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IT Applications in Construction Industry in Gaza Strip

(Conceptual Model for Web-Based Tendering System)

تطبيقات تكنولوجيا المعلومات في صناعة الإنشاءات في قطاع غزة

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Submitted in Partial Fulfillment of the Requirements for
the Degree of Master of Science in Construction Management

October – 2006

سُرِّدْنَا بِالسَّحَابِ الْحَمِيمِ

﴿ وَقُلْ أَعْمَلُوا فَسَيَرَى اللَّهُ عَمَلَكُمْ وَرَسُولُهُ وَالْمُؤْمِنُونَ وَسَتُرَدُّونَ ﴾

إِلَى عَالَمِ الْغَيْبِ وَالشَّهَادَةِ فَيُنَبِّئُكُمْ بِمَا كُنْتُمْ تَعْمَلُونَ ﴿



DECLARATION

I declare that:

This dissertation, "IT in construction Industry in Gaza Strip- Conceptual Model for Tendering procedures" is my own work, that all sources used or quoted have been indicated and acknowledged by means of complete references, and that this thesis was not previously submitted by me for a degree at another University.

Baker Thabet

Signature _____, Date: __/__/____

ACKNOWLEDGEMENTS

First of all, I would like to thank my supervisor, Assoc. Prof. Dr. Rifat Rustom for his continuous support throughout entire process of writing this thesis.

I would also like to express my sincere appreciation to committee members; Prof. Dr. Adnan Enshassi and Dr. Tawfiq Barhoom for their comments and suggestions.

My sincere thanks also to my professors Dr. Kamaleen Shaat and Mohammed Zearah

Finally, a very special thank to my parents and family for their never ending patience, and understanding.

Abstract

Construction process is heavily dependant on the effectively exchange of large and complex data. Information Technology (IT), offer solutions to the exchange of data, and assure almost instant collaboration between parties involve in construction process. Internet is one of these solutions that enable Integration in informational and contractual processes in construction industry.

IT solutions and applications penetrated (almost) all the fields of construction industry. Tendering in the public sector is an important stage of any construction project. This thesis is the first attempt in Palestine that introduces the basics for electronic integration and management of major tendering activities. Electronic management of tendering activities (e-tendering system), can find solutions to the fragmentation of data regarding construction business in Gaza. It will reduce the time and efforts to complete tendering operations; minimize expenses of paper works; improve transparency; and increase competition.

In order to develop the proposed system, the thesis studied the legal framework and the institutional arrangements that regulate the public tendering business in Gaza, some weaknesses were noticed in this area and recommendations were suggested to improve these issues and to create suitable legal and institutional environment to implement the anticipated system. A model for the World Bank (WB) procurement procedures was developed too, as a method of capturing the details of all activities related to the traditional procurement process, in this regard more than 120 procurement activities were analyzed in terms of its relation with each other and with the surrounding environment, Integrated Definition (IDEF0) method of modeling was chosen to model the WB procurement guidelines. The model identifies four potential areas to be automated namely: Project announcement, pre-qualification, distribution of bidding documents, and receiving of proposals.

In addition to that a survey was conducted among the construction stockholders in Gaza to identify their capabilities to implement such system, their requirements from the proposed system and their readiness to accept such system.

Based on the above-mentioned facts the anticipated conceptual model was built with the objective of future development of central web based tendering system for public works in Gaza. The Unified Modeling Language (UML) was selected as an approach to structure the proposed conceptual model.

Key words: Conceptual model, E-tendering, Use Cases, Construction industry, Gaza Strip.

خلاصة

تعتمد صناعة الإنشاءات اعتماداً كبيراً على التبادل الفعال لحجم كبير و معقد من المعلومات. وقد عرضت تكنولوجيا المعلومات من خلال تطبيقاتها المختلفة عدداً من الحلول لتبادل المعلومات و لضمان تعاون سريع بين الأطراف المختلفة المشتركة في أعمال الإنشاءات. و كان أحد هذه التطبيقات هي استخدام الإنترنت لتبادل المعلومات و لتحقيق التكامل الفعال في هذه العملية. و في هذا السياق فقد اخترقت حلول و تطبيقات تكنولوجيا المعلومات تقريباً جميع المجالات في صناعة الإنشاءات.

و بما أن أعمال المناقصات في ترسية العطاءات الحكومية هي إحدى الخطوات المهمة في المشاريع الإنشائية فقد جاءت هذه الدراسة كمحاولة أولى في فلسطين لتقديم نموذج لإدارة العطاءات و ترسيتهما إلكترونياً استفادةً من تطبيقات تكنولوجيا المعلومات. حيث أن هذه الخطوة من شأنها أن تجد الحلول للكثير من المشاكل المتعلقة بهذا القطاع مثل عدم و جود بنك معلومات لهذه الصناعة، الهدر في المال العام نتيجة تعدد الجهات الحكومية التي تدير هذه الفعاليات، و من شأنها أن تحسن من الشفافية في اختيار المقبول أو الاستشاري المناسب، و تزيد من المنافسة. و بهدف تطوير مثل هذا النظام درس هذا البحث الواقع القانوني و التنظيمي الذي يحكم العطاءات الحكومية في غزة حيث وجد بعض الضعف في بعض جوانبه و اقترح بعض الحلول لتحسين هذه الجوانب و النهوض بها لخلق مناخ ملائم لتطبيق مثل هذا النظام. كما و درس هذا البحث إجراءات البنك الدولي التعاقدية بهدف معرفة التفاصيل الدقيقة للعملية التعاقدية التقليدية و عليه فقد حلل هذا البحث حوالي ١٢٠ فعالية باستخدام طريقة (IDEFO) يقوم بها الموظف المختص بإجراء أعمال المناقصات و درس علاقة هذه الفعاليات ببعضها و بالوسط المحيط بها و من خلال هذه الدراسة استطاع البحث التعرف على بعض الجوانب التي يمكن اتمتها في أعمال المناقصات و تشمل هذه الجوانب: الإعلان عن المشروع، تأهيل المقاولين، توزيع وثائق العطاء، و استقبال العروض. بالإضافة إلى ذلك فقد قام الباحث بعمل استبيان و توزيعه على العاملين بصناعة الإنشاءات في قطاع غزة بهدف التعرف على قدراتهم من ناحية تطبيق مثل هذا النظام، متطلباتهم، و جاهزيتهم للتعامل مع هذا النظام.

بناءً على الحقائق التي تم استنتاجها تم بناء النموذج المقترح و الذي يهدف إلى تطوير نظام مستقبلي لإدارة العطاءات الحكومية في قطاع غزة بطريقة إلكترونية و قد تم اختيار بناء النظام

المقترح بطريق (Unified Modeling Language (UML)

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Chapter 1

Introduction

1.1 Research Background

Information technology (IT) has been widely applied in many industrial sectors in order to increase their profit, competitiveness, and to reduce unnecessary project costs. The Oxford Concise English Dictionary defines IT as: the study and use of systems for sorting, retrieving and sending information, (cited by Lee, 2003). Also, IT is defined as: the use of electronic machines and programs for the processing, storage, transfer and presentation of information (Rivard, 2000).

In the era of IT, Internet and World Wide Web (WWW, or Web) were commercially introduced at the mid of 1990s. Electronic Web pages are graphically based tool for sharing information. They are more accessible than printed pages; they can be accessed 24 hours and provide the fastest way to access information or to promote commercial services.

Concerning commercial services, Roskill, (2000) stated that a business-to-business electronic marketplace, or a B2B e-marketplace, can broadly be referred to as any internet-based system that provides e-commerce services to several businesses, primarily focusing on facilitating the business interaction (cited by Erick, 2000) . In construction industry, Issa et al. (2002) mentioned that, Internet and web-based technology is changing the way business is done in construction, the web has become a source for information, goods and services, and a means of communication.

Proper communication is vital a factor in the whole life cycle of any construction project. Procurement is part of any project life cycle; it encloses several interrelated activities with massive volume of information flow between the performers of these activities. The flow of information can be automated and the activities can be integrated. Zabel et al. (2000) mentioned that the case studies confirm the potentials of e-commerce in procurement.

Automation of procurement activities lead to the concept of e-procurement, Codoni et al. (2005) defined e-procurement as: the electronic integration and management of all procurement activities including purchase request, authorization, ordering, delivery and payment between a purchaser and a supplier.

In public sector, governments can be seen as bulk purchasers, they invest huge amounts in infrastructure improvement, hospital buildings, roads' construction, and school structures. From the other side, governments need to get the best value of money and to guarantee transparency and efficiency in the contractors and consultant's selection. Accordingly, several governments adopted e-procurement solutions that enable public institutions and private sector to communicate electronically during the procurement stages (Rambel management, 2004).

Although tender documents for public works produced electronically in Gaza Strip, but they still need to be transferred manually. This situation leads to a lot of repetitive work, paper consumption, and lose of time. No work has been done on the national level to automate the communication between parties that are involved in the procurement activities.

1.2 Research problem

Electronic transformation of information in the public procurement process has become important in the information age. The effectiveness and efficiency of this process is essential to obtain works and services at the right quality, cost, and time. The main feature supported by electronic procurement system was tendering (Cagar, 2005). This feature is assumed to provide an online tendering environment for government purchasing. There are several IT organizations providing e-procurement software solutions targeting governments and public sector entities. These solutions were constructed on well-defined legal, institutional, and procedural frameworks.

In Palestine, solutions for e-tendering component are seldom found in the local IT Market, since the public procurement process is not mature enough to invest in this area. Also, the Public Procurement Law and regulations that regulates the tendering activities of the government are still drafts and subject to frequent changes. In this respect, this study is the first attempt to identify the requirements and to develop conceptual model for e-tendering system for public works in Palestine.

1.3 Research objectives

This research aims to propose a conceptual model for future development of central web based tendering system for public works in Palestine. The system should be able to implement e-tendering stages that will support tendering activities of the Palestinian Authority in the field of construction related projects. The main objective is to be achieved via the following specific objectives:

- To assess IT capabilities among construction stakeholders in Gaza Strip, i.e. contractors, consultants, and public owners.
- To study the current procurement procedures for consultant hiring and contractor employment.
- To identify current institutional and legal framework regarding procurement of works and services in public sector.
- To recognize the user requirements towards the proposed system.
- To build up a conceptual model for the proposed system.

1.4 Research scope

This research focuses on the collaboration between two or more organizations in the tendering process. Inter-organizational collaboration such as proposals evaluation is out of the scope of this research.

This research will cover the following two areas:

- 1- The stakeholders need (requirements determination) from the system through literature review, survey, and study of current procurement procedures.
- 2- The interaction between the proposed system and the persons who suppose to interact with it via Use Case documentation.

Designing commercial software for e-tendering process is out of the scope of this research since it needs multi discipline skills in the area of software development. From the other side, flow charts that will be presented in the scope of this research aims to develop the understanding to the relation between parties. It articulates the user point view rather than the system development specialist.

1.5 Research methodology

System development life cycle encloses several steps, system analysis is one of these steps. The first step in system analysis is the requirement determination (Hoffer et al. 2002). The purpose of this step is to provide a description of the stakeholders needs from the anticipated system. Chandran, et al. (2003) quoted that system requirements can be divided into two categories:

- Functional requirements, which describe the scope of the system and the necessary business functions.
- Non-functional requirements, which describe other special requirements such as the system security, performance etc. Other references defined it as, the look and feel of the system (Hoffer, et al. 2002).

Methods for requirements gathering include questionnaires, observations, study of existing documents, systems and procedures, prototyping, joint application development, interviewing users and experts, and rapid application development (Hoffer et.al 2002).

In this research, three methods were chosen for requirement gathering: study of existing procurement procedures; study of existing e-tendering systems; and questionnaire survey. Informal interviews with procurement specialists and IT experts were also conducted. The questionnaire (see Annex A) was designed in order to achieve the following goals:

- 1- Identify users' requirements, and the level of acceptance to the proposed system.
- 2- Study stakeholders' capabilities to adopt such system.

Ideas on the type of questions to be asked and the associated methods were generated and developed, based on the questionnaires presented in international journals. A draft version of the survey questionnaire was generated and distributed (via e-mail) to well known contractors, consultants, high level educational professionals, and IT private firms. The draft was distributed in order to examine the questionnaire validity based on the identified objectives. After comments and amendments, a final version of the questionnaire was produced. The first section of the questionnaire sought to identify the organization's size and character in terms of the number of completed projects, annual turn over, type of business, number of personnel, and the contractors' classification. The questionnaire then asked for the types and software names in use in the organization and the most significant factors in selecting this software. The next questions related to the

hardware in use by the organization. The fourth section sought to identify the Internet and communication technology applied by the organization and the ability to implement e-procurement concept by the organizations. The last two groups of questions were about the factors restricting the use of IT and the prospects of IT implementation in Gaza. A cover letter (in Arabic and English) was attached to the front page of the survey questionnaire for each organization in order to spot the objectives of the survey and to identify the meaning of IT in this research.

