The Importance of E-Construction Implementation in the Syrian Projects

Dr. Jamal Omran[*]

□ ABSTRACT □

Did we have in Syria the need to implement the E-Construction in our projects? This question seems to be very significant; when we know that, a lot of the industry obstacles and problem can be easiest using E- Construction tools. Construction industries are internationally today in rabid development of E-Business and other technologies to increase productivity and performance. In this paper, I demonstrate the effective utilizing of the E-Construction tools in a pumping station project to elucidate the benefits, opportunities and challenges of Information and communication Technology (ICT) and E-Business in Syrian construction industry. New technology using ICT and E-Business brings changes in construction industries. ICT applications improve workflow and communication in diverse levels of organization. ICT and E-Business are important to both large and small enterprises facilitating integration and collaboration with business partners, suppliers and customers and to make electronic transactions. Syrian construction companies are not yet started adopting speedy communication tools to get efficient work done.

Keywords: E-Construction , ICT , BIM, E-Business E- Procurement, E- Tendering

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[*] **Associate Professor, Department of Construction and Management Engineering, Faculty of Civil Engineering, Tishreen University, Lattakia, Syria.j-omran@tishreen.edu.sy**

أهمية تطبيق E-Construction في المشاريع السورية

د. جمال عمران*

□ ملخّص □

هل لدينا في سوريا ضرورة تنفيذ الوسائط الإلكترونية في مشاريعنا؟ يبدو أن هذا السؤال مهم للغاية. عندما نعلم أن الكثير من العوائق والمشكلات في الصناعة يمكن أن تكون أسهل باستخدام أدوات البناء الإلكترونية. تتواجد صناعة البناء على الصعيد الدولي اليوم في تطوير سريع للأعمال الإلكترونية وغيرها من التقنيات لزيادة الإنتاجية والأداء. في هذه الورقة، نوضح الاستخدام الفعال لأدوات البناء الإلكتروني في مشروع محطة الضخ لتوضيح فوائد وفرص وتحديات تكنولوجيا المعلومات والاتصالات (ICT) والأعمال الإلكترونية في صناعة البناء السورية. تسبب التكنولوجيا الجديدة باستخدام تكنولوجيا المعلومات والاتصالات والأعمال الإلكترونية تغييرات في صناعة البناء. كما تساهم تطبيقات تكنولوجيا المعلومات والاتصالات على تحسين سير العمل والاتصال في مستويات متنوعة من التنظيم. تعد تكنولوجيا المعلومات والاتصالات والأعمال الإلكترونية مهمة للمؤسسات الكبيرة والصغيرة على حد سواء لتيسير التكامل والتعاون مع شركاء الأعمال والموردين والعملاء وإجراء المعاملات الإلكترونية. لم تبدأ شركات البناء السورية بعد في اعتماد أدوات اتصال سريعة لإنجاز العمل بكفاءة.

الكلمات المفتاحية: الإنشاءات الإلكترونية، تكنولوجيا المعلومات والاتصالات، نمذجة معلومات البناء، المشتريات الإلكترونية للأعمال الإلكترونية، المناقصات الإلكترونية.

* أستاذ مساعد – قسم الهندسة الإدارية والانشائية– كلية الهندسة المدنية– جامعة تشرين– اللاذقية– سورية.

INTRODUCTION:

E-Construction is a construction administration delivery process without using paper including: electronic submission of all construction documentation and data by all stakeholders, electronic document routing/ approvals (e-signature), and digital management of all construction documentation in a protected environment allowing distribution to all project stakeholders. The administration of projects needs a significant amount of documentation. This has usually been established through paper-based documentation systems by using traditional postal delivery, project handbooks, note taking, stamped plan sets, design and construction submittals, and physical signatures on multiple copies of many documents. A paper-based system needs time and money to generate process and stock documentation. In an age of direct communication, on-the-fly information access, and technology-skilled workforce, this an old-fashioned way of work.

Therefore, E-Construction is an effort to conduct business in a paperless environment by transmitting construction documentation electronically. E-Construction is mainly accomplished by utilizing project collaboration sites with the support of other technology. Some of these tools are:

- Electronically capturing construction data
- Electronic submission of all construction documentation
- Increased use of mobile devices
- Increased automation of document review & approval
- Essential use of electronic signatures by all parties throughout the process
- Secure document and workflow management accessible to all stakeholders.

