BIM's Effective Role in Enhancing Collaboration by Designing Syrian Sports Buildings

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□ ABSTRACT □

Effective flow of data and communication at all stages of a construction project is important for reaching required coordination and collaboration between all project stakeholders, leading to effective management of the projects. In present situation, when project participants are geographically divided, operation of information communication technology (ICT) enables such effective communication. Thus, the purpose of this paper is to focus on BIM implementation and collaboration for construction project management.

Nowadays, participants in the process of construction are increasingly concerned about the cost and time required to complete the design of projects. However, they know that the design environment have become substantially more complex, which provides great opportunities to improve the process. The initial phases of the design process are particularly important for the quality of the final product, since most of the features and expenses of the construction life cycle are allocated at this stage. The main goal is to determine and back up a new method of working with integrated cycle from a life cycle perspective, obtaining, during the early design stage of a construction project, both client requirements and collaboration between stakeholders.

Developing an open and dynamic framework for collaboration, where all partners share information in a common Open Information Environment and supplement knowledge to the project, is the objective. Improving communication, faith and cooperation are the main motives lying behind this. The means and methods to achieve this are derived from innovative development and the use of existing possibilities of Building Information Models and neutral exchange formats, Product Lifecycle Management and new advanced software applications, together with the development of shared guidelines.

As a case study is the design of the rehabilitation of the Khaled Bin Al-Waleed Stadium in Homs City.

Keywords: Building information modelling –Collaboration- ICT

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دور BIM الفعال في تعزيز التعاون بتصميم المشاريع الرياضية السورية

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□ ملخّص □

يعتبر التدفق الفعال للبيانات والاتصالات في جميع مراحل مشروع البناء أمرًا مهمًا للوصول إلى التنسيق والتعاون المطلوبين بين جميع أطراف المشروع، مما يؤدي إلى الإدارة الفعالة للمشاريع. في الوضع الحالي، عندما ينقسم المشاركون في المشروع جغرافياً، فإن استخدام تكنولوجيا اتصالات المعلومات (ICT) يتيح هذا التواصل الفعال. وبالتالي، فإن الغرض من هذه الورقة هو التركيز على تطبيق BIM والتعاون لإدارة مشروع البناء.

يهتم المشاركون في عملية البناء بشكل متزايد بالتكلفة والوقت المطلوب لإكمال تصميم المشاريع. ومع ذلك، فإنهم يعرفون أن بيئة التصميم أصبحت أكثر تعقيدًا إلى حد كبير، مما يتطلب جهود كبيرة لتحسين العملية. تعتبر المراحل الأولية لعملية التصميم ذات أهمية خاصة لجودة المنتج النهائي، حيث يتم تخصيص معظم موارد دورة حياة البناء في هذه المرحلة. الهدف الرئيسي هو تحديد ودعم طريقة جديدة للعمل مع دورة متكاملة من منظور دورة الحياة، والحصول على متطلبات الزبون والتعاون بين أطراف المشروع خلال مرحلة التصميم المبكرة لمشروع البناء.

الهدف هنا هو تطوير إطار مفتوح وديناميكي للتعاون، حيث يشارك جميع الاطراف المعلومات في بيئة معلومات مفتوحة مشتركة ويؤمنون المعرفة بالمشروع. تحسين التواصل والإيمان والتعاون هي الدوافع الرئيسية الكامنة وراء ذلك. إن الوسائل والأساليب لتحقيق ذلك مستمدة من التطوير المبتكر واستخدام الإمكانيات الحالية لـ BIM وتنسيقات التبادل، وإدارة دورة حياة المنشأ وتطبيقات البرامج المتقدمة الجديدة،

كدراسة حالة تم أخذ مشروع تصميم تأهيل استاد خالد بن الوليد بمدينة حمص.

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Introduction:

"Collaboration is a creative process undertaken by two or more interested individuals, sharing their collective skills, expertise, understanding and knowledge in an atmosphere of openness, honest, trust and mutual respect, to jointly deliver the best solution that meets their common goal." (Wilkinson 2005)

Any global optimisation of a construction project requires collaboration between the participants, starting right from the beginning. The absence of efficient collaboration limits each partner's ability to enhance the project to just his own field of responsibility, i.e. each partner's participation is restricted to his or her own perspective. The only way to reach a global optimisation from the perspective of the overall project objective is to provide every partner with the possibility to collaborate with each other. This is why in a working framework, collaboration comes first, and second comes the integration of the following levels: culture of the stakeholders, organisation of the project and applied processes, which support new collaboration methods and tools.