In order to study all activities in the existing procurement process, the World Bank (WB) procurement procedures were modeled. Integrated Definition (IDEF0) method of modeling was selected as a modeling tool, since this method is an activity-oriented method rather than object-oriented one (Computer Association International, 2004). The model with description of the method of modeling is shown in Annex B.

The conceptual model of the proposed system was developed utilizing the Unified Modeling Language (UML). UML was selected because it is a visual modeling language for specifying, visualizing, constructing, and documenting the objects of software system, which can easily map the conceptual model to software product (Davar, 2003). So, by utilizing UML the domain experts can present their ideas in understandable way to the IT specialist.

1.6 Research layout

The thesis consists of six chapters. Figure 1.1 represents the relationship between the chapters. The first chapter gives a general layout of the research.

The other chapters are as follows:

Chapter two is the literature review that covers the following areas:

- Scope of IT applications in construction industry;
- Level of IT applications in other countries;
- Recent work and future directions of IT in construction industry;
- Internet and web utilization in construction industry; and
- E-procurement in construction industry.

Chapter three explains the procurement related issues in Gaza: the legal environment; the intuitional arrangements; and the recent procurement procedures. As stated previously the procurement procedures will be demonstrated using IDEF0 method of modeling.

Chapter four illustrates the survey findings about the level of IT usage in construction industry in Gaza Strip.

Chapter five is the conceptual model for the proposed system. The requirements of the proposed system will be extracted from the second; third; and fourth chapters.

Chapter six is the last chapter, it includes the conclusions and recommendations of the researcher.

Annex A contains the questionnaire structure.

Annex B contains the WB procurement guidelines model.

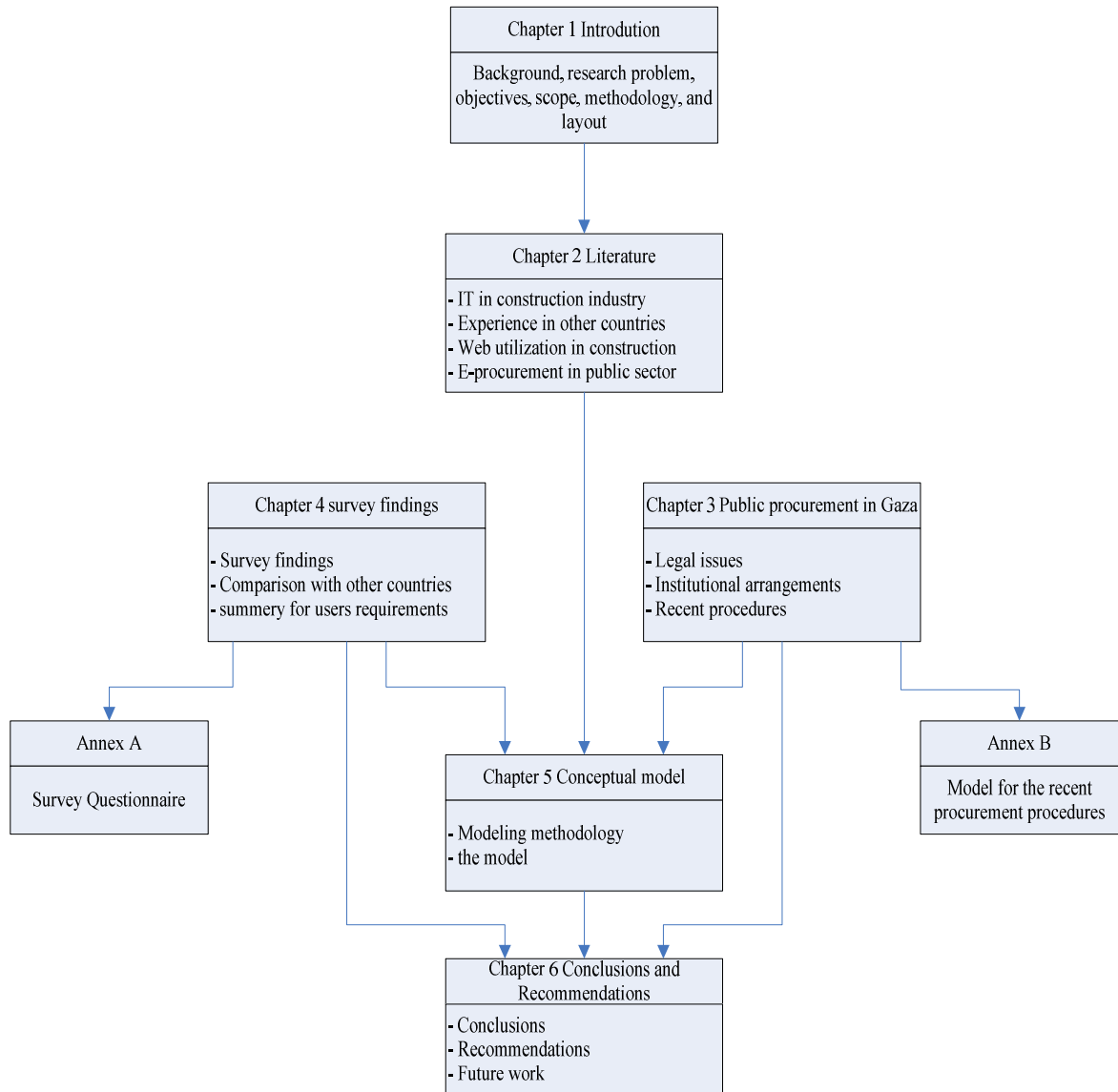


Figure 1.1 Flow chart summarizes the layout of the thesis

Chapter 2

Literature Review

This chapter aims to present literature review for (i) the utilization of IT in construction industry in general; and (ii) the concepts of e-procurement; government e-procurement; experience of other countries in this field; benefits of e-procurement and methodologies to develop e-procurement systems.

2.1 IT in construction industry

This section presents other studies findings regarding scope, recent works, future directions, and experience of other countries regarding IT applications in construction industry.

2.1.1 Scope of IT applications in construction industry

Rivard, (2000) stated that IT covers wide range of technologies such as: computers, software, networks, telephones, and fax machines. These technologies can be utilized in numerous applications: documents generation, information processing and storage, facilitating the exchange of information, and management of information are examples of IT applications in construction industry. Turk, (1997) compared traditional and IT supported technologies used in construction information processes. Table 2.1 illustrates the comparison. The comparison was developed according to the aspects of scope, actors and time. Scope is directly related to project, company specification, and industry wide information. Actors are related to man, application and machine.

Other researchers' grouped IT capabilities into broad categories. Ahmad et al. (1995) stated that the current and emerging capabilities in the field of IT in construction industry could be grouped into three categories:

- 1- Information management and services that include shared databases, data warehousing, and web pages.

Table 2.1 Comparison between IT and traditional supporting technologies used in construction industry. Turk, (1997).

	Item	Traditional Technology	Information Technology Supported
Scope	Project	Drafts, folders	Document management, product and process models.
	Company	Archives, microfilms	Data warehouse
	Country	Libraries, building regulations	National construction information systems
	World	Journals, conferences	Global IT networks
Actors	Man with man	Speeches, phones, faxes, mails	e-mail, video conferences
	Man with application		Visualization, 4D, Virtual reality, graphical user interfaces
	Man with machine	Direct manipulation	
	Application with machine		Robotics, remote sensors
Time	Just-in-time	Book look-up, library look-up, phone call to expert	Database lookup, Internet search, discovery and search agents
	Just-in-case	Reading books, magazines, journals, schools, visiting conferences.	Subscriptions to customized content, distant learning.
	Once-in-time	Watching TV, listening to radio	Not-archived discussion systems push and cast services.

- 2- Communication that includes networks, e-mail, on-line chatting, and video conferencing
- 3- Processing/Computing.

Laudon et al. (1995) identified the IT functions in construction and recognized the common IT tools for each function as presented in Table 2.2

Table 2.2 Common IT tools for relevant IT functions. Laudon et al. 1995 (cited by Shen et al. 2000) .

IT function	Common IT tools
Communication	Telephone, Fax, Electronic mail (e-mail); Networks (Internet, Intranet, Extranet); Electronic Data Interchange (EDI)
Data processing	Document management (Microsoft office, Lotus 1-2-3 etc.); Design software (CAD, 3D graphics simulation); Management Information System (MIS); Expert System (ES)/ Artificial Intelligence; Geographic Information System (GIS); Decision Support System (DSS); Visualization (Multimedia, Virtual Reality (VR))
Data-Share	Standards and protocols: Internet Protocol and Transmission Control Protocol (TCP/IP); Asynchronous Transfer Mode (ATM); IPX (one protocol for internet)

Summery

As noticed, IT penetrated almost all functions in construction industry. Communication between parties seems to be one of the areas that was highly affected by the development IT. The presented references agreed that e-mails and networks are common tools to communicate information and documents.

2.1.2 IT applications in construction

Rivard. (2000) investigated the current and planned use of IT and its impact on the architecture, engineering, and construction industry in Canada. The author noted that numerous business processes in the construction industry in Canada are almost completely computerized and the tendency is toward a greater computerization of the remaining processes. According to the investigation, the two most important areas of research for the industry are:

- 1- The implementation of computer-integrated design and construction, which integrates data and communication among firms, and
- 2- The development of new design tools that would let several designers participate and work together on a project that would assist them in the conceptual stages of design.

Mui, et al. (2002) investigated the internet usage in the Malaysian construction industry. The authors found that the respondents to their survey have accessibility to internet, comparable to countries such as the United States, but, the main use of internet is only for e-mails and information search. One third of the investigated firms use internet for marketing purposes, the authors foresee that this will be the trend in the future. The authors recommended that the Malaysian construction industry development board should ensure that firms in the construction industry providing opportunities for their workers to be trained in the skills of information technology. The training should upgrade the internet skills to include e-bidding and e-meetings in an effort to fully utilize the potential of internet.

Doherty (1997) conducted a survey about the computer usage in the New Zealand building and construction industry. He concluded that a large majority of the businesses either do not use computer or use them only casually; one of the author's suggestions was to develop guidance on how the industry can make best use of internet and data interchange technology.

Samuelson (2002) studied the use of IT in the Nordic construction Industry; his study covered three countries namely: Sweden, Denmark, and Finland. The study found that 88% of all employees work at workplaces with computers. The most common types of software are word processors, administration and e-mail. 54 % of the employees have their own computers at the workplace. The use of CAD in general has increased and the use of model based CAD software has increased among architects. Property owners are those who use computers most widely in their core business, while contractors do this the least. The documents that are most often sent digitally are minutes of meetings and construction drawings. 83 % of all employees work at workplaces with access to the internet and 45 % have access to internet from their own computer. The use of project webs and electronic trade in the industry has started but it is not widespread. Many companies are still increasing their investments in IT but the speed of increase is slowing down. The industry experiences that IT has increased productivity, mostly in general administration. Consultants experience a higher productivity rise than contractors. The greatest advantages with IT are stated as better financial control and faster access to information, while the greatest obstacles are costs, which are too high for investment and upgrading of systems. The motives and plans for IT investments are concentrated on well-tried techniques in the companies support business. The comparison between Sweden, Denmark and Finland shows that Finland and Denmark have a greater use of model based CAD and that more employers have their own computer at the workplace. Companies in Sweden think they get better financial control with IT and also priorities costing/cost control and accounting systems to a greater extent.

Summery

Investigation about the use of IT in construction industry in six countries was studied. The study showed that most of the questions were about the percentage of hardware and software usage among construction participants. One of the studies reported that consultants (Architects) use computers and computer applications more than contractors. Communication is a common question in the six cases.

2.1.3 Recent work and future directions of IT in construction industry

Amor, et al. (2002) analyzed the papers and reviewed the key research issues that have been addressed by the International Council for Innovation and Research in Construction (CIB). The papers were collected from twelve workshops covering the period from 1992-2002. From the analysis of past papers and the future synthesis of IT vision, Amor et al. (2002), identified three topics to be used for more discussions, these topics are:

- 1- The modeling of processes and products and the integration of this with visualization and standardization of information life cycles.
- 2- Issues associated with implementation adoption and behavior and the management of technology, and
- 3- Reengineering of processes and the search for integrated supply chains.

(Kiviniemi 1999) (Aouad, 1997) (Alshawi, 1996) have acknowledged the limitations of current approaches to the management of information in projects, (cited by Sarshar et al. 2004). Most of these limitations are due to:

- Most project information is stored in papers as drawings and written documents. This is frequently unstructured and difficult to use.
- This process (storing information in papers) leads to incomplete understanding of the planned construction, functional inefficiencies, inaccurate initial work or clashes between components.
- People responsible for collecting and archiving project data may not always understand the specific needs of those who will use it, such as those involved in building maintenance.
- The data is usually not managed while it is created, but instead it is captured and archived at the end of the construction stage. This means that people who have knowledge about the project are often likely to have left for another project by this time- so their input is not captured.
- Lessons learned are not organized well and are buried in details. It is therefore difficult to compile and disseminate useful knowledge and best practice to other projects.