1- ICT IN CONSTRUCTION

ICT is short for Information & Communications Technology. ICT covers all forms of Computer and Communications equipment as well as the software used to create, store, transmit, receive, interpret, and manipulate information in its various formats. Information comes in various formats and it is all around us: Voice Conversation- Text – Pictures- Data- Motion Pictures or Video- Multimedia Presentations - Radio and Wireless Broadcast- Television Broadcast

ICT deals with all the systems involved in creating, storing, sending or transmitting, receiving and manipulating these kinds of information. The systems behind ICT include both hardware devices and the software that allow the hardware devices to carry out or to be used for their intended functions. [1]

ICT in construction industry can be defined as: The application of tools that support decisions, using devices and software that process, store, analyse, control, transfer and present construction information or data during the entire development stages of a construction project, which are predesign, design, construction, operation and maintenance. [2]. Information and Communication Technology (ICT) aims at offering information and analytical tools to construction stakeholders so that they manage to achieve optimal control and delivery of the construction processes. ICT consists in computer hardware, software and communication devices that are used to gain access and ability to communicate easily on both local and global levels. One of the main conditions for a comprehensive approach to project delivery is ICT, which gives professionals the choice to consider and produce making alterations in the project. [3][4]

Fields in which ICT is used in Construction Industry are: [3] Designing.-Accounting. - Scheduling.-Record-keeping. -Marketing. Document- and knowledge-sharing (between

head office and sites).-Document- and knowledge-sharing (with other firms). -Document- and knowledge-sharing (within office).-Document- and knowledge-sharing (with clients).

RESEARCH OBJECTIVES AND SCOPE:

The aim of this research is to improve the use of E-Construction in the Syrian projects, in which all participant interchange 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 approaches for achieving this goal are based on advanced improvement and the use of existing options for Building Information Models BIM and ICT tools.

2-   IMPLEMENTING ICT WITHIN CONSTRUCTION INDUSTRY:

Recently, the desire to construct a building in a virtual environment before the inception of real construction, even before the purchasing stage, has been one of the goals aimed at in the construction business. This has given a chance to a prior knowledge of whether the building is constructible or not, which in turn helped contractors make enormous savings and enabled the testing of the feasibility and efficiency of design solutions.

Virtual prototyping is the development of a simulation process that is used to test, evaluate and modify original models in a virtual design environment. The aim is to avoid the otherwise necessary making of physical models. Virtual prototyping usually includes analysing BIM models for different consumer appliances, such as the possibility of manufacturing. Virtual prototyping makes use of the simulation in order to test, assess and alter the design of prototypes from the conceptual, or abstract, form to reach the final product. This will help designers in the construction phase envision the interactive results of the alterations made on the design. It will also "allow tests to be performed during each phase of product development, help programme managers identify programme risks, enhance economic competiveness, etc."

One of the ways proposed for implementing ICT in the construction industry would be boosting communication management and data transfer on both inter-organisational and intra-organisational levels, and among various stakeholders, participants and teams. Establishing virtual collaboration within the construction business processes was one method frequently suggested by BIM academic reports and papers.

3-   E-BUSINESS IN CONSTRUCTION

The term "E-business" is defined as the use of information and communications technology to change and improve business relationships. The "business relationships" referred to are not only limited to those between the business and its customers, suppliers, etc., but also include those with employees and governmental institutions. With respect to the technology part of the definition of E-business, the Internet is an important enabler, giving a host of new possibilities. [5],[11]

The term "E-business" is commonly used to describe Internet-enabled systems that provide information, facilitate transactions or provide shared business. E-business technology typically supersedes either paper-based systems or Electronic Data Interchange (EDI) to provide an improved communication channel between business partners. Other definitions of E-business that are evident in other industry sectors include:

• The undertaking of business related transactions and information exchanges utilizing an electronic format and environment.

• The creation of networks that act as electronic supply chains.