Accordingly, we could define collaboration as a process in which two or more organization work together to achieve a common goal. Moreover, cooperation and coordination are two terms that are related to the concept of collaboration.

Coordination is a significant process, which complements collaboration. One role it plays is that it defines the working rules that accompany successful collaboration. These include identification, decision-making process and follow-up traceability. Coordination deals with several significant aspects including the need of a common exchange format, and the problem of change management, which, in turn, encompasses validation and/or approval, versioning and alternatives. Management of coordination requires the gradual ongoing definition of data, moving from a large-scale view to an increasingly detailed one. The lifecycle of the project "is divided into two phases according to the different contractual steps, in which the inputs and output deliverables are defined." (Pierre Benning 2009).

Research Objectives and Scope

The aim is to develop an open and dynamic framework for collaboration, in which all partners exchange information in a common, open information environment and add knowledge about the project. Improving communication, belief and collaboration are the main motives behind it.

Methodology

The methods for achieving this goal are based on innovative development and the use of existing options for Building Information Models BIM and there exchange formats, product lifecycle management and new, progressive software applications, as well as the development of common guidelines.

Collaborative Project Management

Previously, it was vital to position all the participants together in one place, working simultaneously and for long periods, in order to design a project. Evidently, it was easy to monitor the project. The order of the day was frequent and frequently changed in improvised meetings. The same problems faced competitors – slippages, over-budgets and failures – who used to act similarly, relying on the same business model. Things are different now. IT (Information Technologies) and its tools and processes are altering the project management process and its paradigm. Today not only are the project's inputs and outputs are important, but also the process by which projects are carried out is of great significance.

One of the consequences of the Internet revolution is the possibility of creating teams, whose members are geographically distributed over various locations, with different time zones, using web based project management software. Developing different types of teams – low-cost teams, high performance teams, expert teams, etc. – has now become possible. Thanks to the modern type of software, these teams are now heterogenic; that is, their members speak different languages, have different work times and different cultures. However, they all work together.

Tasks in traditional project management are carried out with team members being physically present in one place at certain times. In collaborative project management, on the other hand, tasks are sent by email or on shared message-boards.

Collaborative project management does not only regard project management as a reporting tool (such as Gantt chart or PERT chart generating). It also brings in other significant dimensions associated with project management :(Margarida Silva 2011)

• (information, decisions, processes, intervenient …);
• Information generation that is collected in a permanent repository;
• Changes tracking which help to follow and understand the wisdoms of the team;
• Earlier decisions study which can be extracted from the repository;
• Greater appreciation of work - why they are doing what they are doing;
• Knowledge and communication become explicit rather than implicit and tacit;
• Information details are shown;
• Dynamic ongoing processes;
• Maximal transparency in processes and of the information;
• Easier managing future, if something changes.

The diversity of these dimensions guarantee that, even in complex situations where business environments can undergo considerable changes (changes in inputs, turnaround in outputs, alterations in or disappearance of technology and platforms in use, reduction of resources in terms of time, money, personnel infrastructure, etc.), the collaborative project management will succeed.(Omran , Haddad 2014)

It is true that the term "collaborative project management" is a widespread concept, which has existed for a long time and is used by so many people. Nonetheless, it seems that it does not have a formal definition, not even on the web. The reason for this might spring from the fact that it is a very wide-ranging term, comprising a lot of domains.

Semantically speaking, a collaborative project is a project where several people work together to achieve a predetermined goal. From this point of view, any project involving more than one person can be considered collaborative. However, this term is being used more often in Information and Communication Technology (ICT), and is being increasingly associated with a virtual dimension due to the real distance between participants.

We will avail ourselves with a simple definition. A collaborative project is "a project where persons work jointly with others, having participation in a collective work, creating a virtual team, by virtue of using different work places, normally distant from each other and therefore may be using different work times." (Margarida Silva 2011)

The construction of a "collaborative project" relies :(on five major stages Figure 1)

Stage 1 includes selecting the right people for the project. This step is sometimes precedes the project definition. It's also a main ingredient for the success of the project, as its success requires the commitment of each member of the team.