Sarshar et al. (2004) mentioned that research in project information management can respond to some of these challenges by:

- 1- Examining a vision for the future of IT in construction.
- 2- Identifying two key areas of research in construction IT namely: integration and collaboration.

In this regard, Sharhar et al. (2004) quoted that the EU developed a project called Distributed Virtual Workspace for enhancing communication within the construction industry (DIVERCITY). This project developed virtual workspace that improves communication and collaboration. The project focused on three construction processes, i.e. client briefing; design reviews; and site operations and constructability. DIVERCITY allows users to produce designs and simulate them in a virtual environment. All stakeholders within the project team can view the designs.

Another important European project named e-construct project was developed too; Tolman et al. (2001) mentioned that the project aims to develop, evaluate, and demonstrate how the next generation of internet can be used to improve meaningful communication in the European building and construction industry, supporting future e-Commerce and e-Business.

STAR research program is another European project developed by the technical research center of Finland (VTT). Karhu et al. (1997) mentioned that the transfer towards computer-integrated construction also presupposes the systematization of operations. In this regard, the author managed a team to develop a report named (Construction process model, generic present-state systematization by IDEF0) as part of a three-year STAR research program that aims to build up a theoretical foundation, systematic methodology, tools and knowledge for continuous improvement of the construction process. The construction process model report has modeled the overall construction process systematically creating a generic state-of-the-art model that covers the design and construction of a building project from the conception of the project in the client's mind to its completion for hand over and use covering more than 300 construction activities.

Chen et al. (2004) identified three types of IT applications for innovative construction management that involves:

- 1- Procurement: e-commerce system for procurement of construction material and equipments.
- 2- Automatic identification: barcode and radio frequency identification system (RFID) for construction material and equipment management on site.
- 3- Documentation: construction project information system and knowledge management.

Summary

Integration and collaboration between project team are the most important areas that should be developed in the future research and development programs. The direction in recent construction industry research is to adopt IT for creating effective team work, from the start of any construction project to the stage of handling it over.

2.2 Internet and Web utilization in construction industry

This section aims to present previous works regarding the utilization of internet and web services in construction industry. At the beginning, adopting these services in developing information systems will be introduced, and then the section will illustrate the effect of these services in the issues of e-procurement and e-tendering.

2.2.1 Information systems in construction industry

Electronic document management (EDM) effects the construction information management. Bjork (2002) argued that most of documents handled today produced by computers, but a lot are still transferred by printing them out and sending them to the other parties by mail or couriers. The author mentioned that recent evidence from Sweden and Finland indicates a quick growth in the use of project webs, in particular in bigger

projects, where the use of EDM is likely to become the rule rather than the exception in the near future.

Lee (2003) developed a Web-based Construction Site Management System called (WCSM) that incorporates some major features including: integration of web technology and mobile computing into construction site management and automatic project schedule updates.

Chan et al. (2004) described web-based construction project system. The authors proposed a conceptual model of web-based information system for construction project management. The system aimed to provide almost instantaneous data exchange among project participants. The proposed system is able to intelligently search for relevant information, extract useful data from the original documents, recognize the information according to specific tasks and users, and display it in an integrated web page accessible to all relevant parties in the construction project.

Alshawi and Ingirige (2003) studied the introduction of automation into management practices and the influence of the Internet and the business models on project management. In addition, they pointed out the stages in which web-enabled project management software is used, specifically in the tender stage, the design and construction stage, and trading (e-commerce). Finally, they introduced samples of web-enabled project management software.

2.2.2 E-procurement in construction industry

IT contribution in the construction industry radically affected the interaction between parties involved in the construction process. IT changes the traditional way of information sharing by enabling parties to immediate access to information, allowing the participation of various people for real-time collaboration, and permitting broader reach to the information. Veeramani et al. (2002) quoted “IT can lead to fundamental changes in the business processes associated with project delivery”.

Knowing the opportunity represented by technological advancements, some companies are pioneering new tools and systems that use internet to perform business tasks. In this regard, Berning et. al, (2000) reported that surveys indicate that 80 percent of contractors and owners use Web-based communications, 25 percent purchase or sell products over the Internet and 17 percent bid for jobs online. Fifty-eight percent of the owners report that they used a project management Web site.

Utilizing electronic communication (as part of IT revolution) in the construction business process delivered the concept of E-business, which could be understood as: using the internet for conducting key business process and interactions in business-to-consumer (B2C), business-to-business (B2B) and intra-business contexts Veeramani, et al. (2002). Also he defined E-commerce as: a type of e-business initiative for the buying and selling of goods and services and the transfer of funds through the Internet.

2.2.3 What is e-procurement?

In the definition of procurement, Kalakota et al. (2001) drafted the following statement: "purchasing refers to the specific activities associated with the buying process, whereas procurement is a broader term for all activities associated with obtaining goods and services from a supplier, including requisition, transportation, warehousing and inbound receiving processes". Regarding e-procurement, several definitions were presented in the literature, some of these definitions are:

- Barua, et al. (2001) defined e-procurement as the most important element of e-business operational excellence for large corporations.
- E-procurement is essentially an internet\ Intranet based purchasing application or hosted service that streamlines buying trading partners, maximizes trade efficiency across the entire supply chain, and provides strategic e-commerce capabilities in internet time (Parida, 2005).
- E-procurement is the term used to describe the use of electronic methods, typically over the Internet to conduct transactions between awarding authorities and suppliers. The process of e-procurement covers every stage of purchasing,

from the initial identification of a requirement, through the tendering process, to the payment and potentially the contract management, (Curran, 2004)

- E-procurement is the electronic management of all the procurement activities. It is the use of web communications to e-Enable purchasing processes and strategy, and is part of the wider e-Commerce revolution, (www.and.s.gov.af)

2.2.4 Government e-procurement

Government e-procurement is defined as: the use of information technology systems and networks by governments in conducting their procurement relationships with suppliers and contractors for the procurement of works, goods, services and consulting services required by the public sector, (Multilateral Development Bank, 2005).

The term e-procurement covers a vast number of different methods of purchase and sale in terms of IT systems, procedures, and underlying technologies. In order to distinguish between the different methods of government e-procurement, the office of deputy prime Minister in United Kingdom published an official report (delivering e-procurement, 2004) distinguishing between the following e-procurement solutions:

- E-tendering
- E-Auctions
- E-purchasing
- E-procurement cards

Figure 2.1 represents the method of procurement in government sector. E-tendering defined as the use of electronic means throughout the tendering processes. E-tendering enables suppliers in different geographic locations to be notified of an opportunity, to express an interest, to pre-qualify, to download tender documents and to submit a response. This promotes completion for the tender, and provides a process that is efficient for both institutions and suppliers and a selection process that is transparent to bidders. The tendering process should be efficient, cost effective and transparent.

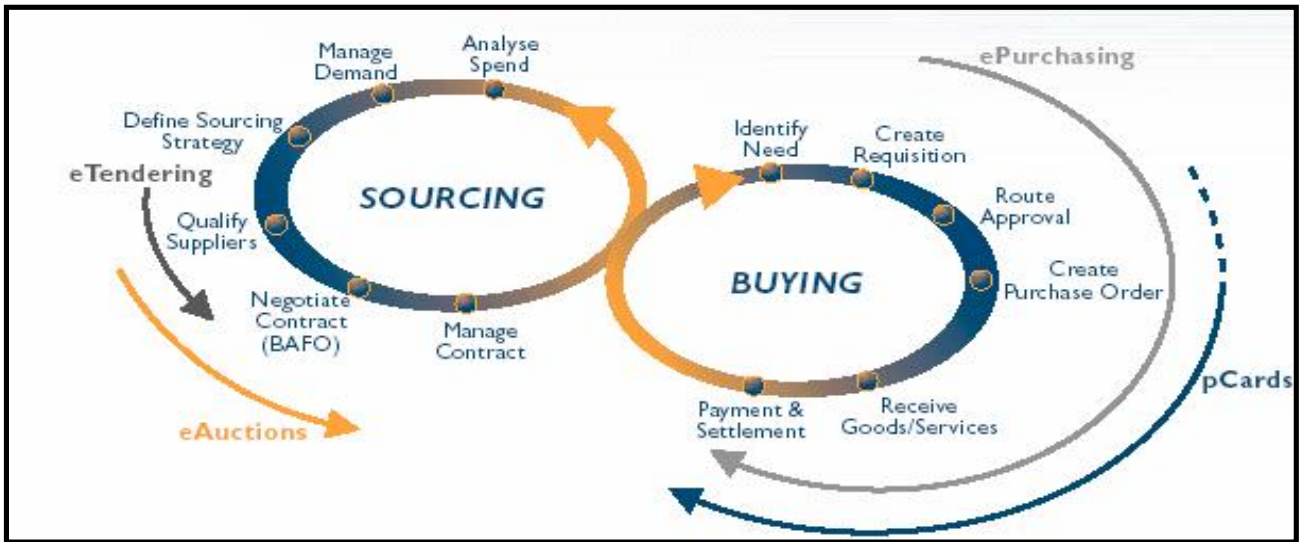


Figure 2.1 Methods of e-procurement in government sector, (Delivering e-procurement, 2004)

All stages of the tendering process can benefit from electronic processes, including pre-qualification, advertising, preparation and issuance of bidding documents, receipt of bids, bid opening, evaluation of bids, clarification and modification, notification, and publication of results. Even though, all stages can benefit from electronic processes, still some stages benefit more than other stages. Codoni et al. (2004) identified the most important procurement portals and e-marketplaces in the EU member states the research showed the percentage of utilizing the mentioned procurement stages by the identified systems. Table 2.3 summarizes these findings.

2.2.5 Benefits of e-procurement

Government institutions and private enterprises can benefit from e-procurement solutions in different areas. Transparency, equal opportunity, and time saving are some of these areas.

Table 2.3 Procurement stages covered by identified procurement systems, (Codoni et al. 2004).

	Frequency	%
Notification about tenders	33	92%
Publication of tenders	17	47%
Management of receipts/submission of tenders	9	25%
Evaluation of tenders	3	8%
Ordering	8	22%
Invoicing	1	3%
Total	36	100%

Crishna et al, (2003) developed a report about the benefit of e-procurement for the government of India. The report stated that there are no grounded figures on benefits. However, there are estimates that e-tendering might save vendors approximately 70% in their costs of transaction (e.g. eliminating travel, courier costs, bribes, etc). Estimated savings for government are as follows: advertising cost savings can be reduced by approximately 75% and printing costs by approximately 90%. There will also be improvements in the speed of the tendering/procurement process.

The same report stated that there are likely to be transparency savings in the elimination of the corrupt 'risk premium' that those seeking government contracts find themselves having to pay; this is generally estimated at between 2% and 10% of contract price. Since this payment is always factored into a vendor's budget in normal tendering, this cost saving should also be passed on to government.

Leipold (2003) reported that benefits of e-procurement applications covered wide areas. Table 2.4 represents the report findings regarding the benefit of e-procurement in public projects.

Table 2.4 Benefits of e-procurement solutions, (Leipold, 2003)

	Government	Supplier	Public
Transparency	<ul style="list-style-type: none"> • Anti-corruption • Increased number of suppliers • Better integration and interaction between governments • Professional procurement monitoring/management • Higher quality of procurement decisions and statistics • Political return from the 	<ul style="list-style-type: none"> • Increased fairness/competition • Improved access to govt. market • Open the government market to new suppliers • Stimulation of SME participation • Improved access to public procurement information 	<ul style="list-style-type: none"> • Access to public procurement information • Monitor public expenditure information • Participation • Government accountability
Efficiency	<p><i>Costs</i></p> <ul style="list-style-type: none"> • Lower prices/transaction costs • Staff reduction • Reduction in fiscal 	<ul style="list-style-type: none"> • Lower transaction costs • Staff reduction • Improved cash flow 	<ul style="list-style-type: none"> • Redistribution of fiscal expenditure
	<p><i>Time</i></p> <ul style="list-style-type: none"> • Simplification/elimination of repetitive tasks • Communication anywhere/time 	<ul style="list-style-type: none"> • Simplification/elimination of repetitive tasks • Communication anywhere/time • Shorter procurement cycle 	<ul style="list-style-type: none"> • Communication anywhere/time

Another report prepared by Mahidin (2003) about the time saving in e-tendering system for construction projects in Malaysia stated that the actual manually based tender activities take about 73 days. However, for e-tendering system the participants took only about 30 days to complete one tender life cycle. Table 2.5 represents the report findings.

Table 2.5 Comparison between tender duration based on traditional process and tender duration based on e-tendering system, (Mahidin,2003) .