• The creation of commercial efficiency with subsequent benefits for all stakeholders. [6]

E-Procurement:

E-procurement or electronic procurement is the exchange of information across electronic networks, at all stages in the supply chain, whether within organisation, between businesses or between businesses and consumers. E-procurement is the business-to-business purchase and sales of supplies and services over the Internet that has been used to streamline, manage and report on the corporate purchasing function, and range from basic catalog access tools to systems that encompass the entire requisition-to-delivery process. [7],[8]

E-procurement is generally defined as the use of the internet for requisitioning, authorising, ordering and payment of products and services. It is the application of a span of digital technologies to expand the front-end and back-office integration of contracting, service, transportation and payment of the products and services through electronic processes, decisions, and transactions. **[9]**

E-procurement comprises a variety of methods and techniques, which rely on the Internet, covering each phase in the process of purchasing goods or services. These methods and techniques are employed to get data about prices, "awarding and managing contracts, etc."). This applies to e-Tender. E-procurement can be more than just a system for online procurement. An E-procurement system can connect a construction enterprise and its business processes directly with suppliers while managing all interactions between them. This includes management of correspondence, bids, questions and answers, previous pricing, and multiple e-mails sent to multiple participants. **[9]**

E-procurement characteristics:

E-procurement enjoys a number of characteristics, including: Reduction in transaction costs. - Quicker and more accurate transaction purchasing. - Elimination of maverick buying.- Reduced inventory.-• Improved order tracking.- Improved information management. - Increased contract compliance. - Lower prices.- Increased employee satisfaction. **[8]**

E-tendering:

It is the use of electronic means throughout the tendering processes, i.e. finding and selecting suppliers of works or services. **[9]**. E-tendering is a procedure that substitutes the conventional system of paper tendering in the procurement of goods or services. It is also utilized to notify, involve, assess and pick suppliers electronically. E-tendering represents an electronic tool for competitive "bidding for contracts." E Tendering allows a cutting down on the costs brought about by the engendering of tender documentation. It also saves time in the tendering process, and provides a secure, ongoing and more structured method of exchanging tenders. Moreover, e-tenders are also portable, inexpensive and simple to compile. **[10]**

When the buyer is a public authority, the term public E-tendering is used, which is defined as the acquisition of high value, low volume goods, works and services by seeking bids(proposals) via a public process followed by the evaluation of bids and award of contracts. **[9]**

One of the advantages of E-tendering is that it gives the contracting authority the opportunity to perform an online management of the entire tendering process. "This includes supplier sourcing, advertising the requirement, issuing the Invitation to Tender and other tender documents, supplier completion and submission of the tender return, and a closed tender box." E-tendering also allows the contracting party to receive and respond to questions asked by bidders and to continuously communicate with the suppliers or the individuals.

Benefits of E-Procurement:

The potential efficiency gains from E-procurement are especially expected from savings related to: Procurement prices. Administrative costs for the buyers. Administrative costs for the suppliers. These savings can be achieved by using E-procurement and in public E-tendering. The potential savings in the Construction industry when using E-procurement were illustrated by expert comments arguing that the construction sector will be able to lower the cost of individual items purchased by 20-30%. **[9]**

According to latest research by e-Market Services, an enterprise engaging in electronic procurement could cut procurement costs by as much as 8 to 15%. **[9]**

Another analysis by e-Market Services of E-procurement in European enterprises showed the average payback period for the investment in E-procurement to be less than a year. **[9]**.Geoffrey, S and Matthew (2001) stated that the benefit, which the government and the supplier could get by adopting E-procurement system, are: **[8]**

A. Cost Savings

● Easier cost comparison among bidders, catalogues, etc.Accepting the lowest bidder and supplier quality control are endorsed by comparisons of costs "among bidders, catalogues, etc." There will be much economizing thanks to the retreating need to use "paper, postage, printing, and copying."

● Just-in-time procurement: It is well known that on account of modern technology, purchasing processes, unlike times of yore, can take place more often – "delivery overnight, or within days in most cases." This absolutely provides cuts on the undesirable costs of warehousing.

● Reduction of off-contract buying: "Many employees purchase goods off contract," without being aware of the cutbacks discussed and settled in the contracts. The employees' tendency to make off-contract purchasing will ebb due to E-procurement, as "the transaction costs of purchasing under the contract will fall."

