2-1-2015

Towards the adoption of E-Tendering in the public sector of the Egyptian construction industry

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Towards the Adoption of E-Tendering in the Public Sector of the Egyptian Construction Industry

A Thesis Submitted to

The Construction and Architectural Engineering Department

In Partial Fulfillment of the Requirements for

The Degree of Master of Science in Construction Engineering

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B.Sc. in Construction Engineering, AUC, January 2012

Under the Supervision of

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December 2014

ABSTRACT

The construction public sector in Egypt, like most countries in the world, is tendering its projects through the traditional paper-based tendering procedure, which has many weaknesses including bureaucracy and lack of transparency. Due to the considerable volume of projects tendered each year, it was therefore essential to study the possibility of implementing another more efficient procedure that would overcome the inefficiencies of the paper-based tendering procedure. The main aim of this research is to improve the uptake of E-Tendering in Egypt through highlighting the best technical/operational practices that should be adopted, identifying the barriers, challenges and concerns of the Egyptian tenderers and providing solutions to address them. An identification and analysis of the current level of adoption/implementation of E-Tendering in Egypt is carried out through thoroughly examining the literature and through conducting two semi-structured face-to-face expert interviews. The findings show that there is evidence that Egypt is moving steadily but on a slower pace towards adopting E-Tendering within the governmental entities, especially that, so far, few steps/measures were taken in this regard towards the Egyptian tenderers. Hence, the barriers and concerns to the implementation of E-Tendering in many foreign countries have been thoroughly examined through the literature review. 19 challenges are highlighted and categorized into 4 categories: security challenges, user acceptance and staff resistance, accessibility issues and legal barriers. These challenges are then examined and ranked with respect to their importance by a panel of 15 academic and industry experts to identify whether or not they will face the Egyptian tenderers. The most important highlighted barriers are the SMEs access difficulties (Relative Importance Index "RII"$_{\%}$ = 88.33%), the expected technical malfunctioning of the portal (RII$_{\%}$ = 86.67%), the reluctance/resistance to change (RII$_{\%}$ = 80%), the breach of confidentiality of information (RII$_{\%}$ =

76.67%), the electronic signature problems (RII $_{\%}$ = 76.67%) and the document tampering (RII$_{\%}$ = 75%). In addition, literature is carefully examined to point out/come up with solutions/recommendations to the barriers, challenges and concerns of the tenderers in Egypt. The effectiveness of these solutions/recommendations is thoroughly analyzed by the same panel of experts. The findings showed that the identified barriers are completely neutralized and successfully addressed by the presented solutions/recommendations, hence, they should be adopted and implemented since improving the uptake of E-Tendering in Egypt is only achievable when addressing the needs of its stakeholders and especially the tenderers.

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CHAPTER 1: INTRODUCTION

1.1 Background and Problem Statement

The construction industry plays a vital role in the economic growth and development of any nation. It satisfies lots of social, physical, and economic needs of the citizens through providing shelter, enhancing the infrastructure and creating employment opportunities, hence contributes to the fulfillment of essential national goals (Moavenzadeh & Rossow, 1976, p. 2). In Egypt, construction is one of the most active and dynamic sectors of the economy. It accounts for 7% of the Gross Domestic Product (GDP) and by the year 2015, the investments in this sector are expected to reach US$7.3 billion (General Authority for Investment and Free Zones [GAFI], 2014). Unfortunately, a number of research have shown that bribery and corruption are rampant in the construction sector worldwide according to Transparency International's 2002 to 2011 Bribery Payers Index (BPI) (Hardoon & Finn, 2011, p. 20). Concerning Egypt, the European Bank for Reconstruction and Development (EBRD) has published a report in 2013 containing a review about its public procurement practices. The report highlighted that companies in Egypt face a high risk as the procurement process is burdened with lack of transparency, bureaucracy, ineffective monitoring and review mechanisms together with unethical public procurement officials (Business Anti-Corruption Portal, 2013). Moreover, it is argued that the traditional "paper-based" tendering process in Egypt is full of inefficiencies (EBRD, 2013, p. 11). It is also worth noting that according to the Canadian Construction Association (CCA), in a typical construction project, the cost of tendering to a client accounts for up to 5.85% of the total cost of the project (Hore et al., 2007, p. 1).

So it is imperative to find a more efficient approach/mechanism to replace or complement the traditional "paper-based" tendering processes within the construction public works in Egypt in order to reduce the huge cost of tendering, save lots of money wasted due to the inefficiencies of

the traditional tendering techniques, increase transparency and reduce corruption in the public sector.

In order to accomplish this, a number of steps are crucial to be carried out:

The first step is to explore the traditional "paper-based" tendering processes and highlight the major inefficiencies within this traditional tendering method. In Addition, the current practices for public tendering/procurement in Egypt are examined in order to identify the quality of the current tendering/procurement processes within the Egyptian construction industry. The study of the Egyptian traditional tendering system is important as it helps to identify the shortcoming and drawbacks of the current system in order to find means to enhance its processes.

The second step is to identify the state of the art tendering methods/techniques "Electronic Tendering" (E-Tendering) which is adopted by the more developed countries to overcome the major inefficiencies within the traditional paper-based tendering processes. The E-Tendering processes, types, advantages/benefits/drivers over the traditional "paper-based" tendering processes and its challenges and barriers are examined in order to have a clear understanding of the proposed system, its adequacy to replace the already existing traditional "paper-based" tendering process and its suitability for the Egyptian construction industry tendering practices.

The third step is to identify the best practices when designing and running the technical/operational processes of E-Tendering in order to come up with solutions and recommendations that should be incorporated in the Egyptian E-Tendering system.

The above mentioned steps are highlighted in the literature review and will pave the way for reaching the thesis aim and objectives.

1.2 Thesis Aim & Objectives

The aim of this research is to improve the uptake of E-Tendering in Egypt through highlighting the best technical/operational practices that should be adopted, identifying the barriers, challenges and concerns of the Egyptian tenderers and providing solutions to address them. This aim is accomplished through a number of more specific objectives:

1. Comparing the proposed phases/options that are planned to be applied on the Egyptian E-Tendering portal with the current applied phases in the tendering process for public works in order to identify to what extent the Egyptian government is taking advantage of E-Tendering.
2. Examining and thoroughly analysing the issued decrees and actual measures taken by the government to implement E-Tendering and improve its uptake in Egypt. The effectiveness of each measure to attain its goals is evaluated together with its practical impact on the tendering process. Also, the current level of adoption E-Tendering among the governmental organizations and the tenderers is presented.
3. Identifying from the literature the barriers, challenges and concerns of the tenderers to fully accept and adopt E-Tendering and then conducting expert interviews to examine and verify the applicability of these barriers, challenges and concerns to the Egyptian tendering context.
4. Examining the best practices when designing and running the technical/operational processes of E-Tendering and then editing, filtering and categorizing these processes to point out/come up with solutions to address and tackle the identified barriers of the tenderers; hence, improving the uptake of E-Tendering for the construction public works in Egypt. The effectiveness of these solutions is thoroughly analysed through conducting

interviews and survey questionnaires with key personnel working as contractors and consultants.

1.3 Research Methodology

1.3.1 Research Approach

Given the exploratory/interpretive nature of this research, the qualitative research approach is adopted. The researcher collects extensive verbal data, organizes the data and uses verbal description to interpret the situation in consideration (Leedy & Ormrod, 2005, p. 94).

1.3.2 Data Collection

Data is collected using a wide range of techniques and methods like semi-structured interviews, face-to-face and telephone survey questionnaires, documents review, careful analysis of different sources (e.g. The Egyptian Governmental E-Tendering Portal), etc. The following is a description of two of the techniques used:

1. The semi-structured interview is more flexible and comprehensive as it gives the interviewer the ability to revolve around a number of central questions while giving room for individually tailored questions in order to get more clarifications or probe the interviewee's reasoning (Leedy & Ormrod, 2005, p. 184). This technique captures the interviewee's beliefs and understanding.
2. Given the fact that most Egyptian construction professionals are unaware of E-Tendering, face-to-face survey questionnaire is adopted as the physical presence of the interviewer helps assisting the interviewees in clarifying ambiguities and hence obtaining quality results (Doyle, 2005, p. 3). The face-to-face survey questionnaire also called personal interview survey outstands the web-based surveys because recently due to the increasing

number of invitations to web-based surveys from different sources, the participants became less likely to respond and if they do, the quality of their answers may not be good. This usually happens as in many cases the respondents/participants do not take sufficient time to examine critically before replying to each question in addition to misinterpreting the questions if they are not clear enough. The disadvantage of the face-to-face survey questionnaire is that it is not as fast as the web-based questionnaires, which permits obtaining a large number of answers from different respondents/participants in a short period of time. In addition, another disadvantage in the personal interview surveys is that the interviewee's answers maybe be influenced by unintentional actions or words from the interviewer "interviewer's bias" (Doyle, 2005, p. 4); hence, care should be taken to avoid such influence on the interviewees. It is also worth noting that face-to-face interviews yield higher response rate than telephone interviews (Leedy & Ormrod, 2005, p. 185).

1.3.2.1 The Sampling Design and Size

The sampling design for the experts face-to-face and telephone interviews is nonprobability sampling and more specifically purposive sampling which is based upon choosing the participants for a specific purpose. The reason is that the experts' experience and expertise add more depth to the research taking place and they are trustworthy to identify major challenges/problems, examine the effectiveness of the proposed solutions and provide more solutions/recommendations if any; hence, improve the adoption of E-Tendering in the public sector of the Egyptian Construction Industry.

1.3.3 Data Interpretation and Analysis

The qualitative analysis is accomplished through thorough examination, categorization, description and interpretation of the data. For the survey questionnaires, the relative importance index (RII) is used to identify the rank (relative importance) of each barrier/challenge hindering the uptake of E-Tendering in Egypt in order to address and tackle them. The RII is widely used in construction research as in (Olukayode & Adeyemi, 2011), (Eadie et at., 2010); (Lavelle & Bardon, 2009), etc. The RII equation used in this research is as follows (Holt, 2014, p. 8).

$$\text{RII \%}_{\text{adjust (5)}} = 125 * \frac{\sum_{i=0}^{N} \text{P}_i}{\text{N}n} - 25$$

Where,

RII = Relative Importance index

RII $\%_{\text{adjust (5)}}$ = Relative Importance Adjusted Per cent using scale (R_{min}=1 to R_{max}=5)

Pi = Participant's rating of the barriers/challenges hindering the uptake of E-Tendering

N= Sample Size

n = Highest attainable rating for one trial

The above equation is only valid when the used scale is R_{min}=1 to R_{max}=5. This is because if the lowest rating (R_{min}=1) is used and all the participants chose the value of 1, the overall RII per cent will be zero. In other words, assume we have 10 participants and they all responded with the lowest rating 1, the total is zero and if all responded with the maximum rating 5, the total is 100.

- The minimum rating is $\text{RII \%}_{\text{adjust (5)}} = 125 * \frac{10*1}{10*5} - 25 = 0$
- The maximum rating is $\text{RII \%}_{\text{adjust (5)}} = 125 * \frac{10*5}{10*5} - 25 = 100$

1.3.4 Research Flow

The following is a description of the steps used in order to tackle the research objectives.

- First, in order to identify and compare the proposed vs actual E-Tendering phases adopted by the government, and the measures (decrees and amendments to the law) taken to implement E-Tendering, literature is examined together with conducting face-to-face interviews with 2 highly ranked officials in the government.
- Second, given the fact that few measures are taken towards the Egyptian tenderers, and since the widespread adoption of E-Tendering is only achievable when addressing the needs of the stakeholders, the barriers, challenges, and concerns of the tenderers against participating in a public E-Tendering process are investigated. Hence, a list of the challenges/barriers facing the tenderers worldwide is identified from the literature and then the list is introduced to a panel of 15 Egyptian academic and industry experts. The experts are introduced, in semi-structured face-to-face and telephone interviews, to a survey questionnaire in which they mark/check on a 5-scale Likert item the probability/likelihood that a tenderer considers the challenges as obstacles against the adoption of E-Tendering in Egypt. The survey output is analyzed using the adjusted relative importance index to identify and rank the highest obstacles against the tenderers.
- Third, literature is carefully examined to identify the best practices when designing and running the technical/operational processes of E-Tendering. These technical/operational processes are then edited, filtered and categorized to point out/come up with solutions to address and tackle the identified barriers of the tenderers. The effectiveness of these solutions is thoroughly analyzed by the same panel of experts who are asked again to check/mark the same barriers on a 5-scale Likert item the probability/likelihood that a

tenderer still considers the challenges as obstacles against the adoption of E-Tendering in Egypt even after being introduced to the solutions/recommendations. The survey output for each of the challenges is analyzed through graphically representing, comparing and thoroughly examining the results of the face-to-face and telephone survey questionnaires before and after the experts are introduced to the solutions/recommendations.

The following is a summary of the qualitative research methodologies adopted to attain the thesis objectives. A more detailed methodology is provided at the beginning of each chapter.

Thesis Objectives		Research Methodologies Adopted	Relevant Chapter
1	Comparing the proposed phases/options to be applied on the Egyptian E-Tendering portal with the current applied phases	* Literature review *2 Semi-structured face-to-face interviews with highly ranked officials in the government	3
2	In depth analysis of the measures/decisions taken by the government	* Literature review *2 Semi-structured face-to-face interviews with highly ranked officials in the government	3
3	Identification of the barriers, challenges & concerns of the tenderers	* Literature review *15 Semi-structured interviews (11 face-to-face & 4 telephone interviews) with academic and industry experts that comprised contractors and consultants. The experts were asked to mark/check a survey questionnaire	4
4	Providing solutions to address the barriers, challenges and concerns of the tenderers and examining the effectiveness of these solutions	* Literature review *15 Semi-structured interviews (11 face-to-face & 4 telephone interviews) with academic and industry experts that comprised contractors and consultants. They experts were asked to mark/check a survey questionnaire	5

Table 1: Thesis Objectives vs Research Methodologies

1.4 Research Limitations

The barriers and challenges to the client (government) are not taken into consideration in this research since the government is already tackling the needs of the governmental entities through the different measures and issued decrees as highlighted in chapter 3.

CHAPTER 2: LITERATURE REVIEW

2.1 The Traditional Tendering System (Paper-Based)

2.1.1 The Definition of Tendering in Construction

The Aqua group in 2006 defined tendering as: "A process to select a suitable contractor at a time appropriate to the circumstances and to obtain from him at a proper time an acceptable offer upon which a contract can be let" (O'Connel, 2010, p. 10). The Chartered Institute of Building "CIOB" further clarified that tendering is "the process of preparing and submitting for acceptance a conforming offer to carry out work for a price, thus converting the estimate to a bid" (Chinyio, 2011, p. 2). According to MERX (2014, p. 1), the leading electronic tendering service in Canada, it should be noted that the tendering practices adopted nowadays are largely manual relying heavily on papers.

2.1.2 The Process of Traditional Tendering in Construction

According to Vee and Skitmore in 2003, the most important and critical phase during the construction project lifecycle is the tendering phase as it defines the legislative and contractual agreements between all the stakeholders of the project (i.e. the client, the consultants, the contractors, etc.) (Choen & Alshawi, 2009, p. 99).

Choen & Alshawi (2009, p. 99) explained that the process starts when the client asks his team and the consultant to prepare, finalize and compile the tender documents, which comprise the letter of invitation to tender, the form of tender, the form of contract, the bill of quantities "BOQs", the project drawings, the specifications and others if applicable. It is a hectic information intensive phase, which is the product of lots of meetings with the client to get his approvals. The authors also stated Lou in 2006 clarifying that the production of tender documents is expensive, troublesome and tedious, paper intensive and thus not portable.

After that, as Mastor et al. (2006, p. 2) mentioned, the client publishes invitation for tenders in public newspapers and other print medium. When a contractor is interested in the advertisement made by the client, he will buy the tender documents from the location specified by the client in the advertisement, fills it according to the requirements of the client in the specified period of time and submits his tender before the tender submission deadline.

The following process is the assessment and evaluation of the tender documents submitted by the different contractors based on a number of criteria that the client has already set clear in the tender documents. According to the Aqua group in 2006, it must be justifiable choosing a contractor over another (O'Connel, 2010, p. 12). A summary of the process of traditional tendering is illustrated by Ezanee, Norlila & Nurshuhada in 2005 in figure 1 (Mastor et al., 2006, p. 3).

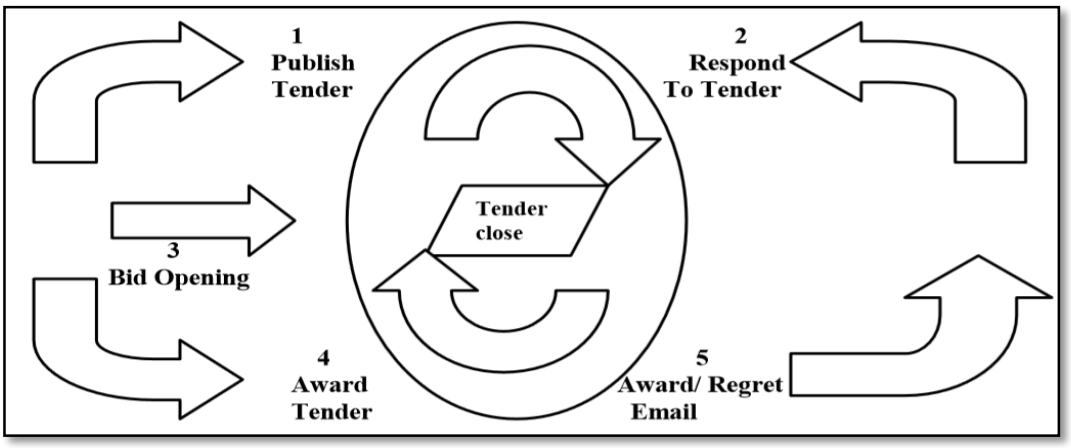


Figure 1: Traditional Tendering Process
by Ezanee, Norlila & Nurshuhada in 2005 (Mastor et al., 2006, p. 3)

2.1.3 Problems and Inefficiencies within the Traditional Tendering System

It is worth noting that according to the Canadian Construction Association (CCA) in 2005, in a typical construction project, the cost of tendering accounts for up to 5.85% of the total cost of a project (Hore et al., 2007, p. 1). So it is imperative pointing out all the defects or leaks in

the tendering system in order to reduce this huge cost and thus saving lots of wasted money in return.

The following issues represent the main inefficiencies and areas of concern in the traditional (manual or paper-based) tendering process.

1. Access Problems

- As illustrated earlier, the paper-based traditional tendering forces the interested contractor to go and buy the tender documents from the location specified by the client. This is a serious disadvantage and risk for the contractor located out of that particular geographical location, as they need to send somebody to grab the documents (MERX, 2014, p. 1). This is clearly a waste of time (delays in working on the tender due to idle time waiting for the documents) and consequently cost (loss of money due to wasted working hours of the employees and also transportation costs).
- Furthermore, when there are modifications in the tender documents made by the client and there is a need for sending addenda and modified drawings to the tenderers, the fact that there is no instant communication leads to huge loss of time and cost to the contractor since the contractor still works on old tender documents as he is unaware of the new modifications.
- Last but not least, the contractor located in a remote area from the client suffers major unfairness. This happens because while the nearby contractor is working till the last minute before the tendering submission deadline, the contractor located in the remote area needs to wrap up and finish compiling his work early enough to allow for adequate time to send the documents to the client (either by postal system or via travelling to his destination). This is obviously a waste of both time and money.

2. Problems when Subcontracting

Hore et al. (2007, p. 6) clarified that usually the main contractor spends/loses more money and faces delays because of forwarding some tender documents to the subcontractors to price. This finding is further stressed and elaborated on by Curtis in 2006 as he argued that in many occasions, the subcontractor does not price the tender documents and consequently it is a mere waste of time and money (papers and working hours being wasted in vain) (O'Connel, 2010, p. 22).

3. Poor Paper Trail and Audit History

- Keeping track of all the different drawings, plans and addenda is a tedious process that requires lots of human resources and thus it is expensive to be managed (MERX, 2014, p. 1)
- In addition, because it is not an automated process, the probability of human error is present which could lead to major cost impacts.
- Another problem that could arise due to the lack of effective audit history and poor paper trail is a difficulty in resolving disputes (MERX, 2014, p. 1).

4. Rekeying of Information

The Australian Cooperative Research Centre (CRC) in 2006 (Hore et al., 2007, p. 2 & p. 6) highlighted that re-keying of information occurs heavily in the tendering phase due to manually inputting the contractor's tender documents like the detailed BOQs into a customized software for evaluation. This finding was originally argued by The Construction Industry Trading Electronically Group (CITE) in 2000 (O'Connel, 2010, p. 21). The following are major concerns due to re-keying information:

- There is a probability that errors can occur leading to unfairly awarding to the less deserving contractor.
- In addition, this is the gate through which corruption finds its way when data sent by the contractor is deliberately altered by the employees of the client/consultant while if caught the employees could claim that errors happened by coincidence.

5. Security Concerns

O'Connel (2010, p. 21) cited Du et al. in 2004 identifying the security concerns that could happen when using the traditional process of tendering. One of which is the possibility of exposing the prices of one contractor to his rivals and hence giving them unfair advantage over him in future tenders.

6. Problems in Case of Re-tendering

According to CITA in 2006 (Hore et al., 2007, p. 1), the consultants produce hundreds of tender documents comprising the form of contract, the BOQs, the project drawings and the specifications. These tender documents are further replicated into lots of copies and offered to tenderers on daily basis. This is a waste of time and money to the client or the contractor (sometimes there is a significant cost for buying the tender documents).

Moreover, the presence of many contractors ensures the receipt of competitive tenders, which makes it easier, fairer and justifiable when awarding the project execution to one of them. MERX (2014, p. 1) highlighted the fact that in many cases, a few number of contractors submit their tenders, consequently the client and the consultant decide to re-tender the project. This is a serious problem because re-tendering increases costs and causes delays. The cost associated stems from the repetition of lots of procedures like photocopying, compiling, advertising in different media and the clerical work which is

associated with the tender evaluation. On the other hand, the delays occur due to the time spent repeating each of these phases that were already done for the original tender.

Given all the above problems and concerns within the traditional manual (paper-based) tendering process, the need for a reliable innovative process to tackle and address all the inefficiencies within the paper-based process emerged.

2.1.4 Traditional Paper-Based Public Procurement/Tendering in Egypt

The EBRD Legal Transition Programme issued a report assessing the public procurement sector of the Southern and Eastern Mediterranean (SEMED) region, which covered Egypt. The assessment examined Egypt's "public procurement regulatory framework and the local procurement practice benchmarked against the internal best practices" (EBRD, 2012). The following charts/figures represent the efficiency assessment of the Egyptian public procurement process in practice for the pre-tendering and tendering phases. Both phases were assessed against the 5 key indicators of the legal efficiency concept of EBRD: simplicity, fit-to-context, certainty, cost and speed. The scores were calculated from a questionnaire answered by local contracting entities based on "EBRD Core Principles for an Efficient Public Procurement Framework" (EBRD, 2013, p. 8). 100% represents the optimal score.

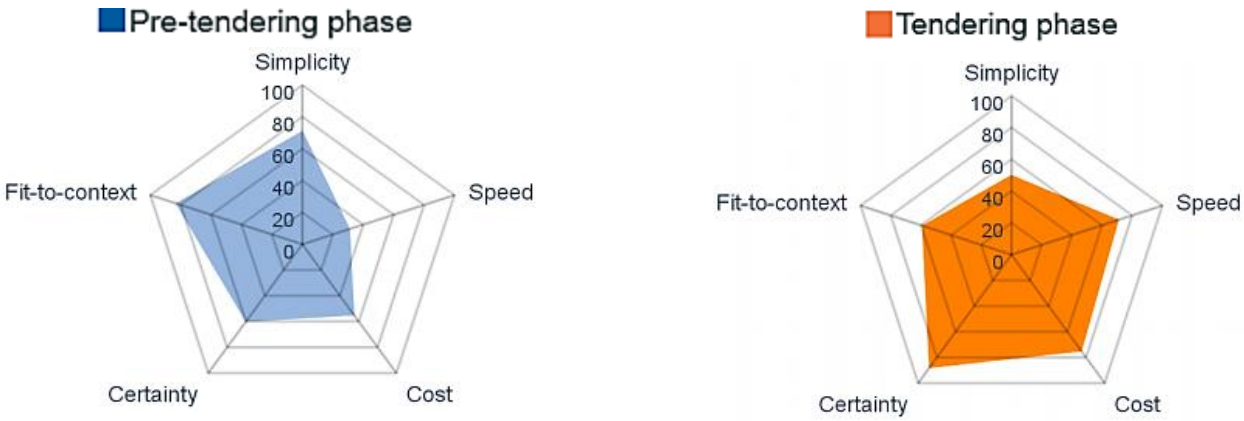


Figure 2: Egypt – Efficiency Assessment of the Public Procurement Process in Practice (Pre-Tendering & Tendering Phase)
(EBRD, 2013, p. 9)

Pre-tendering phase:

The report published by EBRD (2013, p. 9) highlighted that pre-tendering procedures are sufficiently regulated and corresponds to the needs of the contracting entities; however, these procedures are perceived to be costly and slow.

Tendering Phase:

The report also emphasized that the tendering procedures are too complicated for the contracting entities and the contractors. Simplicity of the processes and alignment with the contracting entities' needs scored markedly low together with the fact that specialist skills are required to submit a tender that could pass the technical evaluation.

Assessment overview:

The following figure/chart 3 represents the results for the Egyptian local procurement practice quality as compared to other countries in the EBRD region. Unfortunately, Egypt is placed as shown in the lowest quartile.

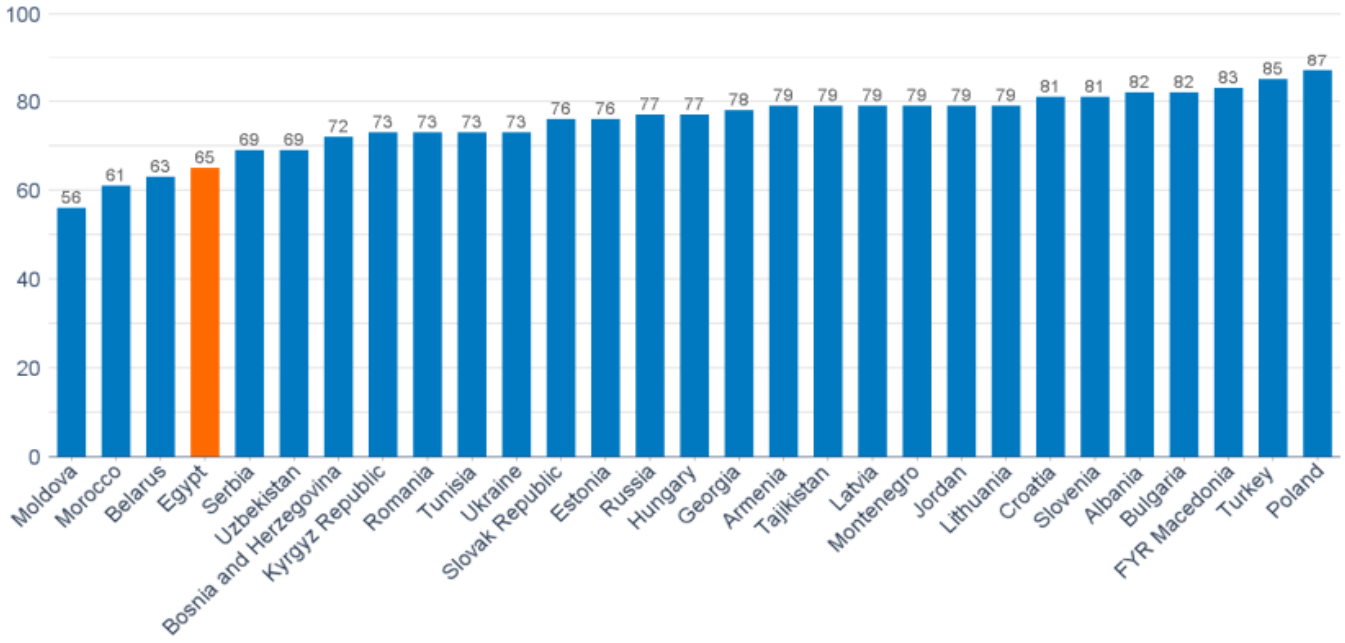


Figure 3: Egypt – Quality of Local Procurement Practice as Compared to Countries in the EBRD Region (EBRD, 2013, p. 11)

According to EBRD (2013, p. 12), the current Egyptian legislative and institutional framework of public procurement is outdated and must be upgraded as it does not comply with the international standards of best practices for public procurement and hence, does not facilitate economic development nor ensures efficiency of public spending.

- The Egyptian public procurement law does not standardize the public contracts terms and conditions or the tender documentation (EBRD, 2013, p. 1). In addition, the procurement procedures do not reflect the size and scope of the contract which reduces simplicity, speed and increase participation cost (EBRD, 2013, p. 6).
- Moreover, in Egypt the review process is not judicial but fully administrative. So tenderers, if unsatisfied with the administrative review decision, have to direct their complaints to the administrative court; however, this process is lengthy as courts are relatively slow. Consequently, the results are normally obtained well after the tender/contract has been awarded, which creates a further dispute between the claimant and the contracting entity also in the administrative court (EBRD, 2013, p. 5). This clearly demonstrates that there is no effective public procurement review and remedies body/mechanism that would ensure speed, enforceability and certainty; consequently, the process lacks credibility and transparency (EBRD, 2013, p. 12).
- It is also important to note that the level of competition in the public tenders is inadequate and very low as that there is limited information about the procurement opportunities, and hence there is limited number of submitted tenders and consequently a large number of project tenders gets cancelled. Also this stems from the fact that there is no evidence regarding the development of internal procurement procedures and policies by the contracting entities to increase transparency and consequently tenderers do not participate

as they have less faith in the procurement decision making/awarding of the tenders (EBRD, 2013, p. 13).