• Participation must be voluntary - teams are destined to fail if not supported by its members;
• Members must have previously demonstrated satisfactory work responsibilities and habits.

(Figure .1 Stages of collaborative project)

There are several characteristics and aspects in the team, which are necessary if the project is to succeed. The team should be able to work under "limited supervision and feedback," with social action at its minimum. The team must also obtain "good organizational and time management skills", and it should be self-motivated. Being away from the workplace must not affect the team's concentration. Another significant issue related to the team is its size; the bigger the team is, the more difficult it is to achieve collaboration.

Stage 2 involves developing the leadership. When running a collaborative project, the project manager needs to meet specific demands. Making the team ready for collaborative work might be the most difficult challenge. In short, the project leader must "communicate the vision, develop a mission statement and define the goals." Moreover, "norms, work roles, meeting processes, communication processes, and work processes" all have to be defined by the leader if the project is to be fruitful.

Stage 3 involves keeping members of the team interested in and preoccupied with the project. This can be achieved through organizational, task and team design. This involves endowing the team with the authority to make decisions, discuss compensation and provide feedback, all in favour of allowing members to develop and become recognized. Recognizing team values, being involved, and knowing the team's limitations and expectations are all elements that need to be understood by each team member. To be brief, in stage 3 the team's identity needs to be constructed, and connections with external resources and support parties need to be made.

Stage 4 is related to realizing the project, fulfilling it, which is largely dependent on the subject of the project. Collaborative projects, however, face many more obstacles and more efforts are needed to build trust and keep the communication unrestricted.

Stage 5 is all about completing the project. A good way to announce the completion of the project and give recognition to team members is by presentation. Team members can be credited via a face-to-face or a final video conference.

When working within the frame of a collaborative project, it is of utmost significance to precisely define the Collaborative Project Management Architecture. Four major modules in the project coordination scheme can be recognized: (Margarida Silva 2011)

• The **project repository,** which serves as a project memory as all the information about the project is stored here;

• The **project planning,** which allows users to plan the project in terms of time and resources;

• The **project execution,** which supports workflow management by using the project plan, and allows re-planning and re-scheduling.

• The **project control,** which supports monitoring of the project, and allows users to assess the current state and collect metrics.

Both traditional and collaborative projects include the aforementioned modules. Nevertheless, there are differences in the relationship between the modules and each type of project. For instance, unlike traditional projects, the project repository in collaborative projects poses hurdles due to the lack of face-to-face communication. Therefore, team

members in collaborative projects must be provided with efficient means of electronic communication, and this is one of the problems specific this kind of projects.

When information is managed using IT, the teams may create what is known as "islands of information"_ pieces of information that cannot be shared. In such situations, the projects suffers losses. It is widely known that project members are generally oriented towards carting out their tasks rather than seizing and archiving data they come across, even though this data might be of great use in the future. Therefore, one of the problems that result from this is the inadequate documentation of the project, especially when lacking an electronic project repository. This might also lead to redundancy as project members might not be aware that other members have already carried out the same task.

To make management proactive, project analysis, communication, and process monitoring must be made easy by using collaborative tools. Proactive management, in turn, needs a didactic organizational "project memory". This means that team members have the opportunity to learn and acquire skills with reference to earlier and implement them in future projects. Using an electronic project repository is one way to put into operation an efficient organizational memory of the project. This way, the members of the project would be able to update, view one another's work progress, collect project measures, and access the current work of others on time. It should be noted that the loss of organization memory and learning is one long-term drawback of the absence of a project repository.

Collaborative Working Supported by ICT

Construction projects are complicated and require high coordination among many project members. There is a direct proportion between the size and complexity of construction projects and the number of those taking part in them. It has been found out that methods employed in managing and executing traditional projects do not comply with the requirements of modern projects. In addition, there has to be much more reliance on present-day communication tools to enhance coordination among efforts in favour of successfully accomplishing projects.

Technology is no longer a tentative block to implementing collaboration. The surge of "personal computers, wireless computing, Internet connectivity and programming framework" has made planning and coordinating efforts much easier. It is still true that many are hesitant to break away from the traditional approaches, which is one of the obstacles facing collaborative work. These limitations indicate that many aspects of running and executing construction projects still require meticulous planning and rigorous implementation in order to achieve better alignment with innovative concepts of collaboration.