Tender document activity	Duration (traditional process)	Duration (e-tender system)
Tender document preparation	14 days	7 days
Invitation offer preparation	2 days	13.8 minute
Preparation of document tender	1 day	13.2 minutes
Duration of selling tender	21 days	21 days
Payment method	30 minutes	2 minutes
Tender analysis	21 days	1.5 minutes
Tender award	14 days	2 days
Total	73 days and 30 minutes	30 days and 30.5 minutes

2.2.6 Experience of other countries

Evidences about the benefits of adopting e-procurement solutions for government supplies of other countries are many. In this section some of these benefits are presented. For more information refer to (i) case studies of e-procurement implementation, department of finance and administration, Australian government information management office (2005); and (ii) action plan on electronic public procurement developed by RAMBOL management (2004).

- In Britain using the national education portal www.feonline.net, some 500 schools achieved price reductions of up to 100 million British Pounds per year and time reduction of about 90% in order processing, (Gehrmann/Schinzer, 2002)
- Introduction of the Government electronic Procurement System (GePS) , Korea is able to save some US\$ 2.7 billion of all government procurement (US\$ 17.1 billion) as compared to US\$ 26 million investment. Between 1998 and 2002, staff of the Public Procurement Service PPS was reduced from 1,058 to 935, while the total government procurement volume increased by some 30% (from US\$ 12.8 billion to US\$ 17.1 billion). Payments to suppliers are electronically transferred which usually takes no longer than 4 hours, (World Bank, 2003)

- Romania uses a government-wide e-Procurement system bringing together about 1,000 public agencies and 8,000 suppliers. During the first 4 months of 2003, more than 60,000 transactions were completed. According to the Ministry of Communications and Information Technology, the savings through this e-GP platform amount to some 22% (US\$ 35.5 million) of the volume of purchased goods and services (US\$ 161.4 million), (World Bank, 2003)
- During the first three years of the procurement portal [COMPRASNET](#), the Federal Government of Brazil spent about US\$ 7million on system development and maintenance. During the first two years of on-line reverse auction use, the Federal Government is estimated to have saved up to US\$ 1.5 million. While the normal procurement process takes more than two months, the on-line reverse auction may be completed in less than 15 working days. The use of on-line procurement has also increased the participation of small businesses in government supplies, (<http://www.egov4dev.org/brazeproc.htm>, 2002)

2.2.7 Methodologies to develop Information System (IS) solutions

Hoffer et al. (2003) stated that most organizations find useful to adopt a standard set of steps, called a System Development Life Cycle (SDLC), to develop and support their information systems. SDLC or (waterfall methodology in other references) encloses six steps, each one lead to the next as shown in Figure 2.2.

Ramirez et al. (2005) argued that this methodology is a very satisfactory process where requirements are well designed and not expected to change, for example automating a well proven manual systems. The weaknesses of this approach show with less well-defined problems. Invariably some of the uncertainties in the requirements will not be clarified until well into the analysis and design.

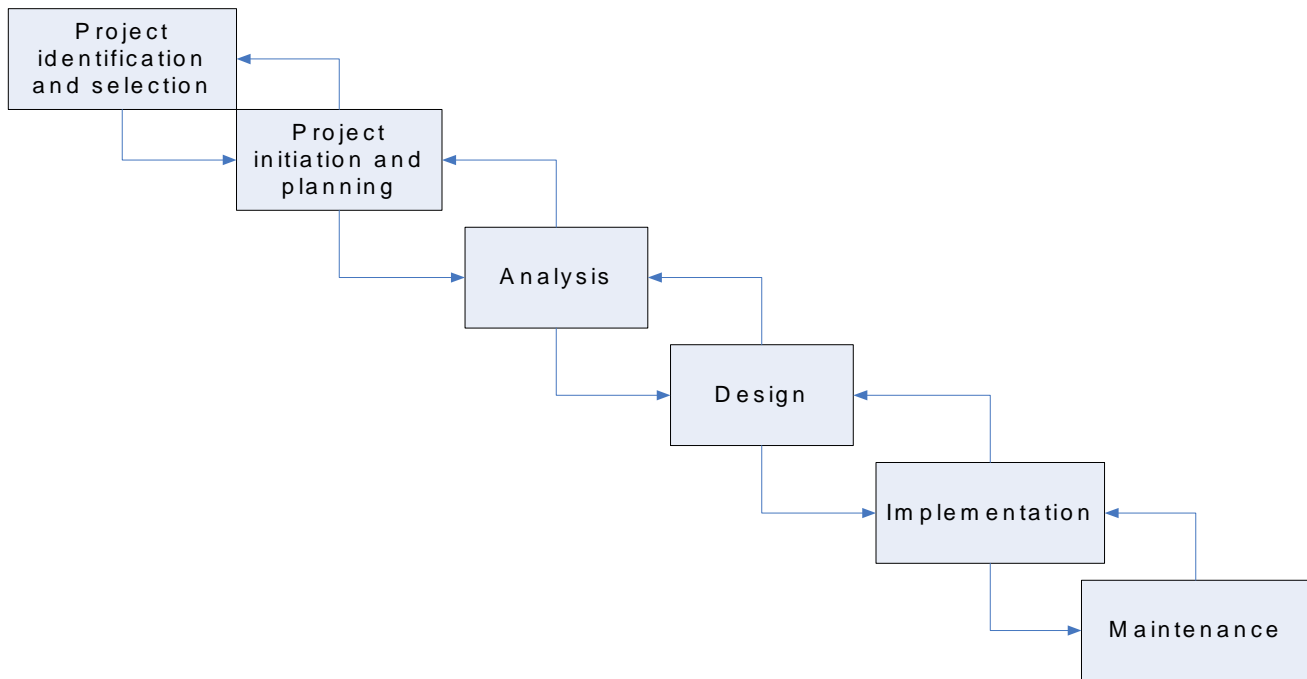


Figure 2.2 The System Development Life Cycle (SLDC), Hoffer et al. (2003)

Ramirez et al. (2005) stated that the waterfall process is still probably the dominant design process. However because of its limitations it is increasingly replaced by *iterative* processes, particularly for projects where the requirements are not well defined. In recent years, a new approach has been used, this approach uses a series of “mini-waterfalls” defining a few requirements, the most important first, taking them through analysis, design and build to get an early version of the product, with limited functionality related to the most important requirements. Feedback from this can then be used to refine the requirements, spot problems, etc. before more work is done. The process is then repeated for further requirements to construct a product with a step up in functionality. Again further feedback can be applied to the requirements. The process is repeated, until eventually all requirements have been implemented and the product is complete. It is this *iteration* that gives these processes their name.

Inter-American Development Bank (2002) mentioned that the greatest difficulty involved in implementing e-procurement procedures is to determine how to get started and what type of staged process should be followed. A team of experts from the Bank studied the

various experiments around the world and found a number of different approaches for setting such system. Accordingly, the Bank team developed what they called a road map based on the collected information, Figure 2.4 represents the road map. The road map covers four stages, namely:

- 1- Planning stage
- 2- Assembly stage for e-tendering procedures
- 3- Development stage for contract management
- 4- Assembly stage for e-purchasing procedures

This process was designed for two reasons:

- It facilitates institutional changes and the modernization of the civil service; and
- It starts from the simplest functions and progresses to the most complex along a cumulative development path.

This makes for a faster, less expensive, and institutionally sounder introduction of e-government procurement.

Summary:

As noticed, collaboration and integration in construction industry can be achieved by the utilization of internet and web based applications. This section introduced some of these applications; concepts of e-procurement and e-tendering were presented too.

For the purpose of this thesis, the analysis stage of the presented SLDC will be applied on the defined concept of e-tendering. Assessment of internet capacity among the construction stakeholders in Gaza; assessment of the legal and institutional framework regarding public procurement in Gaza; and identification of the tendering activities for public works will be performed as part of the preparation stage of the presented road map to develop government e-procurement system.

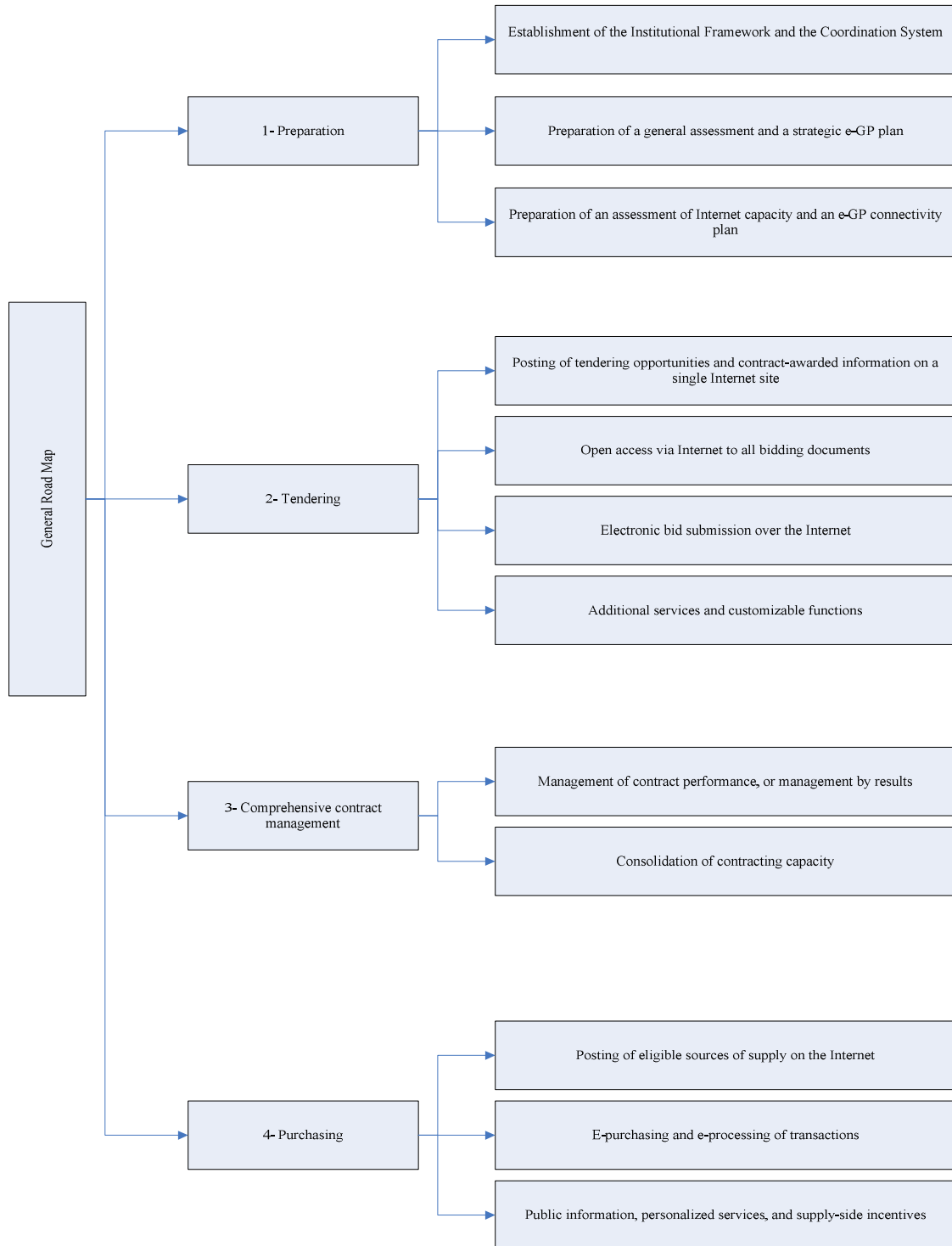


Figure 2.3 Road Map to develop government e-procurement system Inter-American Development Bank (2002)

2.2.8 Conceptual Modeling Methodologies

There are two major conceptual modeling methodologies in the construction IT application domain: The STEP methodology, and the UML methodology Leung, (2002).

- **The STEP Methodology**

STEP (STandard for the Exchange of Product Model Data) is an ISO programme involving researchers and industrialists in many countries in the development of an engineering product data exchange standard, which is documented as ISO 10303 Industrial Automation Systems – Product Data Representation and Exchange [ISO 1994], (cited by Liu et al. 2000). STEP methodology is based upon the concept of Application Protocol (AP). APs are formal documents covering a set of activities in a product life-cycle. Liu et al. (2000) mentioned that the process of developing an AP includes the following activities:

- Development of Application Activity Models (the scope): Application Activity Models are the scope statement of the domain of the planned AP domain. It describes the application context and functional requirements. APs described using IDEF0 diagrams (WB procurement procedures will be modeled utilizing this methodology)

- Development of Application Reference Models: Application Reference Models describe the information requirements and constraints for the specific AP. These models document the required data and relationships.

- Development of Application Interpreted Models: The Application Interpreted Models specify the interpretation of the Integrated Resources to satisfy the information requirements of the AP described by this model.

