Exploring the Adoption of Building Information Modeling (BIM) in the Jordanian Construction Industry

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Abstract

: BIM; Construction industry; Jordan

Although the construction industry is considered one of the biggest industries worldwide [1]; but it is still lagging behind other industries in terms productivity, e ciency, quality and sustainability. For industries other than construction, improved productivity could be attributed to advances in and increased usage of information technologies, increased competition due to globalization, and changes in workplace practices and organizational structures.

Since the traditional industry model has no signi cant changes accompany the introduction of new digital tools and technologies; therefore, it still exhibits a low maturity in the use of IT that has negative re ection on its productivity level. Many studies [2,3] were conducted to address this gap between building industry and IT, one of the most important studies was conducted in 2004 by the National Research Council (NRC) that focused on providing strategy for advancing the competitiveness, e ciency and productivity of the U.S. construction industry. Findings of this study identi ed that interoperable technology application, also called Building Information Modelling (BIM) is

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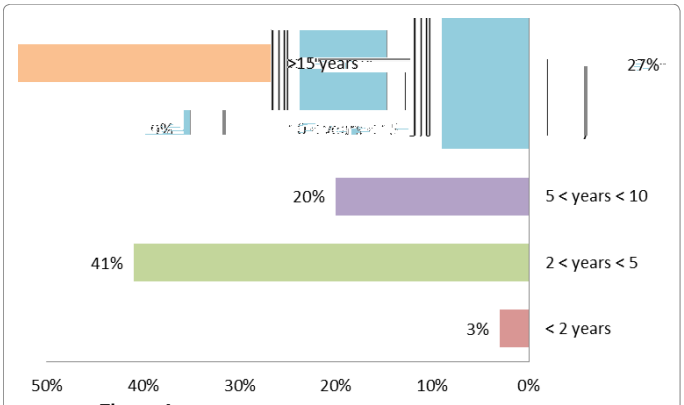
statistics from 2007 to 2015), it can be seen that major private and government owners were driven to institutionalize its bene t faster, more certain delivery, and more reliable quality and cost. It can be seen that many countries have realised the potentials of such technological and procedural evolution within the construction industry [12]. According to Lee et al. [13], BIM technologies were mandated by US, UK government entities to empower design and construction and to meet and exceed enlightened owners targets. In US, since 2006, the general services administration (GSA) has included spatial programme

sized companies. Figure 1 presents the percentage of the respondents based on the size of the rm. It shows that 69% of the companies are medium companies (with 50 to 199 employees) followed by large companies (21%) of 200-999 employees, the least respondents were found in two categories: the very large companies with more than 1000 employees (1%) and the small companies with fewer than 50 employees (9%) (Figure 2a). Respondents' pro les were classi ed



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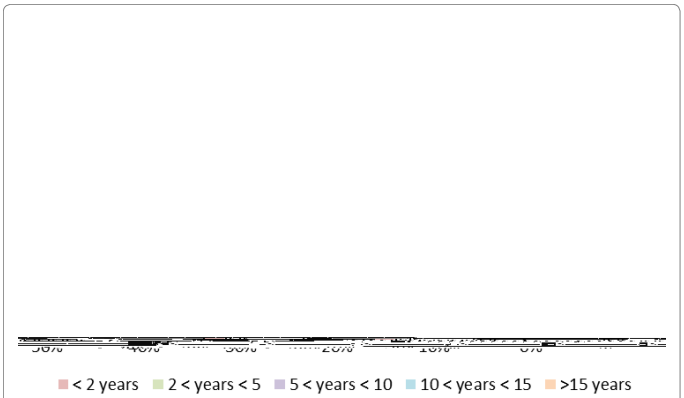

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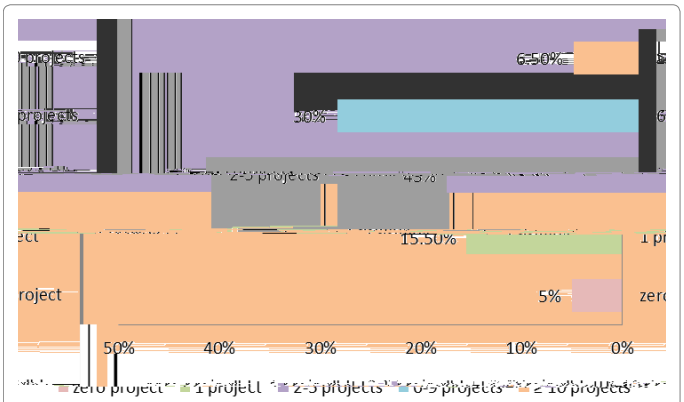
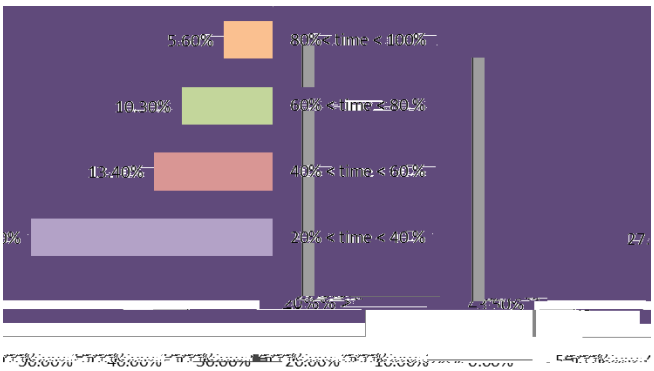


Figure 6:

who worked on 6 to 9 projects, only 15.5% had worked on one project. Only 5% had not worked on projects, where only about 6.5% worked on more than 10 projects.