To conclude, the public procurement process is overregulated, the policies and procedures are underdeveloped, the objectives are unclear and the laws are not in compliance with the current international standards of best practice in public procurement (EBRD, 2013, p. 12). Accordingly, it is crucial that that the Egyptian public tendering system revolutionize to incorporate modern procurement/tendering methods and processes, such as Electronic tendering (E-Tendering), which will significantly contribute to the modernization, simplification, cost and time reduction, increase of transparency and credibility of the whole tendering process.

2.2 Electronic Tendering

2.2.1 Background and Overview of Electronic Procurement

In order to explain electronic tendering, it is first important to introduce and define electronic procurement. According to the UN Procurement Practitioner's Handbook (2006, chap. 4, p. 11), electronic procurement "involves electronic data transfers to support operational, tactical and strategic procurement". Therefore, E-Procurement has been present for longer period than the actual term, which was first introduced after the creation of the internet in the early 1990s. The historic development of the electronic procurement is illustrated in figure 4 shown below.

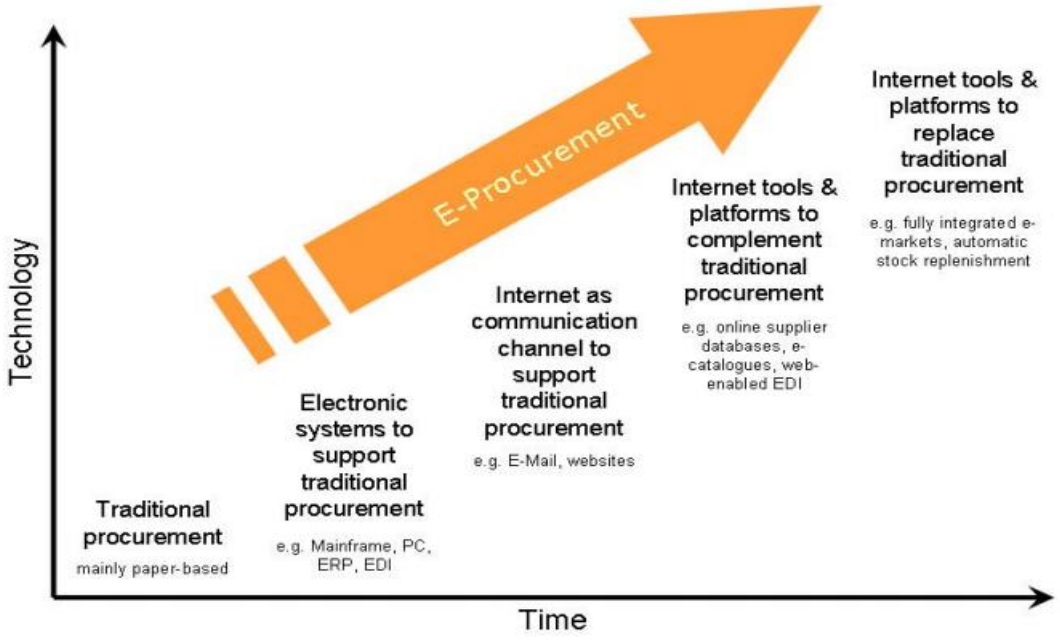


Figure 4: Development of Electronic Procurement
(UN Procurement Practitioner's Handbook, 2006, chap. 4, p. 11)

2.2.2 The Definition of Electronic Tendering in Construction

The E-Procurement Golden Book of Good Practice (Bausà et al., 2013, p. 5) defines electronic procurement as "the use of electronic communications and transaction processing by government institutions and other public sector organizations when buying supplies and services or tendering public works."

According to this book, the process of E-Procurement is divided into two phases, linked in between by the contract award: pre-award and post-award phases.

1. Pre-Award: Its phases (E-Notification, E-Access, E-Submission, E-Evaluation, E-Awarding) take place before the contract award.
2. Post-Award: Its phases (E-Ordering, E-Invoicing, E-Payment) take place after the contract award.

The UN Procurement Practitioner's Handbook (2006, chap. 4, p. 15) further explained the concepts of E-Procurement in a more simplistic form together with highlighting the electronic tendering phase in the following figure 5.

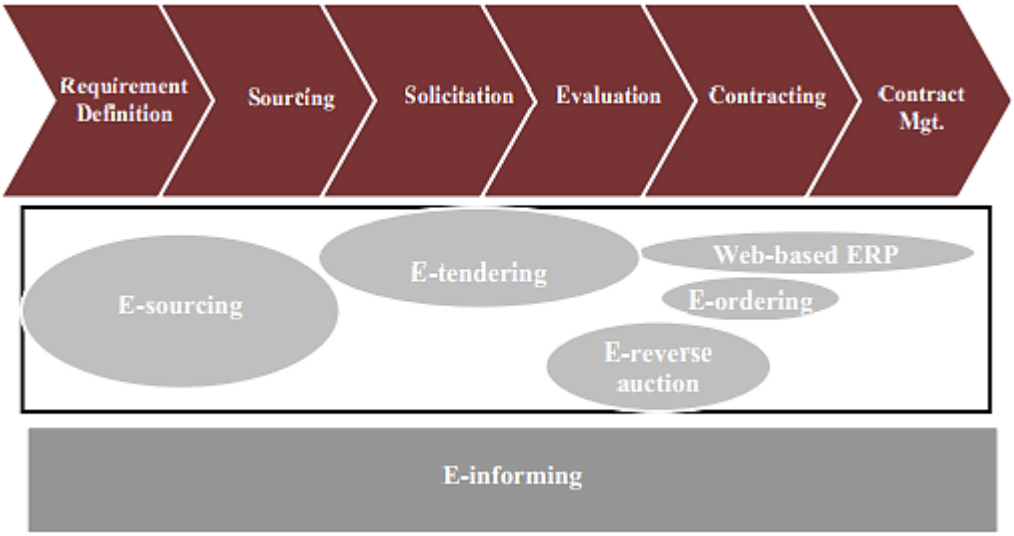


Figure 5: Forms of Electronic Procurement
(UN Procurement Practitioner's Handbook, 2006, chap. 4, p. 15)

The following is a definition of each of these forms as illustrated in the UN Procurement Practitioner's Handbook (2006, chap. 4, p. 15).

- E-Sourcing: supports identifying the supplier suitable for the project specifications.
- E-Tendering: supports the selection phase, the analysis and evaluation of tenderers.
- E-Reverse auctioning: supports closing the deal and awarding the contract to the supplier.

- E-Ordering and Web-based ERP: supports the phase of procurement requisitions, making purchase orders, receipt of goods/services ordered, via using a software system based on the internet.

According to the Royal Institute of Chartered Surveyor (RICS, 2007, p. 2), the basic principles of traditional tendering are preserved in E-Tendering while enhancing the way of communication through finding an alternative medium through which the tender documents and information is exchanged. This medium is further defined by Amarapathy et al. (2013, p. 222) as E-Tendering portals that are "secure dedicated websites, specifically set up for the exchange of information and tender documents electronically over the internet".

The ultimate goal/objective of E-Tendering as clarified by Amarapathy et al. (2013, p. 222) is a complete shift from paper-based manual tendering, to fully automated electronic means of communication. This would significantly decrease or even eliminate paper handling, speeding up interaction and communication between the different parties involved, and hence increases productivity and efficiency (Seah, 2004, p. 2).

2.2.3 The Process of Electronic Tendering in Construction

Experts in the construction industry had argued that E-Tendering is an information technology tool which can assist in revolutionizing the industry's culture and significantly enhancing its processes (Lavelle & Bardon, 2009, p. 104).

As described by MERX (2014, p. 5), the E-Tendering process is very secure. Brook (2008, p. 316) confirmed this finding and further elaborated arguing that E-Tendering is "a relatively simple technical solution based around a secure email and an electronic document management. It involves uploading the tender documents to a secure website with a secure login, authentication and viewing rules."

Technically, E-Tendering combines a number of processes that take place before the award of the contract. It mainly involves E-Notification, E-Access, E- Submission, E-Evaluation, and sometimes E-Awarding. Each of these processes is thoroughly described as follows:

1. **E-Notification:**
    - After the tender documents gets prepared, they are uploaded to the system (MERX, 2014 p. 5), then the client/consultant notifies a number of potential tenderers he wishes to have or makes it an open tender.
2. **E-Access**
    - The interested tenderers register and are given security codes to be able to download the tender documents, and all the procedures of the tender submittal together with the submission deadline of the tender submittal are clearly defined at this stage (MERX, 2014, p. 5).
3. **E-Submission**
    - The interested tenderers have to submit their tenders abiding by the data format set forth by the client/consultant which significantly improves communication.
    - The client/consultant clearly defines the data format that the tenderers must abide by to make a successful submission (Amarapathy et al., 2013, p. 221).
    - Seah (2004, p. 3) clarified that some advanced portals give the tenderer (main contractor) the ability to obtain and choose the best quotations submitted from different subcontractors and suppliers through an integrated E-market place inside the E-Tendering portal. Consequently, this service clearly facilitates the coordination and compilation of the submitted tender.

- According to MERX (2014, p. 5), the tenderer is given the luxury to keep updating all his files until the tender submission deadline specified earlier. Also all the activities performed are automatically saved which gives the luxury of an electronic automated audit trail. Moreover, the submitted tenders are securely stored until the opening of the tenders.

4. E-Evaluation

- The authorized staff members open the submitted tenders after the submission deadline for evaluation (MERX, 2014, p. 5).
- Although automation is the key to increasing productivity and hence saving money, unfortunately not all E-Tendering portals are automated. In other words, Seah (2004, p. 2) highlights that "in some portals which operate on the Construction Industry Trade Electrically (CITE) format, the tenderer can input the rates and/or quantities into the engine which easily processes the information into intelligent and useful data for the Quantity Surveying consultant to evaluate and report" and hence reduces clerical work and saves money. Other portals are only used as a gate to receive the tender submittal of the contractor and the entire evaluation process is manual.

5. E-Awarding

- E-Awarding is concerned with administrating the awarding process of the contract. It can include negotiations with potential tenderers after the first phase of evaluation and also "handling the legality of awarding, through signatures / encryption and time limit" (Amarapathy et al., 2013, p. 221).

2.2.4 The Different Types and Functions of the E-Tendering Systems

Christensen & Duncan (2006, p. 3) categorized the E-Tendering systems into the following three main categories:

1. **Principal to Tenderer Communication**

   In this simple system, the principal/client/consultant posts the tender documents on a website and the tenderers download them. Then the tenders are submitted on papers. Two-way communication does not take place in an electronic environment.

2. **Tender Submission and Two Way Communication**

   This is a more sophisticated system than the first one, where two-way communication takes place online as the tenderer is allowed to submit his tender electronically. Also this system facilitates the communication between the different parties involved as it includes the distribution of addenda, negotiations of some terms of the deal, etc. Usually this type of system does not provide the luxury of awarding the tender electronically.

3. **Electronic Tendering Contract Formation**

   This is a fully electronic system that provides all the facilities and operations of the second system (the two-way communication taking place online) and builds on it via allowing the tender award and contract formation to occur electronically as well.

2.2.5 Advantages and Benefits of Electronic Tendering in Construction

Kajewski & Weippert (2004, p. 4) cited the NSW Government and Department of Commerce highlighting the benefits that construction professionals and governmental organizations could gain when implementing electronic tendering processes. These benefits and advantages are grouped in the following three categories: General Perspective, Industry perspective and Government perspective.

1. **General Perspective:**

- Streamlines the entire tendering process.
- Provides secure and improved access to the tender documents.
- Makes it easier for businesses to obtain tender documentation and to submit an offer online on time as the postal system is no longer needed (Lavelle & Bardon, 2009, p. 105).
- Maintains an audit trail of all communication (RICS, 2007, p. 2).
- Virtual elimination of errors due to strict process (MERX, 2014, 5).
- Ability to eliminate automatically noncompliant tenders, hence saves time (MERX, 2014, 5).
- Saves money and time as the electronically submitted tenders are downloaded in a suitable form that facilitates evaluation without requiring the client's representatives to re-enter the data manually.
- Reduces the time and effort spent by the client to prepare, publish, evaluate and award the tender while reducing the time and effort exerted by the tenderers to identify the tender opportunities and respond to the tendering procedures (The e-Tendering Expert Group [e-TEG], 2013, Part 1, p. 6).

2. **Industry Perspective:**

- Increases tender opportunities, competitiveness and promotes transparency
- Provides easy and fast access to private and public tender information.
- Facilitates remote accessibility to the tendering system which improves access for geographically isolated industry practitioners/organizations (Amarapathy et al., 2013,

p. 222); and hence assures fairness regardless the tenderers' geographical area (MERX, 2014, 5).

- Reduces the cost of printing and copying which saves time and resources (Lavelle & Bardon, 2009, p. 105).

3. Government Perspective:

- Better value for the money of the taxpayers.
- Increases effectiveness and efficiency.
- Standardizes the tendering processes across the government.
- Promotes E-Government/E-Commerce initiative.
- Environmentally friendly due to a predominantly paperless process, so no waste generated (RICS, 2007, p. 2).

Preston in 2001, as cited by Lavelle & Bardon (2009, p. 105), demonstrated additional benefits for E-Tendering such as the reduction in administration processes via providing one single source of information. Consequently, duplication of documents does not occur and all revisions to the documents are kept track of and notified to the tenderers since audit trail/log is provided through the system. This has also been highlighted by Tindsley & Stephenson (2008, p. 277) quoting a contractor that stated "if a change is made, it can be instantly viewed by all the relevant parties rather than traditionally, where it would take days to receive and distribute such amendments by post".

Another benefit/advantage indicated by Tindsley & Stephenson (2008, p. 277) is that E-Tendering can provide full automated assessment with computerized analysis, hence, fairer and faster evaluation of the tenders submitted. Furthermore, the system could automatically identify incomplete or unusual entries, thus reduction in communications and faster analysis as well.

Moreover, as described earlier in the process of E-Tendering, the E-market place that is available in some tender engines reduces/enhances communications with suppliers and subcontracts which makes the tendering process effective, efficient and with no mistakes (Seah, 2004, p. 3).

Last but not least, the following table 2 is a comparison between traditional and electronic tendering presented by Ezanee, Norlila & Nurshuhada (Mastor et al., 2006, p. 4). It clearly highlights the advantages/benefits of E-Tendering.

COMPARISON BETWEEN TRADITIONAL AND ELECTRONIC TENDERING:

Traditional Tendering	E-Tendering
Poor audit trail	A log of all actions (accessing, downloading or submitting a tender,..) is automatically created providing a systematic and accurate audit trail.
High paper usage & storage	Paper usage is minimized by more than 90% as the tender documents can be accessed/downloaded and then submitted online. It is also important to note that no physical storage space is required as electronic documentation takes place.
Lots of time and money is wasted due to requiring the tenderers to physically go to the client's location to purchase the tenders	Tenders can be accessed and downloaded through the internet, hence it eliminates geographical boundaries and makes the tendering process faster and more convenient.
Poor information safety and availability	Instant access to tender documents that are stored securely online and backed up regularly.
High operational/processing cost	The online availability of the documents eliminates the need to manually manage the documents requested by the tenderers hence saves more resources. Also through process automation, cost is significantly reduced.
Time consuming and slow processing	Through automated documentation flow, tedious data re-entry and compilation is reduced over 80%, hence, the time to process tenders is significantly reduced making it faster to evaluate lots of tenders.

Table 2: Comparison between Traditional And Electronic Tendering
by Ezanee, Norlila & Nurshuhada (Mastor et al., 2006, p. 4).

2.2.6 Drivers for the Adoption of Electronic Tendering

Lavelle & Bardon (2009, p. 104) conducted a number of surveys which revealed that time and cost are the main drivers for the implementation of electronic tendering. Gebauer et al. in 1998 are also in agreement with their findings, confirming that time and cost are the two most important factors when evaluating/assessing the success of the procurement processes (Lavelle & Bardon, 2009, p. 108).

Furthermore, the research studies carried out by the International Data Corporation (IDC, 2013, p. 15) identified more drivers for the adoption of E-Procurement in the European Union (as highlighted earlier, E-Tendering is part of the E-Procurement). Table 3 shown below demonstrates the main drivers of E-Procurement implementation for national policy makers and for contracting authorities.

	National Policy Makers		Contracting Authorities	
Drivers	Price reduction of Purchases	**1**	Efficiency and productivity benefits	**1**
	Transparency of processes	**0.96**	Price reduction of Purchases	**0.86**
	Efficiency and productivity benefits	**0.86**	Transparency of processes	**0.82**
	Better access to the public markets by Economic Operators	**0.24**	Improvement of competition for Economic Operators	**0.28**
	Confidence of achieving full compliance	**0.22**	Greater choice of Economic Operators for public buyers	**0.11**
	Greater choice of Economic Operators for public buyers	**0.14**	Confidence of achieving full compliance	**0.05**

(Index 0 to 1: the factor with the highest number of votes from interviewees is index 1, all the others are indexed based on their relative distance from the 1st)

Table 3: Main Drivers of E-Procurement Adoption to Policy Makers and Contracting Authorities (IDC, 2013, p. 13)

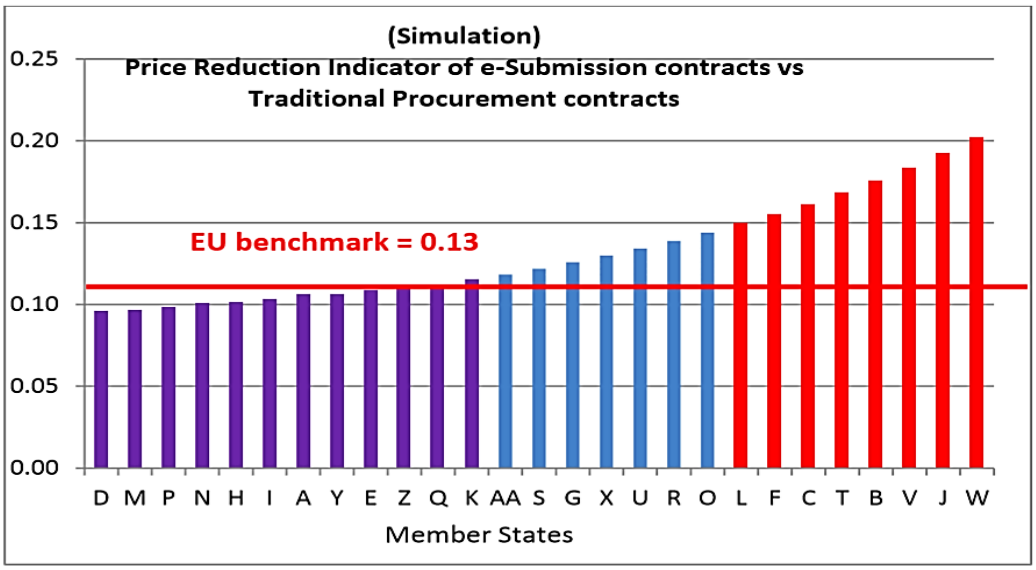
As can be interpreted from the table, price reduction, transparency and effectiveness/productivity are the main drivers for the implementation of E-Procurement.

2.2.7 Measures of Effectiveness of Electronic Tendering

The following are data from a number of governmental and academic reliable sources highlighting the benefits and effectiveness of E-Tendering.

- **Cost Reduction**

According to the IDC in 2012, EU public contracts tendered electronically and processed with electronic submission were 13% lower on average than public contracts traditionally tendered. Price reduction per EU member state varied from +10% to +20% as shown in figure number 6 (IDC, 2013, p. 41). These savings stem from many reasons some of which are the higher competitiveness E-Tendering provides since more opportunities are revealed to more competitors, the higher efficiency resulting in less man-hours spent on clerical work, less project re-tender, etc.



Source: IDC 2012

Legenda = High Price Reduction; Medium Price Reduction; Low Price Reduction

0 = the Price reduction of contracts with e-Submission is equal to that of contracts with traditional procurement

Figure 6: Price Reduction Indicator of E-Submission Contracts vs Traditional Procurement Contracts (IDC, 2013, p. 41)

- **Litigation Reduction**

According to IDC (2013, p. 44), the frequency of litigation for EU public contracts tendered electronically and processed with electronic submission was 55% lower than the litigation of contracts for public contracts traditionally tendered. Litigation reduction per EU member state varied from -17% to -67% as shown in figure number 7.

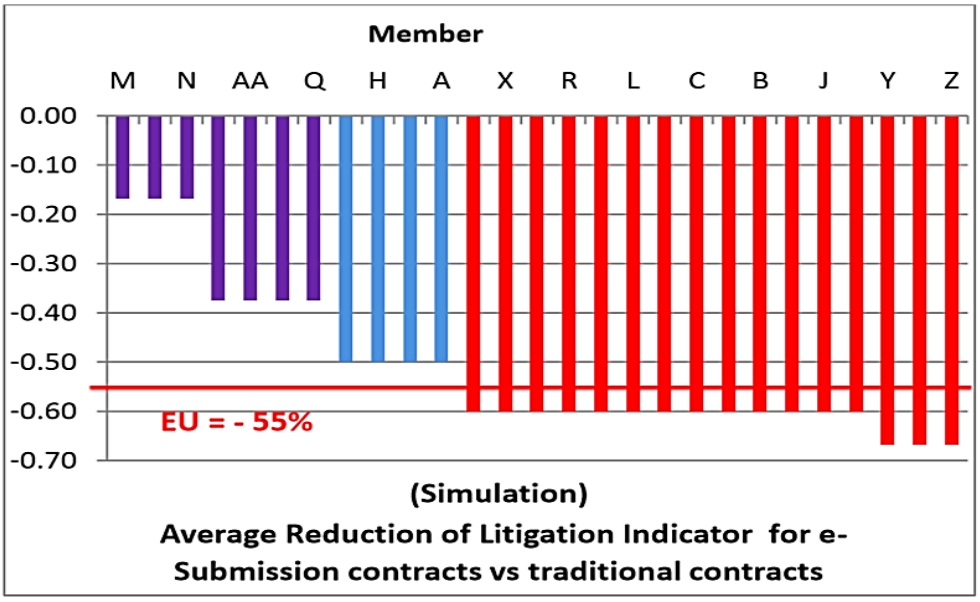
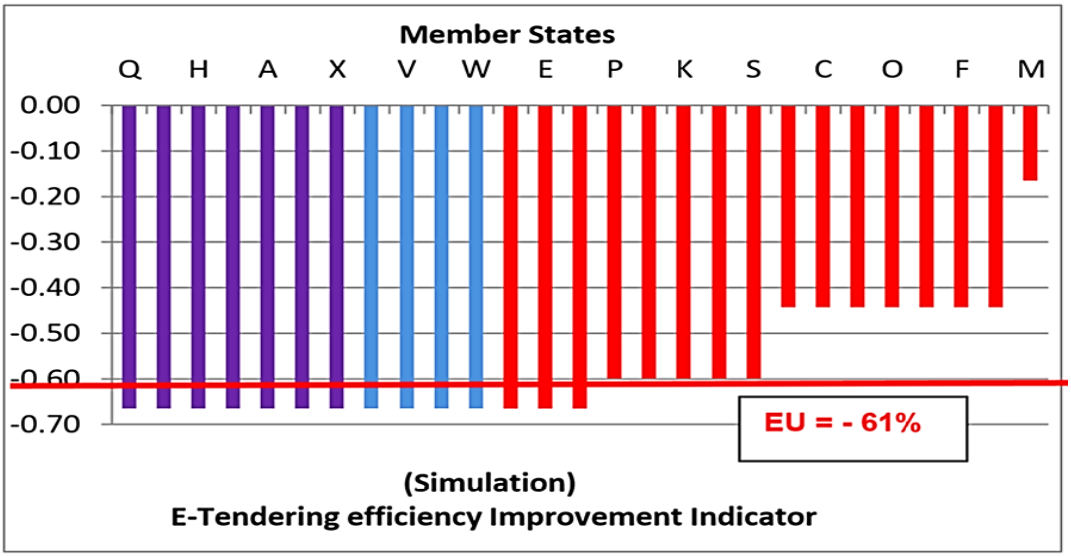


Figure 7: Average Reduction of Litigation Indicator for E-Submission vs Traditional Contracts (IDC, 2013, p. 44)

- **Efficiency Improvement (Time Saved)**

The average time spent by the EU contracting authorities in the pre-award phase when implementing electronic tendering is 9.3 hours compared to 23.8 hours when public contracts are traditionally tendered; hence, 61% of the time is saved when using E-Tendering. This efficiency improvement (reduction in time) per EU member state varied from -17% for the least efficient to -67% for the most efficient as shown in figure 8.



Legenda = High Efficiency (= high time saved); Medium Efficiency (medium time saved); Low Efficiency (low time saved)

Figure 8: E-Tendering Efficiency Improvement Indicator
(IDC, 2013, p. 47)

A number of case studies were reported in the literature highlighting the degree of effectiveness and the benefits E-Tendering provides. These case studies are shown below.

- **Case Study Number 1**

Hore et al. (2007, p. 8) cited a case study carried out by UK Woking Borough Council in 2003. The study was intended to capture the time and cost savings associated with electronic tendering. The council ran a pilot project where a fully electronic tender was adopted in parallel with a traditional paper-based tender process. Using E-Tendering, the actual time from creating the tender to its submission was reduced by an average of 50% and the time spent managing the tender responses (receipt, data entry and analysis) was cut by an average of 60% with 80% reduction in the data analysis time. Moreover, printing, production and distribution of hardcopies were avoided which saved more money and contributed significantly to the council's sustainability objectives.

- **Case Study Number 2**

Tindsley & Stephenson (2008, p. 274) cited a case study highlighted by Clark in 2005 in which the use of electronic tendering by a company saved more than £200,000 in tender costs representing a reduction of around 73%.

- **Case Study Number 3**

Tindsley & Stephenson (2008, p. 274) cited a case study presented by Booty in 2004 which highlighted savings of up to £1500 per tender in paper and administration costs and a reduction in time of 1.5 days to administer the tender. (20% reduction to the overall spending against the budget).

- **Case Study Number 4**

Davila et al. (2002, p. 16) claimed that companies using electronic procurement technologies reported savings of up to 42% in purchasing transaction costs. This cost reduction stems from less paperwork, which translates into fewer mistakes and a more simple and efficient purchasing process.

The conclusion and findings drawn by the case studies demonstrated above are very similar to the actual figures indicated by IDC about the degree of effectiveness of E-Tendering in the Member States of European Union. It is also important to point out that the first three case studies were carried out in a European country. Certainly a number of people could claim that this is a reason why there is much correlation/similarity with the findings of IDC; yet there is a clear difference between the scale of work and also the date in which these findings were drawn. Another point to highlight is the discrepancy in the cost reduction percentage when shifting to using E-Tendering, hence, more studies should be carried out to clarify and quantify the exact savings.

2.2.8 Challenges and Barriers to the Implementation of Electronic Tendering System

Despite the numerous benefits of electronic tendering, Mastor et al. (2006, p. 9) identified the following challenges as barriers impeding the implementation of E-Tendering in the construction industry.

1. Security Challenges

According to Amarapathy et al. (2013, p. 223), the internet is an open source through which information could be easily leaked and due to the usage of different or incompatible software, the data could be wrongly displayed at the other end. Kajewski & Weippert (2004, p. 8) have further questioned how to make sure that the information sent has not been altered or modified during transmission or storage. They also highlighted that confidentiality of the data (controlling the access to information) and authenticity of the data (ensuring the source of communication is authentic) are important challenges that face E-Tendering. The CRC also raised the same issues as they stated that "one of the main negative issues surrounding E-Tendering is the security threats impacting on the systems involved, including violations of data integrity and confidentiality" (Lavelle & Bardon, 2009, p. 105).

Furthermore, Darlington in 2006 argued that viruses, hacking, pirating, fraud, illegal trading and money laundry are significant risk factors threatening electronic transactions and the entire credibility of the tendering process (Olukayode & Adeyemi, 2011, p. 561).

2. User acceptance

Lack of awareness and knowledge about the processes of E-Tendering and the vast benefits it offers is a critical challenge towards its implementation (Mastor et al., 2006, p. 2). Rezgui et al. in 2004 have further claimed that senior management lack the awareness of the available and new trending technologies which is a major hit to the adoption of new innovative approaches

like E-Tendering as they are the decision makers who invest and adopt such technologies (Olukayode & Adeyemi, 2011, p. 561).

3. Accessibility Issues

Tindsley & Stephenson (2008, p. 276) argued that paper-based tendering will remain to be largely used as a large portion of the stakeholders in the construction industry (other than the main contractors) does not have adequate software/hardware requirements to fully immigrate to E-Tendering. The same has been highlighted by Lavelle & Bardon (2009, p. 105) when citing both RICS in 2004 and Rankin et al. in 2005 raising a concern that small medium enterprises (SME) and subcontractors will not be able to participate in the E-Tendering processes as they certainly lack the needed pricy equipment. Consequently, the contractors will have to bear the costs and responsibility of copying and printing the drawings for the subcontractors.