- **The UML Methodology**

Unified Modeling Language (UML) is a language for systems engineering (OMG, 2000). It is developed primarily from two of the most popular modeling formalisms for object-oriented modeling, OMT and Booch. It is chosen for this study because the language is rapidly being established as a de facto standard for object-oriented modeling, and has been adopted as an international standard within the OMG (Object Management Group) that develops the Common Object Request Broker Architecture.

In order to present this study in an understandable way to system analysts, activities were modeled using UML language, as this model is a front end to design e-tendering system

for public works. There are many CASE (Computer Aided Software Engineering) tools that support UML, among which is AgroUML that has been applied by this research. UML provides series of diagrams, such as use case diagram, class diagram, object diagram, sequence diagram, collaboration diagram, state chart diagram, activity diagram, component diagram, deployment diagram, and package diagram (McKinney, 2002). The conceptual model in this study includes mainly the following diagrams:

- Use Case diagram, which describes the functionality provided by a system to external integrators.
- Activity diagram that describes the behavior in response to internal processing.
- Collaboration diagram that describes the flow of messages, focusing upon the relationships between the objects in some stages of the procurement activities.

As stated in the introduction, the diagrams in this chapter were presented to help in describing the system not designing it. In order to design the system, the system analyst should review the presented diagrams and build upon it.

There are two UML approaches of conceptual modeling: the use case driven approach and the class driven approach. The use case driven approach describes the system from the external user's point of view and is most suitable for domain knowledge analysis. The class driven approach describes the system from the system designer's point of view and is for technical development at a later stage (Schneider, and Winters, 2001) cited by Leung, (2002). This study applied the use case driven approach, since conceptual modeling is at an early stage of the development cycle.

Chapter 3

Public procurement in the West Bank and Gaza

3.1 Introduction

Assessment of current legal, institutional, and procedural arrangements regarding public procurement in Palestine is an important step towards creating sound e-procurement system. This chapter aims to highlight the current practices in the mentioned issues. Recommendations to improve the current situation will be presented in the last chapter.

WB, (2004) reported that the Palestinian National Authority (PNA) spends about 10 percent of GDP on public works, goods and services. This estimated percentage could be translated into an annual procurement volume of US\$320 million including donor-financed procurement. The approximate annual value of public procurement of goods is US\$70 million, and US\$250 million for works and consultant services (consultant services constitute only 3 percent of this figure). PNA procures about 50 percent of goods under donor- financed projects, and the other 50 percent from its own budget. Some 85 percent of works and consulting services is donor financed. About 95 percent of public procurement follows competitive bidding procedures, including shopping and National Competitive Bidding (NCB). In a few cases direct contracting is used, (West Bank and Gaza Country Procurement Assessment Report, 2004). Given these facts, officials as well as citizens have a key interest in improving the quality of the public procurement system.

3.2 Legal framework

The legal framework governing public procurement in the West Bank and Gaza (WB&G) consists of the following laws and regulations:

- a) Law No. 9 of 1998 on General Supplies
- b) Law No. 6 of 1999 on Procurement of Public Works
- c) Law No. 3 of 2000 on Arbitration
- d) Regulation No. 1 of 1999 issued by the Minister of Finance on General Supplies

- e) Regulation No. 1 of 1998 issued by the Ministry of Local Government concerning Procurement and Execution of Public Works in Local Government pursuant to Law No. 1 of 1997
- f) Financial Regulation issued under Law No. 10 of 1965 on Contracting, Tendering and Purchasing by Municipal Councils (applicable in Gaza Municipalities)
- g) Financial Regulations issued under Law No. 3 of 1967 on Contracting, Tendering and Purchasing by Rural Councils (applicable in Gaza Municipalities).

Law No. 6 of 1999 on procurement of public works (Works Law) states that the Ministry of Housing and Public Works (MHPW) is the coordinating authority for the procurement and supervision of public works for all other Ministries. The Works Law provides for three levels of tendering committees (Arts. 6 to 9):

- (i) Central tenders committee for government buildings, water, irrigation, sewage, dams, roads, transportation and mining, and electro mechanics and telecommunications;
- (ii) Department Tenders Committees for works values up to US\$150,000 and engineering supervision services up to US\$7,000; and
- (iii) Governorate Tenders Committees for works values up to US\$25,000.

At present, these separate committees are not yet operational, and a single Central Tenders Committee currently conducts all tenders, which relate only to the MHPW. It is supported by a Central Tenders Department (CTD), called for in Articles 2 and 3 of the Works Law and assigned responsibility for:

- 1- Examining and analyzing works and technical services tenders, and saving and analyzing all information related to tenders;
- 2- Adopting unified conditions for contracting and tendering procedure and developing such conditions and procedures in consistence with effective laws and regulations;
- 3- Issuing periodical bulletins on the building construction sector, and on prices of building materials and works clauses and items; and
- 4- Provide secretariat services to the relevant Central Tenders Committee.

Other Ministries and Departments are in charge of conducting procurement tenders for supplies, works and engineering services up to the approved thresholds. The Ministry of Education has a technical department that procures construction of schools and sector-specific supplies, and the same is true for the Ministry of Health. The Palestinian Water Authority also carries out its own procurement for water sector-specific works, goods and services.

3.3 Institutional framework

CTC offices located at the MHPW building at Gaza city. The field study shows that CTC staffed by 8 qualified employees. The staff is equipped by two computers, two printers, photocopier, CD writer, and fax machine, CTC doesn't allocate any budget for the hardware renewal. The operating system of the computers is MS- Windows XP. The software in use by the department's staff is MS-Excel and MS- Word for general administration purposes. Software regarding design, cost estimating, finance and project planning are not installed.

The department neither has a web site home page, nor connected to the Internet. CTC employees believe that lack of management support, lack of available funding, and the difficulties in proving that the benefits of IT is greater than the associated cost are the main reasons restricting the use of e-mail within the organization. They agree that IT will improve project control, communication, and procurement functions within the next five years.

Due to the shortage of employees, lack of equipment, and poor management support, the main duties of CTC staff are limited to cover the following areas:

- 1- Classification of contractors;
- 2- Help the procurement units of other ministries by participating in the opening and evaluation committees; and
- 3- Perform some studies regarding the local procurement law, procedures, and bidding documents.

Figure 3.1 shows the organization chart of the CTC department. Main positions are presented in this organization chart.

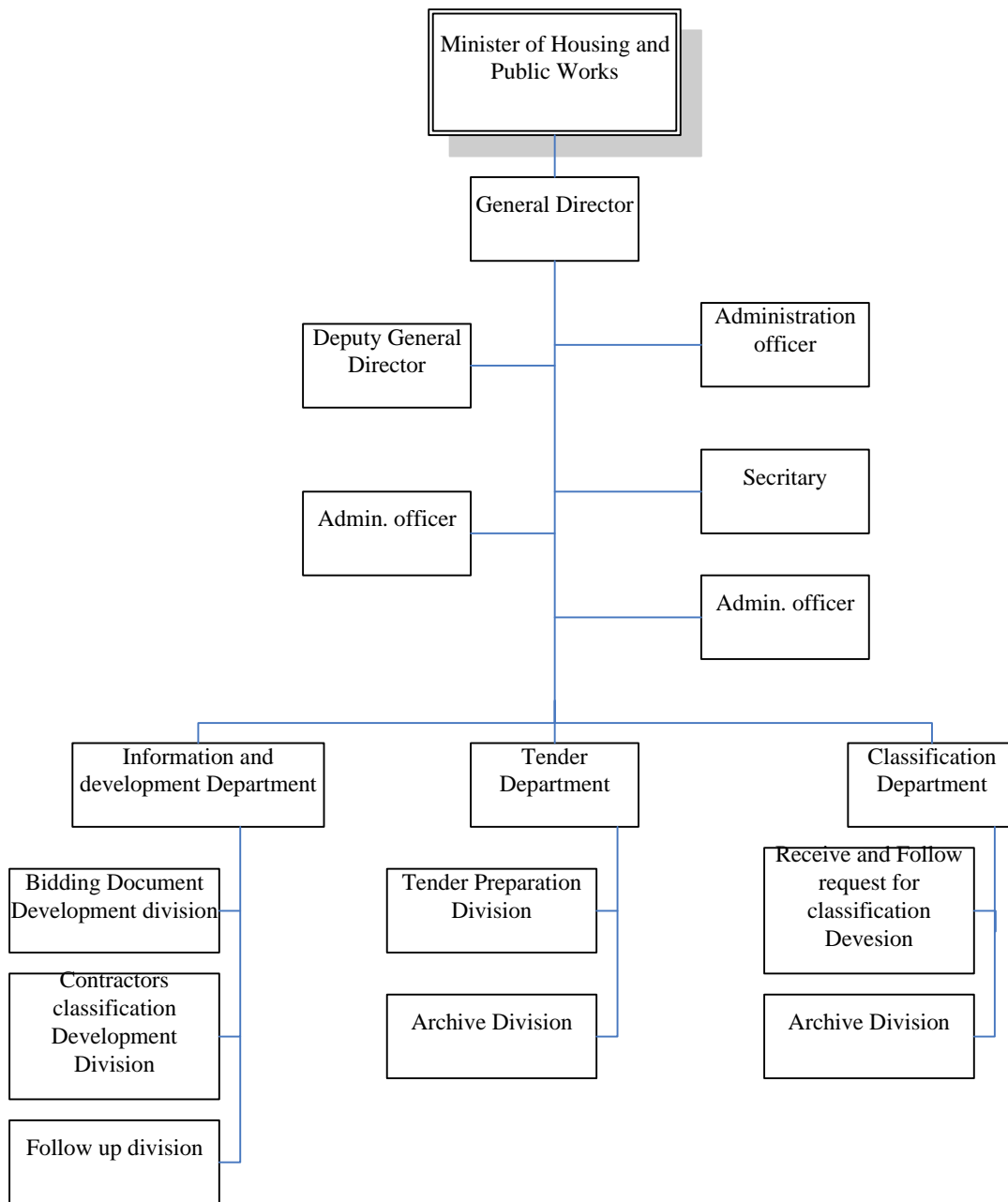


Figure 3.1 Organization chart for CTC, (Central tendering department, 2004)

3.4 Current procurement procedures

Procurement process encloses numerous interrelated activities performed by different parties with high level of information transaction between them. Developing e-procurement system requires comprehensive understanding for the activities, their relationship, and the role of parties involved in these activities. In Gaza Strip, procurement units use different bidding documents depending on the donor financing the project. In most cases, they use WB-standard bidding documents (SBDs) for WB-financed projects, with modifications for other donor-financed projects. But some PNA institutions use bidding documents that they have created themselves. For example, PEC DAR has prepared its own bidding documents for NCB which mainly follow WB standard bidding document, and MHPW has just prepared a draft bidding document for the procurement of works, based mainly on the Jordanian national SBD for works. The multiplicity of bidding documents creates additional work and complications during tender and bid preparation. The questionnaire survey shows that the World Bank procurement procedures for consultant's hiring and contractor's employment are highly adopted, since applying these procedures is a precondition for Bank aided projects due to the absence of local procedures. On the other hand, WB procurement procedures are internationally recognized and accepted. Accordingly, this research will outline these procedures and use it for proposing the e-tendering system.

WB procurement procedures were published in several textbooks, this research referred to the red book for contractors' employment (Guidelines Procurement under IBRD Loans and IDA Credits, 1995 and revised 1999) and the green one of consultants' selection (Guidelines Selection and Employment of Consultants by World Bank Borrowers 1997 and revised 2002). The WB guidelines identify several procurement routes such as: competition, direct contracting, force account, and others (presented in Annex B).

This section of the chapter aims to high light the different activities that take place between the parties to complete one procurement cycle based on the competition method of procurement (other methods are not part of the proposed e-tendering system). The relationship between the activities and the relationship between each activity and its outer

environment will be presented. In order to capture these activities, the procedures in the two mentioned books were modeled using IDEF0 technique of modeling.

IDEF0 activity modeling is a technique for analyzing whole systems as a set of interrelated activities. The technique combines a graphical notation (boxes and arrows) with a text to improve the quality of the completed model. IDEF0 allows the hierarchal decomposing of activities down to the required level of detail (Computer association international, 2004). Figure 3.2 represents the basic concepts of the IDEF0 technique.