Two vital parts of collaborative strategies are teamwork and the employment of a single project model with 3D. All the information related to the project can be set in the model, which would allow all the members to access and make use of it. One advantage of this is that it can eliminate certain faults and prevent the waste resulting from indecision caused by the different disciplines of design and construction information. Because it is advantageous, partnering in construction projects have become so common. Both two- and three-dimensional systems represent a huge jump forward.

The new approach dictates, Information should be created once and once only. It should be considered as doubtfully one of the most important project assets. If information has to be reconstructed or duplicated then the sharing processes are not working properly.

New business processes cannot be developed unless present difficulties and obstacles are dealt with. Most often, there are delays that result from confrontations and arguments arising among project members. Another hindrance appears when using Information Technology as there is no universal compatibility agreed upon between the varieties of

software at use. Some aspects related to traditional approaches to construction processes, such as cost saving, have already been explored. Some other aspects, however, still need to be improved. These aspects involve lack of spatial co-ordination, poor appreciation of manufacturing and construction tolerances, poor management of data, drawings and documents and poor management of information flow. These unknown savings can only be realized with the help of coordinated use of IT, collaborative working and early involvement of the supply chain. A top priority as well is defining a set of standard methods and protocols for the project, because they would guarantee the insertion of only suitable data in the project model. It follows then that project collaboration not only saves costs, but it also helps the industry to recover. (Omran et al 2014)

The Role of the BIM in Collaboration:

Fragmentation, low innovation, adversarial relationships and slow adoption of Information Communication Technologies have all had a negative effect on the productivity of the industry of Architecture Engineering and Construction (AEC). What is of great help to overcome such industry difficulties is the increasing public acceptance of Building Information Modelling (BIM), along with online collaboration forums.

Building Information Modelling (BIM) is a collaborative way of working, underpinned by the digital technologies, which unlock more efficient methods of designing, creating and maintaining our assets. BIM includes several things that can be utilized to achieve efficiency in information management during the lifecycle of a project. These include asset data and a 3 dimensional computer model. IT is thought of BIM as a game-changing ICT and cultural process for the construction sector. BIM processes are very common now in the industries of building and infrastructure. Moreover, when complementary workflows such as laser scanning and rapid energy analysis are used, BIM processes have more to offer in 'retrofit' and 'refurbishment' projects. BIM technology should be seen as a ‘collaboration' between the construction sector and the software industries and creates an environment in which there are opportunities and synergies for both.

BIM will integrate the construction process and, therefore, the construction industry. Nevertheless, it will also have many additional benefits for the Syrian construction industry. It will enable intelligent decisions about construction methodology, safer working arrangements, greater energy efficiency leading to carbon reductions and a critical focus on the whole life performance of facilities (or assets).

Collaboration is not only about the capacity to transfer data electronically, it is also a business process involving the entire delivery team of the project. Single Model Environments (SME) or Common Data Environments (CDE) has been on the lips of the industry since the early 1970s.A Common Data Environment is an environment where we can collect, manage and disseminate the project design, production, construction and asset management information to give:-

- Greater certainty of delivery.
- Better management of risks.
- Increased profit to all involved.
- Greater certainty of costs.
- Best quality for cost.

A "cloud", which is a project extranet capability provided on the Internet, can be used to center the collaborative environment. Large quantities of data must be managed in both image and native forms on the cloud. At present, most clouds offer a quasi-managed

environment, which is a little more than an excellent email system where the communication responsibility falls on each team member.

SME (or CDE) is a managed environment that is capable of passing information to the recipient via a managed document and data management system, with a workflow process and a fully maintained audit trail. This might assure the team members that no one will make changes on the information they share in this sharing environment.

Literature Review

Further measurement and research on the factors hindering its adoption and on its benefits, particularly on the counterbalance on the cost and time saving against the following the recommendations by the BIM Industry Working Group (BIS, 2011) the UK Government has decided to mandate the use of "fully collaborative 3D BIM (with all project and asset information, documentation and data being electronic)" for its projects by 2016.Collaboration assumes that participants have common objectives hence share resources and knowledge and seek more benefits than by working alone (Son et al., 2011). As indicated by (Isikdag and Underwood, 2010) effective collaboration can only be achieved through effective coordination and communication.

ICT made it easier to adopt collaborative methods in the last years. BIM technology is an excellent problem-solver. This is accomplished through opening communication channels, and prompting agents from different disciplines to contribute (Succar 2009), eventually reaching an almost optimal design right from the initial stages.