Mastor et al. (2006, p. 10) argued that in the developing countries E-Tendering will not be widely adopted because of the lack of accessibility to computers and the expensive high speed internet services; they also insisted that it is crucial to make the technology not only accessible but also affordable. Olukayode & Adeyemi (2011, p. 557) further added that poor telecommunication infrastructure and irregular power supply are also major problems that face the developing countries.

4. Low levels of computer literacy

Mastor et al. (2006, p. 10) indicated that in the developing countries, there are low levels of computer literacy which can significantly hamper the adoption of E-Tendering.

5. Legal Barriers

Kajewski & Weippert (2004, p. 4) argued that "the successful implementation of an E-Tendering process within the industry is susceptible to the current legal status regarding electronic transmissions, use of electronic signatures". This has also been highlighted by Mastor et al. (2006, p. 10) claiming that there are no standards or regulations governing what makes a valid signature in electronic tendering.

Concerning cross border implementation, Mastor et al. (2006, p. 10) argued that E-Tendering will face the problem that countries have different legal systems. Olukayode & Adeyemi (2011, p. 558) highlighted a serious problem as they stated that "the various forms of contract available for use within the construction industry usually give no indication of the admissibility of electronically exchanged documents in contracts; hence, the use of ICT remains legally ineffective/not allowed in current conditions."

6. Staff Resistance

Mastor et al. (2006, p. 10) stated that "some officials are resentful or fearful about the potential loss of bribe income the E-Tendering system could entail". They also argued that many lack the necessary skills to use E-Tendering and hence ignore it. Also some believe that it will be an additional workload with no compensation. Lou in 2006 added that when new technologies are introduced, the employees fear responsibility and fear that it could replace them which will make them lose their jobs (Amarapathy et al., 2013, p. 221).

Furthermore, the research studies carried out by IDC (2013, P. 17) identified more barriers to the adoption of E-Procurement in the European Union (as highlighted earlier, E-Tendering is part of the E-Procurement) and also ranked them. Table 4 shown below demonstrates the

main barriers to E-Procurement implementation for national policy makers and for Contracting Authorities.

	National Policy Makers		Contracting Authorities	
Barriers	Reluctance/ Inertia of Contracting Authorities	**1**	Reluctance/ refusal by potential Economic Operators	**1**
	Reluctance/ refusal by potential Economic Operators	**0.61**	Insufficient awareness about benefits	**0.98**
	Insufficient awareness about benefits	**0.49**	Onerous technical requirements for bidder authentication	**0.82**
	Complex and onerous regulatory requirements	**0.35**	Reluctance/ Inertia of Contracting Authorities	**0.81**
	Insufficient/ difficult access and/or usability of e-Procurement for Economic Operators	**0.3**	Lack of availability of e-Procurement services	**0.6**
	Onerous technical requirements for bidder authentication	**0.26**	Complex and onerous regulatory requirements	**0.6**
	Lack of availability of e-Procurement services	**0.2**	Insufficient/ difficult access and/or usability of e-Procurement for Economic Operators	**0.47**

(Index 0 to 1: the factor with the highest number of votes from interviewees is index 1, all the others are indexed based on their relative distance from the 1st)

Source: IDC 2012

Table 4: Main Barriers to E-Procurement Adoption for Policy Makers and Contracting Authorities (IDC, 2013, p. 17)

As can be interpreted from the table, the reluctance/refusal of adoption of the processes, the insufficient awareness and the complex regulatory requirements are the main barriers to the implementation of E-Procurement.

An interesting and important study had been carried out by Lavelle & Bardon (2009, p. 110) to understand/figure out how the personal characteristics of the human beings influence/affect the perception/adoption/acceptance of electronic tendering. The results/conclusion of this study is highlighted in the following table 5.

Statement	How personal factors affect QS views on e-tendering
Willingness to adopt e-tendering	Younger and inexperienced QS are more willing to adopt e-tendering than older and experienced QS
Likely to save cost	Younger and inexperienced QS believe e-tendering can reduce costs more than older and experienced QS
Likely to save time	Younger and inexperienced QS believe e-tendering can reduce time more than older and experienced QS
Likely to be fairer	QS of larger companies believe e-tendering is fairer than those of smaller companies
Likely to be more sustainable	–
Concerns over security	Older and experienced QS have greater concerns of security of e-tendering than younger and inexperienced QS
	QS of smaller companies have greater concerns of security of e-tendering than QS of larger companies
Concerns over choice and quality of systems	Older and experienced QS have greater concerns over systems available than younger and inexperienced QS
Concerns over complexity and IT skill required	Older and experienced QS have greater concerns with the complexity of e-tendering than younger and inexperienced QS
	QS of smaller companies have greater concerns with the complexity of e-tendering than QS of larger companies
	QS who have not used e-tendering have greater concerns with the complexity of e-tendering than those who have
Concerns over reliability	Older and experienced QS have greater concerns with the reliability of e-tendering than younger and inexperienced QS
Concerns over ability to share information	Contractor QS have greater concerns over sharing information when using e-tendering than client QS
In future e-tendering is likely to supercede traditional methods	Younger and inexperienced QS believe e-tendering can take over from traditional methods more strongly than older and experienced QS

Table 5: How Personal Factors Affect QS views on E-Tendering
(Lavelle & Bardon, 2009, p. 110)

As shown in the table, age and experience are particularly significant, with older and more experienced surveyors being more critical and negative than younger surveyors towards E-Tendering. The size and type of a company affect attitudes with regard to electronic sharing of information and the related aspects of infrastructure and security. Smaller companies have more concerns with regard to security, while contractors' quantity surveyors have much more concern over sharing information than clients' consultants. Prior use also affects attitudes, with

inexperienced users expressing more concerns over the use of E-Tendering (Lavelle & Bardon, 2009, p. 1).

Last but not least, it is important to highlight that most quantity surveyors and architects have experienced resource savings when using E-Tendering, while contractors and sub-contractors on the whole, have not. This is a serious challenge because the widespread adoption of E-Tendering will only be guaranteed when the benefits are realized by all the stakeholders, not just the client and the quantity surveyor in order to guarantee the wide spread adoption of E-Tendering (Lavelle & Bardon, 2009, p. 1).

2.2.9 The Current Level of Adoption of E-Tendering Worldwide

Betts et al. (2006, p. 1) argued that an increasing number of governments are implementing E-Tendering as they noticed how its implementation is enhancing the tendering processes and that it is an adequate mechanism to fairly award construction and procurement contracts. Furthermore, Amarapathy et al. (2013, p. 222) highlighted that this increasing number is due to the wide range of benefits E-Tendering provides like the ability to operate instantly across many portals, the reduced costs and the higher efficiencies.

E-tendering is increasingly used in almost all developed countries as they have all the basic requirements needed for its implementation and because as clarified by Tonkin in 2003, many governments believed that E-Tendering can "be used as a vehicle for the achievement of a number of public policy objectives" (Hore et al., 2007, p. 7).

For instance in the US and Canada, their governments have supported and encouraged the implementation of E-Tendering through introducing a number of legislations that gave E-Tendering the same binding effect of traditional manual paper-based tendering (MERX, 2014,

p. 5). Such legislations have also provided legal validity and credibility to the electronic signatures (Hore et al., 2007, p. 7).

In Europe, there are lots of governmental data concerning electronic procurement which embraces electronic tendering. According to a report issued by the European Commission (2010, p. 5), the European Union implementation of E-Procurement is less than 5% of the total value of procurement taking place. This 5% could actually account for €100 billion savings for the European public purse given the huge size of its procurement market (European Commission, 2012, p. 2). Furthermore, the European Commission (2010, p. 5) highlighted the success of the Portuguese government in nearly 100% adoption of E-Procurement due to the mandatory approach they implemented, this is a promising finding which encourages all the other state members. On the other hand, E-Procurement adoption in Italy and France was estimated to only be 2.5% and 4% respectively. Concerning Lithuania, the Organisation for Economic Co-operation and Development (OECD) identified that its law on public procurement forces contracting authorities to implement 50% of its public procurement electronically (Racca, 2013, p. 48). It is also important to demonstrate that according to the European Commission in 2011, "only 1.6% of public contracts are awarded to operators from other Member States" (Racca, 2013, p. 51). In the UK, Martin in 2008 stated "less than 20% of tender documentation is sent out and received through E-Tendering" (Eadie et at., 2010, p. 24); however, this finding contradicts a survey done by RICS in 2004 which identified a percentage of 46% of receipt of documents using E-Tendering by the interviewed surveyors (Lavelle & Bardon, 2009, p. 106). In Ireland, the Construction IT Alliance (CITA) in 2006 carried out a survey which revealed that a large number of firms interviewed only received electronically the tender documents, but they turned them back in paper format (Hore et al., 2007, p. 3). The authors also claim that the Irish

construction industry is more dependent on paper-based tendering. Furthermore, they cited the Department of Enterprise, Trade and Employment (DETE) in 2006, which highlighted that the Irish government is not exerting serious efforts to encourage the use and adoption of Information and Communications Technology (ICT) in the construction industry.

Other figures highlighted by the European Commission (2012, p. 2), showed that in Brazil E-Procurement for public projects accounted for 80%; and in Korea, E-Procurement made savings of 4.5 billion US dollars which accounts for around 8% of their annual total procurement spending. Also many of the countries located in Southeast Asia are increasingly adopting E-Tendering like Malaysia, Indonesia, Singapore, etc.

In Egypt, the construction industry is completely dependent on traditional manual paper-based tendering; however, efforts are exerted to adopt E-Tendering in order to provide an improved secure, fair, and transparent government procurement system. (Please refer to chapter 3 for more information about the exerted efforts).

2.3 Technical/Operational Guidelines for E-Tendering Best Practices

The following are guidelines meant to describe the best practices when designing and running the technical/operational processes of E-Tendering, which should improve and enforce its application.

These technical/operational processes are heavily based on the "Recommendations for Effective Public E-Procurement part I and part II" published in February 2013 by the Expert Group on E-Tendering (e-TEG), a consultative entity set up by the European Commission. These recommendations provided by e-TEG serve as “a blueprint for an ideal pre-award E-Procurement system” (European Commission, 2014). Also they are based on the "E-Procurement Golden Book of Good Practices" prepared by PricewaterhouseCoopers (PwC) for "The Internal Market and

Services Directorate General, (DG MARKT) which is one of the Directorates General and specialized services which make up the European Commission" published in March 2013 (Bausà et al., 2013). The Golden Book of E-Procurement provides good practices aimed to improve the e-procurement system. The e-TEG reports and the Golden book are complementary and address all procurement needs (European Commission, 2014).

It is important to note that the below guidelines are tailored to suit the Egyptian public tendering processes.

2.3.1 User Registration

1. Simplified registration procedures and authentication

A user is assigned a profile and he is set out permissions depending on his role on the portal (client, tenderer, etc.). In addition, appropriate security levels corresponding to the different tendering phases should be implemented in order to facilitate the user registration and avoid putting much burden on the users.

- Tender notices or opportunities should be posted on the portal and no registration shall be required to access these tender opportunities.
- Registration is required to use the full functionality of the portal such sending the tender response. Minimum information shall be required for the registration such as a valid e-mail address and a password. The portal should verify the user's e-mail and credentials.
- The use of CAPTCHA "for Completely Automated Public Turing Test To Tell Computers and Humans Apart" for validation is advisable, in order not to allow computerized systems to make fake accounts as humans can read distorted images whereas current computers cannot. To complete the registration, the user who wants to register has to click an activation link which is sent to his/her e-mail.

- For tasks involving tender preparation and submission, stronger authentication is a must which should involves digital signature and encryption based on asymmetric keys. (For more information, please refer to the Submission section 2.3.6 point 9).

2. Enabling collaboration for tender preparation and responses
   - The client/consultant or the tenderer shall be able to control multiple users.
   - From the client perspective, multiple staff from the organization and the consultants from the different organizations shall all be able to contribute to the tender preparation.
   - Also, from the tenderer perspective, collaboration efforts are needed from the different staff profiles to prepare the tender. This is more significant especially in the case of joint venture between 2 different companies that need to submit one tender.
   - The responsible staff member for the tender preparation from the client's team or the tenderer's team shall be able to create profiles, update permissions and disable profiles for the users in their teams. For instance, the staff member responsible for the tender response shall be able to allow specific users (like consultants, etc.) to contribute to the preparation of specific tender parts without granting them access to the whole tender.
   - In order to ensure that all users on the portal regardless of their absence (due to vacation or illness) are communicated the updates like the tender notices, queries, amendments etc., the portal must be able to send correspondence to one or more e-mail addresses to different staff members in the same entity/organization.

2.3.2 Planning and Preparing the Tender Documents

1. Enable the storage and re-use of information
   - Linking or copying information or structured requirements from previous tenders shall be made possible as it makes the tendering process more efficient for the client's staff.

- The portal should allow the users to store confidential information that is relevant to the overall tender preparation but not necessarily directly related to the tender dossier that will be published (such as planning or financing the works).

2. Enable the simulation of the whole tenders, the tender responses and evaluation
   - The portal should guide the client's staff to fill in all the required information, like the selection of category (supplies/work/services), the tendering procedure, the technical and financial requirements. Video presentations and other means like instant notifications should be available to offer guidance for the users on setting up the required procedure.
   - Simulation and preview of the entire tender dossier should be available prior to publication of the tender for review.
3. Enable the use of structured information
   - Structuring the required information facilitates the automation of the qualification procedures and the evaluation processes of the submitted tenders. Also, it increases the number of compliant tenders accepted by the client's staff.
   - The structured information facilitates:
     i. Tender preparation and pricing by the tenderer.
     ii. Carrying out simulations by the tenderers to figure out their scores especially when the client gives calculable criteria.
     iii. Evaluation of the submitted tenders by automating the processes of the selection and award criteria.
     iv. Contract award by the client.
     v. Post-award services such as contract management and electronic invoicing.

4. Enable traceability, version control and changes to the tender dossier
    - After issuing the tender documents, all necessary changes to the tender must be done through issuing amendments highlighting what has been modified. The modified documents shall be clear to all the users and version control is necessary for the users to know the latest version of the documents and how many times these documents were modified. It is crucial not to abuse the system, in other words, the client shall not continuously make modifications to the tender documents as such behavior could cause serious problems to the tenderers.
    - All the changes must be communicated to all the users and published on the portal in order to ensure transparency to all stakeholders even the ones not participating in the tender.
5. The portal should warn the client's staff responsible for the preparation of the tender documents from enforcing deadlines that do not comply with the applicable public tender law.

2.3.3 Publication of the Calls for Tender

1. All tender notices must be published on a central portal.
    - The portal should support all possible devices, such as PCs, smartphones, tablets.
    - Tenderers should be able to search the opportunities on the portal via a set of search criteria.
    - It is important to note that tender opportunities above the threshold should be electronically tendered, whereas tenders below the threshold should be traditionally tendered to avoid the E-Tendering regulatory procedures. The reason is that the Egyptian Federation for Construction and Building Contractors has categorized the Egyptian contractors into 7 grades. A contractor categorized in grade 7 has very limited capabilities and most of his employees might be computer illiterate, hence, enforcing E-Tendering on all tenders without having a threshold is not favored as it will challenge the capabilities of such

tenderers and hinder their abilities to participate in the tendering process. This will be considered unfair and thus cannot be allowed as the Egyptian public tendering law promotes and guarantees equal opportunities, the freedom to compete and equality. The threshold shall be determined by a regulatory authority and regularly updated. Furthermore, a tendency to divide the tender into smaller contracts to avoid compliance with the E-Tendering procedures is likely to arise and hence, the regulatory authority shall carefully monitor the different entities in order avoid the occurrence of such manipulation.

2. Same as recommended in the registration section, any user should access freely with no registration required, all the tender opportunities available on the portal.

2.3.4 Enable Access to Tender Documents and Information

1. The client has to ensure that the information he furnished on the portal is detailed enough which enables the users to decide rapidly whether to participate in the tender or not.
    - Accordingly, the call for tender, the instruction to tenderers and tender specifications should be available for free. Then, if a tenderer is interested to participate in the tender, he shall buy through an online transaction the tender documents and download them through the portal. In Egypt, payment of these fees is required as it guarantees seriousness from the part of the tenderers.
    - It is argued that uploading and making the full tender documents accessible on the portal requires a large space on the portal; hence, it is recommended to archive and remove the bulky tender documents regularly in order not waste space on the portal and consequently save money and improve the performance of the portal.

- The ability to search and sort opportunities shall be improved because leaving the tenderers to navigate through hundreds of tenders is very confusing and time consuming. This can be accomplished through sorting opportunities by:
    i. The type of works to be accomplished (Hospitals, Towers, Malls, Power plants, etc.).
    ii. The type of lots to be accomplished (concrete works, structural works, piling works, MEP, landscaping, etc.).
    iii. The type of contract of the project that will be accomplished.
    iv. The type and category of contractors in accordance with the categorization of the Egyptian Federation for Construction and Building Contractors.
    v. The contract value of the works to be accomplished, hence helping SMEs filter the appropriate tender for their scale.

2.3.5 Enquiries and Clarifications on the Tender Requirements

1. Provide a clear timeframe for providing answers to the tenderers clarifications and enquiries about the tender requirements.
2. Clearly specify the deadline for enquiries and questions which should be a specific number of days before the tender submission deadline. This allows the tenderers to revise their tenders after receiving the clarifications from the client.
3. It should be clearly stated in the tender documents that any clarification not raised through the portal will not be addressed. No direct one-to-one communication shall take place.
4. All questions and answers shall be automatically posted on the portal once the tender clarification period is finished.
5. The clarifications provided by the client shall be automatically addressed/sent to the tenderers once posted on the portal.

2.3.6 Submission

1. The submission of the tender response can be accomplished through two alternatives:
    - Offline system: In this system, the tenderer works on the tender offline on his computer, then he logs onto the portal to submit his entire tender. In order to allow automation of the evaluation process, the client should require the tenderers to fill in and submit standard BOQs, which are part of the tender documents and can be downloaded from the portal.
    - Online system: In this system, the tenderers work on the portal to fill in the required data/tender fields. For instance, the tenderers fill in the BOQ onto the portal, this helps automating the evaluation of the tender response once submitted.

    A mixture between these two alternatives can be used to submit the tender depending on how the client will handle the evaluation of the tender responses and the security schemes applied. In other words, the tenderers would work offline on their computers to submit part of the tender, and the other part of the tender is filled in online onto the portal.
2. Submission of the qualifications documents
    - The expert group on E-Tendering (e-TEG) recommends that the client shall promote and require the tenderers to use self-declaration when submitting tenders and to only require evidence from the selected tenderer as the submission and evaluation of the same qualification documents repeatedly over and over again constitutes a huge administrative burden to both the client and the tenderers. However, on the contrary, in Egypt, this self-declaration could actually cause much disturbance to the E-Tendering process as many ineligible tenderers will participate to disrupt the process without giving much consideration to the self-declaration knowing that no serious sanctions will be applied if

they get caught (especially that a number of laws in Egypt are issued but not effectuated). Hence, it is wise to remove the roots of any risk/expected problem before its occurrence.

- The portal should give the tenderers the ability to re-use the qualifying documents they submitted in previous tenders. This can be done through allowing the tenders to create a secured profile on the portal to store their confidential data.
- Instead of requesting official/qualifications documents from the tenderers, it will be very efficient to request such data from the public authorities/administrations that issue it. For instance, instead of requesting a bank guarantee from the tenderer, the client representatives could check it with the bank. Also instead of requesting the contractor to submit an official document clarifying his grade, the client representatives could automatically identify his grade through the Egyptian Federation for Construction and Building Contractors.

3. Tenders must be submitted in a standardized structured format.
4. Tender completion support
    - The portal should check the completeness of the tender requirements through warning the tenderer of any missing required fields, but the portal must not refuse any tender that is missing fields. The expert group on E-Tendering (e-TEG) stresses that the portal shall not validate the tender content; however, in Egypt, providing such option to the tenderers would encourage them to accept and participate in the E-Tendering. Therefore, the portal could check and warn the tenderer about the mistakes in the tender content, like the clerical errors or arithmetic errors committed by the tenderer in the bill of quantities or the tenderer's staff years of experience, etc. especially in case the tender or part of it is being filled online on the portal.

- The tenderer should be able to export his dossier as PDFs in order to visualize his work compiled before signing it.
- Session timeouts are essential security tools; however, these timeouts should not be too short which can cause frustration and negatively affects the users' experience. Also, these session timeouts shall not be too long which can have serious security risk. Accordingly, the session timeouts shall be balanced and the portal shall alert the user through sending notification before timeouts and/or include countdown to timeouts.
- The tenderer should be able to make modifications to his submission until the tender submission deadline.

5. After submitting the tender on the portal, an electronic receipt shall be sent to the tenderer confirming the receipt of the tender.
6. The identity of the tenderers shall be kept confidential to the evaluation committee of the tender.
    - It is important to note that since the name of the tenderer is always present in the technical envelope, at least the financial envelope should be submitted in a format which will make it impossible for the evaluators to recognize and differentiate between the tenderers, hence eliminating subjective decisions and making the evaluation process more transparent and fair.
    - It is argued that in order to eliminate collusion between the client's staff "the evaluators" and the tenderers, the E-Tendering system should automatically select random procurement experts from a database of experts (Tuan & Debenham, 2012, p. 50).
7. In order to investigate the case of a party claiming that the tender submission shall be postponed. A detailed record of the portal performance shall be automatically generated and

kept to judge whether the portal has failed "technical malfunctioning" (hence the tender submission deadline must be postponed) or nothing went wrong on the portal (probably failure in the tenderer network). In addition, in case electricity was cut down and it affected negatively the tenderer which made him unable to submit the tender, the tender deadline should be postponed to account for such incident. It is important to note that article #14 point 4 in the UNCITRAL Model Law on Public Procurement (2011) states, "the procuring entity may, at its absolute discretion, prior to a deadline for presenting applications to pre-qualify or for pre-selection or for presenting submissions, extend the applicable deadline if it is not possible for one or more suppliers or contractors to present their applications or submissions by the deadline initially stipulated because of any circumstance beyond their control".

8. Handling late submission

- The portal tender box shall not reject any tender once the deadline has elapsed; actually, the portal should keep accepting the tender responses while tracking the exact time and date of receiving the offers. This guarantees that all tenderers will be able to submit their tenders and that if the tenderer submits a late tender, he will be disqualified unless he was able to prove that this occurred due to a problem out of his control such as a technical malfunctioning of the portal or electricity cut off. Accordingly, this process helps reducing the number of claims raised by the tenderers since there is a detailed record of everything taking place on the portal.
- Furthermore, the portal should automatically send reminders to the tenderers to notify them that the tender deadline is approaching through all possible means like SMS(es) or E-Mail(s).

9. Digital signature, tender submission and opening

- Digital signature using asymmetric keys (private and public key) should be used for both signing the tender content and also for the tender encryption. Conceptually, when using the asymmetric keys, if the tender is encrypted using the public key, the tender can only be decrypted by using the private key; and vice versa.
- There are 2 different scenarios to choose from:
    i. 2-Step Process
    ii. Hash Code Process

i. 2-Step Process

- Given the fact that currently in Egypt there is a lack of trust between the governmental organizations and the tenderers, it is recommended to sign the tender using the private key, and then encrypt the tender using the public key. This 2-step process guarantees maximum protection for the tenderers and for the government. On one hand, authenticity, non-repudiation and data integrity are guaranteed as the tenderers will be required to sign using their private keys; and on the other hand, the client cannot open/decrypt the tenders unless the private key of the tenderer is used, hence confidentiality of the tender is guaranteed before the tender submission deadline. It is recommended that a trusted third party certificate authority (CA) be licensed/assigned to issue the asymmetric digital signatures and control the encryption of the tenders and not the government (client).

a. Tender Signature

- The software using a process called hashing, crashes down the tender content to just a few lines called message digest.
- The software using the private key encrypts the message digest, the result is a digital signature.
- The software appends the digital signature to the tender content, hence all the content has been signed.
- The time showing when the tender got signed using the private keys will be recorded.

b. Tender Encryption

- The tenderer will use his public key to encrypt the tender, hence, confidentiality is guaranteed as the client cannot open the tender before the tender opening session, when the tenderer uses his private keys to decrypt the tender.
- The time showing when the tender got encrypted using the public key will be recorded.

c. Tender Submission

- The tenderer will send the public key to the client, so that the client checks with the certificate authority that the digital certificates are authentic, valid and issued by a certified certificate authority. Also the record of the tenderer will be carefully examined to check against any violations of contractual or legal obligations committed during the tendering phase or contract implementation of any previous tenders he participated in. It is important to note that the client cannot open

the tender using the public key of the tenderer since it has been already used to encrypt the tender.

d. Tender Opening

- On the tender opening session, the tenderer will first use his private keys to decrypt the tender (in order to open it). Then the client will use the tenderer public keys to decrypt the tenderer's signature. Afterwards, the integrity of the tender will be verified as the hash of the tender at the time of signing the tender will be checked against the hash of the tender at the time of opening the tender. Time log will show the actual time the tender got encrypted and then got decrypted. The process of decrypting the tenders using the private keys can be done remotely.
- This 2-step process is recommended as it guarantees maximum protection for the tenderers especially that trust between the governmental organizations and the tenderers is not present for the time being.
- If a 1-step process is used, where the tenderer signs using the private key, the tenderer will fear that there is a probability that the tender can be opened before the tender submission deadline by corrupted staff in the government hence disclosing the confidential data to other tenders. Tender integrity/alteration is not a main concern as in both the 1-step process or the 2-step process, the tender hash is being checked before submitting the tender and after the tender opening,

and in case of any mismatch, the whole tender will be cancelled. The problem is that the cancellation of the tender will cause time and cost impacts as the whole tendering process will have to be repeated again. Also this will create huge adverse impact as the confidentiality and integrity of the E-Tendering process will be doubted.

e. Obstacles:

- How to decrypt/open the tender if:

1. The tenderer lost his private keys
   - If the tenderer lost his private key, through written request from the tenderer, the tender can be decrypted via the certificate authority. In this case, the digital certificate will be revoked and the tenderer must apply for a new digital certificate to use it for other tenders.
2. The tenderer did not show up on the tender opening session
   - The tenderer can remotely decrypt the tender using his private key.
   - Also, another way, is that the certificate authority should revoke the tenderer digital signature and decrypt the tender. In this case, the tenderer must apply for a new digital certificate to use it for other tenders.
3. The tenderer applied to 2 different tenders, but his digital certificate got revoked during the 1st tender, before decrypting the second tender.

- The tenderer will not be able to decrypt the tender using his revoked certificate, hence, the certificate authority should be contacted to reveal the scenario of why his certificate got revoked and to check the identity of the tenderer in order for the certificate authority to decrypt his tender.

ii. Hash Code Process

- In this second scenario, the tenderers only send their hash codes before the tender submission deadline.
- After the tender deadline, the tenderers will be asked to upload their tenders after being signed and encrypted by their private keys.
- On the tender opening day, the committee decrypts each tender using the tenderers' public keys and compares the newly received hash codes of the submitted tenders vs the hash codes of the tenders that were sent before the tender deadline. In case the tender hash codes do not match, the tender will be automatically discarded.

- Both methods described above guarantee maximum protection for both the client and the tenderers; however, the use of the first method described above "the 2-step process" is recommended. The reason is that Egyptian legislators might not accept that all tenders get uploaded at a later stage after the tender deadline.

10. Important policies for the E-Tendering system

- Widespread security standards (ISO 27000 series) should be enforced to implement the best security practices that protect the users and the data without creating unnecessary barriers hindering the smooth operations of the users.

- Information Security Management System should be implemented defining the scope of service, the identification of who has access to which data, procedures of staff vetting, the policies on maintenance of the service and developing and monitoring risk assessments against possible threats.
- The users shall be notified of all maintenance operations to the system that could affect their E-Tendering operations. Such maintenance operations shall occur out of the normal business hours and the system shall not be completely taken down.
- Optimizing the page load time is crucial especially for the users on a low internet bandwidth and for the key functions (like the registration, tender search, tender upload, etc.).
- There should be adequate support streams for all the users to provide assistance whenever needed. This could include e-mail, telephone, FAQs section, user guides, etc.
- There should be a service level agreement (SLA) for all the services provided by the portal operators or third parties (for example for customer care services, etc.).

2.3.7 Tender Evaluation

1. The portal should automatically classify the tenders submitted as compliant or non-compliant.
2. The portal should evaluate automatically part of the tender based on a pre-defined criteria assigned by the client.
3. The portal should be able to sort the tenderers in terms of the tender value they submitted and highlight abnormally high or low submitted tenders.
4. The portal should help the evaluators visualize the data submitted by the tenderers through providing standardized comparisons and charts.

2.3.8 Awarding

1. Before publicly announcing on the portal the tender results, a functionality on the portal shall allow the client to inform all the tenderers of these conclusions. This marks the beginning of a standstill period which gives the tenderers the opportunity to appeal against the conclusions reached. The portal should not permit the client to publicly announce the tender results before this standstill period ends.

2.3.9 Bridge to Post Award

1. Savings in time and cost could be achieved through electronically sharing, signing and archiving the contract documents.
2. Contract management can be carried out on the E-Tendering portal.
3. Electronic invoicing (E-Invoicing) can be enabled on the E-Tendering portal.