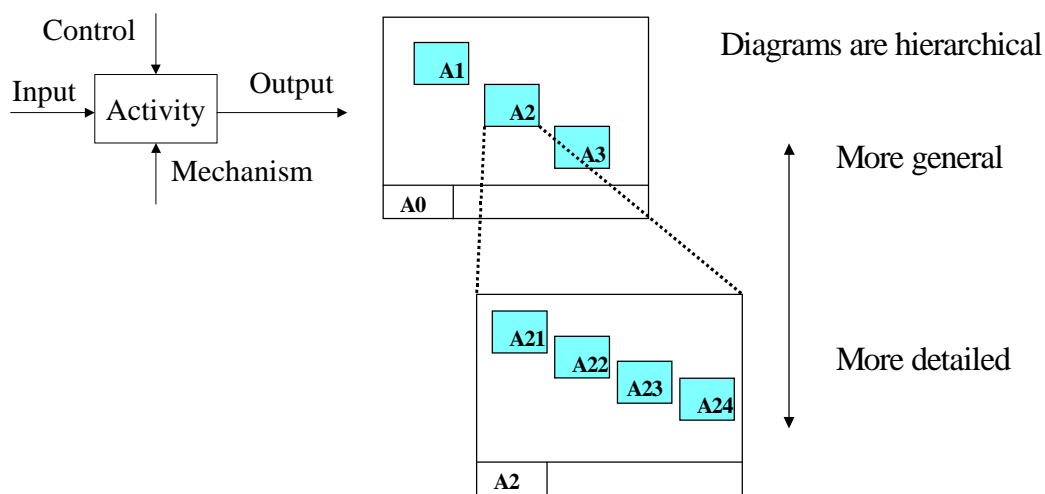


Figure 3.2. The basic concepts of the IDEF0 method. (Karhu 2000).

The main elements of this method are the activity and the flow. The flow will be in the form of input, output, control and mechanism (ICOM). The different forms of flow can be described as follows:

- An input represents something, which in an activity is consumed to produce an output. Typical inputs could be raw materials, energy, human labour, and information.
- Outputs can be reused as inputs to further activities, feedback loops from the outputs are possible too.
- Activities are controlled by controls. Typical examples for controls or constraints can be laws, guidelines and instructions for carrying out an activity.

- Mechanisms, which point at activities from below, are persons, organisations, machines, software, etc. that carry out the activities.

By using this methodology, about 120 tendering activities were modeled, the model is shown in Annex B. The model distinguishes between the following two types of procedures that take place in the competition method of procurement:

- 1- Some procedures calls for pre-qualification for bidders (restricted procedures): Following this procedure, the client issues a contract notice for advertising the contract. Any bidder may express interest to participate by submitting an appropriate request for participation to the client. The client may restrict the number of bidders that will be invited to tender. In this case, the client must state the criteria for short-listing in the contract notice. Subsequently, only candidates who are short-listed are invited to submit proposals. Figure 3.3 represents the restricted procedures for consultant selection based on the WB guidelines.
- 2- Open procedures: this procedure allows any interested bidder to submit a tender in response to a call for tender. Following this procedure, the bidder doesn't need an invitation letter to submit proposal. Prequalification stage is not required in this type of procedures. Figure 3.4 represents the open procedures for bidder selection based on the WB guidelines.

Description of the WB procurement procedures identifies several potential areas that can be computerized. In addition to that, article 6 of the Palestinian works law nominates the Palestinian Central Tendering Committee (CTC) as the government tool for procurement of infrastructure works and government buildings. In order to take its role, CTC should take part of the client's duties during the procurement process. At the same time, the client should be aware of the progress of the procurement process. So, this section will briefly (i) address the areas that can be automated in the competition method of procurement transaction; and (ii) identify the roles of CTC, client, and bidder.

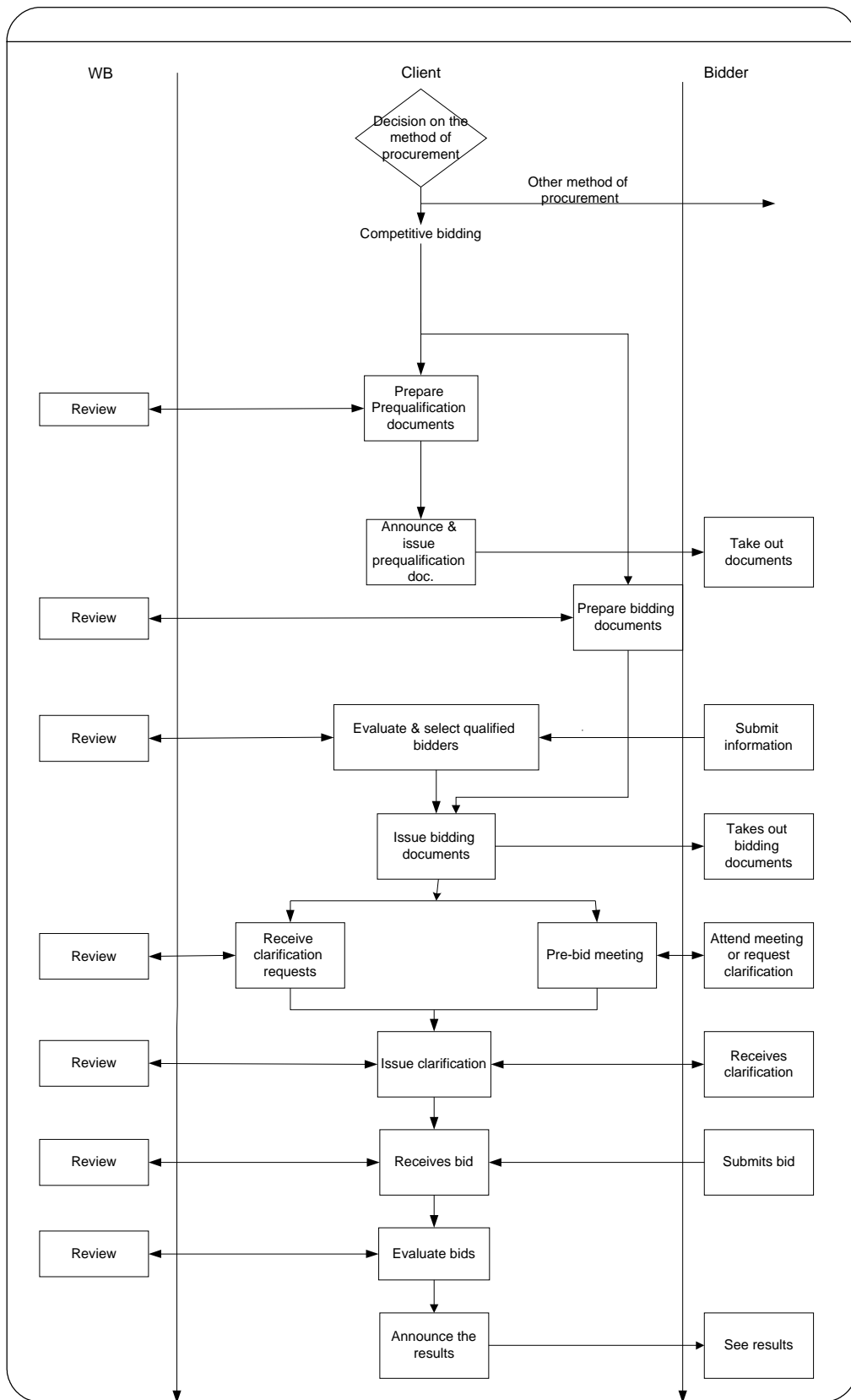


Figure 3.3 Restricted procurement procedures

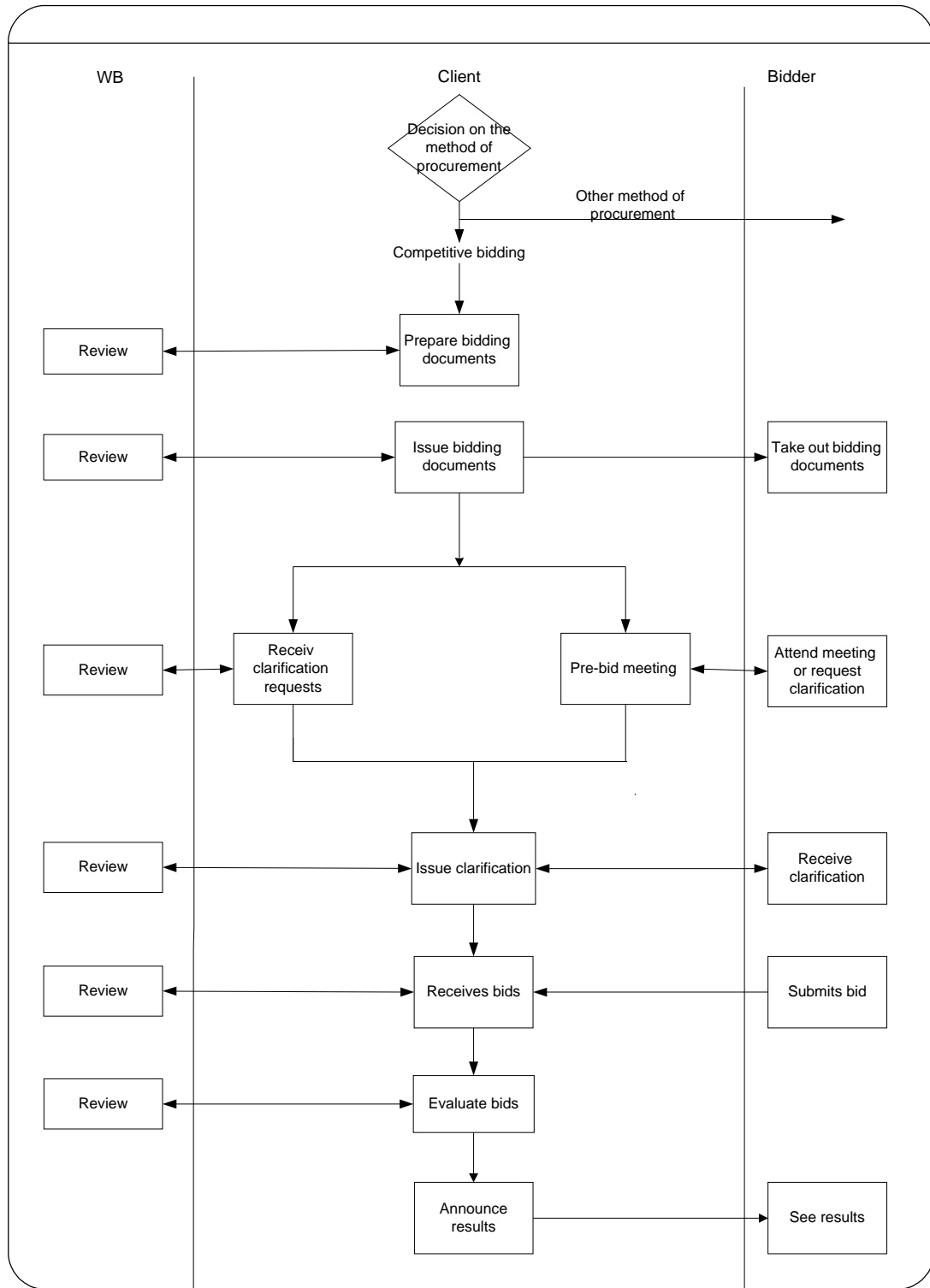


Figure 3.4 Open procurement procedures

Areas to be automated

Communications between parties in the procurement process are numerous. All activities related to the communications between parties are potential to be web-based activities, such as: advertisements, distribution of prequalification documents, distribution of bidding documents, receive proposals, payments, meetings, and evaluation. Chapter 4 will assess the acceptance and capabilities among Palestinian contractors to employ such system.

Role of parties

As mentioned previously CTC should take part of the process, so the role of parties should be re-engineered. In the proposed system, CTC will be the core of the system to which the bidders can bid. Figure 3.5 represents the role of parties and the areas to be automated in the proposed system. In figure 3.5, some activities are to be fully controlled by the CTC such as: advertisement and tendering, other activities are to be partially controlled by the CTC such as: evaluation and preparation of bidding documents.

3.5 IT in the West Bank and Gaza Strip (WB&G)

This section aims to highlight some issues regarding IT in general in Gaza Strip and the West Bank, as part of this assessment. The Palestine IT Association of Companies (PITA) statistics indicated that more than 1500 people are working in the private IT companies with an estimated turnover for the year 1999-2000 of 120 million US\$ and 20-30% of which is software (these statistics doesn't include the telecom sector).

The IT related activities and services companies started in the WB&G in the early to mid 1980s. At that time, there were a handful of companies responding to mainly the demand for selling computers and electronics. At the beginning of the 1990s, a notable sum of serious IT activities and private companies were present in the area. The demand for IT services arose from the private sector, universities, and the local governments. Hardware companies were just sub-agents to the Israeli dealers with limited experience in services. The handful of software companies focused on accounting related packages to serve the local market.