● Bulk or "warehouse" purchasing: E-procurement facilitates the easy assembling of governments to purchase products, "enhancing their ability to negotiate lower prices from vendors, thereby cutting costs." In a much similar way to that of "consumer warehouse clubs", as the amount or number of the demanded products increases, there goes a reduction in per-unit cost. In other words, "Teaming up drives down costs and saves money," which is a case enabled by technology.

B. Increased Competition and Access

● Wider "market" participation: Governments usually announce bids in local newspapers, which inevitably results in a small number of possible bidders. The Internet, on the other hand, is vast, which allows grabbing a huge number of bidders. This will surely raise the competition and reduce the costs.

● Greater Access: The fact that the Internet is open day and night means that data related to government bidding can be accessed by dealers and suppliers whenever they want to. This increases the chance of having many more participants in the bid. Furthermore, better access means fiercer competition and, therefore, means even lower costs.

C. Administrative Savings

●Faster Transactions: Postponement and interruptions characterize traditional paper transactions. On the other hand, once authorization is obtained, purchases can be carried out "almost instantaneously" by way of E-procurement.

● Paperwork reduction: There can be a loads of paperwork removed from staff's duties, giving them more time to spend on more urgent matters.

● Easier management of purchasing and costs: Any manager will be a click away from all the details related to each purchasing decision. This, unlike the case of paper form, will facilitate an efficient and quick examination of expenditures.

D. Enhanced Accountability

● online accomplishment of trade and business allow government agencies to how "taxpayer dollars are being spent much more easily," which will nurture "accountability for cost overruns and waste." **[8]**

Industry perspective:
* provides quick and easy access to public and private tendering information;
* increased tender opportunities;
* improved access for geographically isolated industry organisations;
* increased market share and competitiveness; and
* Reduces the cost of printing - saving time and resources.

 Government perspective:
* best value for taxpayers' money;
* increased efficiency and effectiveness;
* consistent tendering practice across Government;
* promotes overall e-Commerce initiative; and

Environmentally friendly due to a predominantly 'paperless' process.

Those taking part, whether on behalf of the construction industry or government, commonly concur that the adoption of "an automated E-tendering process or system" is greatly advantageous for the tender process in terms of quality, time and costs. It also offers a smoother and more efficient way of "receiving, managing, and submitting tender documents than the traditional paper-based process." **[7]**

E-business applications:
Potential applications of E-business can be divided into 3 main categories: **[5]**, [11]
1. E-business applications supporting communication processes with the customer/principal (e.g. concerning design information).
2. E-business applications supporting communication processes on the purchasing side of the company (concerning information about contracted out supplies).
3. E-business applications supporting internal processes within the construction company.

E-business in relation to the customer:
This concerns the sales aspect of the construction organisation. , E-business has the potential to enhance and develop "the relation with the principal." Investigating the clients' aspirations, offering progress data on the project, dealing with complaints, establishing and directing a customer service department, etc. are all examples of the utilization of the Internet.

E-business in relation with suppliers:
E-procurement (including E-ordering) and E-tendering are E-business matters on the purchase level of the construction company. After uploading tender data on the web, "potential subcontractors can subscribe to the bid." There are benefits including broadening the scope of the market and the grouping of various tenders. This would eventually contribute to a reduction in costs.

E-business supporting internal processes:
The implementation of ICT can help improve the integration and management of internal processes. This would help companies find out a way to efficiently cut failure costs. Knowledge management, document management and workflow management are all instances of E-business regarding internal processes.

E-Evaluation:

It is a computerized process of assessing tender in relation to "pre-agreed criteria." E-evaluations enables evaluation panels to streamline processes in order to develop and organize criteria, carry out tender assessment, and compare tender replies.

E-Collaboration:

An extranet, which is a shared working environment, offers this tool to make it possible for teams that are of various geographical locations to deliberate and share documents throughout any phase of the tendering process.

E-Contract management:

It is a web-based tool whose function is to create, direct and observe contracts including collating supplier bid histories and the value and number of contracts awarded. This tool sends email-notifications to buyers when contracts renewal is due and organize data related to the performance of suppliers against contractually agreed criteria.

An E-Contract Management System (e-CMS) automates the contract management lifecycle from supplier sourcing and tendering to contract exit and renewal. It enables authorities to take a more proactive and consistent approach to contract management with existing or fewer resources.