2.3.10 Miscellaneous

1. Anonymous feedback on every aspect of the E-Tendering portal shall be collected during the tender preparation and after the awarding of the contract in order to tackle any difficulties faced by all the users and hence improve the portal performance and the users' experience.
2. It is important to provide foreign translations to certain technical information in the tenders.
3. Records management and archiving of all the processes taking place on the portal shall be created and maintained in order to promote accountability and transparency. This should be compliant with international standards and specifications like ISO 15489.
4. A dedicated independent public procurement national regulatory authority/agency shall be created. The following are the main tasks of this independent entity (EBRD, 2013, p. 6):
    - Monitoring the different organizations and sharing knowledge and lessons learnt.
    - Setting the threshold below which low value tenders shall not be electronically tendered.

- Developing and ensuring uniform E-Tendering standards, processes and good practices.
- Continuous identification of non-transparent and redundant processes shall be carried out in order to ensure best procurement practices (Das et al., 2010, p. 390).
- The agency should also monitor, evaluate, define penalties and sanctions for entities violating or deviating from implementing E-Tendering, and bonuses for entities promoting E-Tendering.

5. Support centers across the country shall be established to provide training and support for all public authorities and tenderers through the different means (workshops, seminars, etc.).
6. A private module on the E-Tendering portal should be created to facilitate one-to-one communication between the contractor and his subcontractors.
7. Targeted awareness campaigns are essential through the different media: newspapers, TV, Internet, radio, conferences and workshops to describe the benefits of E-Tendering for the country and all the stakeholders.
8. Disciplinary, contractual, criminal and/or civil sanctions should be applied in case any party committed violations of contractual or legal obligations (Mittermaier & Marschall, 2010, p. 3).
    - Debarment (Temporary or permanent exclusion from other contracts) is one of the very effective deterrents to the corrupt practices and misconduct of the entities before contract award or during contract implementation (Mittermaier & Marschall, 2010, p. 7). Accordingly, a central database showing the performance of the entities during the tendering phases and contract implementation is vital. In the prequalification phase, or before any contract is awarded, all tenderers will be checked against this central database to point out and eliminate the tenderers which have a bad record.

- Non-disclosure agreement of the data transmitted online to the client should be introduced and implemented incorporating severe penalties for its breach.

9. In Egypt, it is recommended that E-Tendering be applied on a long term. In other words, the phases of the E-Tendering processes shall not be all enforced abruptly at the same time. Actually, each phase shall be applied after its precedent gets widely accepted and adopted by the different entities and tenderers. First, the phase of publishing the call for tenders shall be applied. Then uploading the tender documents by the client and allowing the tenderers to download them. Afterwards, allowing the submission of the tender documents online. Then the semi-automatic evaluation and fully automatic evaluation of the tender documents. Finally, the post contract services (contract management, electronic invoices, etc.).
10. Recommendations over the Long Run

- In Egypt, it is expected that a number of private E-Tendering portals will be created since the private companies will realize the benefits of E-Tendering over traditional tendering. Hence, the governmental E-Tendering portal shall be designed in a way to allow automation and interoperability between the different portals (Rosa, 2014, p. 14) (i.e. that the tenderers become able to participate in the governmental tender regardless of which E-Tendering portal they used to create and submit the tender). In addition, the Egyptian legislators and regulators shall take into consideration the above in order to create a fully functional E-Tendering system that addresses the expected needs of the construction practitioners.
- A proof of compliance with environmental and social legislations as well as international agreements shall be a prerequisite for participating in the governmental tenders (Hidson & Ochoa, 2006, p. 4).

- The evaluation of the tenders shall not only include technical and financial evaluation, but actually a best value approach considering technical, financial and sustainability score shall considered (Hidson & Ochoa, 2006, p. 5). According to the Mayor of the City of Malmö, Sweden, Ilmar Reepalu, "our challenge is to make sure that every euro we spend can maximize social benefits, reduce environmental impact and contribute to sustainable economic development" (Mattauch, 2012, p. 2). Egypt shall seriously consider the aforementioned statement and adopt it in order to address the needs of its citizens.

2.4 Conclusion

Traditional paper-based tendering is full of problems and inefficiencies such as access problems, poor paper trail and audit history, security concerns, etc. Consequently, countries worldwide have seriously considered E-Tendering as an alternative to the paper-based tendering process. E-Tendering is a complete shift towards a fully automated electronic means of communication. It ensures process transparency, equality of access, fair competition, effectiveness and accountability (Das et al., 2010, p. 390). Furthermore, guidelines meant to describe the best practices when designing and running the processes of E-Tendering are covered in this chapter.

CHAPTER 3: TOWARDS THE IMPLEMENTATION OF E-TENDERING IN EGYPT

This chapter explores the efforts exerted by the Egyptian government towards the adoption of E-Tendering in Egypt. The chapter starts with identifying all the proposed E-Tendering phases/options that are planned to be applied in Egypt, then highlighting the actually applied phases in the tendering process for public works till date. Furthermore, the actual measures (decrees and amendments to the law) taken by the government to implement E-Tendering and to improve its uptake in Egypt is thoroughly examined to highlight the effectiveness and practical impact of these measures to attain their goals. Moreover, the current level of adoption of E-Tendering among the governmental organizations and tenderers is presented and compared to the earlier statistics when the portal was launched. In order to achieve the above, the qualitative approach is adopted given the exploratory nature of the research in consideration. More specifically, literature is thoroughly examined and two face-to-face semi-structured interviews are conducted with highly ranked officials in the government (their names are not revealed for confidentiality reasons) together with thorough analysis of the Egyptian E-Tendering portal.

3.1 The Beginning of E-Tendering in Egypt

In order to modernize the tendering/procurement system in Egypt and make it more secure, fair and transparent, the Egyptian government, in 2007, launched the E-Tendering portal. This portal is supposed to comprise the following three main phases (General Authority for Government Services [GAGS], 2010, p. 8):

3.1.1 E-Tendering Phase

This phase comprises creating and uploading the tender documents on the portal and publishing notifications to the registered users. The interested users can also send clarifications (if any) on the tender and the client replies back to all the registered tenderers.

3.1.2 E-Submission and E-Evaluation Phase

This phase comprises the submission of the tender documents of the tenderers electronically on the portal. Afterwards, technical and financial evaluation is carried out by the evaluators and the announcement of the winning tenderer is published online.

3.1.3 Contract Administration Phase

This phase is carried out after the award of the contract. It comprises contract follow-up and other post contract services.

3.2 The Actual Phases and Steps Implemented till Date in Egypt

3.2.1 Implemented Phases till Date

Till date only phase one has been implemented partially and a minor part in phase two as shown below:

- The governmental organization wishing to publish the tender creates the tender documents offline then sends part of the tender documents electronically through e-mail to a central authority in order to publish them on the portal.
- Afterwards, users on the portal download for free the uploaded parts of the tender documents, then, if interested, will have to go to the governmental organization which has created them in order to buy the full tender documents.
- In addition, a brief concerning the evaluation of the submitted tenders is published.

Unfortunately, one of the very critical issues with E-Tendering in Egypt is that there is no defined plan that illustrates approximate dates concerning the adoption of all the E-Tendering phases. In other words, most of the countries have a defined goal and timeframe for the application

of each phase of the E-Tendering processes. Setting goals and achievable plans is essential; this is evident in the famous quote of Benjamin Franklin: “If you fail to plan, you are planning to fail”.

3.2.2 Issued Decrees

The Egyptian government has issued a number of decrees in order to improve the adoption of E-Tendering. The below is a list of the issued decrees together with a thorough analysis of each one of them.

1. Decree number 33 of the year 2010: This decree urges all the governmental organizations to publish the call for tender, the instruction to tenderers, the project specifications and any amendments to the tender on the E-Tendering portal in addition to publishing in the newspapers (Egyptian E-Tendering Portal, 2010).
    - This decree aims to increase transparency and competition between tenderers through highlighting all the available opportunities. It also aims at publishing sufficient data which makes the users decide whether to participate in the tender or not (buy the tender documents or not).
    - The problem with this decree is that no sanctions were highlighted/defined for the entities not abiding by this decree. Consequently, it took so long for the different organizations to publish such documents on the portal and even, until now, there are some governmental organizations that still do not use the E-Tendering portal when publishing about their tendered projects. The exact figures of the participation on the E-Tendering portal are highlighted in the statistics section 3.2.4 below.
    - Few governmental organizations abide by this decree since the decree itself requires the organizations to upload a very big part of the tender documents. Most governmental organizations registered on the portal announce their projects that will be tendered, but a

small number uploads the full tender specifications. There are no strict rules concerning which documents to upload.

- Furthermore, this decree does not include the whole set of tender documents. In fact, another decree shall be issued urging the different entities to upload the whole tender documents on the portal so that the tenderers can download them easily and hence, one of the very important benefits of E-Tendering could be taken advantage of.
- It is important to note that, although the E-Tendering portal was launched in 2007, this very important decree was issued in 2010. This shows that the decision making takes a long time.

2. Decree number 21 for the year 2011: This decree states that given the fact that the E-Tendering portal is not being used by the governmental organizations to publish their tender announcements, GAGS in collaboration with the Ministry of State for Administrative Development will provide training workshops in this regard. These training workshops will be conducted in the location where the governmental employees work, in addition to providing workshops in the head office of GAGS (Egyptian E-Tendering Portal, 2011).
   - Providing the training sessions to the employees is a good step towards the adoption of E-Tendering. However, this decree was issued after realizing that the E-Tendering portal is not used by the governmental organizations. This shows that no clear plan towards the adoption of E-Tendering is defined as the government is trying to solve problems instead of finding measures to prevent the problems from happening in the first place.
   - In addition, although the decree is essential, applying it is very hard because GAGS needs a big number of resources to cover the 27 Egyptian governorates. (To find applicable solutions to this issue, please refer to chapter 5).

3. Decree number 463 for the year 2012: This decree urges the governmental organizations to publish the financial and technical evaluation of the awarded tenders on the E-Tendering portal (Egyptian E-Tendering Portal, 2012).
    - The main aim of this decree is to increase the transparency through allowing the stakeholders to check the evaluation results of the submitted tenders.
    - Unfortunately, no requirements or guidelines are specified concerning the level of detail of the evaluation information that shall be posted on the portal. For instance, on the portal, detailed information about the evaluation of a certain tender can be located, whereas the published evaluation of another tender is very brief. Hence, it is crucial to standardize and unify the information published on the portal in order to make the process of awarding the contracts more transparent and fair; thus, achieving the aim of the decree without compromising the confidentiality of information of the tenderers.

3.2.3 Proposed Amendments to the Law of Tenders

The law governing all public construction contracts as well as the procurement of goods and services for the government is the tender law #89 issued in 1998 and its amendments.

According to Gamal (2007, p. 3), a number of organizations reviewed this applicable law and identified the articles that should be modified to address the use of E-Tendering.

Current law	Proposed Amendments to the Law	Further Long Term Amendments (Discussed in the Literature Review Section 2.3)
Tender notices shall be published in two widespread newspapers.	Internet can be used to publish tender notices.	Internet is to be used solely to publish tender notices.
Tenderers must submit the tenders in two closed envelopes until the opening of tenders session.	Tenders can be submitted electronically. They will remain encrypted until the opening of tenders session.	Tenders must be submitted electronically. They will remain encrypted until the opening tenders session.
The tenderer's bid is identified via his stamp.	The tenderer's bid is identified by his E-Signature.	The tenderer's bid is identified by his digital signature.

Table 6: Proposed Amendments to the applicable Law #89 issued in 1998
(Gamal, 2007, p. 4-6)

GAGS (2012, p. 4) added that comprehensive amendments to the legal framework which adapts the fundamentals of the United Nations Commission on International Trade Law "UNCITRAL Model Law" was completed in February 2012. However, these amendments are only pending being presented to the Egyptian parliament for discussion and ratification.

3.2.4 Comparison between Early Statistics and Latest Ones

1. According to a published presentation by Samir (2010), the head of programs and policies sector in the Ministry of State for Administrative Development, there are 750 governmental organizations in total and only 110 organizations until November 2010 had participated in the E-Tendering portal i.e. the percentage of participation was 14%.

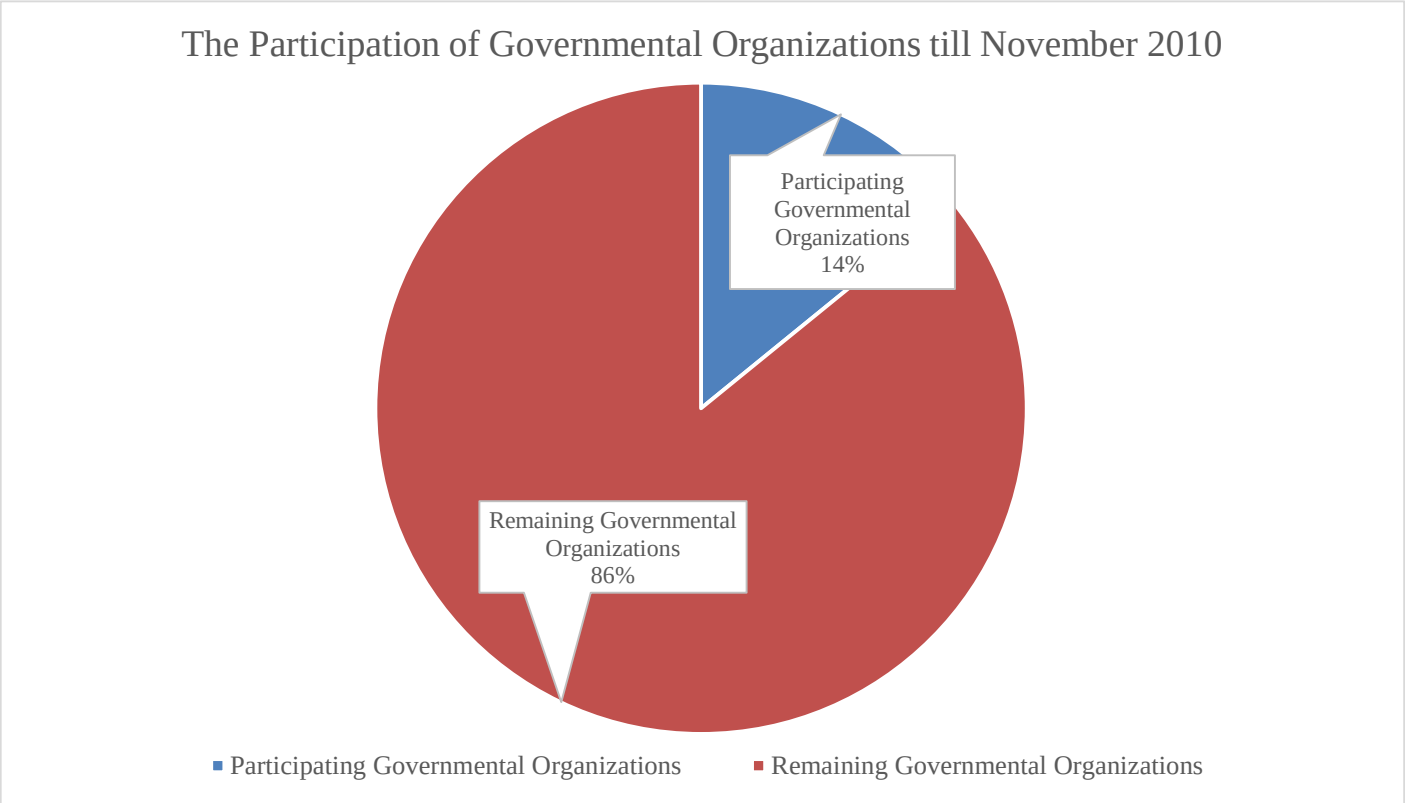


Figure 9: The Participation of Governmental Organizations until November 2010
(Samir, 2010, p. 10)

- As of December 2014, this percentage of participation has increased to be around 78%. More specifically, the total number of participating governmental organizations is now 586 organizations out of 750 organizations.

2. The cumulative number of published tenders grew from almost 40 tenders in Feb 2010 to 400 in November 2010, with an increase of 900% in 9 months (Samir, 2010, p. 14).

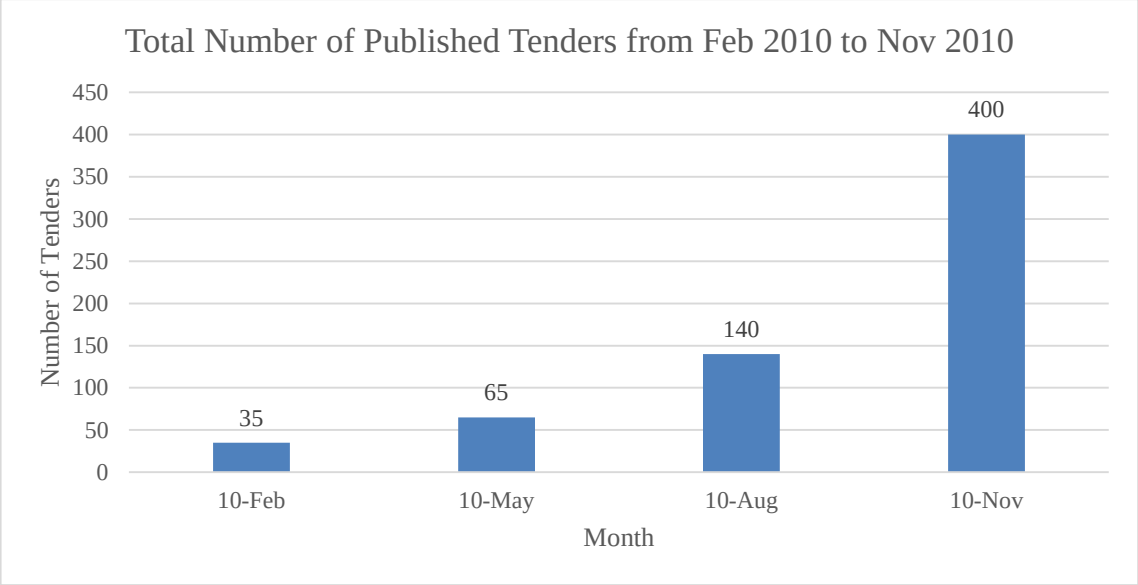


Figure 10: The Total Number of Published Tenders from Feb 2010 to Nov 2010
(Samir, 2010, p. 14)

- It is worth noting that, according to data interpreted from the Egyptian E-Tendering portal, the number of published tenders from December 2013 to December 2014 is almost 4500 tenders. The huge difference in the number of published tenders in the year 2010 compared to the year 2014 shows that the governmental organizations responded to a great extent to the calls of the government concerning announcing on the E-Tendering portal the projects to be tendered.
- Moreover, the total cumulative number of published tenders on the portal as of December 2014 is around 19000.

3. Furthermore, the following chart represents the total number of registered suppliers vs the number of registered non-suppliers on the portal (Samir, 2010, p. 11-12).

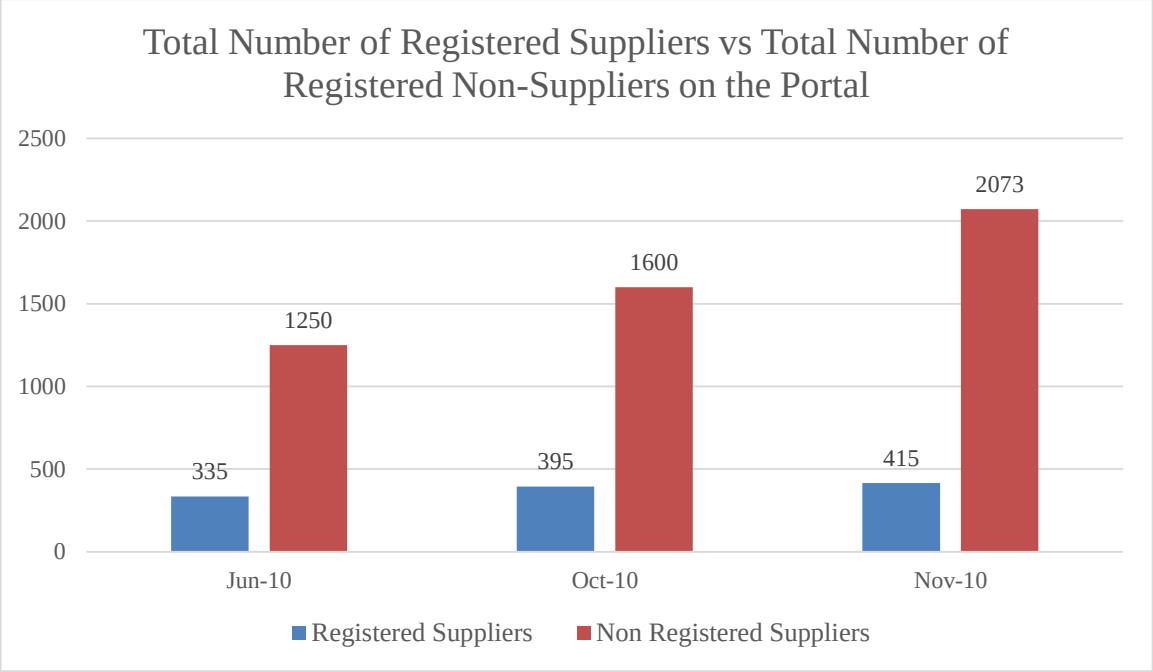


Figure 11: The Total Number of Registered Suppliers vs Registered Non-Registered Suppliers on the Portal from Jun 2010 to Nov 2010
(Samir, 2010, p. 11-12)

- As of December 2014, the total number of suppliers on the portal has increased to be 5000 suppliers and the total number of registered non-suppliers became around 14000.
- These figures demonstrate that E-Tendering has gained much momentum last 2 years.

3.3 Conclusion

The Egyptian construction industry is completely dependent on the traditional manual paper-based tendering system which is complex, bureaucratic, costly, time consuming, less transparent and full of inefficiencies as highlighted earlier. Hence, it is imperative that the public procurement/tendering system revolutionizes to incorporate E-Tendering. The measures, decrees and statistics provided in this chapter indicate that there is evidence that Egypt is moving steadily but on a slower pace towards adopting E-Tendering especially within the governmental entities.

Unfortunately, so far, few steps/measures were taken in this regard towards the Egyptian tenderers. In other words, much collaboration and feedback from the Egyptian tenderers should be considered in order to provide a fully functioning E-Tendering system especially that the widespread adoption of E-Tendering is only achievable when addressing the needs of all the stakeholders.

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CHAPTER 4: BARRIERS/CHALLENGES/CONCERNS TOWARDS THE COMPLETE ACCEPTANCE AND ADOPTION OF E-TENDERING

The main aim of this chapter is to identify the barriers, challenges, and concerns of the tenderers against participating in a public E-Tendering process. Since this is an exploratory research in nature, qualitative approach is adopted in identifying from the literature a list of the most common challenges that influence the tenderers' acceptance/adoption of E-Tendering.

This list of challenges is then presented to a panel of 15 knowledgeable experts in the field of tendering in Egypt in a semi-structured face-to-face and telephone interviews in which a survey questionnaire is filled. Hence, the sampling design used is non-nonprobability sampling and more specifically purposive sampling. The panel of experts is composed of academic and industry professionals, which included consultants and contractors. (Please refer to appendix #1 for the list of interviewed experts).

The experts are asked to check/mark on a 5-scale Likert item, the probability/likelihood that a tenderer considers the challenges presented in the list as obstacles against the adoption of E-Tendering in Egypt. In addition, the experts are asked to identify more challenges/barriers if any.

The survey output is analyzed using the adjusted relative importance index (RII) to identify the rank (relative importance) of each barrier/challenge hindering the uptake of E-Tendering in Egypt in order to address and tackle them.

It is debatable whether the distance between each response in a 5-scale Likert item is equal or not since numerous research provided different conclusions as highlighted by Holt (2014, p. 3-4). In this research, it is important to note that the Likert items are symmetric (5-scale) and interval in nature, hence the difference between each response can be considered equal in distance (Holt, 2014, p. 4).

The preliminary findings for the barriers, challenges and concerns of the stakeholders are grouped in the following 4 categories: security challenges, user acceptance and staff resistance,

accessibility issues, and legal barriers. These challenges/barriers were developed and grouped after extensive review and analysis of literature in order to identify the barriers hindering the adoption of E-Tendering in a developing nation like Egypt.

4.1 List of Identified Challenges/Concerns from the Literature

4.1.1 Security Challenges

- Document tampering i.e. when a person makes unauthorized and unfair modifications to the tender (Eadie et al., 2010, p. 26).
- Problems with data integrity after reassembly - possibility of inaccurate, incomplete, corrupted data after reassembly (Davila et al., 2002, p. 30).
- Confidential documents getting leaked to competitors (Davila et al., 2002, p. 30).

4.1.2 User Acceptance and Staff Resistance

- High investment costs to adopt and maintain E-Tendering with no substantial benefits realized (Samuelson, 2008, p. 16).
- Reluctance/Resistance to change i.e. general attitude that old ways of doing things have worked well throughout the years and changes are unnecessary (Olukayode & Adeyemi, 2011, p. 572).
- Unethical investors and corrupted officials will fight to continue with the traditional paper-based tendering which is full of leaks (fear of potential loss of bribery) (Mastor et al., 2006, p. 10).
- Automation is a threat to the employees' jobs.
- E-Tendering is more time consuming than traditional tendering.
- E-tendering is an additional workload with no compensation/reward.

- Lack of leadership/upper management support (Eadie et al., 2010, p. 25).

4.1.3 Accessibility Issues

- Fear of using non-compatible software with the client/consultant system hence tender submission could get rejected "noncompliance" (Samuelson, 2008, p. 16).
- Irregular electric power supply will affect the E-Tender processes especially the tender submission (Olukayode & Adeyemi, 2011, p. 557).
- A fear that a technical malfunctioning of the portal could cause disturbance to the electronic submission of the tenders.
- Poor telecommunications infrastructure will affect the E-Tendering processes (Olukayode & Adeyemi, 2011, p. 572).
- E-Tendering requires-high speed expensive internet services.
- A large portion of the Small Medium Enterprises "SME's" especially in Upper Egypt are computer illiterate hence will face difficulty to apply, prepare and submit tenders electronically.
- The contractors will bear the costs and responsibility of copying and printing the drawings for the subcontractors.

4.1.4 Legal Barriers

- Complex, time consuming and onerous regulatory procedures (IDC, 2013, p. 17).
- Problems with proof of intent of the tenderer (Eadie et al., 2010, 26).

4.2 Research Methodology

As highlighted in the beginning of this chapter, semi structured interviews with 15 experts were conducted, of which 11 were face-to-face interviews and 4 telephone interviews. The telephone

interviews were conducted since it was not possible to reach the experts. Each telephone interview lasted around 1 hour. In these interviews, the experts were asked to fill in a survey questionnaire. Each expert was asked to check/mark on a 5-scale Likert item, the probability/likelihood that a tenderer considers the 19 challenges presented as obstacles against the adoption of E-Tendering in Egypt. The experts were also asked to identify more challenges (if any) that were not taken into consideration in this sheet of preliminary challenges derived from the literature. The panel of experts included academic and industry professionals working as contractors and consultants. The experts were selected based on their expertise in the field of tendering in Egypt and based on the criteria and they carried out/participated in more than 20 tenders. The expert interviews are conducted since their expertise and experience add more depth to the research taking place. Initially, 5 experts were only selected to conduct this survey questionnaire, but since there was variance in the data they provided and each expert added valuable information to the research, it was essential to conduct more expert interviews in order to reach the point where the data converges i.e. limited variance and hence good coverage of the research in consideration.

Shown below is a sample of the survey questionnaire for the category of security challenges for only the document tampering and the confidentiality of information. (Please refer to appendix 2 for the full list of the survey questionnaire).

Category	Barrier/ Challenge/ Drawback	Check/Mark the probability/likelihood that the user/tenderer sees the corresponding Barrier/Challenge as obstacle against the widespread acceptance/adoption of E-Tendering				
		The **Challenge** will **Strongly Motivate** tenderers to **Accept** E-Tendering	The **Challenge** will **Slightly Motivate** tenderers to **Accept** E-Tendering	The **Challenge** will **Neither Motivate** nor **Prevent** tenderers from **Accepting** E-Tendering	The **Challenge** will **Slightly Prevent** tenderers from **Accepting** E-Tendering	The **Challenge** will **Strongly Prevent** tenderers from **Accepting** E-Tendering
		Strongly Disagree	**Slightly Disagree**	**Neutral**	**Slightly Agree**	**Strongly Agree**
		1	**2**	**3**	**4**	**5**
Security Challenges	**Document Tampering**					
	Description: A person making unauthorized and unfair modifications to the tender.					
	Confidentiality of Information					
	Description: Confidential information/documents being exposed/leaked to competitors.					

Table 7: Sample of the Survey Questionnaire

The survey output is analyzed using the relative importance index (RII) to identify the rank (relative importance) of each barrier/challenge hindering the uptake of E-Tendering in Egypt in order to address and tackle them. The shown below equations can be used in order to calculate the relative importance (Holt, 2014, p. 5-8).