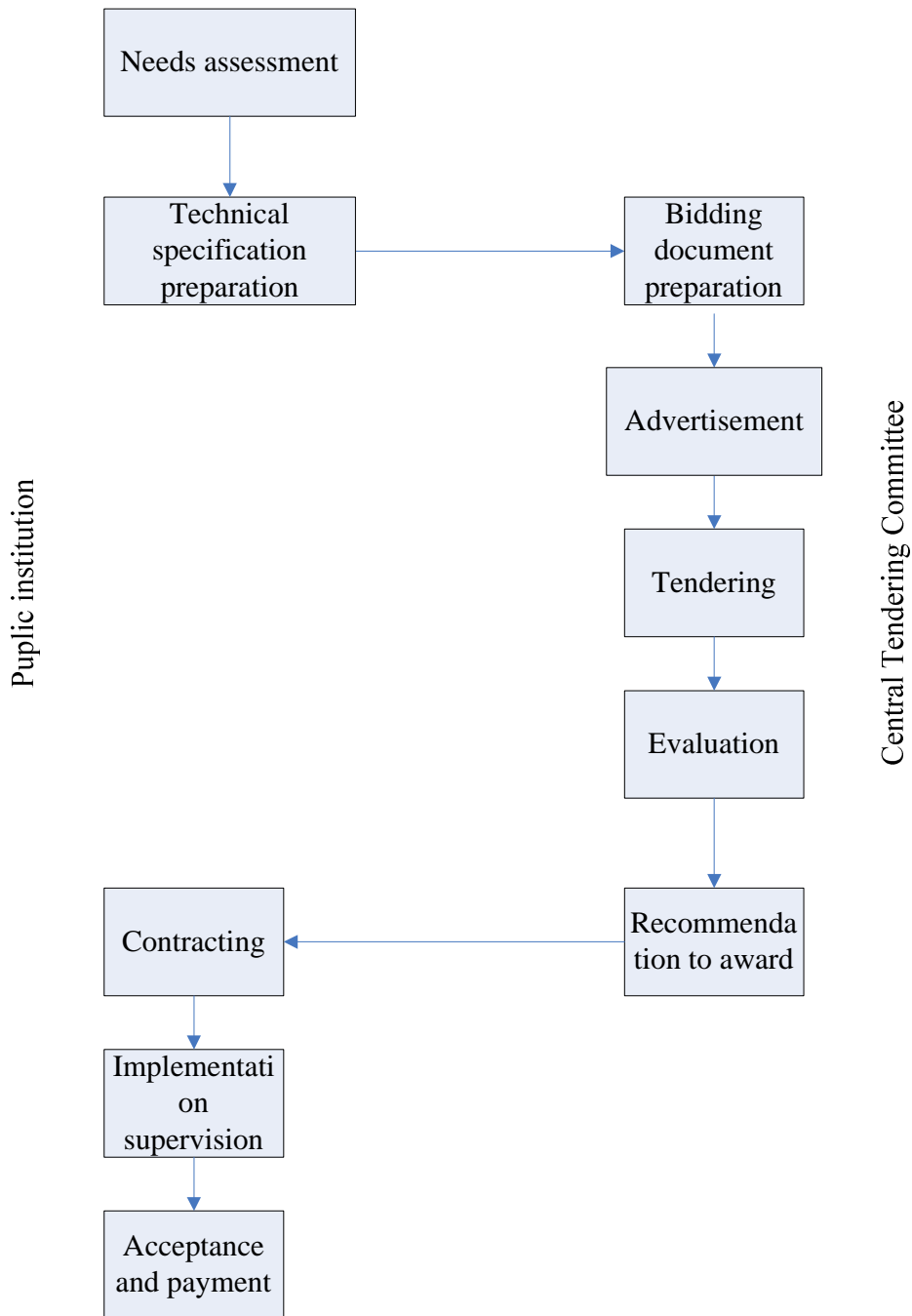


Figure 3.5 Role of parties in the proposed system

Due to the Israeli occupation controlling the telecommunication sector and banning the services of leased line, fax, satellite links, telephone, etc., it wasn't until 1995 that the real spread of IT activities started to take place.

The first Palestinian ISP was established and Internet became commercially accessible to individuals, companies and universities and responding to the establishment of the Palestinian National Authority (the largest IT client in the 1990s) and to the coming of many NGOs, banks and establishment of new companies, the IT sector started to shape and materialized after the 1995.

By 1997, the Palestinian telecom sector was 100% privatized with the establishment of PALTEL, the Palestinian Telecommunication Company. With its complete digital network connecting West Bank & Gaza, Paltel offers a wide range of services that the private sector benefit from, like normal fixed telephone line, leased lines, ISDN connection and much more.

By the end of the year 2000, it is estimated that more than 60 IT companies and more than 100 small computer stores established in the West Bank and Gaza.

Most of IT companies are located in Ramallah, Jerusalem, and Gaza These companies deal with different types of IT sectors like hardware, software, internet services, office automation equipment, etc. In addition to the local companies, many international firms have already opened direct office, or established direct R&D operations in Palestine such as HP, IDS, Timex, and Siemens.

After the current Intifada (2000) some local Palestinian software companies shifted towards software export and outsourcing, some companies already have outsourcing and developing projects for regional and international companies.

Hardware components are usually imported directly from international vendors by local firms, some of these firms cover regional markets.

Several laws and regulations were developed to regulate the IT business in Palestine like the Telecom law, and the Investment Promotion Law. It is important to point out that the investment promotion terms are very competitive in Palestine that allow new companies for example to benefit from a 0% income tax for 3-13 years depending on the investment, which attract new investments in this field.

Chapter 4

Survey of IT in construction industry in Gaza Strip

4.1 Introduction

Legal and institutional public procurement environment in Gaza was reviewed in the previous chapter. Procurement procedures were also demonstrated and the activities to complete procurement operation were described too. In addition to that, the roles of CTC and clients in the proposed e- procurement process were presented. Needless to say that the capacity of construction organizations to adopt IS solutions depends a lot on their readiness and level of utilization of IT on their daily operations.

Several surveys conducted in the past few years to determine the impact of information technology at the construction industry in various countries. Such surveys were conducted in New Zealand (Doherty, 1997); Sweden, Denmark and Finland (Howard et al. 1998); Hong Kong (Futcher et al. 1999); and Saudi Arabia (O'Brien et al. 1999).

In Gaza Strip no work has been done (on a significant scale) to investigate IT applications in the construction industry. Some fundamental issues related to the full extent of IT applications in this industry have yet to be fully addressed, such as the types and sizes of construction organizations that use IT, the type of information technology used and its functions, the extent of utilizing internet and web-sites in project collaboration and document sharing among members of the organization and between organizations, the impact of internet on the organizations daily operations, and the future prospects for information technology in the construction industry in Gaza Strip.

This chapter presents the survey findings concerning IT utilization in Gaza Strip. The survey aims to explore the following areas:

- 1- Appraise IT capacity among construction stockholders in Gaza Strip; and
- 2- Assess the level of acceptance to automate the requirements that were captured at chapter three.

In order to achieve the stated aims, a questionnaire was designed. Ideas on the type of questions to be asked and the associated methods were generated and developed, based on the questionnaires presented in international journals. A draft version of the survey questionnaire was generated and distributed (via e-mail) to well known

contractors, consultants, high level educational professionals, and IT private firms. The draft was distributed in order to examine the questionnaire validity based on the identified objectives. After comments and amendments, a final version of the questionnaire was produced.

4.2 Questionnaire Design

The first section of the questionnaire sought to identify the organization's size and character in terms of the number of completed projects, annual turn over, type of business, number of personnel, and the contractors' classification. The questionnaire then asked for the types and software names in use in the organization and the most significant factors in selecting this software. The next questions related to the hardware in use by the organization. The fourth section sought to identify the Internet and communication technology applied by the organization and the ability to implement e-procurement concept by the organizations. The last two groups of questions were about the factors restricting the use of IT and the prospects of IT implementation in Gaza. A cover letter (in Arabic and English) was attached to the front page of the survey questionnaire for each organization in order to spot the objectives of the survey and to identify the meaning of IT in this research.

4.3 Questionnaire analysis

4.3.1 Part I

- **Respondent's Profiles**

As stated previously, tendering process involves public clients and bidders (consultants, contractors). The survey community was chosen to cover the above-mentioned groups. In order to identify the number and type of the contractors group, a visit was made to the Union of the Palestinian Contractors in Gaza, the visit showed that 214 contractors were registered (at the time of preparing this thesis) to the union with different classifications, accordingly, about 25% of the registered contractors were randomly selected to be surveyed . The total number of the survey community was about 75 organizations among them, 9 were clients, 13 were consultants, and 53 were contractors. Table 4.1 shows the organization's profile

Table 4.1 Organization's profile

	Total distributed	Total replies	Percentage from the total replies
Contractors	53	40	66%
Consultants	13	13	21%
Owners	9	8	13%
Total	75	61	

The surveyed clients included technical directorates of Ministry of Local Affairs, Ministry of Education, Ministry of Housing and Public Works, Ministry of Waqf, Palestinian Water Authority, Palestinian Industrial Estates and Free Zones Authority, Municipality of Gaza, Municipality of Rafah, and PICDAR.

- **Characteristics of the respondents**

29% of the respondents are project managers, 19% are directors, and 52% are site management staff. 46% of the respondents have 2 to 10 years of construction-related working experience, 54% have been working for more than 10 years. These findings reveal that the respondents are construction domain experts. They have sufficient working experience and construction related knowledge to understand the usefulness of IT as a tool for their work.

- **Characteristics of the construction firms**

The number of employees, annual turn over for the last three years, classification of the contracting firms, and the type of business were chosen as factors to identify the characteristics of the contracting firms under discussion.

The number of employees in the contracting firms depends on the availability of jobs. In general, 23 firms stated that they hired an average of 1-10 employees, 12 firms have 11-20 employees, while 4 firms stated that they have an average of 21-30 employees, and only 1 firm has more than 30 employees. Figure 4.2 represents these findings. In general more than 50% of contracting firms in Gaza hired less than 10 employees.

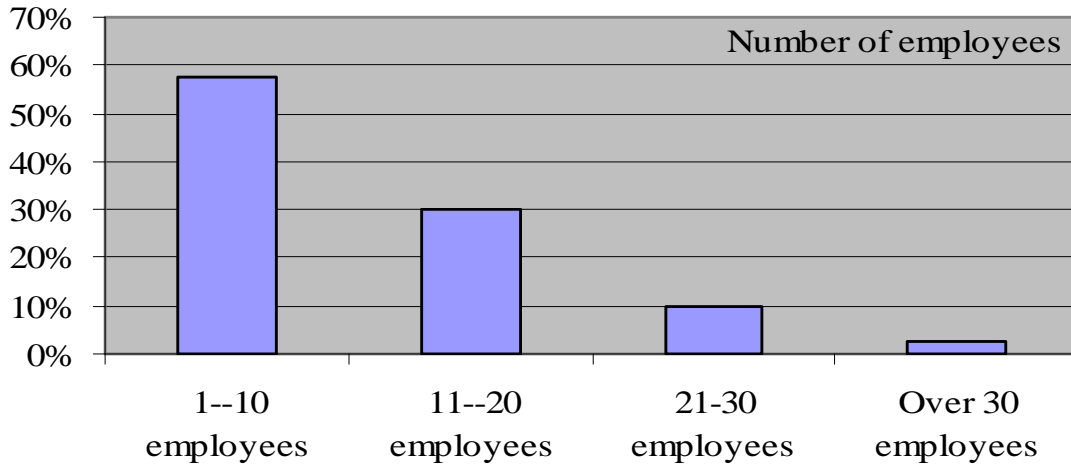


Figure 4.2 Numbers of employees in the sampled

Political situation in the last few years affected the construction business in Gaza; most of the construction companies stated that, their annual turn over is less than one million. Figure 4.3 represents the annual turn over for the companies that were investigated.

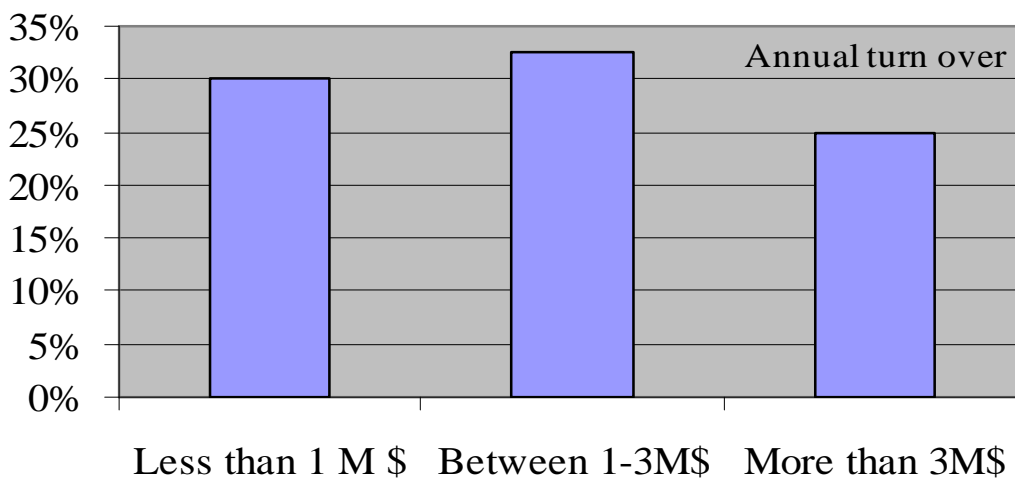


Figure 4.3 Annual turn over of the sampled construction firms

Construction companies in Gaza classified as classes A, B, and C. Figure 4.4 shows the classification of companies that were under investigation.