(Shelbourn ,2007) believes that we do not get good collaboration by merely adopting and using solutions provided by information technology, because there are issues related to organisation and the people taking part in the project, and these cannot be straightaway solved by technology. A review of different studies on collaboration in AEC by Shelbourn et al.(2006a), Lee and Eastman (2008), Son (2011), Simatupung (2005), Isikdag and Underwood (2010), Shelbourn et al. (2006 b) reveals the common themes of common vision/incentive alignment, clarity on responsibilities/decision synchronisation, and intuitiveness and interoperability of software as prerequisites for effective collaboration.

The most important Development is the ISO 19650 and the collaborative production of information. The ISO 19650 standard is an international standard for managing information over the whole life cycle of a built asset using building information modelling (BIM). It contains all the same principles and high-level requirements as BIM Level 2 and is closely aligned with the current UK 1192 standards. (ISO-19650-2018).

Since 2015, Building Information Modelling (BIM) and asset information management experts from around the world have contributed to the development of ISO 19650-1 and ISO 19650-2 which were subsequently released in December 2018.(UK BIM Alliance-Information Management according to BS EN ISO 19650)

ISO 19650 operates within the wider context of an asset management system, such as the one described in the ISO 55000Asset Management Standard. ISO 19650-1 Section 6.2 highlights key principles from both ISO 55000 and ISO 9001and clarifies the relationship with other standards. One of the core elements in the BIM value proposition is defining the operator/owner's Asset Information Requirements, allowing the project delivery team to align their efforts. Information can then be effectively planned and managed to enable collaborative project delivery practices and so that it can then be structured to support ongoing asset management practices.

The construction process usually involves very large and often fluctuating groups of people working together over extended periods. Regardless of how wonderful the technologies are

that are at their disposal, social and cultural factors will typically determine how smoothly and effectively this process runs in practice. This includes, for example, everyone having a clear understanding of the overall information management process over the lifecycle of the asset, and the part they play in that process. This is the real value of ISO 19650 – it provides a common framework for collaboration, communication and managing the exchange of all information between all actors over the project delivery lifecycle whilst facilitating good information handover practices.

Working together not only includes the systematic exchange of information but also understanding what about the information once it is passed on; this is important in ensuring it is created to meet a purpose. This could be, for example, to help the receiving party to perform a task (such as design, analysis) or to make a decision. Finally, information needs to be useful to both people and technology and for this to happen content, structure and format need to be considered. When information isn't useful it becomes unproductive and effects on those needing to use it to do their job. This can cause delays, for example, if the information needs to be re-worked, or it can generate risk of error arising from misunderstanding.

To empower work in a collaborative environment, information needs to be produced in line with ISO 19650-2 clause 5.6.2. Construction information tends to build on the work of others and should not be created in isolation. Therefore, information should be shared on a regular basis during project stages across the project's common data environment (CDE) (which may employ a number of different technologies). During design, information needs to be exchanged with other parties for use as reference or background information to aid coordination. Coordination should be directed as the design develops both geometrically (for example spatially) and non- geometrically (i.e. performance). Delays in sharing information can affect those needing to use it, which can cause a snowball effect across the project.

This shared information together with the concepts covered in ISO 19650 deliver the rules and constraints in which information should be created. The project's information production methods and procedures are particularly important as they establish the rules for collaboration within the CDE. Information should be created in line with the project's information standard to ensure successful exchange with other technologies, using open data formats where possible (see ISO 19650-1 clause 6.1 and ISO 19650-2 clause 5.1.6).

Figure 2 shows the general information management life cycle for operational assets and project delivery, and the relationship between these two distinct parts of the asset life cycle, within ISO standards 9001(quality management) and 19650.