- The mean response = $\frac{\text{Total Sum of Each Expert's Input}}{\text{Total Number of Experts}} = \frac{\sum_{i=0}^{N} \mathrm{P}_i}{\mathrm{N}}$

Pi = Participant's rating of the barriers/challenges hindering the uptake of E-Tendering

N= Total number of experts

- The additive RII = $\frac{\text{Total Sum of Each Expert's Input}}{\text{Total Number of Experts} * \text{Highest Attainable Score}} = \frac{\sum_{i=0}^{N} \mathrm{P}_i}{\mathrm{N}n}$

Pi = Participant's rating of the barriers/challenges hindering the uptake of E-Tendering

N= Total number of experts

n= Highest attainable rating for one trial = 5

- Simple percent eq. 1 = $\frac{\text{Total Sum of Each Expert's Input}}{\text{Total Number of Experts}} * 100 = \frac{\sum_{i=0}^{N} \mathrm{P}_i}{\mathrm{N}} * 100$

- Simple percent eq. 2 = $\frac{\text{Total Sum of Each Expert's Input}}{\text{Total Number of Experts} * \text{Highest Attainable Score}} 100 = \frac{\sum_{i=0}^{N} \mathrm{P}_i}{\mathrm{N}n} * 100$

- Adjusted percent equation = $\mathrm{RII}\ \%_{\text{adjust (5)}} = 125 * \frac{\sum_{i=0}^{N} \mathrm{P}_i}{\mathrm{N}n} - 25$

RII = Relative Importance index

$\mathrm{RII}\ \%_{\text{adjust (5)}}$ = Relative Importance Adjusted Per cent using scale (R_{min}=1 to R_{max}=5)

Pi = Participant's rating of the barriers/challenges hindering the uptake of E-Tendering

N= Total number of experts

n = Highest attainable rating for one trial = 5

It is important to note that all the above equations yield the same ranking; hence, any equation can be used. However, the adjusted percent equation is used since it yields "the true percentage for scales where A_{min} = 1 and, achieve unity (i.e. 0-100 per cent)" as shown below (Holt, 2014, p. 8).

- The minimum rating is $\text{RII \%}_{\text{adjust (5)}} = 125 * \frac{15*1}{15*5} - 25 = 0$
- The maximum rating is $\text{RII \%}_{\text{adjust (5)}} = 125 * \frac{15*5}{15*5} - 25 = 100$

4.3 Results and Discussion

The below table 8 shows that all the experts agree that 16 challenges (RII above 3 or above 50%) out of the 19 identified from the literature can be considered as obstacles against the widespread adoption of E-Tendering in Egypt; whereas 3 challenges (RII below 3 or below 50%) are considered a motivation to the tenderers in Egypt. It is important to note that no more barriers were identified by the experts other than the ones that were provided in the list of preliminary challenges provided to them.

The highest challenges against the widespread adoption of E-Tendering in Egypt are the SMEs access difficulties ($RII_{\%}$ = 88.33%), the expected technical malfunctioning of the portal ($RII_{\%}$ = 86.67%), the reluctance/resistance to change ($RII_{\%}$ = 80%), the breach of confidentiality of information ($RII_{\%}$ = 76.67%), the electronic signature problems ($RII_{\%}$ = 76.67%) and the document tampering ($RII_{\%}$ = 75%).

Challenge/Concern	Mean Response	Additive RII	Simple Percent Equation 1	Simple Percent Equation 2	Adjusted Percent Equation	Rank
SMEs Access Difficulties	4.53	0.91	453.33%	90.67%	88.33%	***1***
Technical Malfunctioning of the Portal	4.47	0.89	446.67%	89.33%	86.67%	***2***
Reluctance/Resistance to Change	4.20	0.84	420.00%	84.00%	80.00%	***3***
Confidentiality of Information	4.07	0.81	406.67%	81.33%	76.67%	***4***
Signature Issues	4.07	0.81	406.67%	81.33%	76.67%	***4***
Document Tampering	4.00	0.80	400.00%	80.00%	75.00%	***6***
Lack of Support	3.93	0.79	393.33%	78.67%	73.33%	***7***
Irregular Electric Power Supply	3.80	0.76	380.00%	76.00%	70.00%	***8***
Poor Telecommunications Infrastructure	3.80	0.76	380.00%	76.00%	70.00%	***8***
Software Non-Compatibility Issues	3.73	0.75	373.33%	74.67%	68.33%	***10***
Corruption Seekers	3.67	0.73	366.67%	73.33%	66.67%	***11***
Subcontractors Dependency on Contractors	3.60	0.72	360.00%	72.00%	65.00%	***12***
Bureaucratic Regulatory Procedures/Requirements	3.47	0.69	346.67%	69.33%	61.67%	***13***
High Speed Expensive Internet Services	3.40	0.68	340.00%	68.00%	60.00%	***14***
E-Tendering High Investment Cost	3.20	0.64	320.00%	64.00%	55.00%	***15***
Data Integrity	3.07	0.61	306.67%	61.33%	51.67%	***16***
Time Consuming	2.40	0.48	240.00%	48.00%	35.00%	***17***
Additional Workload	2.33	0.47	233.33%	46.67%	33.33%	***18***
Automation Job Threat	2.13	0.43	213.33%	42.67%	28.33%	***19***

Table 8: The Ranking (Relative Importance) of the Challenges/Concerns of the Tenderers in Egypt – Before the Solutions

Shown below is a detailed analysis of each of the challenges provided in table 8.

1. SMEs Access Difficulties ($RII_{\%}$ = 88.33%):
    - There is a great concern that the small and medium enterprises will be unable to participate in the E-Tendering processes especially that smaller enterprises in Egypt are probably computer illiterate and lack the basic needs (computer, internet, etc.) which are necessary for the participation in the E-Tendering processes.

2. Technical Malfunctioning of the Portal ($RII_{\%}$ = 86.67%):
    - Given the fact that Egyptians lack trust in any governmental provided service, there is a strong fear that the portal could malfunction (i.e. broken links, service unavailability, slow page load,…) especially during the submission of the tenders. Furthermore, if technical malfunctioning of the portal occurred and it was impossible for the tenderers to submit their tenders, many will be suspicious and will file claims of corruption against the entity running the portal especially that Egyptians nowadays believe in conspiracy theories.
3. Reluctance/Resistance to Change ($RII_{\%}$ = 80%):
    - This is a very strong cultural trait in the Egyptians and humans in general. It is always perceived that if old ways of doing things are good, there is no need for going the extra mile and doing something unconventional (i.e. moving to paperless processes) to the norms is unnecessary.
4. Confidentiality of Information ($RII_{\%}$ = 76.67%):
    - The experts have a great fear that the confidential data sent to the government personnel before the deadline are prone to breach and leak to other competitors even if the tenders were password protected. This stems from a number of reasons, mainly, that the corrupted people will always find a way and that hackers are unstoppable as they always infiltrate through finding vulnerabilities/weaknesses in the system.
5. Signature Issues ($RII_{\%}$ = 76.67%):
    - Most of the experts do not accept putting their handwritten signatures on a document and sending it online (i.e. electronic signature) since their signatures could be copied and pasted on other documents by unethical government personnel or unethical competitors.

6. Document Tampering ($RII_{\%}$ = 75%):
    - Almost all the experts agree that sending tender documents online is not safe since their data could be altered/modified by unethical government personnel or by hackers who could infiltrate into the system.
7. Lack of Support ($RII_{\%}$ = 73.33%):
    - The interviewed experts believe that in Egypt the upper management of the companies would not support adopting E-Tendering. This stems from the fact that most of the upper management figures are old people that are not used to have a computerized system; they do not know how to run an electronic system nor have the time to learn it. In addition, it is also important to note that the decision-making figures of the companies, before submitting their tender envelopes to the client, make last second changes (addition or reduction of a certain percentage) to their tenders. Mainly, this happens because they want to make sure no one knows the submitted tender price especially that they fear the presence of corrupted personnel in their companies who could inform their competitors of the submitted tender price. Consequently, these decision-making figures, in case they will not be capable of using the E-Tendering system (i.e. due to complexity, computer illiteracy, etc.) will never trust an employee to deal with a system on their behalf without their full control and awareness.
8. Irregular Electric Power Supply ($RII_{\%}$ = 70%):
    - Unfortunately, there is irregular power supply nowadays in Egypt especially during summer time and is expected to continue for few more years. The electricity goes down without any notice, for different durations, and in different areas unequally. Consequently, most of the interviewed experts (more than 70%) believe that this irregular

electric power supply could disturb the tendering process especially if the tenderers were unable to submit their tender responses before the deadline due to electricity shortage. It is important to note that not all the tenderers have an Uninterruptible Power Supply (UPS) and also the UPS have time limit capacity.

- Moreover, sometimes, when there is electricity shortage, the landlines (internet) stop working. Hence, the usage of a UPS will not help in submitting the tender online, unless a USB internet modem is used in addition to the UPS.

9. Poor Telecommunications Infrastructure ($RII_{\%}$ = 70%):
    - This is one of the very important challenges that need to be carefully addressed by the government since most of the experts believe that there is a serious problem with the network of telecommunications in the different governorates in Egypt, which will seriously impact the adoption of E-Tendering. It is argued that some areas do not have internet services at all in Egypt.
10. Software Non-Compatibility Issues ($RII_{\%}$ = 68.33%):
    - Given the fact that the tender response will be electronic/softcopy, not a hardcopy, most of the experts believe that a problem of software non-compatibility between the tenderers' computers and the computer of the client will arise, which will seriously affect the submitted tender documents. In other words, the documents sent from the tenderers, will not open on the computer of the tender evaluators due to software non-compatibility issues (different software, different version of the software, etc.).
11. Corruption Seekers ($RII_{\%}$ = 66.67%):
    - In Egypt, although most of the plans proposed by the different governments are always important to be implemented, one of the major problems that hinder their implementation

is that that there is always a strong resistance from within the governmental entities in order to not adopt such plans that could have major impact on the unethical personnel working in the different entities. Also, this problem aggravates when such proposed plans impact negatively the unethical investors and the illegal tycoons who control the market and who would exert all the necessary efforts to halt such plans.

12. Subcontractors Dependency on Contractors ($RII_{\%}$ = 65%):

- Most of the experts believe that always the subcontractors depend on the contractors in the transmission of the tender documents; in other words, there is no difference in the transition from traditional paper-based to electronic tendering. The experts believe that this dependency negatively affects the contractor as he loses both time and cost.

13. Bureaucratic Regulatory Procedures/Requirements ($RII_{\%}$ = 61.67%):

- All the experts stress on the fact that the bureaucratic regulatory procedures required by the government are a major reason that makes the Egyptian tenderers uninterested, unwilling and unable to participate in governmental tenders. Almost one-third of the experts believe that the introduction of E-Tendering will not have any positive impact to solve these bureaucratic requirements (the problems will persist in both traditional and electronic tendering). Another third believe that E-Tendering will actually make the process more complex (especially for the proof of intent and authentication of the tender documents - signature) and the last third believe that E-Tendering will make the process much easier (especially concerning the discovery of the tender opportunities and the submission of the tender documents).

14. High Speed Expensive Internet Services ($RII_{\%}$ = 60%):

- Most of the experts believe that E-Tendering does not require a high speed internet services in order to have smooth operations, however, a number of experts (27%) expect that small tenderers will face difficulties and will have to subscribe in higher bundles than the ones they use.

15. E-Tendering High Investment Cost ($RII_{\%}$ = 55%):

- Almost 50% of the interviewed experts agree that there is a high investment cost needed in order to operate/function adequately on the E-Tendering Portal. This investment cost includes buying new computers, specific software, licenses, hiring competent personnel, training sessions, etc.

16. Data Integrity ($RII_{\%}$ = 51.67%):

- Problems with data integrity, which includes possibility of inaccurate, incomplete or corrupted data after reassembly since the tender response is not sent as a hardcopy, is only perceived by 27% of the experts as a challenge/obstacle towards the adoption of E-Tendering. On the other hand, some experts argued that whenever there are problems with the submission of a tenderer, they get contacted by the client representatives to clarify the ambiguities/unclear data in their tender response.

17. Time Consuming ($RII_{\%}$ = 35%):

- 27% of the tenderers believe that E-Tendering is more time consuming than the traditional tendering and hence this will be an obstacle against its adoption by the Egyptian tenderers.

18. Additional Workload ($RII_{\%}$ = 33.33%):

- 27% of the tenderers believe that E-Tendering is an additional workload since they expect that, after finishing their tender response, they will be required to fill in different forms in order to comply with the tender electronic submission; hence, wasting time without compensation/reward. Furthermore, all the experts affirm that structuring the tender documents in Egypt is too hard to be accomplished.

19. Automation Job Threat ($RII_{\%}$ = 28.33%):

- Automation of the tendering processes is only perceived by 27% of the experts as an obstacle towards the adoption of E-Tendering since the automation of the processes will have a negative impact on a limited number of jobs within the company (i.e. the secretaries, the drivers, etc.).

For detailed information about the answers of the experts please refer to chapter 5.

4.4 Conclusion

As mentioned earlier, the best way to improve the acceptance and adoption of E-Tendering in Egypt is through addressing the needs and concerns of the stakeholders. Therefore, in this chapter, expert interviews were conducted in order to identify the challenges that are expected to face the Egyptian tenderers and hinder their adoption of E-Tendering. A detailed analysis of each challenge is described in this chapter.

CHAPTER 5: SOLUTIONS ADDRESSING THE BARRIERS, CHALLENGES AND CONCERNS OF THE EGYPTIAN TENDERERS

This chapter provides solutions to address and tackle the identified barriers, challenges and concerns of the Egyptian tenderers presented in chapter 4. The effectiveness of these solutions is thoroughly analyzed by a panel of academic and industry professionals, who are working as consultants and contractors. The results of this thorough analysis is shown later in this chapter. The analysis comprised asking the experts, after being introduced to the solutions, to re-evaluate their challenges and concerns presented in chapter 4, hence, figuring out the effectiveness of the proposed solutions in tackling the Egyptian tenderers' identified barriers, challenges and concerns.

5.1 Solutions to the Barriers, Challenges and Concerns of the Tenderers in Egypt

The guidelines provided in the literature review chapter 2 section 2.3 on the best practices when designing and running the technical/operational processes of E-Tendering are edited, filtered and categorized to come up with the solutions to overcome the Egyptian tenderers' barriers, challenges and concerns. These solutions are presented in the following 4 categories (Security Challenges, User Acceptance and Staff Resistance, Accessibility Issues and Legal Barriers).

5.1.1 Security Challenges

#	Challenges	Solutions to the Barriers, Challenges and Concerns of the Egyptian Tenderers
1	**Document Tampering**	**1) The numerous measures taken to confront the risks facing the data transmitted electronically** makes E-Tendering more secure than when using traditional paper-based tendering (Kajewski & Weippert 2004: 5). **2) Digital signatures (for signing the tender content and for tender encryption)** should be used to verify the authenticity, make sure that the data has not been altered (integrity of the tenders), and ensure non-repudiation of the tenderers (e-TEG, 2013, part 1, p. 23). (For detailed information, please refer to the Submission section 2.3.6 point 9). **3) Security measures/systems** should be taken/installed to track any intruders/hackers. **4) Non-disclosure agreement** of the data transmitted online to the client should be introduced and implemented incorporating severe penalties for its breach. **5) Complete traceability** should be ensured via logs to keep evidence of all parties' actions during the tendering process. This is vital in case of a litigation/claim (e-TEG, 2013, part 1, p. 22). **6) Care should be taken when dealing with a tender submission that contains an executable code "program"** as computer viruses could be contained in such program files. It is advisable that both parties "the client & the tenderer" install an up-to-date antivirus software (Cole, 2000, p. 6). **7) Best security practices** should be enforced to protect the users and the data **without introducing unnecessary burdens and barriers** to the E-Tendering use (e-TEG, 2013, Part 1, p. 21). **8) It is worth noting that many sectors (especially the banking sector) are facing similar risks but they have taken the right/suitable measures to confront these risks** (Amarapathy et al., 2013, p. 223).
2	**Data Integrity**	
3	**Confidentiality of Information**	

Table 9: Solutions/Recommendations to the Security Challenges

5.1.2 User Acceptance and Staff Resistance

#	Challenges	Solutions to the Barriers, Challenges and Concerns of the Egyptian Tenderers
4	**E-Tendering High Investment Cost**	**1) The whole process of E-Tendering will be accomplished on a Web Portal**, hence no high set up costs nor cost of maintaining the system will be incurred by the tenderers. **2) Being in the 21st century, it is expected that a good number of employees in the companies applying to win the tender are computer literate** and will be able to handle the simple tasks required for the E-Tendering submission, also all companies are expected to have internet access.
5	**Reluctance/ Resistance to Change**	**1) Targeted awareness campaigns** through the different media: newspapers, TV, Internet, radio, conferences and workshops to describe the benefits of E-Tendering for the country, the clients, the consultants, the contractors and all the stakeholders. **2) Studies quantifying the benefits realized to the different stakeholders** "clients, contractors, etc." when adopting E-Tendering should be carried out.
6	**Corruption Seekers**	**1) E-Tendering significantly improves the tendering processes**, making it more secure, fair and transparent; hence leaves no room for corruption. **2) Disciplinary, contractual, criminal and/or civil sanctions** should be applied in case any party committed violations of contractual or legal obligations. **3) Debarment (Temporary or permanent exclusion from other contracts)** is one of the very effective deterrents to the corrupt practices and misconduct of the entities in the award or during public contracts implementation. **4) A central database** showing the performance of the entities during the tendering phases and contract implementation is vital. In the prequalification phase, or before any contract is awarded, all tenderers should be checked against this central database to point out and eliminate the tenderers which have a bad record.
7	**Automation Job Threat**	**1) On the contrary, actually automation allows employees to better use their time and skills on profitable tasks** rather than on clerical/administrative tasks (Cole 2000, p. 6). Consequently, this provides greater value to the employer (contractor) and improves the services to the clients.

8	**Time Consuming**	**1) On the contrary, actually many studies have proved that switching from traditional paper based tendering is very rewarding** as it saves lots of time and cost, hence it is a clear misconception thinking that E-Tendering is more time consuming than traditional tendering. (For more information, please refer to the Benefits and Advantages section 2.2.5).
9	**Additional Workload**	**1) On the contrary, actually E-Tendering saves time** especially through automation of the different tendering processes.
10	**Lack of Support**	**1) The vast benefits of E-Tendering** will make the upper management of the companies eager to use E-Tendering. **2)** Since E-Tendering will be adopted for the governmental public contracts, **the higher management of the companies who will object to participate will be left out since their competitors will join in and win the electronic tenders, hence, especially after witnessing the success of their competitors, the higher management of the companies will be eager to adopt E-Tendering.** **3) Confidence is built by time** through the day-to-day operations. **4) Sanctions should be applied** on entities violating or deviating from implementing E-Tendering and bonuses for entities promoting E-Tendering.

Table 10: Solutions/Recommendations to the User Acceptance and Staff Resistance

5.1.3 Accessibility Issues

#	Challenges	Solutions to the Barriers, Challenges and Concerns of the Egyptian Tenderers
11	**Software Non-Compatibility Issues**	**1) No pre-defined software must be used to submit the tenders** as the required documents will be uploaded on the web portal. Also the tenderers will be provided with a list of the most common software applications that are acceptable to be used like Microsoft Word, Microsoft Excel, Acrobat Reader, etc. **2) Tenderers will be asked to upload their documents in a .pdf format** in order to ensure that the data is displayed similarly on all evaluators' computers and **digital signature/encryption** will ensure that documents will not altered. **3) When submitting the BOQ, the tenderers will have to enter the rates for each item manually onto the web portal** or **to fill in a structured protected BOQ furnished by the client** instead of sending the BOQ in a PDF format. This will ensure that the client representatives/consultant team will not waste time to re-enter the data submitted by the contractors and also the data evaluation can be easily and instantly automated with high accuracy (no room for mistakes).
12	**Irregular Electric Power Supply**	**1) The tender submissions should be designed in a way that requires the tenderer to divide the tender into a small number of parts together with giving the tenderer the option of saving the documents and returning back anytime to upload the rest (or manually fill the rest).** Hence, even if power supply is cut during uploading the data, not much data or time will be wasted in re-uploading the files as they are originally small parts being uploaded. **2) There should be an automatic backup on the portal** that saves the files being uploaded in case of hacker/virus attack or irregular power supply. **3) The system should be designed in a way to accept uploads even after the deadline has elapsed while tracking the exact time of the upload in order to avoid future claims of being unable to upload because of electricity failure;** hence, if the claimant was right, his tender will be accepted.

#	Challenges	Solutions to the Barriers, Challenges and Concerns of the Egyptian Tenderers
13	**Technical Malfunctioning of the Portal**	**1) A detailed record of the portal performance** shall be automatically generated and kept to judge whether the portal has failed "technical malfunctioning" (hence the tender submission deadline must be postponed) or nothing went wrong on the portal (probably failure in the tenderer's network). **2) The system should be designed in a way to accept uploads even after the deadline has elapsed while tracking the exact time of the upload in order to avoid future claims of being unable to upload because of technical malfunctioning of the portal** hence, if the claimant was right, his tender will be accepted.
14	**Poor Telecommunic-ations Infrastructure**	**1) The telecommunication infrastructure in Egypt is constantly developing and reaching out more users annually**, for instance, according to International Telecommunication Union (ITU, 2013), the percentage of Egyptian individuals using the internet developed as follows: 5.15% in 2004, 13.66% in 2006, 25.69% in 2009 and 44.07% in 2012; these figures were provided by the Ministry of Communications and Information Technology. **2) It is important to note that wireless communication to the internet using a USB Modem can be used in case of the absence of landlines**.
15	**High Speed Expensive Internet Services**	**1) E-Tendering does not require very high internet speed as a normal speed would be adequate to upload the data** due to the fact that the tender submission is divided and uploaded into a small number of parts rather than a single folder. **2) Also in some cases, the tenderers fill in the data manually onto the web portal.** **3)** It should be noted that **the page load time will be optimized** for the users on a low internet bandwidth and for **the key functions** (like registration, tender search, tender upload, etc.). **4) Egypt is taking serious steps towards enhancing the telecommunication infrastructure and providing affordable internet services.**
16	**SMEs Access Difficulties**	Providing support for all the users through different means: **1) Online instant help module on the portal;** this could include e-mail, telephone, FAQs section, user guides, etc. **2) Creating support centers across Egypt** that give face to face and distant support

		and guidance. **3) Making workshops as much as required** for the users who are interested to use the portal.
17	**Subcontractors Dependency on Contractors**	**1) A private module on the E-Tendering portal will facilitate one-to-one communication** between the contractor and his subcontractors.

Table 11: Solutions/Recommendations to the Accessibility Issues

5.1.4 Legal Barriers

#	Challenges	Solutions to the Barriers, Challenges and Concerns of the Egyptian Tenderers
18	**Bureaucratic Regulatory procedures/ requirements**	**1) E-Tendering is to be conducted through a web portal and it is originally designed to facilitate the tendering process not to complicate it**. Hence, no experienced technical personnel are required to handle the submission of the tenders as all the E-Tendering processes are simple. **2) Continuous identification of non-transparent and redundant processes** shall be carried out in order to ensure best procurement practices. **3) Anonymous feedback on every aspect of the E-Tendering portal** shall be collected during the tender preparation and after the awarding of the contract in order to tackle any difficulties faced by all the users and hence improve the portal performance and the users' experience.
19	**Signature Issues**	**1) Digital signature using asymmetric keys (private and public key) should be used for both signing the tender content and also for the tender encryption** to check the authentication, non-repudiation and integrity of the submitted tender. (For detailed information, please refer to the Submission section 2.3.6 point 9). **2) Amendments to the law** will ensure recognition of digital signatures for tender authentication.

Table 12: Solutions/Recommendations to the Legal Barriers

5.2 Analysis of the Effectiveness of the Solutions

Thorough analysis is carried out to examine the effectiveness of the solutions to the tenderers' barriers, challenges and concerns. This is accomplished through introducing the same panel of experts to the proposed solutions to the challenges that they already highlighted in chapter 4, in order to determine whether or not the proposed solutions are adequate in addressing their identified barriers and concerns.

In order to accomplish the above, the same 15 experts in semi-structured face-to-face and telephone interviews are asked to check/mark a survey questionnaire on a 5-scale Likert item the probability/likelihood that a tenderer still considers the challenges as obstacles against the adoption of E-Tendering in Egypt even after being introduced to the corresponding solutions. In addition, the experts are asked to identify more solutions/recommendations that are suitable to address the identified challenges/barriers. It is important to note that, in order to address the barriers, the whole E-Tendering system should be introduced to the experts so that they become aware of all the processes and hence tackle the flows in the system objectively, not subjectively.

The survey output for each of the 19 challenges shown below is analyzed through graphically representing, comparing and carefully examining the results of the face-to-face and telephone survey questionnaires before and after the experts are introduced to the solutions. More specifically, if the experts, after being introduced to the solutions assigned to the challenges, reduced their rating to the barriers i.e. consider that the barriers are adequately addressed by the proposed solutions; hence, this proves that the solutions are suitable. The best scenario that proves the effectiveness of the proposed solutions is when the barriers/obstacles become neutral or seen as a motivation to adopt E-Tendering rather than an obstacle. The blue bars shown below represent the choices made by the experts when asked to mark/check on a 5-scale Likert item the

probability/likelihood that a tenderer considers the challenges as obstacles against the adoption of E-Tendering in Egypt (output from chapter 4) and the red bars represent the choice made by the same experts after being introduced to the solutions and all the processes of E-Tendering. (Please note that the order of experts in the below table is different than the order of experts shown in appendix #1 in order to protect the confidentiality of answers of the experts).

Furthermore, the adjusted relative importance index (RII) is used again to highlight the rank (relative importance) of each challenge hindering the uptake of E-Tendering in Egypt at the end of the analysis to identify any barriers/obstacles that still persist and need to be addressed.

1. SMEs Access Difficulties

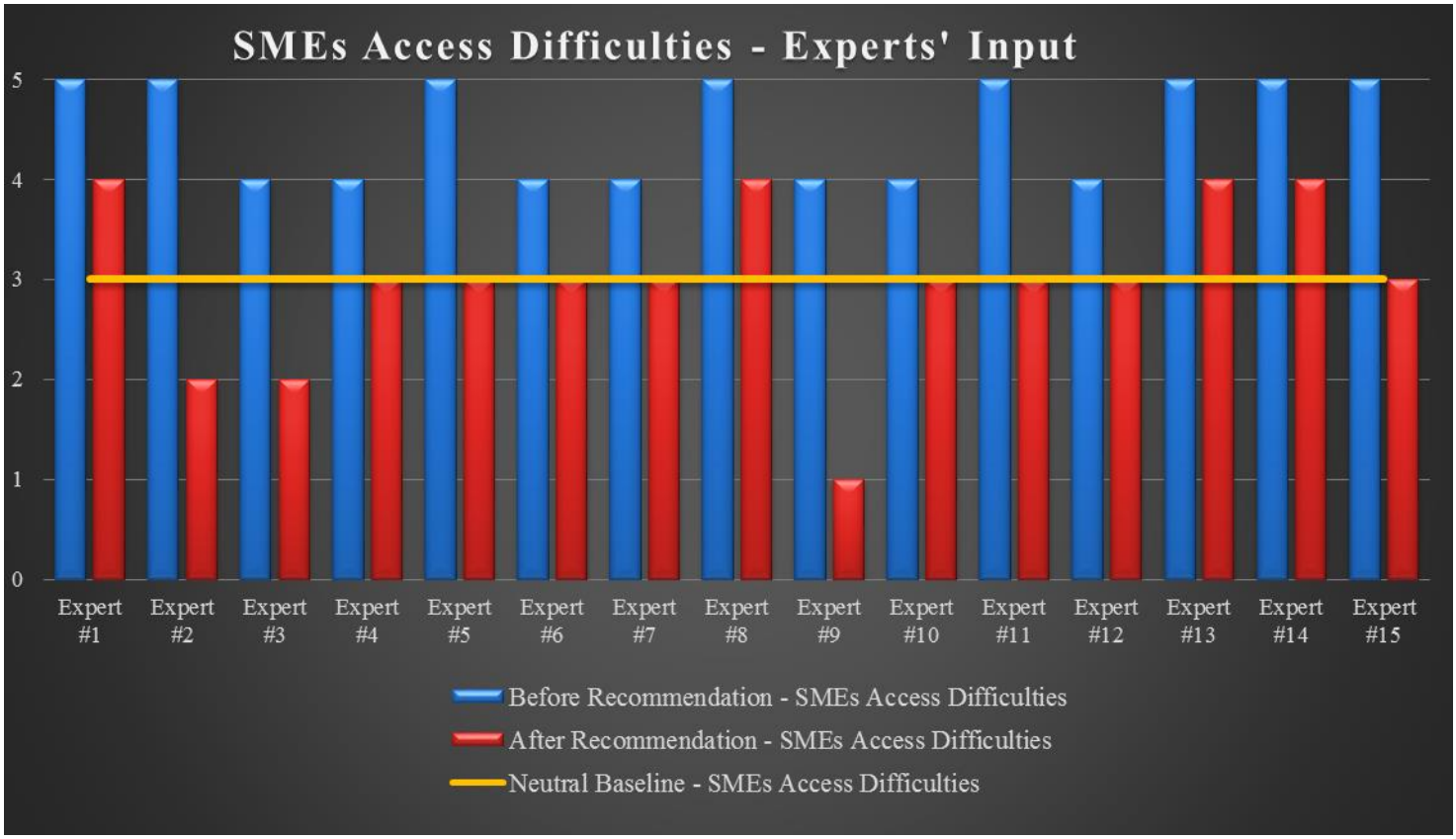

Figure 12: SMEs Access Difficulties Before and After Experts' Input

The solutions neutralized to some extent the challenge of the SMEs access difficulties, yet 4 experts (27% of the experts) insist that this problem is hardly curable as the computer illiteracy of the tenderers working in the small enterprises will hinder their acceptance of E-Tendering. Consequently, it is highly recommended that a threshold be introduced which excludes the small contracts executed by the small contractors/suppliers from being electronically tendered.

