires spread among firms and professionals within Iran.

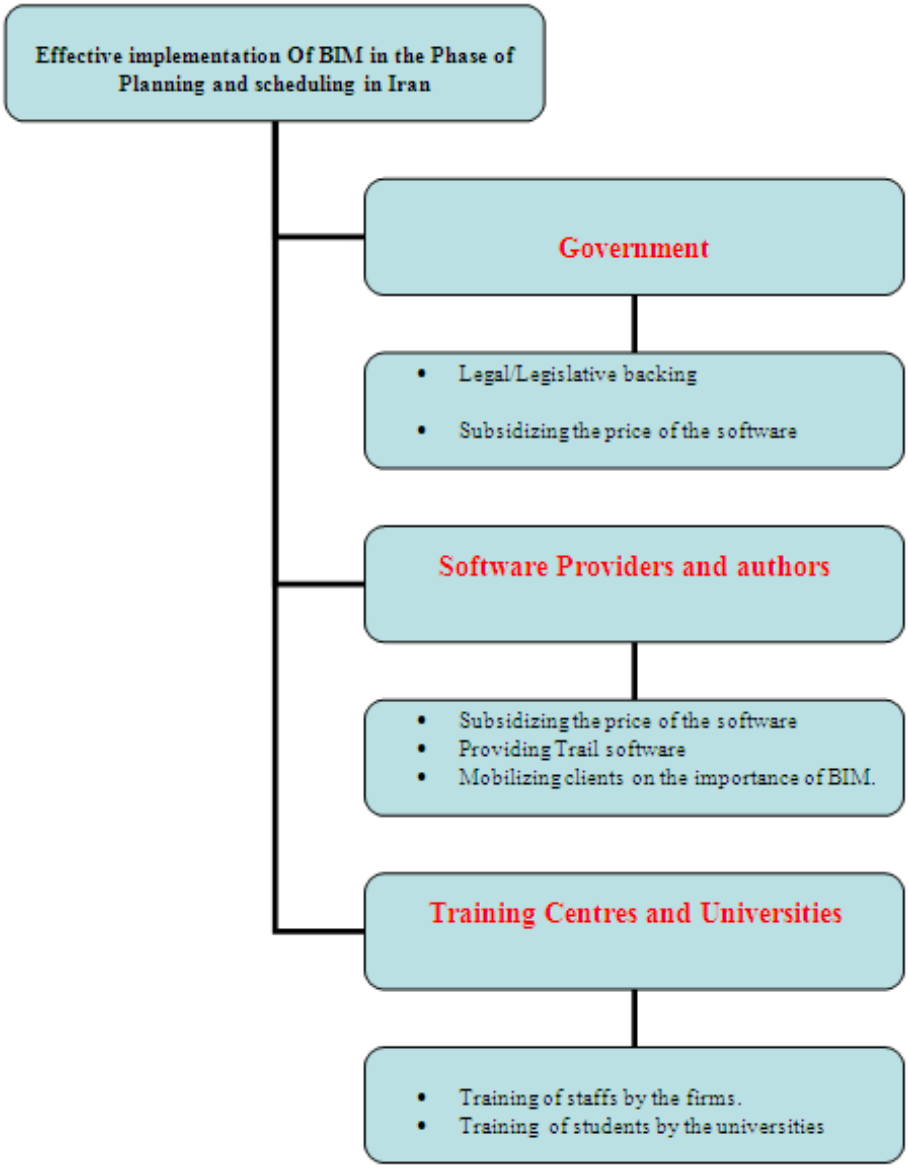

Fig. 5: Effective implementation of BIM based planning and scheduling strategies within Iran

Since this research has determined that there is a significant number of professional building industry testing BIM technologies, it is recommended that more research be undertaken in the following areas:

1- The benefits of implementation and adoption BIM technology in terms of safety and site management.
2- The benefits of implementation of BIM in the field of cost estimating in common projects.
3- Similar study in another part of the world; developed and developing countries.

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