(Figure .2 general information management life cycle)

Lifecycle approach, BIM and OCPs (Online Collaboration Platforms):
Discipline fragmentation, the focus of clients on capital asset value instead of the lifecycle costs and the employment of "design-bid-build contracts and delivery methods" are all causes for the halt in adopting lifecycle management approaches in AEC/FM. Adopting BIM can help tackle the aforementioned problems by:
1. Enabling communication between disciplines;
2. Allowing for the early approximation of lifecycle costs and their elucidation to the client;
3. Drawing/demanding contracts and delivery methods of the form of Design and Build or Integrated Project Delivery.
The biggest "upside potential" by the adoption of BIM is at "use" phase even though, to date, its measured benefit in real projects is low (Building Smart International, 2010).
A building information model should therefore act as:
1 A facilitator and reminder/motivator/instigator of early design decisions to account for lifecycle costs. As explained by Succar (2009), an indicator of BIM maturity is the level by which information flows from the construction and operations phase to the design phase;
2. A central data repository for facility management during the operations phase.
Activating synchronous and asynchronous distributed collaboration gives online collaboration platforms the chance to play a major part in BIM processes. Underwood and Isikdag (2010) point out that "cloud computing will enable the next generation of (full state) BIMs" (or BIM 2.0) where the "digital building model will evolve through the

lifecycle of the building. The Internet, within the integrated environment of (BIM 2.0), will be "the medium through which the BIModel will be continuously updated and open for new information.

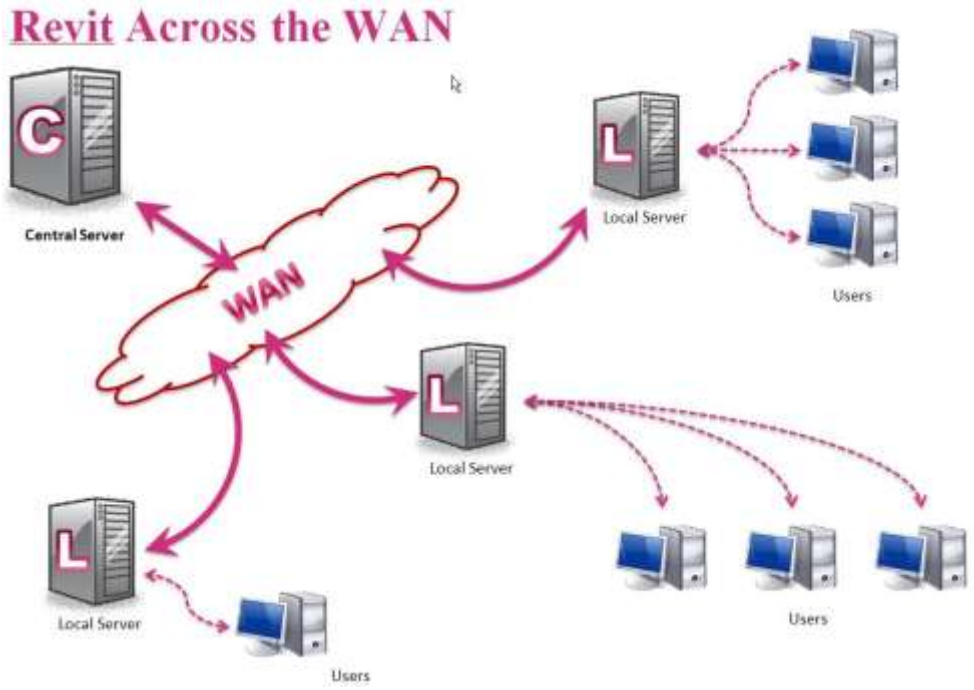
Cloud computing, together with BIM, denote Grilo and Goncalves (2011), will completely change e-procurement by providing the capacity to change traditional unstructured data into structured bodies, which would result in interoperability. As indicated by Beach et al. (2011), issues of sharing, accessing and processing data, which are related to the adoption of BIM, will be tackled by online collaborative platforms.

Revit Server as BIM Collaboration tool

We decided to use Revit Server as software that enables an internet based collaborative BIM environment, it allows big number of designer to work in a connected BIM network, despite being located in distant locations. Revit Server can support collaboration and work sharing between remote sites .We recommend to use and manage Revit Servers for the design works., by installing high-speed Internet with static IPs and by configuring firewalls and VPNs , we can have our own Revit Server running in the Cloud in as little as an hour.

We have to manage the server, including Windows Server and Revit Server updates, running regular backups and monitoring of server performance and hard drive space. The Revit Server's web interface allows us to manage our projects on our hosted Revit Server.