2. Technical Malfunctioning of the Portal

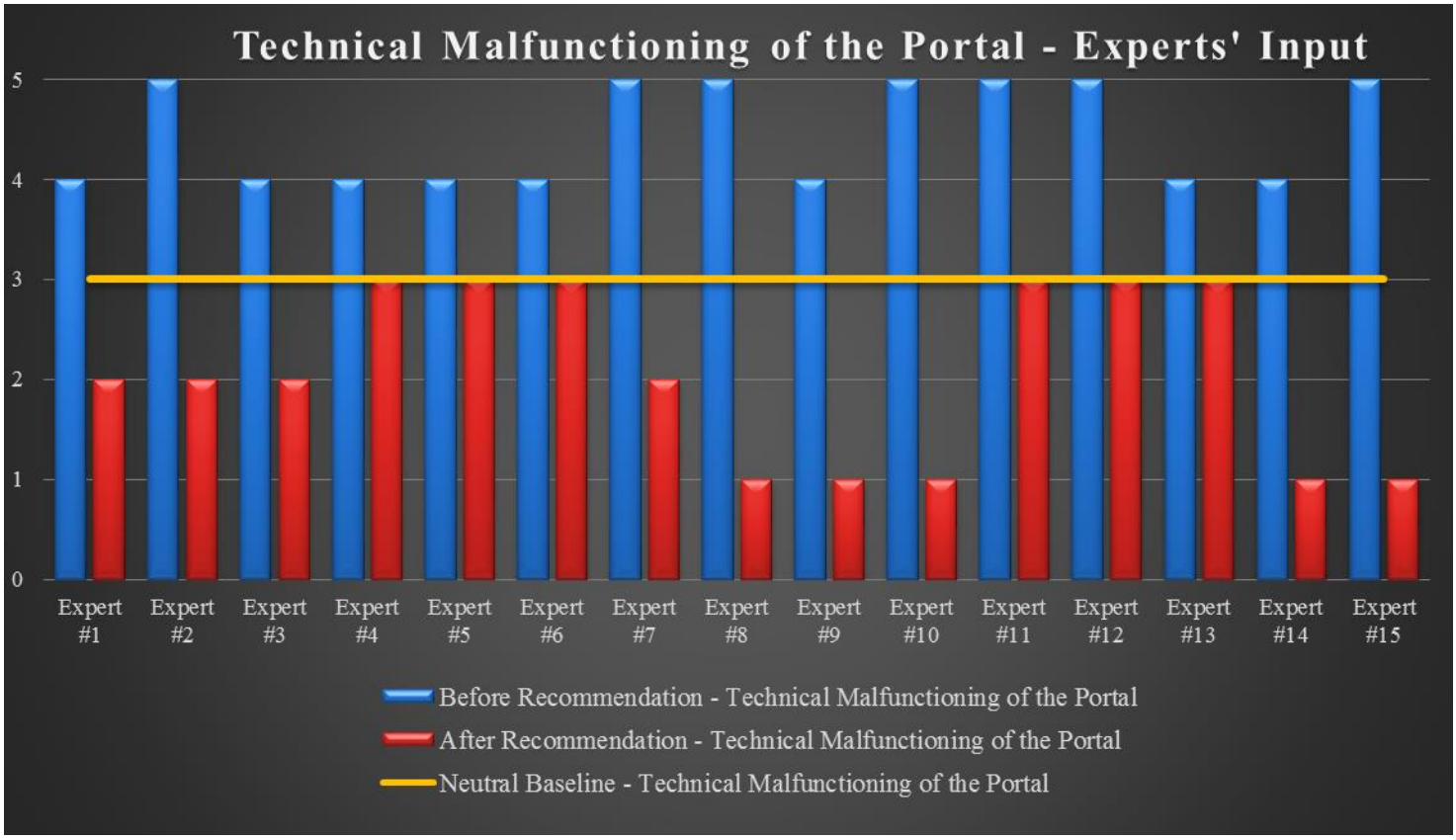

Figure 13: Technical Malfunctioning of the Portal Before and After Experts' Input

All of the experts acknowledged that allowing the acceptance of the tender documents after the deadline with a track record of the portal performance will help in judging whether the portal has failed "technical malfunctioning" (hence the tender submission will be accepted) or nothing went wrong on the portal (probably failure in the tenderer's network, hence tender is rejected). Consequently, avoiding future claims of corruption and disturbance of the E-Tendering processes. Also, it is recommended that there should be an automatic backup on the portal that saves the files which were uploaded in case of any technical malfunctioning of the portal.

3. Reluctance/Resistance to Change

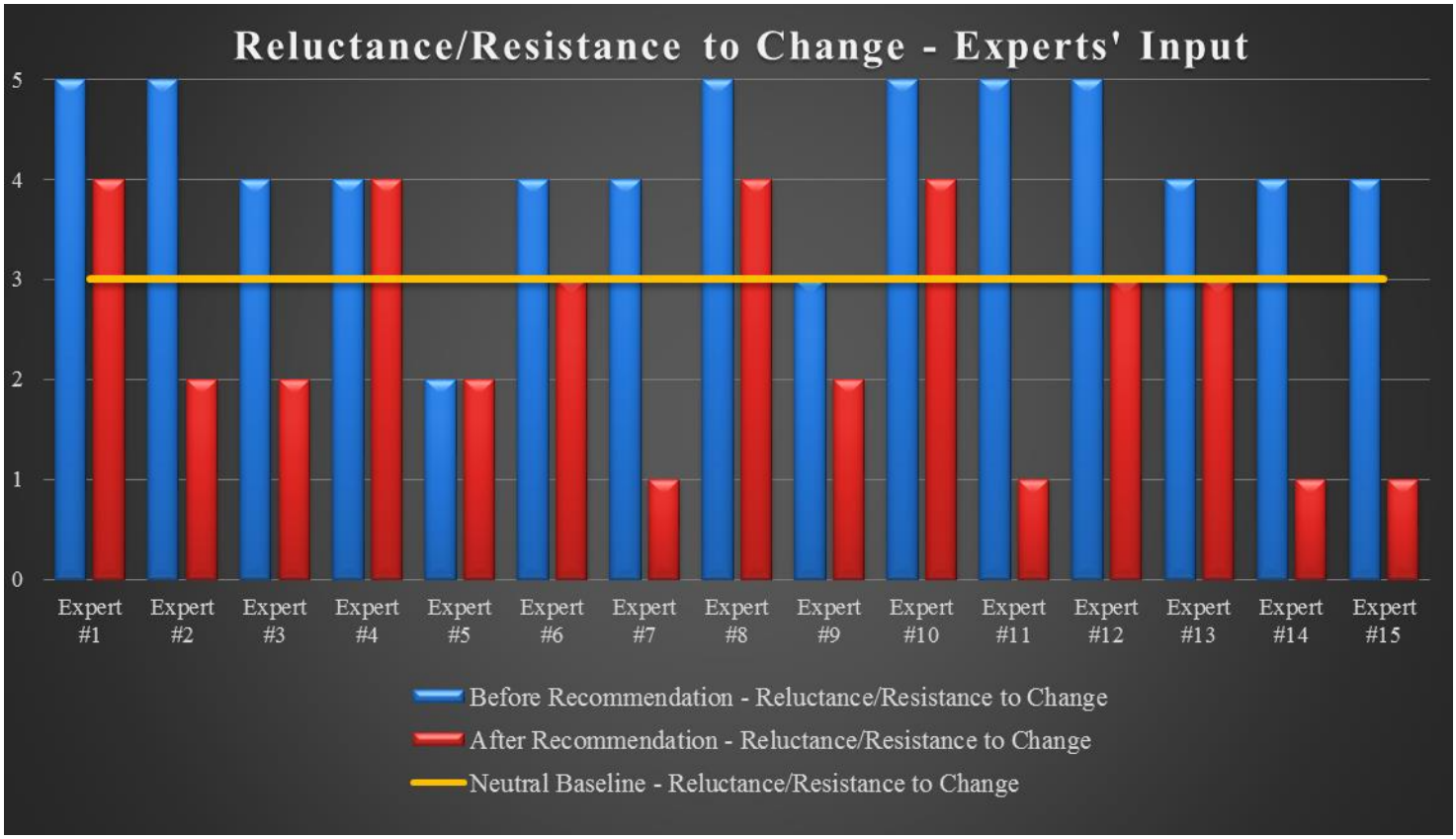

Figure 14: Reluctance/Resistance to Change Before and After Experts' Input

The reluctance/resistance to change persists (even after being introduced to the solutions of the challenge) as one of the strongest challenges facing the adoption of E-Tendering in Egypt since this is a cultural issue. Only by time, the tenderers will accept transmitting the tender documents electronically; hence, it is recommended that the adoption of E-Tendering be gradual since confidence in the system will only be granted by time. In other words, a transitional period which includes accepting the tender submission both traditionally (i.e. in a form of papers) and electronically is necessary to encourage the tenderers to adopt E-Tendering. Also, a transitional period that includes gradual adoption of each process of the E-Tendering phases (upload of the tender documents, download of the tender documents, submission the tender documents, etc.) is important to encourage the stakeholders to fully accept and adopt E-Tendering.

4. Confidentiality of Information

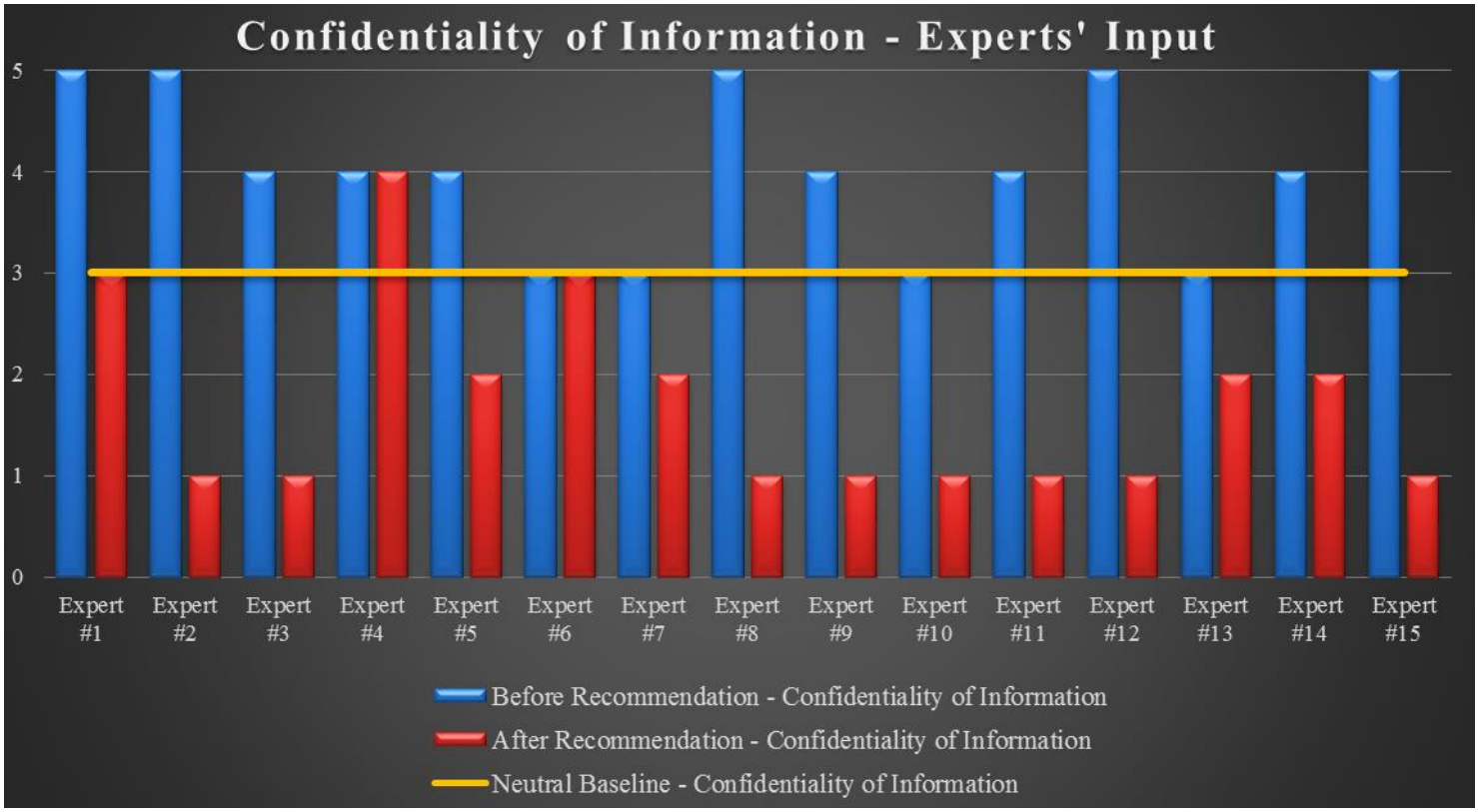

Figure 15: Confidentiality of Information Before and After Experts' Input

The confidentiality of information was perceived by the experts before being introduced to the solutions as a strong obstacle against the adoption of E-Tendering in Egypt. However, almost all the experts acknowledged that, since there is a lack of trust between the Egyptian tenderers and the government personnel, the asymmetric digital signature (signing by the private key) and encryption (encrypting by the public key) are adequate measures to confront the possibility of the breach of confidential tender information before the submission deadline, because the personnel who will receive the encrypted tender will not be able to decrypt it as he does not have the private key of the tenderer. Only one expert insisted that hackers and unethical personnel will exert all the necessary effort to find a way to expose the confidential data.

Furthermore, almost all experts questioned the confidentiality of information after the tender opening; however, this is a serious issue in both the traditional and the electronic processes.

5. Signature Issues

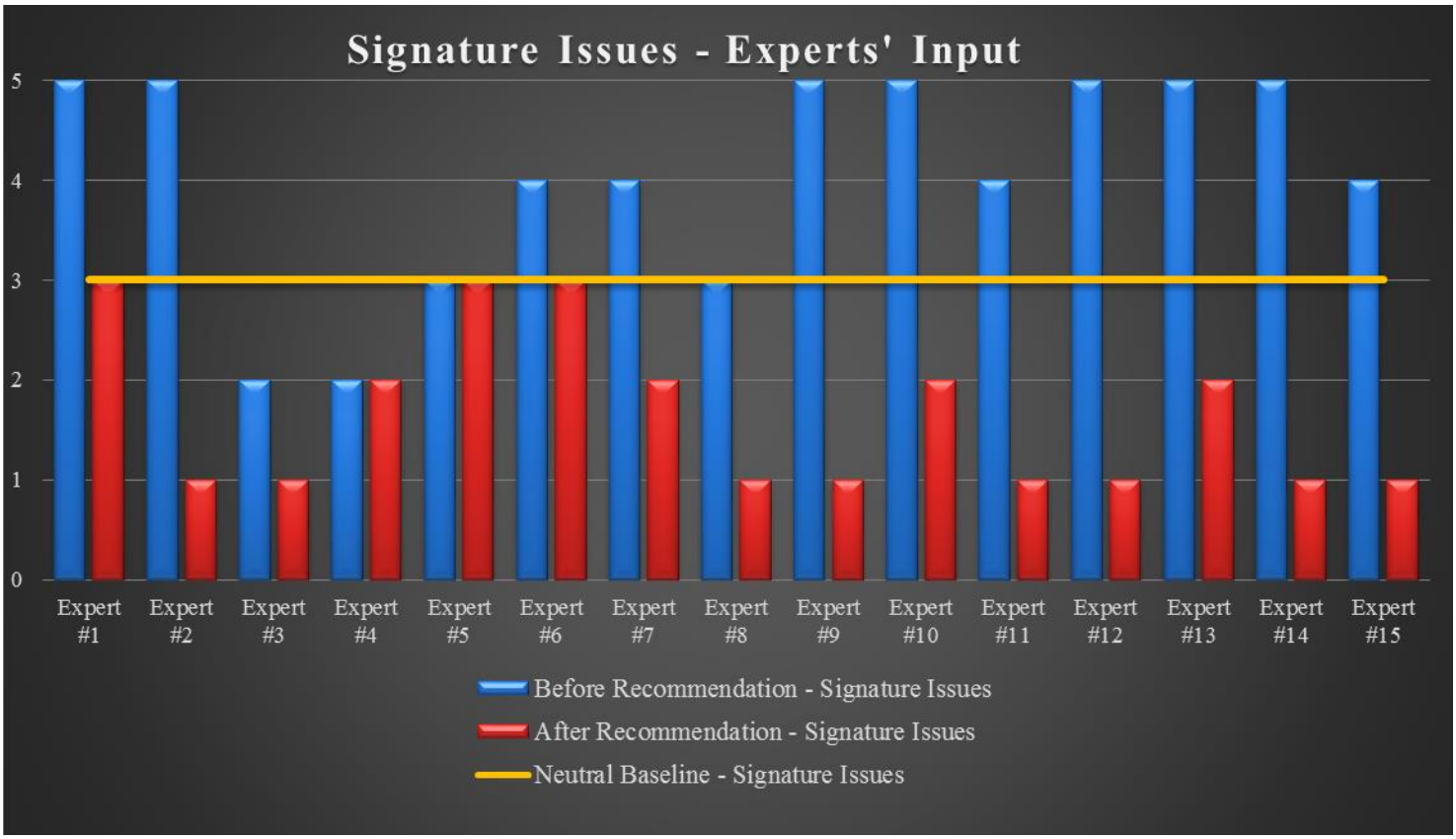

Figure 16: Signature Issues Before and After Experts' Input

All the interviewed experts believe that it is safer to use the asymmetric digital signature to sign (via the private key) and encrypt (via the public key) than using the electronic signature. The only concern is that its use might be complicated for some tenderers at the beginning.

6. Document Tampering

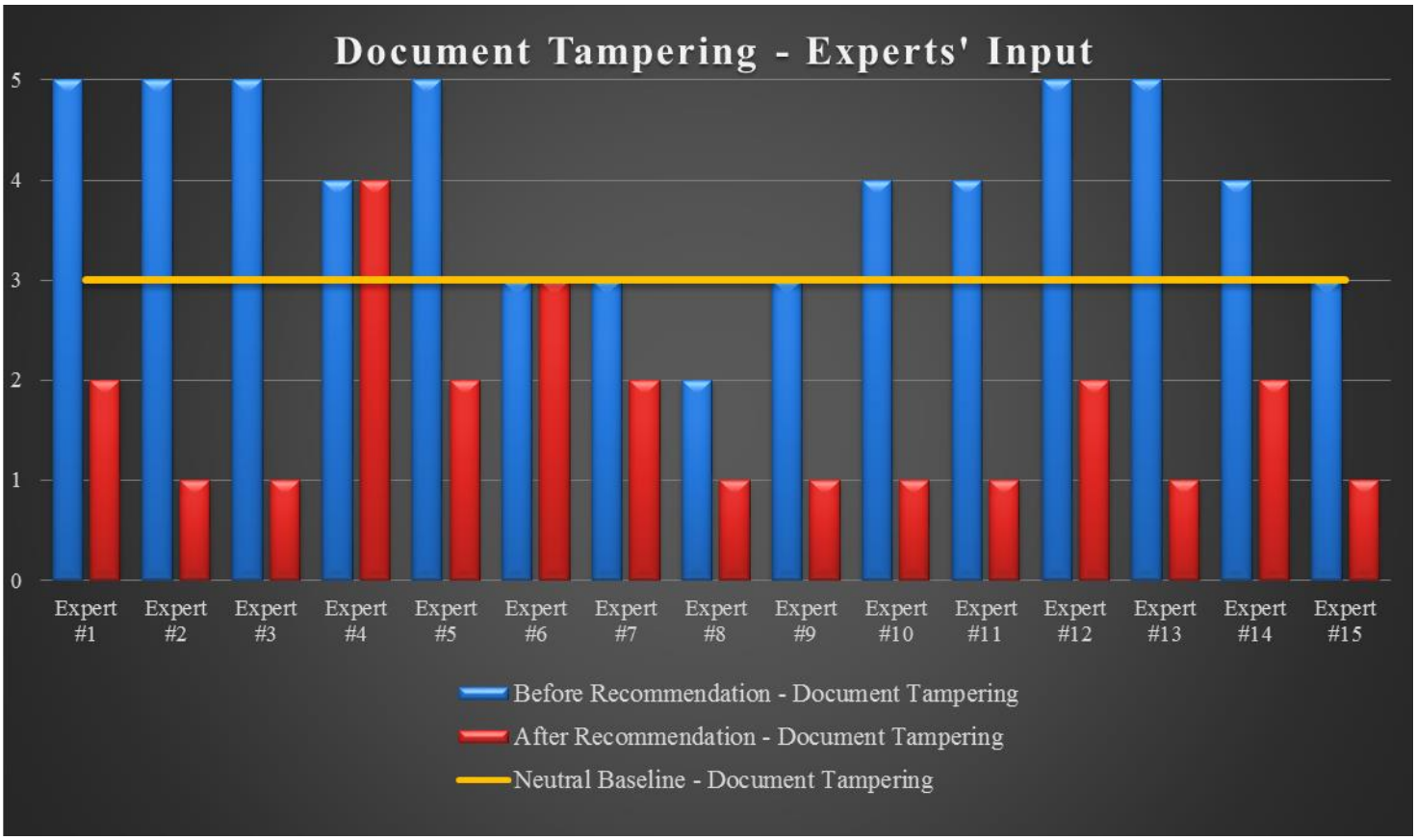

Figure 17: Document Tampering Before and After Experts' Input

Most of the experts believe that the use of asymmetric digital signature for signing and encrypting the tender documents will make the Egyptian tenderers confident that their data were not altered/modified. However, it is argued that nothing can stop the hackers which could lead to serious consequences because the tender response preparation could take as much as 6 months and hence, if the hackers penetrated and made modifications to a tender, the whole tendering process will have to be repeated and time will be wasted in vain.

7. Lack of Support

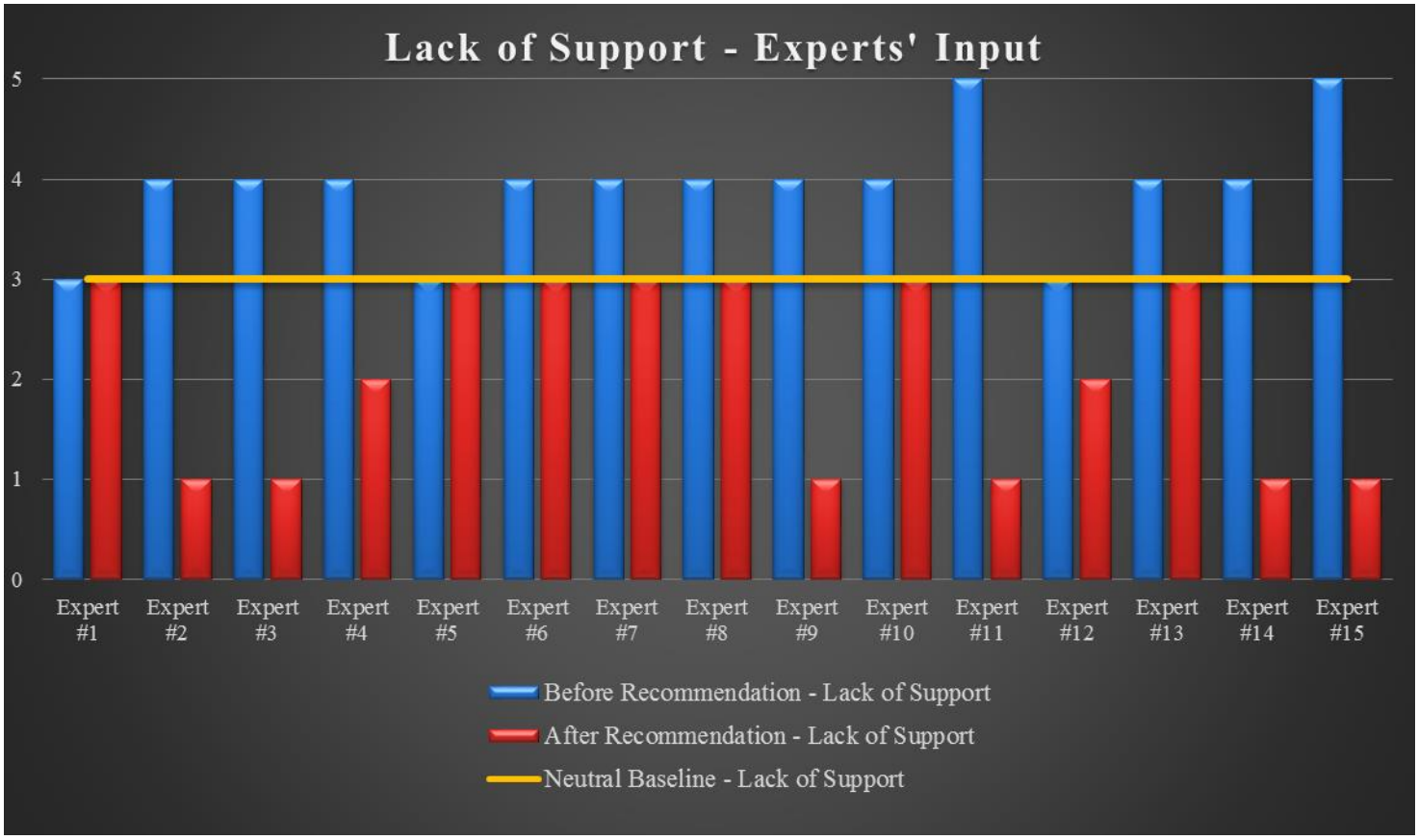

Figure 18: Lack of Support Before and After Experts' Input

It is expected that the vast benefits of E-Tendering will motivate the Egyptian tenderers to adopt E-Tendering. On the other hand, the experts agree that concerning the tenderers who will not support the move towards E-Tendering and will refuse to participate in E-Tendered projects, will be left out of competition and will regret not participating since they will see their competitors win the E-Tendered projects. Consequently, they will have to join and by time they will eventually realize the vast benefits to themselves and to the country. It is also important to note that confidence in the system will be built by time.

8. Irregular Electric Power Supply

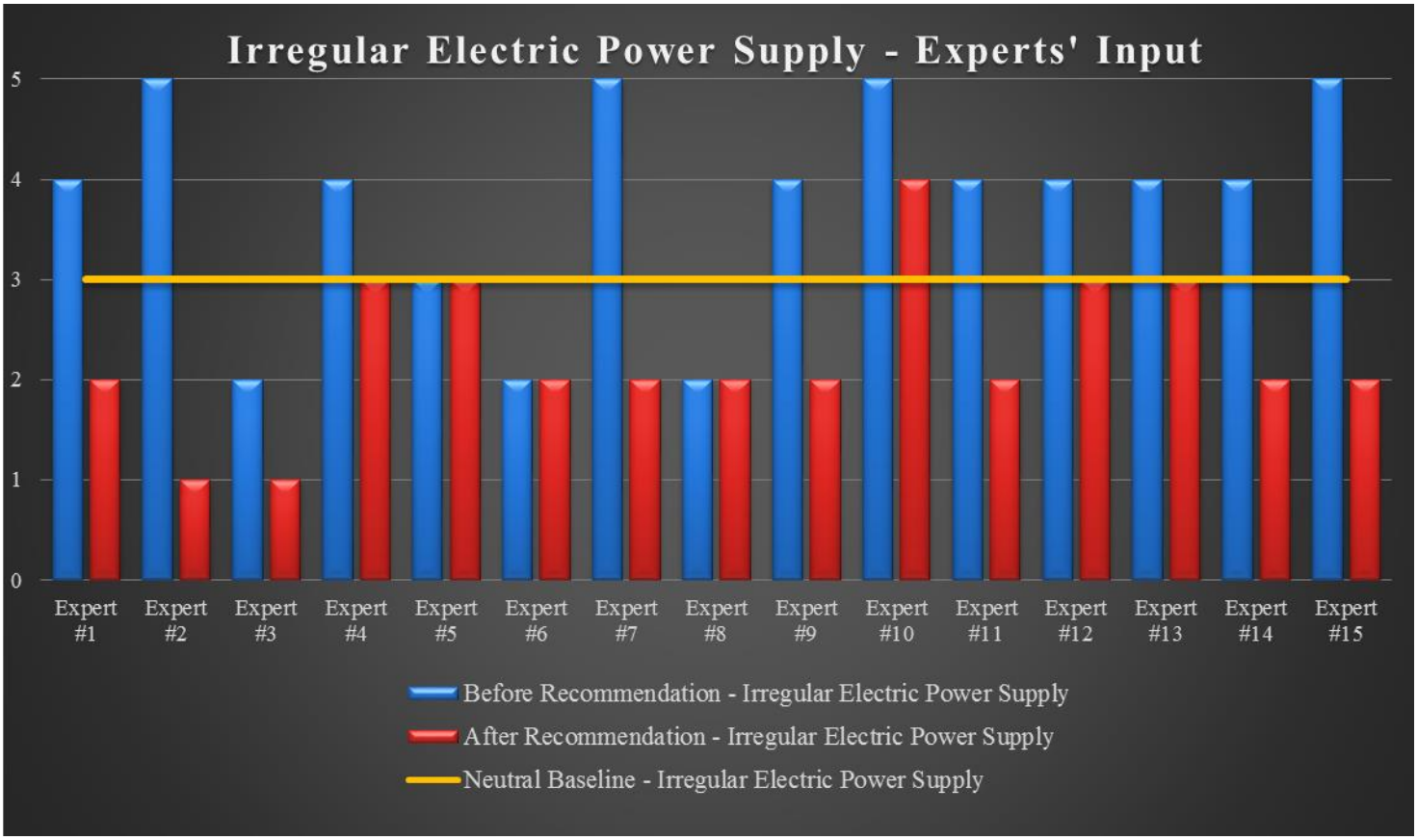

Figure 19: Irregular Electric Power Supply Before and After Experts' Input

All the experts agree that the tender response receipt box shall not be closed after the deadline, and shall be left open while recording the exact time of receipt of the tender by the system so that the claim of inability of a tenderer to submit his tender documents be investigated by the concerned authorities to determine whether or not the electricity shortage affected negatively his tender response submission. It is also important to note that there is an understanding that the irregular power electric supply will affect both the traditional and the E-Tendered projects.