E-tendering tools and techniques:

The most important sites for electronic tendering contain major characteristics that allow the processing and distribution of tender notices and the supplementary documentation. The characteristics encompass:

• Notice creation functions for buyers including the attachment of associated documents
• Search and alert functions for suppliers to locate opportunities
• Ordering function to obtain the documents and amendments
• Audit and tracking functions to support monitoring and follow up

The tendering process is turned into a simple process for both buyers and suppliers due to the capacities of electronic tendering. One advantage is that suppliers are enabled to pinpoint, without difficulty, the interest tenders and gain immediate access to all the documentation essential for the readying of a bid proposal. It is a simple process where buyers upload online the notices and all related documentation. The system itself is going to notify the suppliers and guarantee that they get a full bid set with all associated documents and addenda.

A vital factor for solving arguments is that all the data is trailed and a full audit trail is provided. Sites of E-tendering can contain extra utilities that engender more advantages for both parties: the buyer and the supplier. These extra utilities comprise:

By invitation Tendering:

Normally, this is a process of bidding consisting in several stages. Throughout this process, potential suppliers who have shown an intent to bid are prioritized regarding evaluation. After that, qualified suppliers are short-listed from "the evaluation stage" and are then invited to bid. Other terms that describe this process are Dynamic Purchasing, Select Tendering, Pre-registered Tendering and Qualified Tendering. "By invitation" tendering can be utilized to enhance the establishment and implementation of "Master Vendor lists, Vendor of Record lists, Standing Offers and Supplier Arrangements."

Electronic Bid Submission:

Electronic Bid Submission (EBS), otherwise known as Electronic Bid Response, "is the electronic transfer of proposal bid data between a potential supplier and the contracting

authority." The electronic system for submitting bids involves protection and precautions to guarantee the secure and authentic transference of data.

Virtual Plans Rooms:

Specific to the construction industry, the Virtual or Electronic Plans Room functionality allows for the electronic distribution of plans and specifications. Suppliers save time by accessing all of the information online and are able to view the electronic plans as soon as they are issued. Suppliers may also view pertinent information without ordering the complete set of plans.

Impediments (barriers) and Recommendations for E-business adoption in construction:

Barriers:

Obstacles face the implementation of E-business in a variety of ways, according to the kind of organisation and culture in which the business is carried out. These impediments vary in behavior according to the business features and type, as well as to the organizational culture.

Recommendations:

There are significant aspects such as peer recommendations, moving towards sharing documents in digital format and developing non face-to-face communications, which can escalate the pace of E-business implementation in the field of construction. In the future, there will be a necessity to tackle cultural and attitudinal change toward technological implementation. Other issues such as areas to train and develop staffs also need to be dealt with. This entails an increasingly responsive and perceptive approach to the nature of institutions and an improved awareness of their prerequisites and potentials to welcome change, from the one-man-business to major contractors, from suppliers to consultants.

Best Practices in E-Procurement:

• Technology is a utility not a strategy. To be successful, E-procurement employs technology to endorse a larger strategy for procurement.

• Always be aware of the expenditure. Before commencing any initiative of e-procurement, organisations must know the sums they spend, the products spent on, and the suppliers. A prior expenditure analysis can contribute to the improvement of contract compliance, aggregating spending, and rationalizing the supply base. Analyzing expenditure can also help identify the most effective method for rolling out e-procurement.

• Have a plan. Before pressing the first button in installing E-procurement technology, an organisation needs to come up with a plan for the implementation.

• The first step is standardization. Organisations with successful E-procurement experience have all begun by charting the course of the internal processes. This action of pinpointing the milestones in the process identifies non-value-added process that needs to be reconfigured or eliminated prior to deploying e-procurement. Implementing E-procurement without first benchmarking the procurement processes, organisations run the risk of automating inefficient costly processes.

• Drive E-procurement from the top. The degree of success of any E-procurement initiative relies on the support such initiative receives from "C-level" executives. Indeed, E-procurement reaches and affects every corner in the business, necessitating an efficient management of modifications throughout the business. Only the finest executives can fruitfully employ and implement E-procurement technology.

• "Designate a champion." A champion is required to coordinate, monitor, and manage enterprise-wide deployment of E-procurement technology. This champion is normally picked from the departments of purchasing and IT. He or she is in charge of the

implementation and adoption of the driving system, the assessment of the outcome, the success of communication, and the solving of complications and problems. Incentives are endowed on the champion depending on the success of the E-procurement implementation.