Revit Server is the server component for Revit Architecture, Revit work-sharing for Revit projects and is a viable solution for Revit MEP and Autodesk Structure software. It is the foundation for server-bas project teams in geographically dispersed locations to effectively collaborate on projects over a WAN. The Hardware solution will have the structure shown in Figure (3)



(Figure .3 Structure of the Hardware)

Case Study:

Khaled Bin Al-Waleed Stadium was established in 1960, where it started with earthen field and the stands were not built until 1967. In 1980, the terraces were constructed, and the earthen field was changed to a tartan field. So the stadium has a capacity for twelve

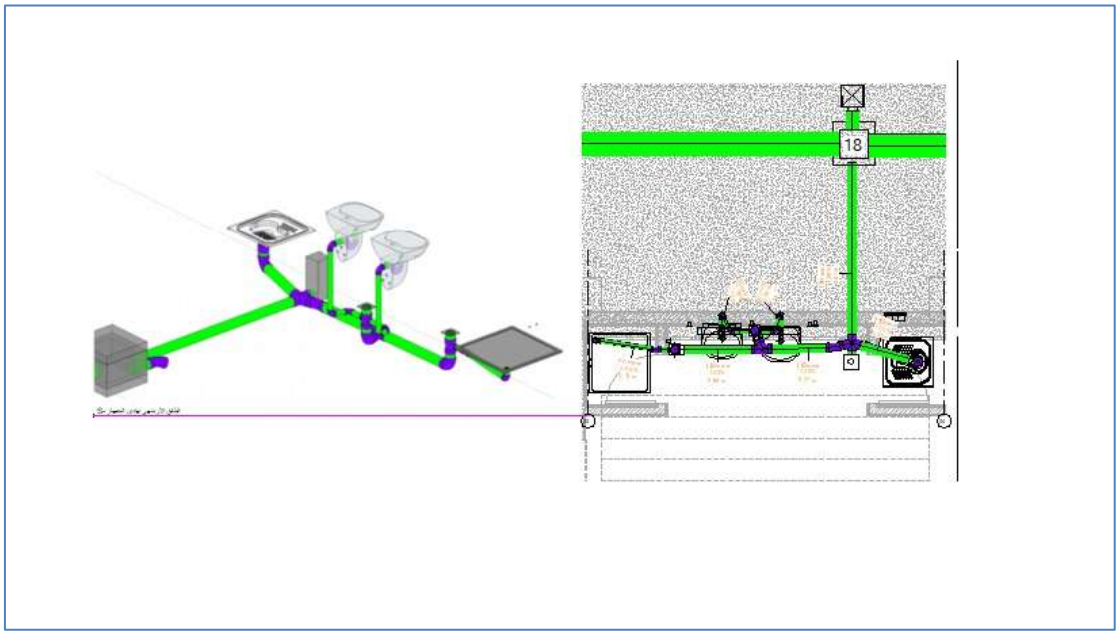
thousand spectators with all its stadiums, and a group of different gyms were built, and the project of changing the stadium's field came with the expansion of the stadiums where the two tartans were removed in 2002 and the stadium was furnished with natural grass and the stadiums were expanded, so it was able to accommodate about Twenty-five thousand spectators, and in the year 2017 a study was submitted to treat water leakage and damaged concrete. This study concluded with a decision to replace the slaps and accordingly a decision was taken to prepare a study for the rehabilitation of electricity, water and sanitation works and civil and architectural works.

The used concept allows the stadium to be modelled without comprehensive data from all three disciplines: architecture, structure and systems (MEP). Since the structural designs were not available, only visually detectable structures were modelled in the architectural BIM model, without changes in the guideline structure and in the modelling workflow. This information can be added during further investigations in the structural component.

The stadium has been surveyed in order to update and correct the as built and design drawings provided: a detailed survey has been performed to gather all the finishing of each space. Information related to the stadium component are a key data for the asset management. A detailed survey has been completed to validate number and type of security, fire alarm systems, light bulb and every maintainable asset. The equipment maintenance and use of information were collected at the same time as the geometric survey. After the survey, identification of architectural, structural, and MEP disciplines elements, the BIM library was built and organized. The information requirements for management and maintenance were linked to the modelled objects. Attributes are inserted in objects thanks to shared parameters file, to allow the implementation and application in other new objects. Attributes are standardized and organized into following categories: (1) project information; (2) codification; (3) general data; (4) fire prevention equipment; (5) electrical equipment; (7) mechanical equipment; (8) spaces; and (9) maintenance.

The use of Revit –Server has had a great benefit in reducing time and reducing conflicts between engineering systems to a minimum, through the great collaboration that has become available with Revit –Server. What is distinctive in the matter is that the entire team works on only one file that is exist on the server and when one of the designers approaches another specialty, the server sends an alert, which makes the possibility of a conflict not likely at all.