Furthermore, the presence of an automatic backup on the system that saves the uploaded files in case power supply shortage occurred is crucial in order not to force the tenderers to re-upload all their tender documents from the very beginning in case their computers went down abruptly.

9. Poor Telecommunications Infrastructure

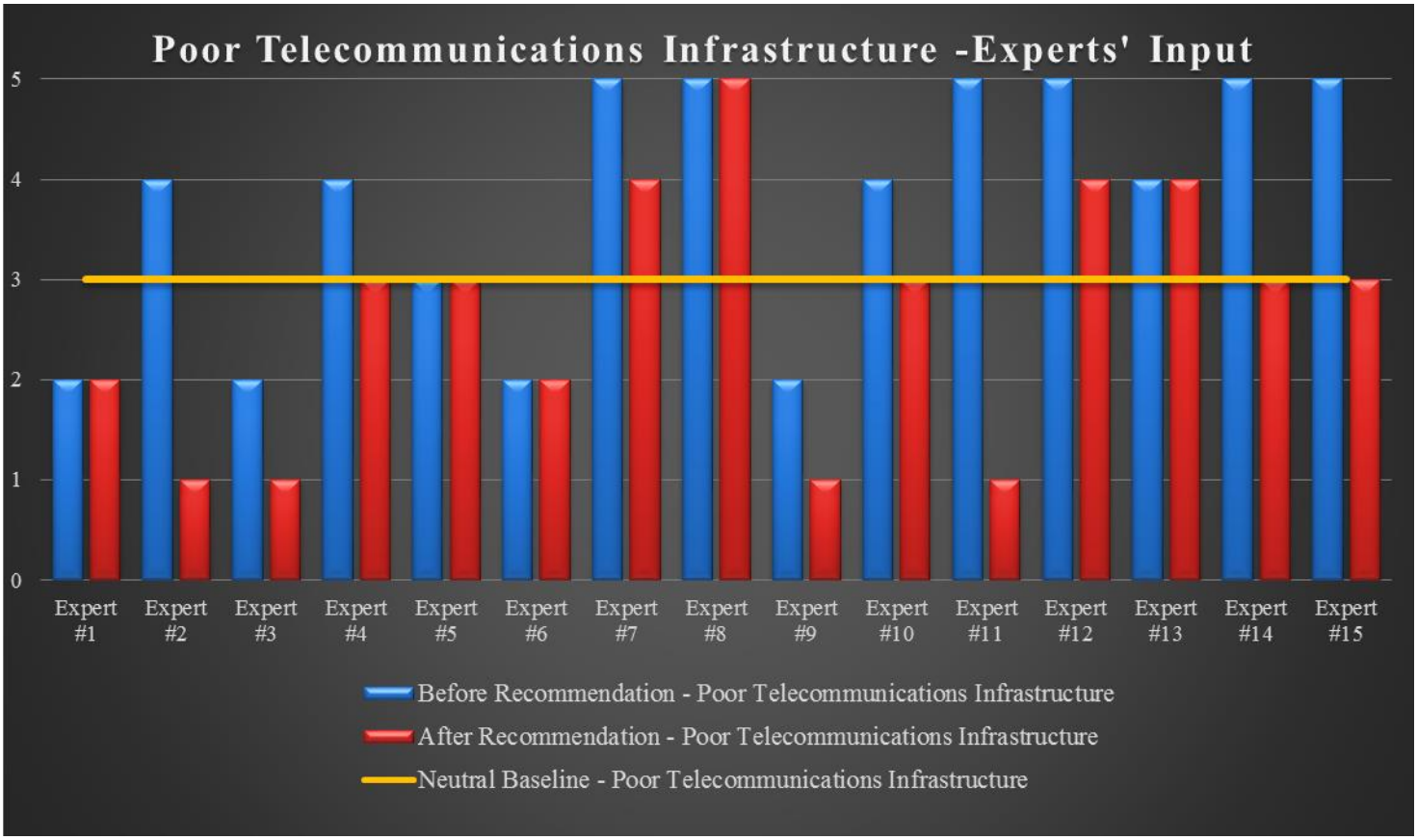

Figure 20: Poor Telecommunications Infrastructure Before and After Experts' Input

A number of experts (around 27%) believe that the poor telecommunication infrastructure in the Egyptian governorates will be an obstacle against the widespread adoption of E-Tendering, while other experts argue that there are banks all over Egypt and hence, the claim of poor telecommunication is not factual. Furthermore, in case there are no landlines, USB internet modem could be used to connect with the internet.

The only problem with the telecommunication network is that it is not related to the E-Tendering system design; hence, not providing suitable infrastructure will make the make participation in the E-Tendering process hard and costly due to using other means like USB internet modem, reallocating or traveling long distances to get internet access.

10. Software Non-Compatibility Issues

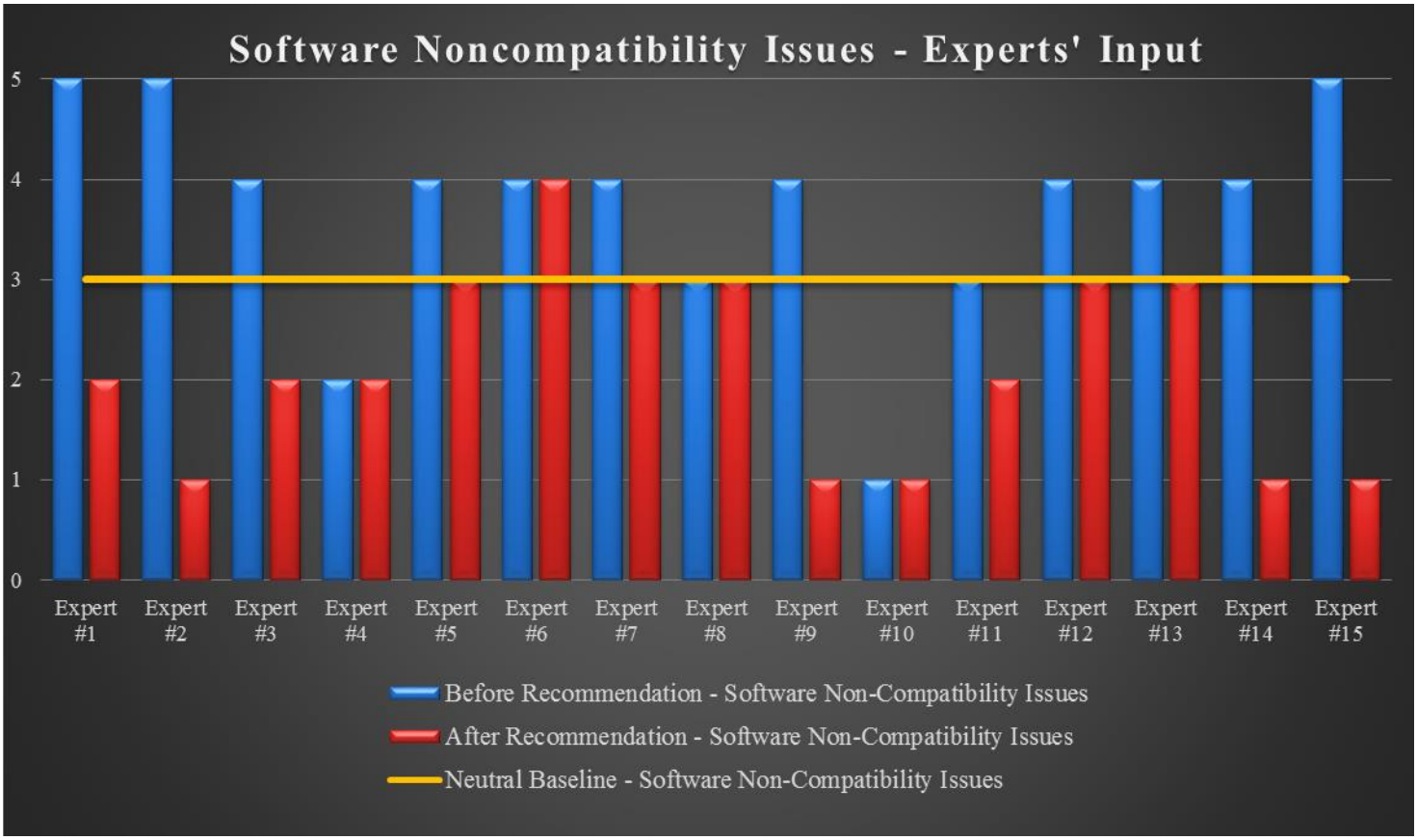

Figure 21: Software Non-Compatibility Issues Before and After Experts' Input

After being introduced to the solutions to the challenge, almost all the experts (except one expert) believe that the problem of software non-compatibility issues will not happen since all the tenderers have the list of approved common software to work with (word, excel,…) together with the approved versions of these programs. Also, all the experts agree that the submitted documents that will not be automatically evaluated should be submitted in a PDF format to avoid any problems with software non-compatibility.

11. Corruption Seekers

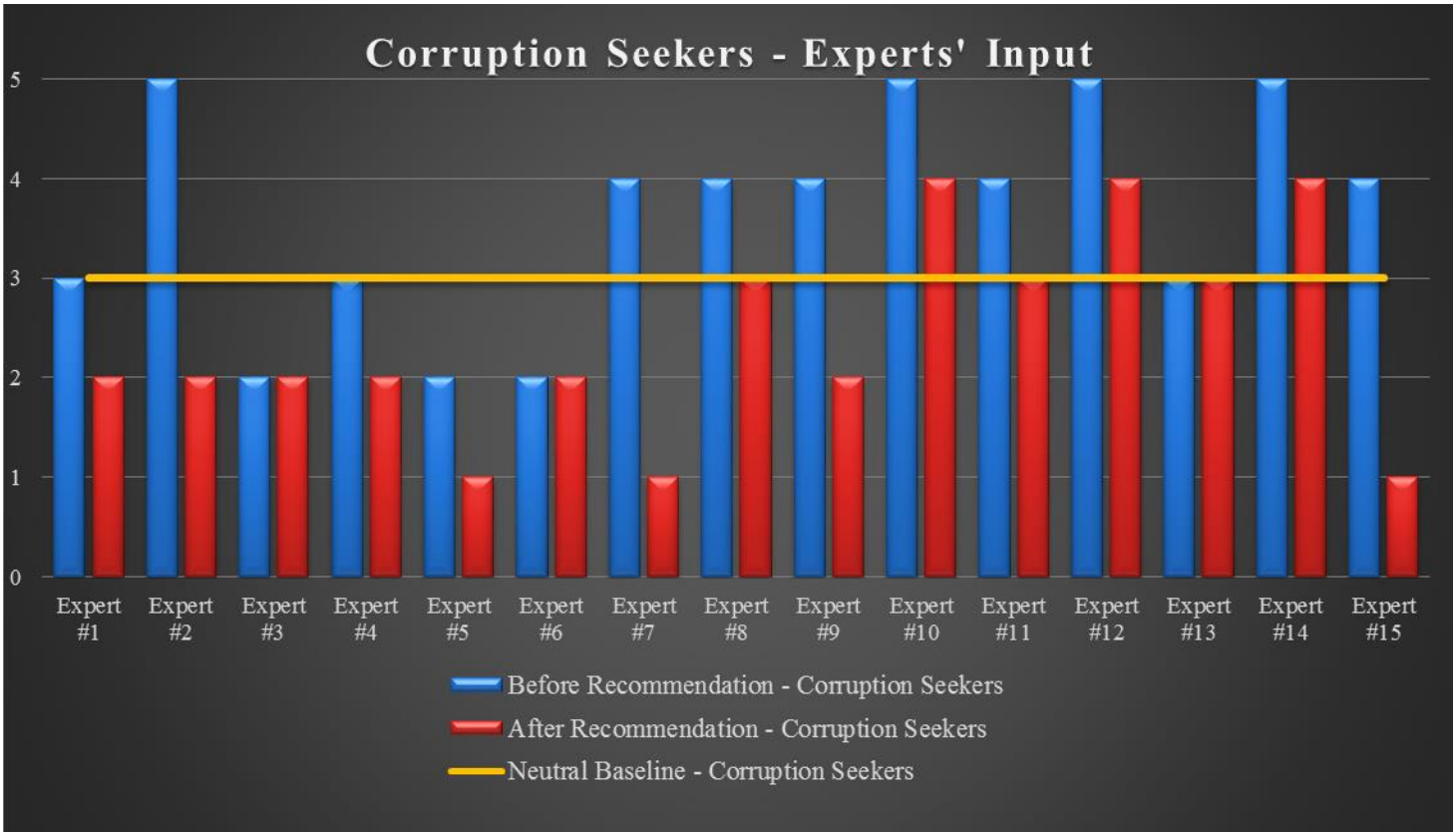

Figure 22: Corruption Seekers Before and After Experts' Input

This is one of the major problems that need to be seriously tackled by the government since 27% of the experts insist that this problem is not curable (even after being introduced to the guidelines and solutions). The reason is that the experts believe that the corrupted personnel working in the government and the unethical investors will always find leaks in the system to infiltrate and reach their illegal purposes.

12. Subcontractors Dependency on Contractors

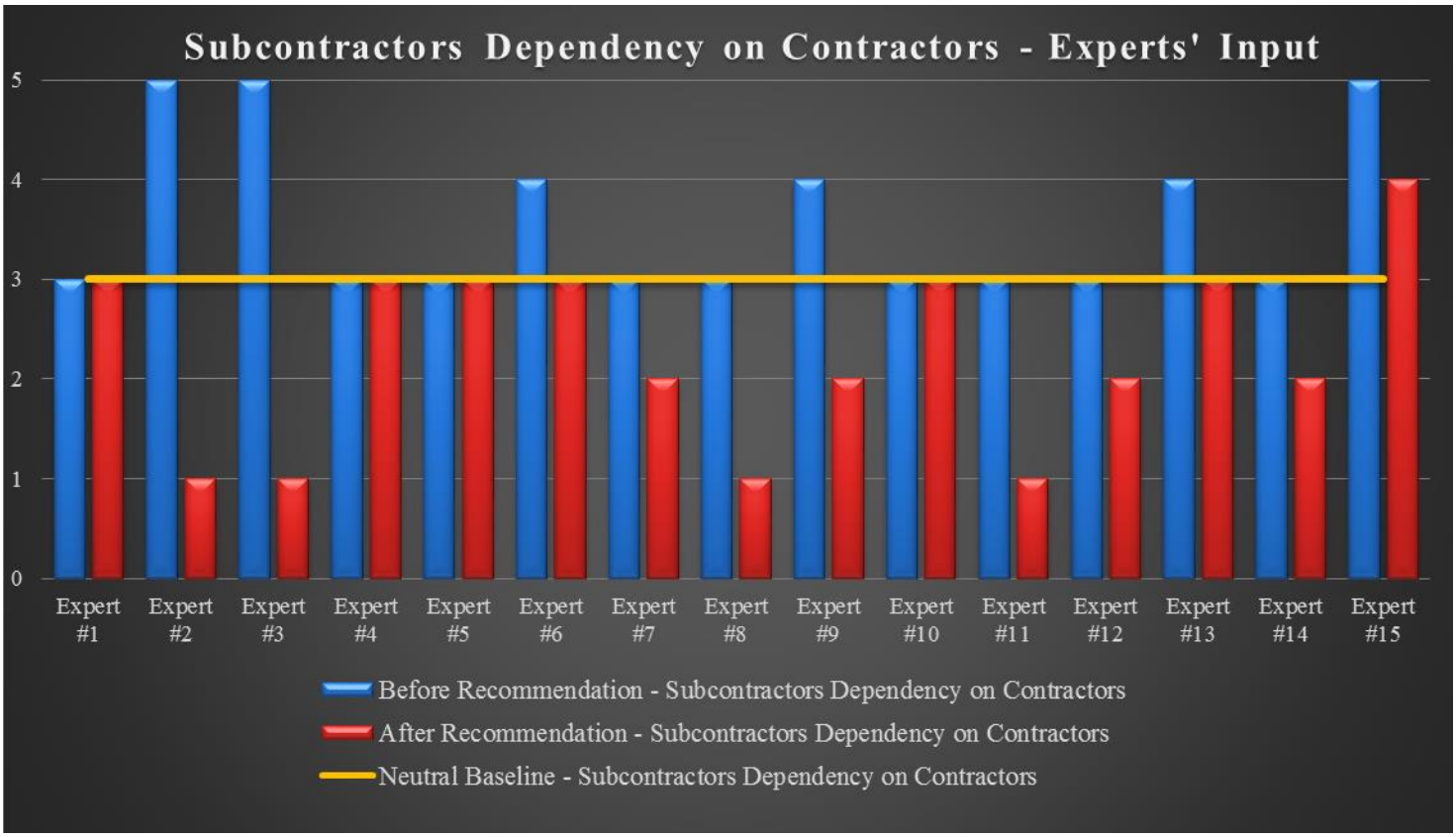

Figure 23: Subcontractors Dependency on Contractors Before and After Experts' Input

Almost all the experts agree that it is very effective to introduce a private module on the portal to be used as a confidential communication channel between the contractor and his subcontractors/suppliers since the subcontractors/suppliers will have direct "limited" access to the tender documents. However, it is argued that the smaller subcontractors/suppliers will always have difficulty to access such documents especially that a large portion are illiterate. But on the other hand, it is worth noting that in either cases, the traditional paper-based or the electronic tendering, these illiterate individuals always rely on the contractor to understand the project in consideration. Consequently, electronic tendering will not hinder/obstruct these individuals, but will actually help the contractors efficiently and effectively communicate with the majority of their subcontractors and suppliers.

13. Bureaucratic Regulatory Procedures/Requirements

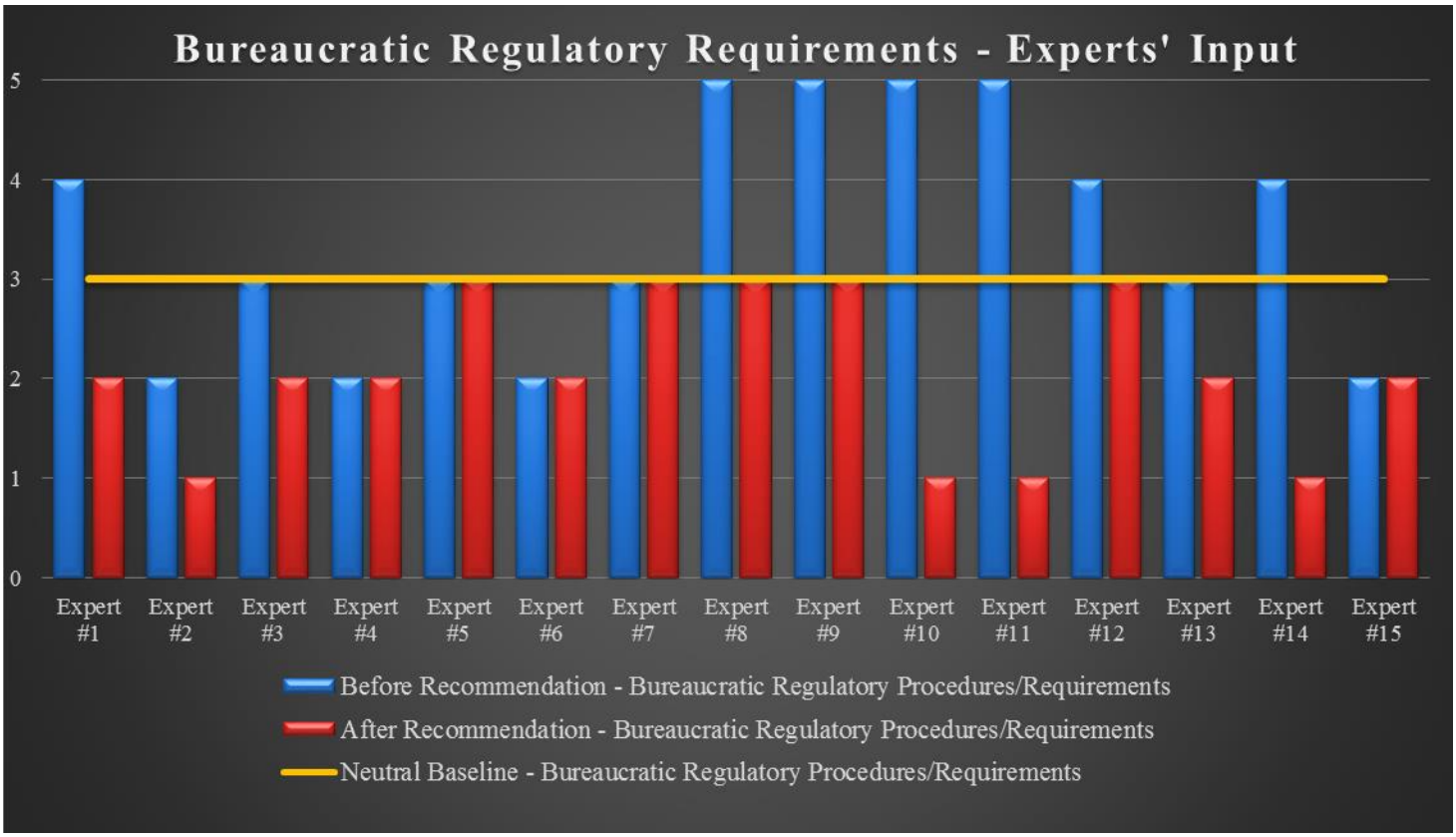

Figure 24: Bureaucratic Regulatory Procedures/Requirements Before and After Experts' Input

After being introduced to all the processes of E-Tendering, all the experts acknowledged that E-Tendering will help to a great extent alleviate the problem of bureaucratic procedures required by the government. Specific interest and need by the experts was in having a mechanism that allows the client representatives to automatically check the official/qualification documents with the entities responsible for their issuance instead of requesting these documents from the tenderers. Such documents as already highlighted earlier in the guidelines include checking the bank guarantee with the bank, checking the grade of the contractors with the Egyptian Federation for Construction and Building Contractors, etc.

In addition, the experts believe that receiving periodic feedback from the tenderers to continuously identify redundant process is a great mean to improve E-Tendering.

14. High Speed Expensive Internet Services

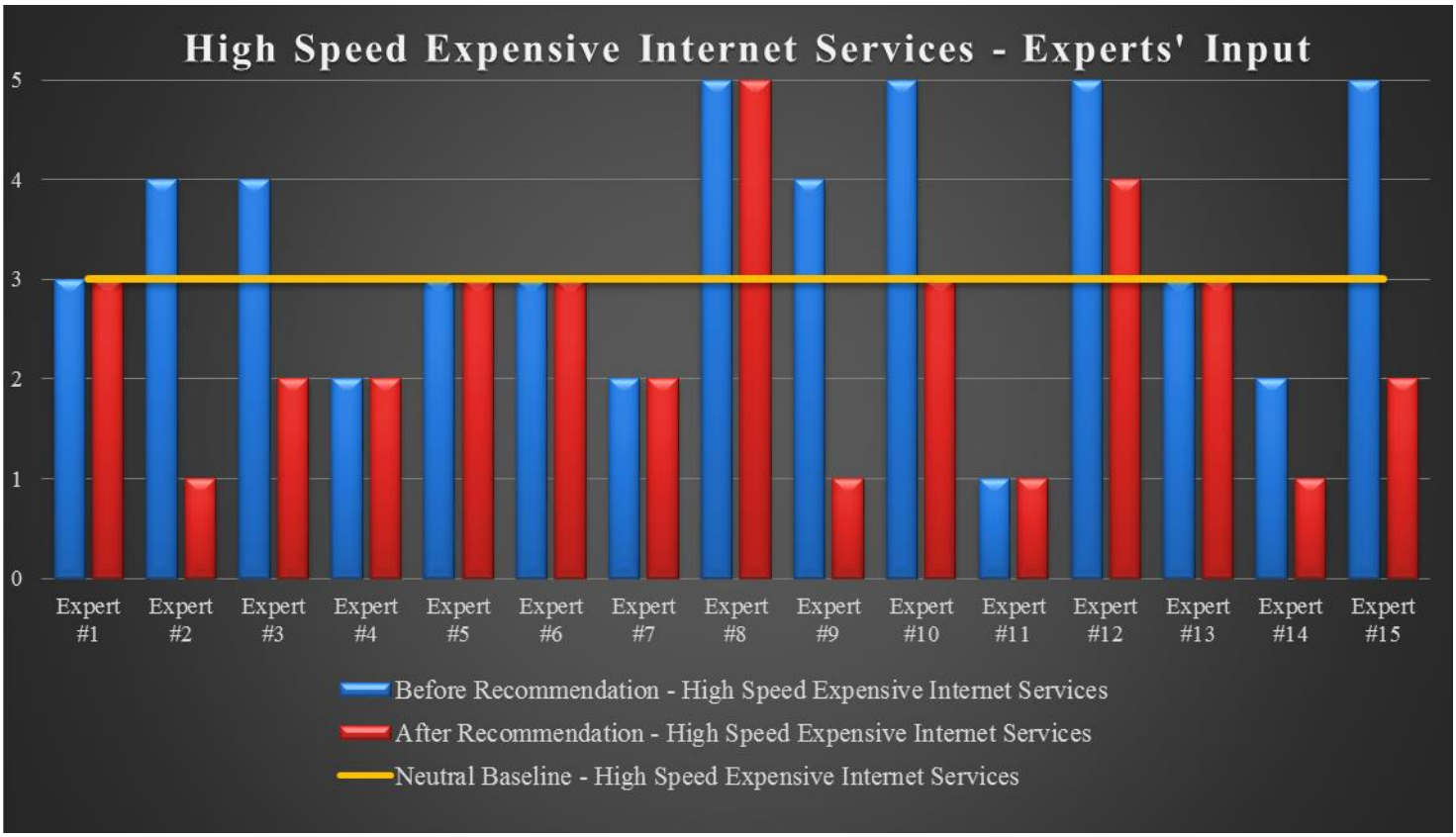

Figure 25: High Speed Expensive Internet Services Before and After Experts' Input

Most of the interviewed experts believe that the savings made in avoiding printing and avoiding the transportation costs in electronic tendering are far more than subscribing in a higher internet bundle. Only two experts (14%) insist that E-Tendering requires high speed internet services in order for the tenderers to function smoothly. This issue probably stems from their previous experience with poorly designed E-Tendering portals (slow page load). Moreover, it is argued that the internet services in Egypt are too expensive compared to the low internet quality provided; however, it is important to note that Egypt is taking serious steps to control this issue through licensing a new 4th communication operator in order to eliminate the monopoly taking place and provide better affordable services.

15. E-Tendering High Investment Cost

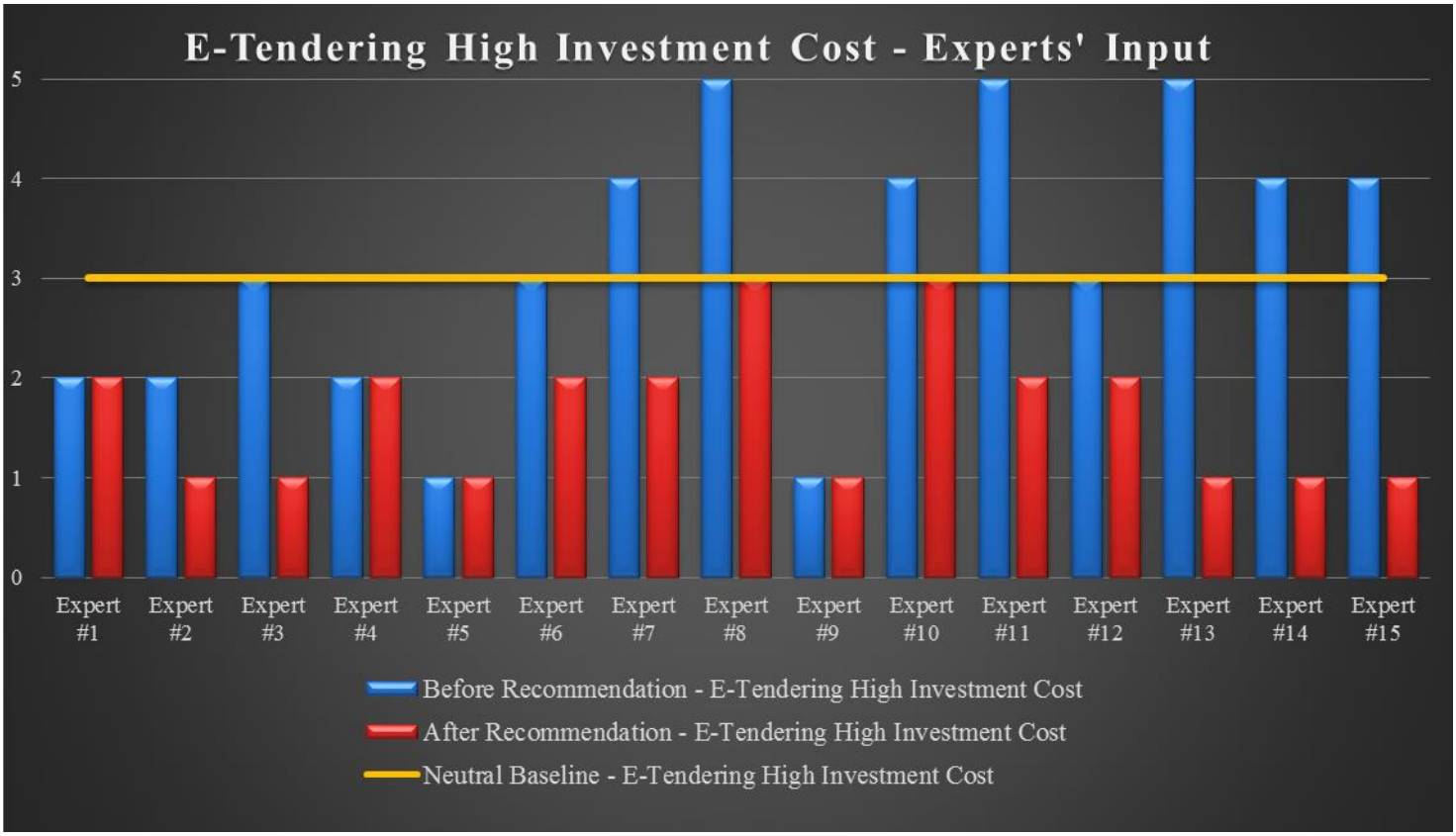

Figure 26: E-Tendering High Investment Cost Before and After Experts' Input

After being introduced to the exact processes/requirements of E-Tendering and the fact that no pre-defined software or license is needed in order to submit the tender response (all the processes are accomplished on the web portal), all the experts acknowledged that the savings made due to immigrating towards electronic tendering will outreach the initial capital cost (if any) in a very short period of time. In addition, it is important to note that electronic tendering will give the tenderers a competitive edge since they will be able to compete in foreign markets as they have the right tools and the necessary experience of dealing with an electronic tendering system, in order words, it is a door to participate in international tenders.