- The participation of suppliers demands a tempting to attract them. A lot of E-procurement initiatives have been thwarted due to the lack of suppliers. Such an obstacle has been triumphed over by implementing a mix of supplier incentives and demands. Particular steps towards this encompass instructing suppliers on the benefits of e-procurement, providing the methods and techniques to facilitate the suppliers' participation, and providing extra business for them. In addition to the aforementioned positive reinforcement, there is negative reinforcement against non-participation. It includes charging suppliers a fee for continuing to exchange documents via fax to limiting the volume of business awarded to noncompliant suppliers.

- Begin with simple targets. For the sake of rallying people to consent on the implementation of e-procurement, there must be a clear value demonstration for all those taking part, from front-line employees to top-level executives and external suppliers. Early support for E-procurement is a prerequisite for those organisations wishing to achieve success. This can be obtained through highlighting the areas of spending that could return biggest benefits and savings in the shortest amount of time.

- "Measure, measure, measure." In order to improve something, you first have to measure it. In order to ceaselessly develop e-procurement, organisations need to continuously monitor user adoption, contract compliance, process improvements, cost savings and supplier performance. Such procedures have several functionalities, which include demonstrating the significance and benefits of E-procurement to all participants and identifying the aspects that need to be improved.

E-Tender Challenges:

The utilization and employment of an E-tendering system or process is facing many obstacles. The following sets of challenges, according to recent research, are the ones that impede the implementation of electronic tendering.

General:

Undoubtedly, exchanging information electronically is becoming more popular in the construction business. However, a number of contractors and consultants, who are not furnished with the capacity to electronically exchange tendering documents, view the utilization of E-tendering as an "unfair practice." This hindrance can be simply worked out by offering tenderers the option of receiving their tender documentation in either paper or electronic format.

Two more impediments to E-tendering have also been found out. The first one is that some consultants consider E-tendering more useful to contractors than it is to them. Secondly, the majority of contractors have not yet adopted E-tendering. Stressing and promoting the advantages obtained by contractors, consultants and customers thanks to E-tendering is one way of overcoming such obstacles. This can be carried out by holding regular programs for "public E-Tender information dissemination."[12]

Employment: One significant issue that invites attention is the influence an E-tendering process may have on the current employment predictions of contractors and consultants. Nonetheless, exchanging tender information is said to save time spent on red tape, which would offer the staff the ability to spend more time on more essential tasks. This would endorse employees' performance, increasing value for employers and projects, thereby improving the overall service to their clients.

Security: A number of government organizations with access to the internet identify 'security' as a major limitation to the greater use of the Internet. Nevertheless, certain studies have revealed that the electronic exchange of information and data is probably more secure than the use of paper.

Legal: There is ascending distress connected to the fact that a number of formal contracts are not introducing explicit reference to future / ongoing use of electronic data exchange. This is because those taking part in E-tendering – including contractors, consultants, customers, etc. – still suppose that only written form means significant communication, and because they do not recognize that electronic communication (such as using an E-tendering system) is legally sufficient.

Guidelines for successful E-tendering implementation:

Core requirements and considerations:

- Distribute all tender documentation via a secure web-based tender system.
- Clients should be able to upload a notice and/or invitation to tender.
- Notifications should be sent out electronically (usually via email) for suppliers to download and respond to electronically.
- Updates and queries should be exchanged through the same E-Tender system during the tender period.
- All tender-related information should be held in a central database, which should be easily searchable and fully audited, with all activities recorded.
- Tender documents must be read or submitted only by authorized parties.
- Users of the E-Tender system are to be properly identified and registered via controlled access.
• Each tenderer is to be an E-Tender system member — registered in a central database.
• Data is to be encrypted and users authenticated by means such as digital signatures, electronic certificates or smartcards.
• Users are to have a unique username and password to confirm their eligibility to participate in the E-Tender system.
- The E-Tender system should ensure that only 'monitored' or 'authorised' alterations could be made to any tender.
- The tenderer should be able to amend the bid online at any stage up to tender close.
- The E-Tender system may also include features such as a database of service providers with spreadsheet-based pricing schedules, which can make it easier for a potential tenderer to electronically prepare and analyse a tender.
- Back-up procedures for E-Tender documents are essential. Routine archiving should take place regularly.
- Consider the possibility of allowing tenderers the option of tendering on paper (at least during a transition period).