(Figure .4 3D Revit Modell for the whole project)



(Figure .5 One 3D Revit Modell for the Plumping)

CONCLUSION:

New approaches to methods of designing, constructing, running and maintaining buildings and infrastructure have been considered due to certain problems confronting the construction industry. Although Revit Server solutions are designed to address challenges in the construction industry, an integrated approach to adopting it has not been found yet. This module endeavors to verify that the utilization of Revit Server on a large level in the construction business will bring about many advantages for the consulting offices taking part in electronic exchange and cooperation .

This study was mainly made to seek a possible level of online collaboration in Syria. The most common collaboration platforms, therefore, were at the heart of this study. Research has shown that the most commonly employed technological medium for collaborative purposes is direct communication. This is probably due to the quickness of this medium in exchanging data. One more thing that can be drawn from these is that informal ways of communication are still very common as collaboration practices among construction projects. Surprisingly, online collaboration came last among the collaboration mediums most commonly used.

The results of the study indicated that the most hampering factor to the implementation of online collaboration platforms has been inadequate knowledge or lack of awareness. . The second most influencing factor has been unavailability in the local market. The absence of local suppliers of up-to-date technologies with compatible software contributes to the lack of enthusiasm in construction businesses regarding adopting such technology. The third factor has been found to be poor IT infrastructure resulting from "low Internet speed" and other matters. Unfortunately, Internet connection is much slower in Syria than in developed countries, which discourages any enterprise in adopting any Internet-based technology. This also discourages technology providers to invest with such technology in the developing countries construction industry. Lack of training, due to the lack of institutions that provide training, ranked fourth among the factors hampering the adoption of IT programmes.

The results of this study can improve the awareness of construction stockholders of Syria regarding to the online collaboration and it obstacles. In addition, the suggested solutions would enhance the online collaboration level.

REFERENCES

1- BSI, 2011 B/555 Design, Construction & Operation Data & Process Management, UK:British Standards Institution.

2- Building Smart International, 2010 http://www.buildingsmart.org.uk/

3- ISO_19650_1_2018_first edition _EN

4- Love, P.E. and J. Smith, 2003. Benchmarking, benchaction, and benchlearning: Rework mitigation in projects. Journal of Management in Engineering. 19(4): p. 147-159.

5- Pierre Benning, Claude Dumoulin & Others:The InPro project is an Integrated Project co-funded by the European Commission within the Sixth Framework Programme Public Report of Deliverable D16B, January 2010

6- Omran, J., Haddad, G., Khosrowshahi, F., Wishardt, M., and Gorse., Ghodous.,P. (2014), Transition of the Design Work from Traditional CAD to BIM - Economic Feasibility Study, Information Visualisation IV14 Conference – Visualisation on Built and Rural Environments - BuiltVis, IEEE Database, 16-18 July 2014, Paris, France.

7- Omran J. Haddad.G. "Comparing Building Information Modeling (BIM) System With Traditional CAD System in Design Phase Tishreen University Journal for Research and Scientific Studies – Eng. Sciences Series Vol. (36) No. (2) 2014

8- Margarida Silva: Collaborative Project management – issues, methods and tools – May 2011

9- Manzione L."Proposition for a Collaborative Design Process Management Conceptual Structure using BIM "Thesis submitted to the Polytechnic School of the Universidade de São Paulo , Ph.D. in São Paulo, 2013.

10- Shelbourn, M., et al., 2007. Framework for effective collaborative working in construction. Proceedings of the ICE-Management, Procurement and Law. 160(4): p. 149-157.
11- Succar, B. (2009) Building information modeling framework: A research and delivery foundation for industry stakeholders. Automation in Construction,18,357-375
12- Wilkinson, P. (2005) Construction Collaboration Technologies: The extranet revolution, Taylor & Francis, UK.
13- Wilkinson, P., 2008. The role of extranets in construction e-Business. e-Business in Construction. p. 81.
14- Williams, T.M. (1999) The need for new paradigms for complex projects. International Journal of Project Management, Vol. 17, pp. 269-273.
15- Yang, J., V. Ahuja, and R. Shankar, 2007. Managing Building Projects through Enhanced Communication-An ICT Based Strategy for Small and Medium Enterprises.