16. Data Integrity

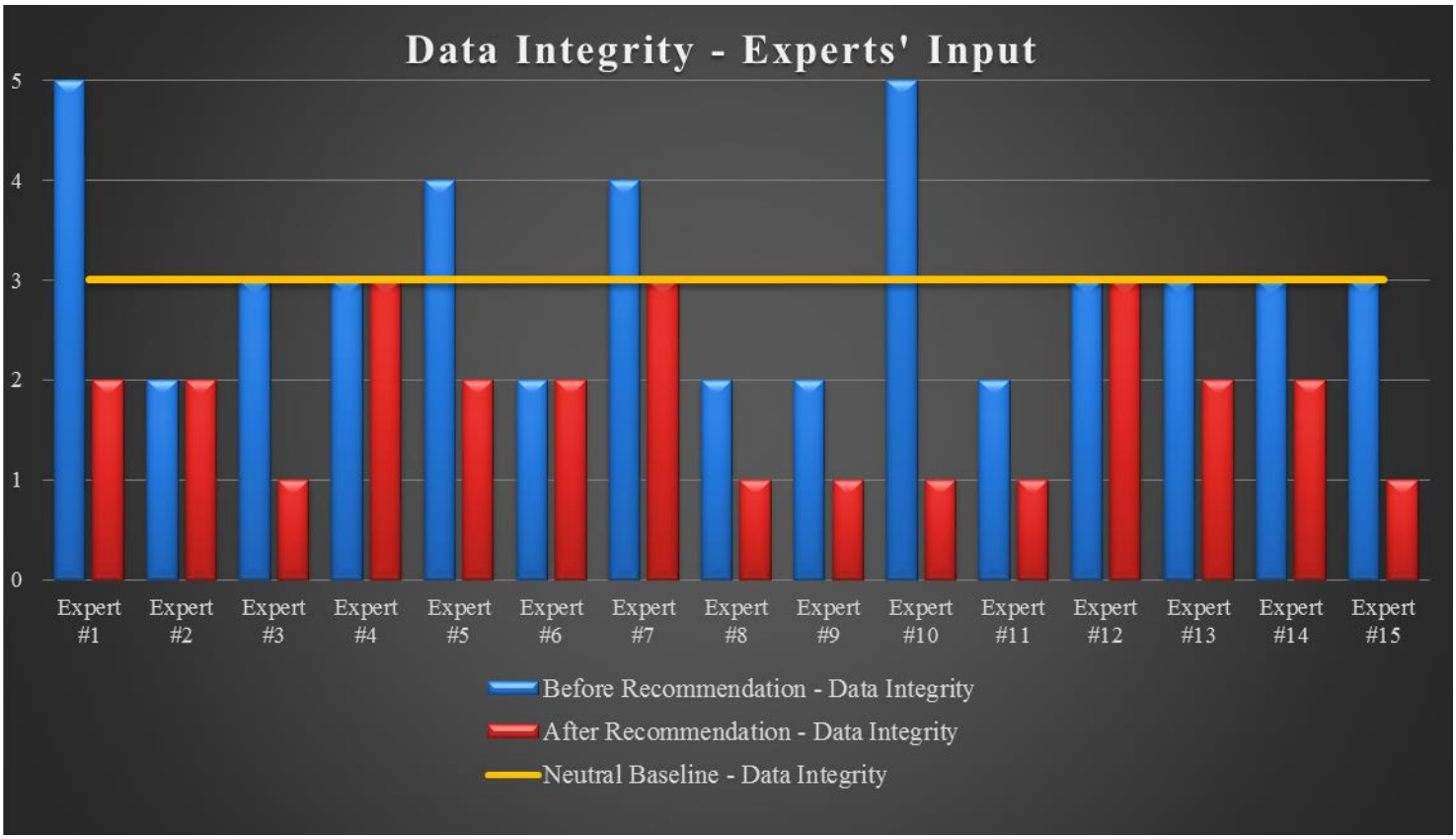

Figure 27: Data Integrity Before and After Experts' Input

After being introduced to the solutions of the challenge, all the experts acknowledged that E-Tendering will actually improve the data integrity of the tender response since the files will be delivered in an organized, safe and secure manner to the client. In traditional tendering, some files used to get lost, torn and wrongly placed/mixed up with another different tenderer's documents.

17. Time Consuming

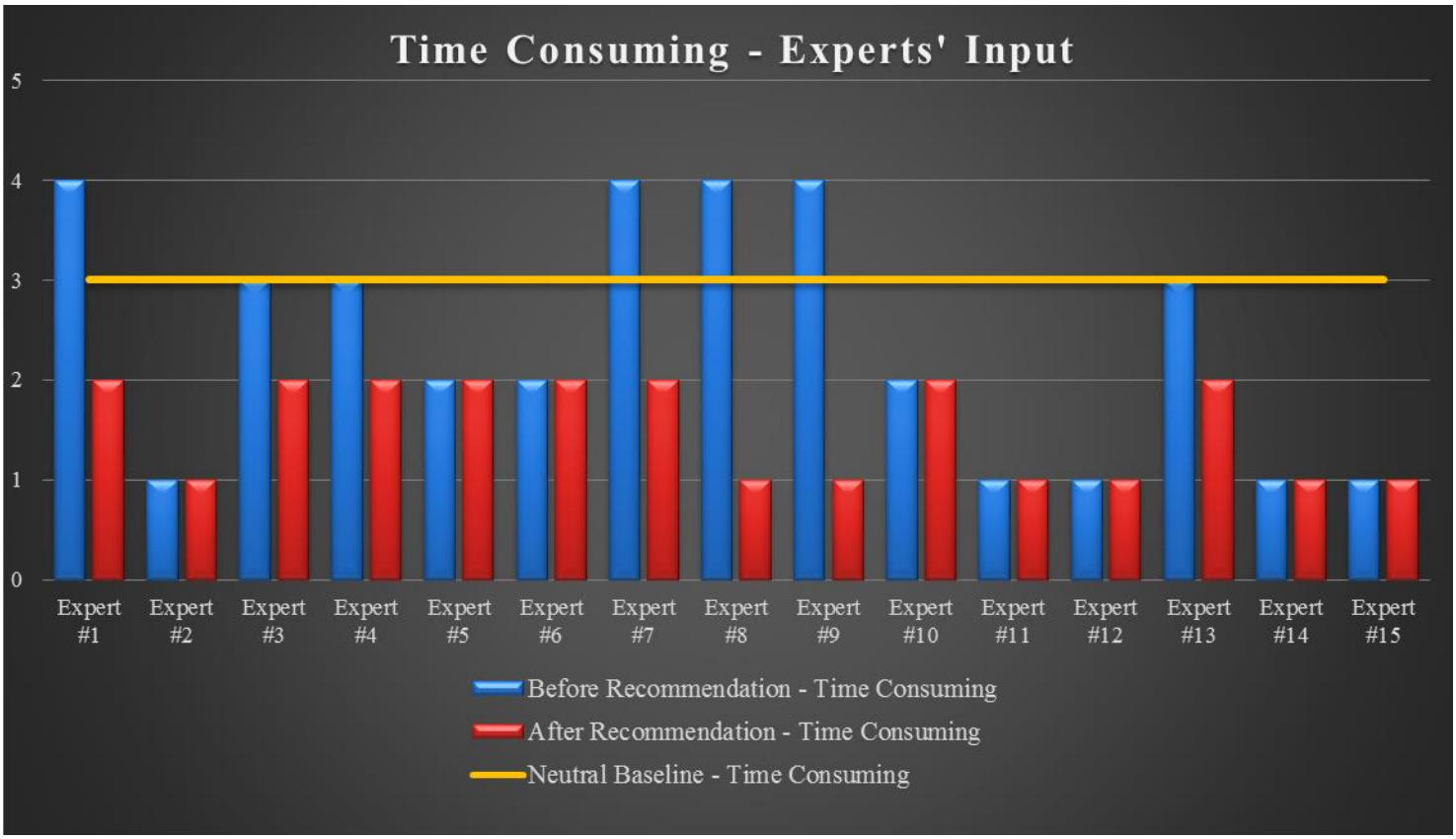

Figure 28: Time Consuming Before and After Experts' Input

After being introduced to the simplified processes of E-Tendering and the provided solutions, all the experts acknowledged that a short period of time will be needed for the tenderers to get used to deal in a paperless environment (the learning curve). They added that the simplified and efficient processes of E-Tendering will save lots of the time that used to get wasted when dealing with the traditional paper-based tendering (e.g. searching for tenders in the newspapers, preparing qualification documents manually, printing and copying the tender documents as well as the transportation costs, etc.).

18. Additional Workload

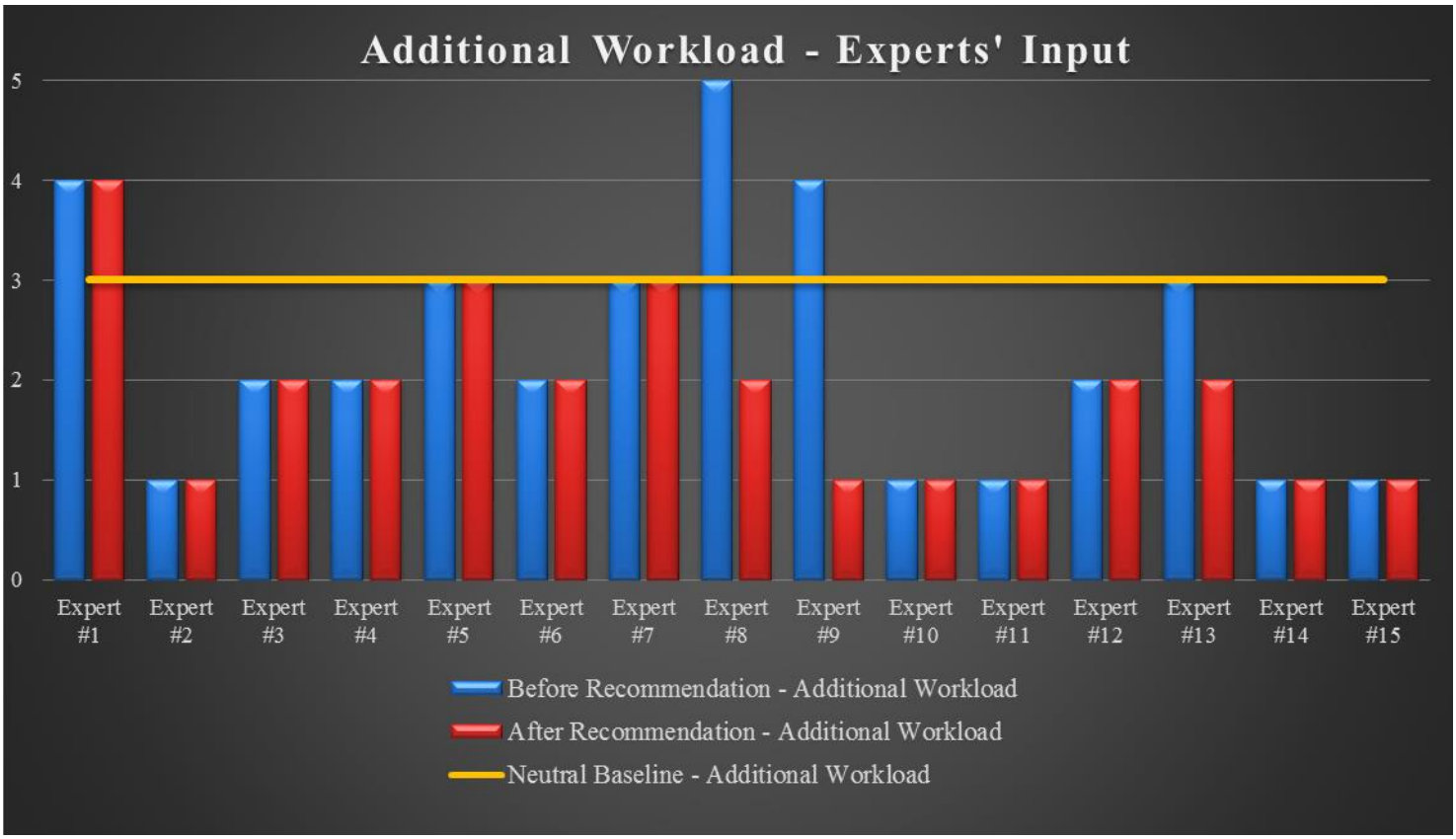

Figure 29: Additional Workload Before and After Experts' Input

All the experts believe that E-Tendering is not an additional workload without compensation; however, only one expert disagrees. This expert persists on perceiving E-Tendering as an additional workload since he will have to fill in the structured forms required by the client in order to submit a compliant tender. On the other hand, it is important to note that the savings in time and the different advantages of E-Tendering will motivate all the tenderers to adopt E-Tendering.

19. Automation Job Threat

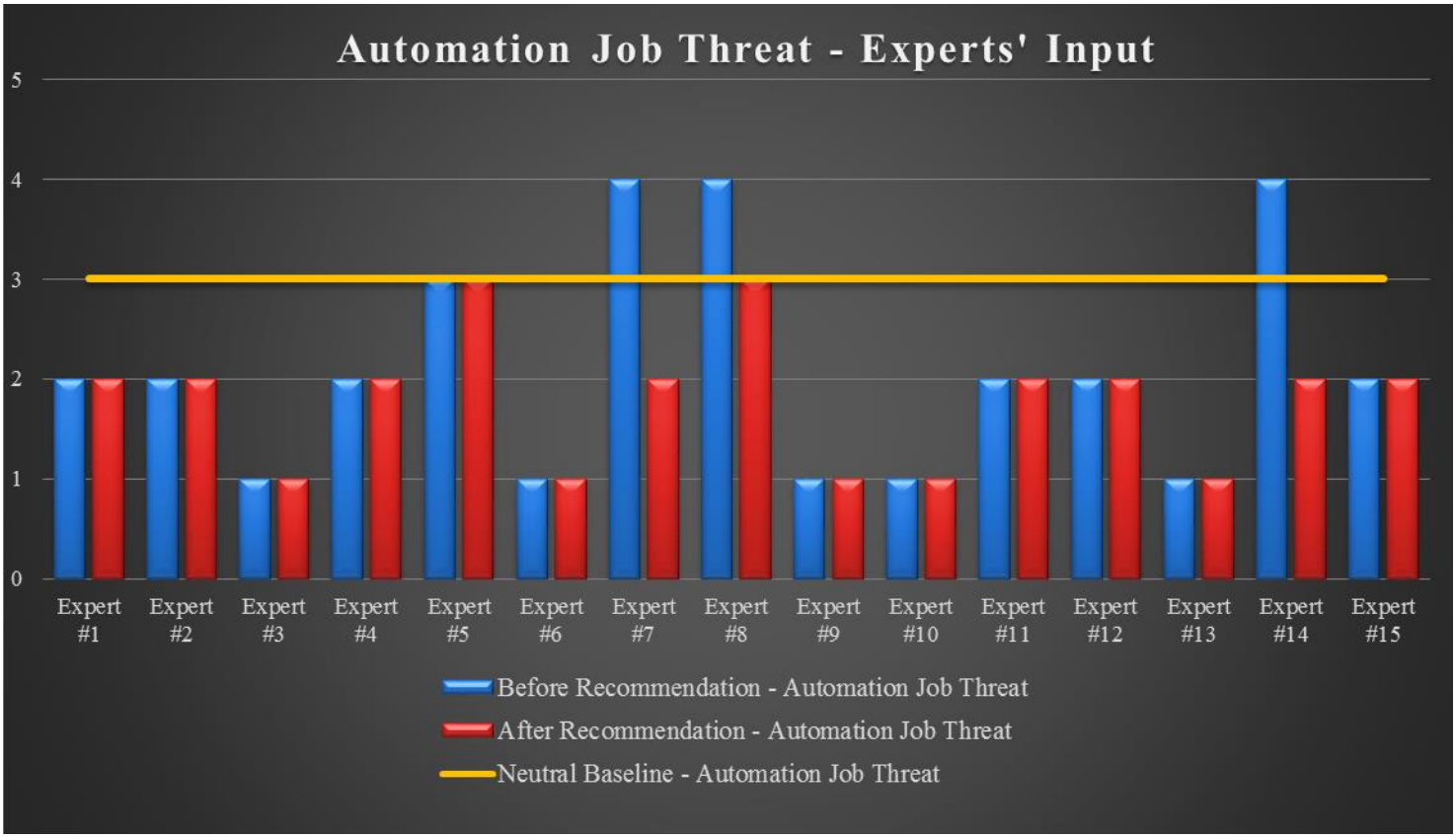

Figure 30: Automation Job Threat Before and After Experts' Input

After being introduced to the processes and guidelines of E-Tendering, all the tenderers perceive the automation of the processes as an advantage and a motive as the employees will be able to use their time effectively and efficiently on profitable tasks rather than on clerical ones.

In addition to the graphical analysis shown above, the adjusted relative importance index (RII) highlighting the rank (relative importance) of each barrier/challenge hindering the uptake of E-Tendering in Egypt is presented herein in order to point out any barrier that still persists and needs to be addressed.

Challenge/Concern	Mean Response	Additive RII	Simple Percent Equation 1	Simple Percent Equation 2	Adjusted Percent Equation	Rank
SMEs Access Difficulties	3.00	0.60	300.00%	60.00%	50.00%	***1***
Poor Telecommunications Infrastructure	2.67	0.53	266.67%	53.33%	41.67%	***2***
Reluctance/Resistance to Change	2.47	0.49	246.67%	49.33%	36.67%	***3***
Corruption Seekers	2.40	0.48	240.00%	48.00%	35.00%	***4***
High Speed Expensive Internet Services	2.40	0.48	240.00%	48.00%	35.00%	***4***
Irregular Electric Power Supply	2.27	0.45	226.67%	45.33%	31.67%	***6***
Subcontractors Dependency on Contractors	2.27	0.45	226.67%	45.33%	31.67%	***6***
Software Non-Compatibility Issues	2.13	0.43	213.33%	42.67%	28.33%	***8***
Lack of Support	2.07	0.41	206.67%	41.33%	26.67%	***9***
Technical Malfunctioning of the Portal	2.07	0.41	206.67%	41.33%	26.67%	***9***
Bureaucratic Regulatory Procedures/Requirements	2.07	0.41	206.67%	41.33%	26.67%	***9***
Additional Workload	1.87	0.37	186.67%	37.33%	21.67%	***12***
Data Integrity	1.80	0.36	180.00%	36.00%	20.00%	***13***
Automation Job Threat	1.80	0.36	180.00%	36.00%	20.00%	***13***
Confidentiality of Information	1.73	0.35	173.33%	34.67%	18.33%	***15***
Document Tampering	1.67	0.33	166.67%	33.33%	16.67%	***16***
E-Tendering High Investment Cost	1.67	0.33	166.67%	33.33%	16.67%	***16***
Signature Issues	1.67	0.33	166.67%	33.33%	16.67%	***16***
Time Consuming	1.53	0.31	153.33%	30.67%	13.33%	***19***

Table 13: The Ranking (Relative Importance) of the Challenges/Concerns of the Tenderers in Egypt – after the Solutions

The above table shows the overall ranking (the relative importance) of the challenges/concerns of the tenderers in Egypt after being introduced to the corresponding solutions and the processes of E-Tendering. This ranking shows that the overall response is below or equal to 3, i.e. all the identified challenges are no longer considered as barriers towards the adoption of E-Tendering and

hence, the solutions are very effective in addressing the needs and concerns of the Egyptian tenderers.

Also, it is important to note that, at the end of each interview, all the experts agreed that they are willing to participate in all the phases of E-Tendering (E-Notification, E-Access, E-Submission, E-Award) except for the E-Evaluation as most have recommended that the system shall not only evaluate the tenders automatically, but the evaluator's input decision is a must. Furthermore, all the experts have considered the post tender services (Contract & correspondence management, E-Invoicing, etc.) as a plus that would help better manage the project, save time and money.

5.3 Conclusion

This chapter provides solutions for addressing and tackling the barriers, challenges and concerns of the Egyptian tenderers. The effectiveness of these solutions is thoroughly examined by interviewing 15 experts in the field of construction tendering and the results show that the barriers, challenges, and concerns of the tenderers in Egypt will be addressed successfully when implementing these solutions/recommendations and hence, will help in improving the uptake of E-Tendering in Egypt. It is important to note that the continuous identification of the concerns of the tenderers, finding applicable solutions and providing guidelines and recommendations for best technical/operational practices is an iterative process that should always be conducted in order to motivate the tenderers to accept and adopt E-Tendering and hence improving its uptake in Egypt.

CHAPTER 6: CONCLUSION AND RECOMMENDATIONS FOR FUTURE RESEARCH

6.1 Conclusion

This research proposes the use of a new procurement approach called electronic tendering (E-Tendering) which is a more efficient mechanism that should replace/complement the traditional paper-based tendering within the construction public works in Egypt in the near future since the traditional paper-based system that is widely used contains inefficiencies. E-Tendering is the process of accomplishing the project tendering, starting from announcing the procurement opportunity till the tender award, in a paperless environment. It ensures process transparency, equality of access, fair competition, effectiveness and accountability (Das et al., 2010, p. 390).

Since addressing the needs of all the stakeholders is one of the essential means through which E-Tendering will be accepted/adopted in Egypt, the barriers/challenges and concerns of the tenderers to fully accept and adopt E-Tendering in Egypt were identified from the literature, filtered and tailored to fit the Egyptian public tendering context. 19 barriers were identified and then thoroughly examined by a panel of 15 academic and industry experts in the field of tendering in Egypt in semi-structured face-to-face and telephone interviews in which they were asked to mark/check a survey questionnaire to highlight the relative importance (rank) of each challenge. The highest challenges identified against the widespread adoption of E-Tendering in Egypt were the SMEs access difficulties ($RII_{\%}$ = 88.33%), the expected technical malfunctioning of the portal ($RII_{\%}$ = 86.67%), the reluctance/resistance to change ($RII_{\%}$ = 80%), the breach of confidentiality of information ($RII_{\%}$ = 76.67%), the electronic signature problems ($RII_{\%}$ = 76.67%) and the document tampering ($RII_{\%}$ = 75%). The research also presented in depth analysis of the effectiveness of the plans and measures taken by the Egyptian government till date towards the implementation of E-Tendering. Then, the guidelines provided in the reports prepared by the e-TEG and from the Golden Book of e-Procurement in addition to other recommendations

highlighted in the literature on the best practices when designing and running the technical/operational processes of E-Tendering were edited, filtered and categorized to come up with solutions to the Egyptian tenderers' barriers, challenges and concerns. The effectiveness of each of the solutions/recommendation was thoroughly examined by the same panel of experts. The research findings showed that the identified barriers were completely neutralized and successfully addressed by the presented solutions/recommendations, and also a number of the challenges perceived by the experts as barriers completely disappeared and are considered by the experts, after being introduced to the solutions, as a motive for adopting E-Tendering since their concerns completely vanished. Hence, these solutions/recommendations should improve the uptake of E-Tendering in Egypt.

It is important to note that all the interviewed experts stress on the necessity of applying all the solutions/recommendations in this research in order to face the expected obstacles that will face the Egyptian tenderers when using electronic tendering and to get full advantage of all the benefits of E-Tendering. Unfortunately, there is a lack of trust in the government's capability or willingness to adopt/implement these recommendations because in many similar cases, the laws are already issued, but are not enforced to the degree that assures smooth and secure operations. Moreover, it is expected that E-Tendering will take a long time to be fully accepted/adopted by the stakeholders in a developing country like Egypt.

6.2 Recommendations for Future Research

Studies should be carried out to quantify the actual benefits realized to the different stakeholders in Egypt when using electronic tendering instead of the traditional paper-based tendering. This is a very important research to accomplish as there is no much literature covering

this area. Quantifying the benefits is also one of the best ways to convince the stakeholders to move towards E-Tendering.

Another point that needs careful examination is identifying the exact threshold below which the tenders should not be electronically tendered. As highlighted earlier, the threshold is essential since it guarantees the small enterprises the ability to compete because not all of them have the ability to work in an electronic environment due to their poor capabilities, limited resources or their computer illiteracy.

Furthermore, a fully automated evaluation E-Tendering system should be developed and integrated with the E-Tendering system.

Finally, the effectiveness of the solutions provided in this research should be validated quantitatively through introducing them to a bigger sample that represents the whole population of the construction industry practitioners. Their contribution should be compared to the findings in this research in order to provide a set of solutions/recommendations addressing the needs of the tenderers and hence improve their acceptance/adoption of E-Tendering in Egypt.

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APPENDIX 1: LIST OF INTERVIEWED EXPERTS

#	Name of the Engineer	Position	Company	Years of Experience as			Total Experience	Submitted Tenders	Issued Tenders	Qualifications	Interview Questionnaire Type
				Contractor	Consultant	Client					
A	Omar Azzam	Principal - Head of Contracts & Tendering Dep.	Dar Al-Handasah	0	38	0	38	More than 20	More than 20	Chartered Engineer	Face-to-Face
B	Mohamed Abd El Wahab	Estimation & Tendering Manager	Arabian Construction Company	28	2	6	36	More than 20	More than 20	Bsc	Face-to-Face
C	Mohamed Abou Zahra	Chairman's Advisor - Contracts, Arbitration	Dorra Group	28	4	0	32	More than 20	More than 20	Bsc	Face-to-Face
D	Eid Moawad	Head of Tendering Department	Gama Construction	22	5	0	27	More than 20	More than 20	Msc	Telephone
E	No Disclosure	No Disclosure	No Disclosure	Yes	Yes	Yes	25	More than 20	More than 20	PHD	Face-to-Face
F	Ahmed Salama	Senior Contracts & Tendering Eng.	Dar Al-Handasah	18	5	1	24	More than 20	More than 20	Bsc	Face-to-Face
G	Helal Abdelsalam	Technical Office Manager	Detac	24	0	0	24	More than 20	More than 20	Bsc	Face-to-Face
H	Noha Masoud	Proposals Manager	Dar Al-Handasah	1	13	0	14	More than 20	More than 20	Bsc	Face-to-Face
I	No Disclosure	No Disclosure	No Disclosure	Yes	Yes	No	11	Less than 5	More than 20	PHD	Face-to-Face
J	Roufail Gayed	Managing Director	Rafaeal for Construction	10	0	0	10	More than 20	More than 20	Bsc	Telephone
K	Yasmine El Ayouty	Senior Contracts & Tendering Engineer	Dar Al-Handasah	0	10	0	10	More than 20	More than 20	Msc	Face-to-Face
L	Mohamed Wahid	Senior Estimation/Cost Eng.	Drake & Scull	6	2	0	8	More than 20	More than 20	Bsc	Telephone
M	Selvana Ramzi	Contracts & Projects Coordinator Eng.	Dar Al-Handasah	2	6	0	8	More than 20	More than 20	Bsc	Face-to-Face
N	Sherif Eid	Senior Tendering Eng.	Rowad Modern Engineering	6	1	0	7	More than 20	More than 20	Bsc	Telephone
O	Omneya Mostafa	Contracts & Project Coordinator Eng.	Dar Al-Handasah	0	4	0	4	More than 20	More than 20	Bsc	Face-to-Face

APPENDIX 2: SAMPLE SURVEY QUESTIONNAIRE WITHOUT THE RECOMMENDATIONS

APPENDIX 3: SAMPLE SURVEY QUESTIONNAIRE WITH THE RECOMMENDATIONS