Success factors for E-tendering implementation, The E-tendering Process:

The purpose of making changes on the tender process is never simply to adopt technology. Instead, the purpose is utilizing technology as a medium to keep a record of the communication process and to make it faster. **[10]**

Preparation of tender

The traditional system differs slightly from the new system in the "people factor," which is related to work force, career background, qualifications and responsibilities of employees. In traditional tendering and E-tendering, the basic concept of tender preparation is practically the same. No change occurs on tender documents either. However, they are

produced using software such as spreadsheets and word processors, giving the user the ability to effortlessly modify and edit them.

Tender documents

These are traditionally made and examined manually. However, in their automated form, e.g. using e-Tender, they will all be compiled in electronic form and then they will be ready to be uploaded on the system. This way they will substitute the traditional and tedious paper-based system. This process has proved to motivate employees and remarkably better their performance.

Tender out

Couriering services, instead of internal staff, are needed within the context of the traditional method, where the bidder receives the documents in hand and keeps them unrecorded. This system is ineffective, untrustworthy and costly. In E-tendering, on the other hand, staff with access to the documents upload the documents onto the system. Thereafter, interested bidders can download them and they will be registered by the audit trial.

Estimating task

In the traditional system, estimation and measurement processes are begun by the bidders once they receive the tender documents. The E-tendering system enables them to examine softcopy or print versions of the documents. An additional advantage to this is that bidders can access the documents on the system wherever they may be. It is true that fewer employees are needed to do E-tendering, but the estimating process has not been automated and still needs to be done in the traditional method. Therefore, it is still monotonous and costly.

Tender enquiries

Both the consultant and the bidder are concerned with tender enquiries. A new method characterized by speed and structure is offered by the E-tendering system to deal with the responses to tender enquiries, correction and replacement of tenders. Emails are the medium used to send the responses within the entirely audited and managed E-tendering system. Moreover, responses are delivered quickly and they are punctual. Unlike the traditional system, the E-tendering system enjoys the capacity to archive, manage and audit trail all mail, documents, drawings and queries completed during the tendering stage. In both systems, the work principle is the same, but the effectiveness and quality of the outcome is far better in the modern system. Additionally, the management believes that many things remain unchanged, such as the manpower involved, experience, background, qualification and responsibility of the employee.

Tender in

The bidder can upload all tender documents on the Internet, just like the tender out stage. The E-Tender system has the advantage of registering the date and time of the uploading of documents by bidders and the capacity of audit trail them. It is guaranteed by the system that all tenders are submitted before the deadline, as any "late tenders are rejected automatically." This is more effective, faster and less costly than the traditional system, which employs external help to deliver the tenders.

Tender analysis

Tender analysis is carried out manually just like the traditional method. The disparity lies in their reference, which is only paper-based documentation within the traditional method, whereas it can be a soft or a hard copy in the case of E-tendering. Finally, there are aspects that are similar in both systems. These include the people factor, manpower, background, qualification and responsibility of the personnel involved.

4- Case Study: Sakhabeh New Pumping Station (Beit Yashout Project

Approximately 120,000 beneficiaries are living in Beit Yashout area and getting their drinking water from Sin Lake through a 3000 m3 reservoir, mounted in Qurfeis.0The scope of engineering services which were provided includes , master plans , feasibility studies and preliminary design , detailed design , construction and erection supervision, as well as programmed and on –the-job training for clients management staff, engineers. The International Committee of the Red Cross (ICRC) funded the project. The Tender for the design work had been established by E-tendering. The ICRC had divided the Design in 2 Phases.

•**Basic Engineering (Preliminary Phase) – hydraulic analysis of situation** starting from Qurfeis reservoir to Ra'as Al Ain and along Beit Yashout line. This phase started with data gathering and creating of design alternatives and obtaining the evaluation criteria,
following criteria expected to be considered: investment cost – operating cost –technical aspects –environmental aspects social impact and other criteria. The result were presented in form of feasibility report according to standards recognized by the international financing institutions.