Respondents' BIM experience level was investigated through asking them about the consumed time on tasks that require hands-on BIM experience. About 43.5% of respondents spent less than 20% of their time on BIM tasks. And only 5.6% of respondents spent from 80% to 100% of their time on BIM tasks. is nding in line with what found of majority numbers of respondents worked on few projects from 2 to 5. Interestingly, when di erent rm types are analysed, general contractors have the least hands-on experience; 73% of respondents spent less than 20% of their time using BIM, followed by 42% of construction managers. Again, architects have more hands-on experience with BIM than the other disciplines (Figure 8).

Next, respondents were asked to determine the way they taught BIM. As observed in Figure 9, 35% of the respondents were self-taught on BIM, where the majority could know the tools of BIM but not the process. "Industry training" was followed with 60 respondents (33%) indicated that their organizations and companies had provided training for employees to learn the process and its tools followed by "in-house training" with 29% and it was only with 3% of respondents who got their training from colleges and universities. Usually university



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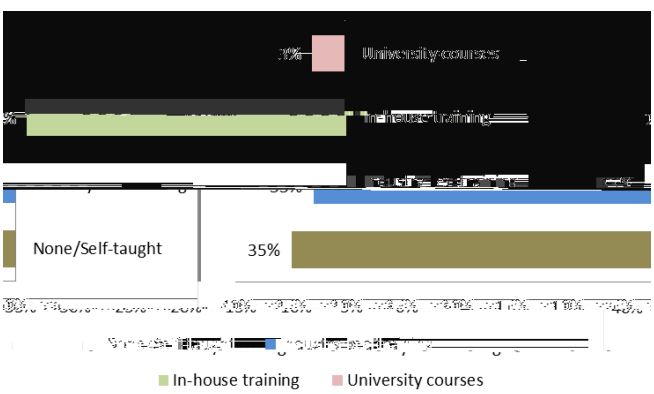

Figure 8:

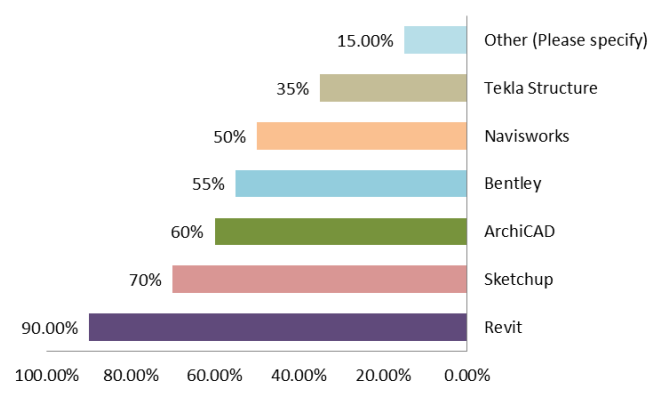

Figure 9:

training courses on BIM is very basic and it's more on the use of the so ware rather than the process of BIM.

is nding con rmed Rita Awwad's (2014) ndings in her research on BIM in Middle East, where she found that universities in Middle East include BIM within their programs' curricula as a course at the graduate level or as a part of a scheduling course at the undergraduate level. None of these colleges have BIM as a requirement for engineering students. In Jordan, its only three universities out of 19 surveyed universities o er BIM as an elective course to their students.

ese ndings show further the lack of BIM awareness in the market. Results presented in Figure 10 shows di erent BIM tools available widely in the Jordanian construction industry market. Based on the survey results the most common BIM tool was Autodesk programs, that are Revit, Sketchup, Archicad and Bentley with 90%, 70%, 60% and 55% respectively. Navisworks was in the second place with 90 responses (50%), where it was mainly used for construction schedule simulation. However, 35% and 15% of the respondents selected Tekla and other so ware respectively. is corresponds to 'most of the respondents indicating that they use BIM in the design stage. Responses to this part of the survey show that traditional CAD vendors such as Autodesk, Bentley and Archicad are most popular ones amongst the users. It can be said that these CAD vendors have taken the lead to introduce BIM to their current users in construction.

Next, respondents were asked to determine the phase of the construction project BIM was implemented. Majority of respondents indicated that BIM was utilized in more than one stage, particularly in the design phase. Figure 11 indicates that the 4 design respondent1.)Tj0.083 Tw -1.575% a5% of the reabouicatesmemen beneect6 rereaIM w

be checked automatically against constraints. To summarize, most of the respondents were in agreement that BIM implementation is very important and bene cial, particularly in term of productivity. Accordingly, the productivity related bene ts of using BIM can be identi ed as follows:

Reduced rework is the highest rated bene t among

industry at both the organizational and project supply chain level. Good and accessible standards have a major role to play in the success of BIM as a growth factor. ere is a need for holistic co-ordination among the industry's stakeholders including the government, industry, BIM vendors, clients and educational institutions.

To address the shortage of BIM practitioners, the industry and academic institutions should work together to develop syllabuses that are in line with developments in industry practice and procedures. ere should also be a system within each rm to ensure that the practitioners retain, actually apply and also share the knowledge gained from such programmes. Yet, the ndings of the study show that