•**Detail Design, (2.Phase) – according to hydraulic report, electronically** delivered detailed design drawings and tender documents. Primary we had consider and check the designs, specifications and BOQ that already issued by water authority. It was considered that this phase of the work is the most critical for minimizing the overall cost of construction and the recurrent costs for operation and maintenance of the system .It was proposed to carry out the optimization process using the recognized computer software. The construction of the pump station will involve work of different complexities requiring contractors with particular expertise. The ultimate objective is to have the pumping station constructed to a predefined time interval and to a specification, which ensures operational longevity and operational safety at the lowest cost. As part of the design technical specification for particular items of work was prepared. On finalisation of the drawings, bills of quantities (BOQ) were with BIM technic prepared and all the quantities were taken off the construction drawings.

Tender Documents were prepared for civil construction works and the manufacture, supply and installation of equipment, and commissioning of the works, were taken from the BIM model. The final Product of the design was the construction drawings and the Design Report finished with BIM –model (Revit file).All Phases of design works were accomplished with E-construction tools. The use of BIM technology facilitated the application of E-construction tools such as E-tendering and E- Procurement.

As a result of this implementation, the project was completed in the specified time and the estimated cost, as this was reflected in the quality of implementation, which confirms the feasibility and efficiency of using the E-construction.
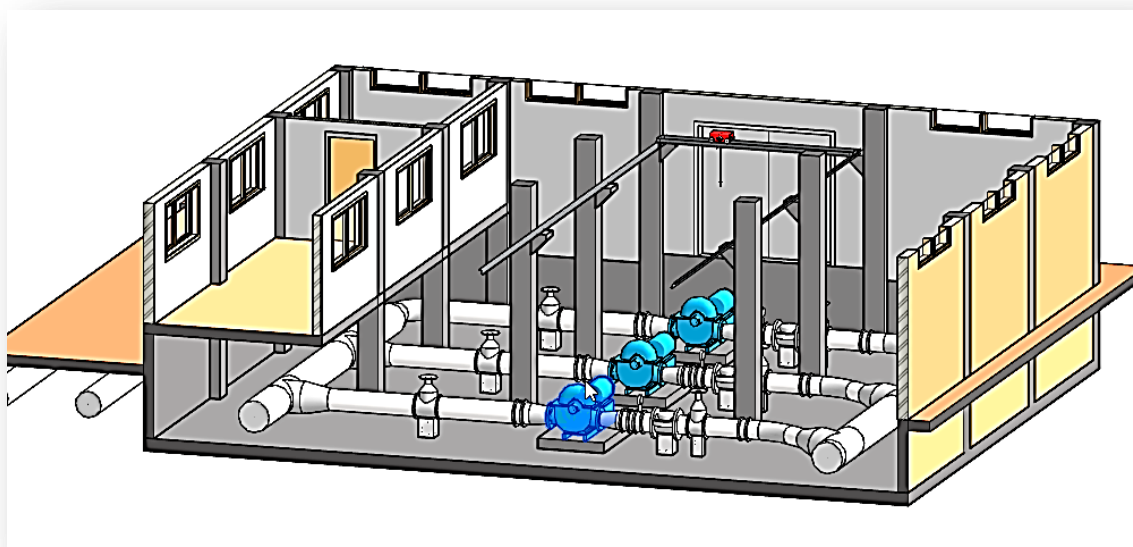
Fig (1)3D Illustration for the Pump Station (BIM Model)

RECOMMENDATIONS:

• Conducting researches in order to examine the current status of ICT in Syrian construction industry and to document and analysis the importance, obstacles and preconditions required for an effective use of E-business and ICT in Syrian construction industry. This can be done via scientific questionnaire survey of organizations comprising suppliers, contractors, consultants and engineers.

• Designing and testing learning and training methodology in order to improve the staff's ICT skills in Syrian construction companies.

• After examining our current situation and raising awareness of the ICT and E-business importance in construction industries. We can design and start a comprehensive plan in order increase the level of ICT and E-business adoption in construction industries, taking into account the guidelines and recommendations presented in this paper.

• Simultaneously, work must be done to increase knowledge and awareness within the construction industry by highlighting the potential benefits and opportunities available to contractors, consultants and clients, when adopting ICT and E-business in construction.

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