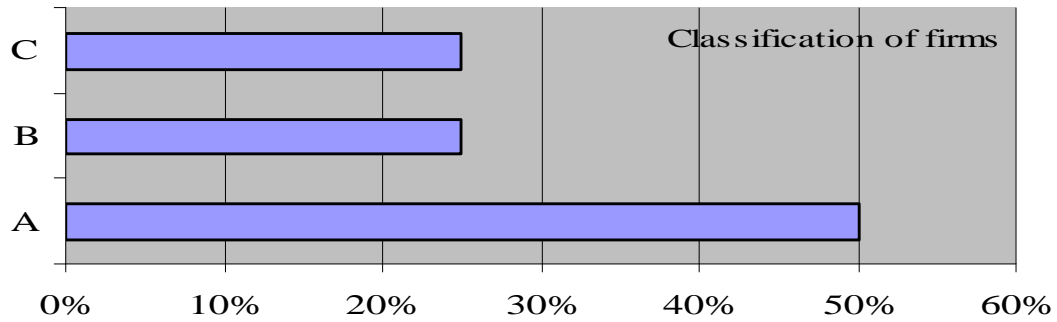


Figure 4.4 Classification of the sampled contractors

4.3.2 Part 2

Software selection and use

This section aims to identify the software used by construction stakeholders in Gaza. To facilitate our investigation, software was itemized into several packages; each package-enclosed a number of software dedicated to serve one area in the construction works.

- **Software for Project planning, estimating, and accounting**

Table 4.2 represents the number and percentage of consultants, contractors, and clients who use software for planning, accounting, and cost estimating in their jobs. Trade names of famous software in Gaza were suggested, in addition to that, participants have the choice to select and identify others if they have.

Table 4.2 Types of software for planning, estimating, and accounting

Software in use	Consultants		Contractors		Owners	
	Respondent	Percentage	Respondent	Percentage	Respondent	Percentage
MS Project	13	100%	34	85%	7	88%
MS Excel	13	100%	39	98%	8	100%
Primavera	3	23%	3	7%	2	25%
Power point	8	61%	3	7%	6	75%
Accounting	5	38%	21	53%	4	50%

The survey results show that 100% of the consultants, 85% of the contractors, and 88% of the clients use MS project as a planning tool. 100% of the consultants, 98% of the contractors, and 100% of the clients use MS Excel. Less than 30% of the respondents use primavera. Power point mostly used by owners (75%) and consultants about 61%, while contractors rarely use this software (7%). About 50% of the contractors and owners use accounting software, only 38% of the consultants use accounting software. The results above show that the consultants are using these packages of software more than others due to the types of duties they are involved in. most of the respondents mentioned that they use local software for accounting purposes such as Al-Assel and Alsheree. One of the consultants mentioned that he uses Quicken application for his accounting purposes.

- **Software for general administration**

This package intends to identify the software used for administration purposes. Table 4.3 shows the percentage of companies using this software.

Table 4.3 Software used for general administration

Software in use	Consultants		Contractors		Owners	
	Respondent	Percentage	Respondent	Percentage	Respondent	Percentage
MS Word	13	100%	40	100%	8	100%
MS Excel	13	100%	39	98%	8	100%
MS Access	4	30%	2	5%	4	50%
Personal system	0	0%	0	0%	1	13%

The survey results show that MS word and Excel are the most popular software for general administration purposes. 50% of the owners use MS Access as a data base for their administration programs. Only 13% of the owners adopt personal systems in their daily works. Most of the respondents from contracting and consulting firms mentioned that the numbers of employees they employ don't need such software. One

of the consultants stated that he uses Lotus notes, Visio, and Front page software for general administration purposes.

- **Software for design purposes**

Software for designing purposes is the third package. As noticed in Table 4.4, Auto cad seems to be the most usable software by the three categories (consultants, contractors, and owners). The consultants depend on software in their jobs more than owners and contractors. Software for structure design and water systems one used more than others. In general, most of the software used for structure purposes are PROKON, and STRAP. The consultants used to outsource the surveying and air conditioning works, so software regarding these two items is seldom found.

Table 4.4 Software for design works

Software in use	Consultants		Contractors		Owners	
	Respondent	Percentage	Respondent	Percentage	Respondent	Percentage
Auto Cad	13	100%	40	100%	7	88%
Micro station	0	0%	1	3%	0	0%
Graphics	6	46%	3	8%	1	13%
Air Conditioning	2	15%	0	0%	0	0%
Water system	7	54%	2	5%	3	38%
Sewer System	4	31%	1	3%	3	38%
Structures	12	92%	6	15%	3	38%

- **Operating systems**

This question was added after the validation of this questionnaire by one of the IT vendors in Gaza. It aims to find answers for the question whether construction participants in Gaza update there operating systems or not? As noticed from Table 4.5, most of the participants use MS Windows XP. That means the participants follow the technology and update their operating systems.

Table 4.5 Operating systems

Software in use	Consultants		Contractors		Owners	
	Respondent	Percentage	Respondent	Percentage	Respondent	Percentage
MS Windows 95	0	0%	1	3%	1	13%
MS Windows 98	3	23%	8	20%	2	25%
MS Windows XP	13	100%	34	85%	7	88%
MS Window 2000	6	46%	12	30%	5	63%

• **Factors considered in selecting computer software**

This is the last question in this group. It aims to identify the factors considered in selecting the software. As noticed in Figure 4.5, the most important factors that owners select were user friendly, integration, flexibility, and cost factors respectively. Consultants chose user friendliness, cost, flexibility, integration, and past experience as the most important factors. Contractors select the past experience, cost, user friendliness, flexibility, and integration sequentially as the most important factors. In general, user friendliness and past experience with the software seems to be the most important factors in selecting any product.

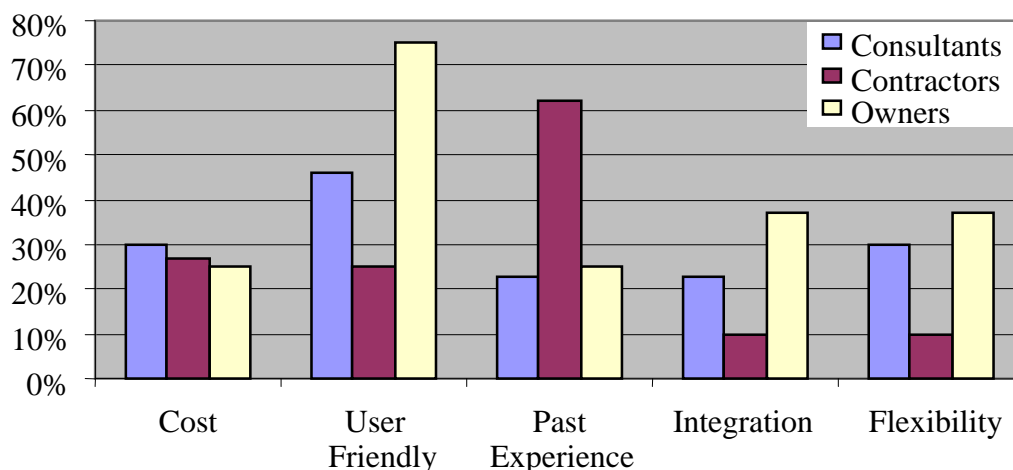


Figure 4.5 Factors considered in selecting software

As a result, this part of the questionnaire concluded the following:

- The percentage of consulting firms depend on software are more than others.
- Construction industry is a good market for local software.

- Construction participants are familiar with the technology and they use to update the operating systems of their computers.
- User frienliness and past experience are the most important factors in selecting a software.

4.3.3 Part 3

Hardware selection and use

This section aims to identify the hardware adopted by construction participants in Gaza in terms of type of hardware and the allocated budget for renewal if any. Figure 4.6 represents the type of hardware and the percentage of usage by each category. It is clear that almost all participants of all categories own fax machines. Almost all participants own CD writers and photocopier. 45% of consultants own plotters, participants are rarely own Video conference equipments. This section is important because developing any information system should take into consideration the availability of hardware i.e. e-meetings depend on the availability of videoconference equipments.

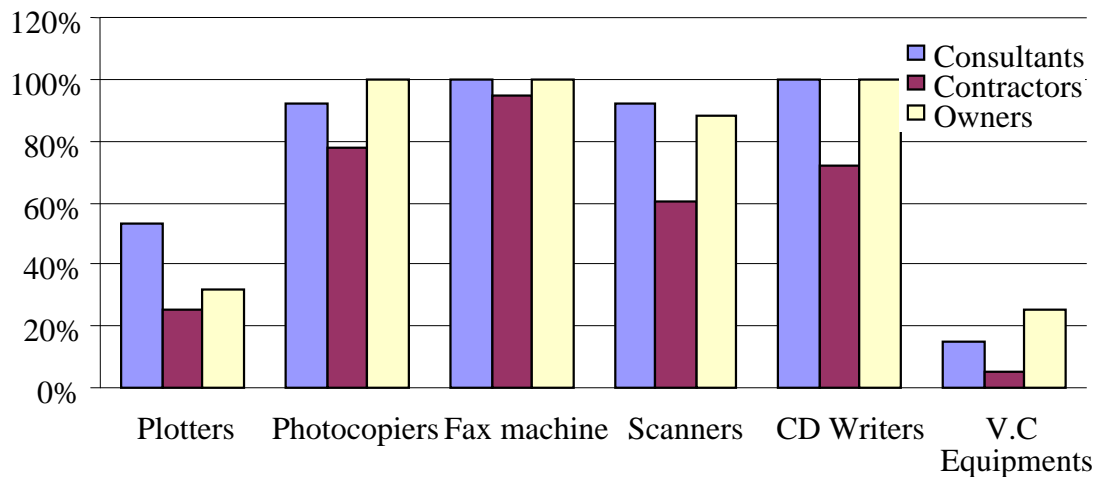


Figure 4.6 Hardware selection and use by construction industry participants in Gaza

In general, clients own hardware equipments more than consultants and contractors.

Budget for hardware renewal

This section aims to identify the allocated budget for hardware renewal by construction organizations in Gaza. Figure 4.7 shows that 70% of the consultants Allocate an annual budget for this purpose with an average amount of \$ 3,900. 37% of the contractors allocate an average annual amount of \$ 3,600 for this purpose. 62% of the owners allocate an average amount of \$ 9,800/year for hardware renewal.

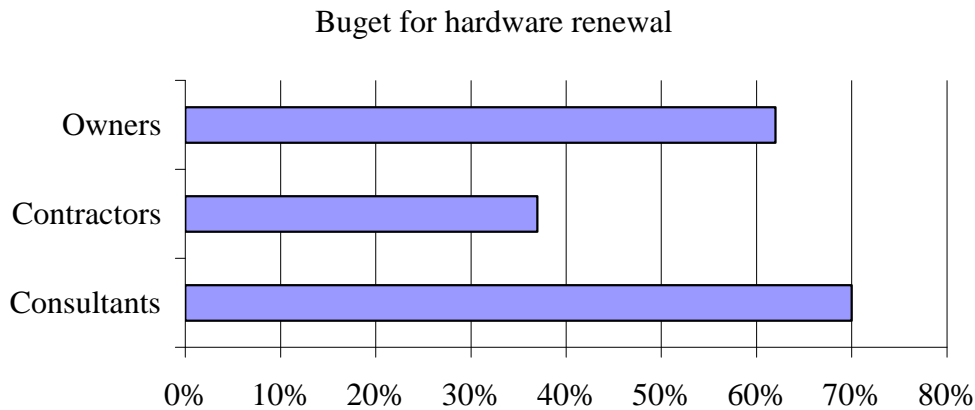


Figure 4.7 Percentages of construction organizations that allocate budget for hardware renewal

4.3.4 Part 4

Internet and communication technology applied by the sampled:

This section of the questionnaire is directly connected to this research. The purpose of this section is to investigate aspects related to the usage of Internet and web by the construction community in Gaza. This section will cover the following areas:

- **Availability of the organization's web site.**

Figure 4.8 represents the research findings regarding this issue. About 75% of the investigated owners' answers confirmed that they have a web site for their organizations (it is understood that the owners' web sites belong to the institution and not dedicated for the technical directorate in the institution). 53% of the consultants have a web site for their organizations. 25% of the investigated contractors mentioned that they have web sites.

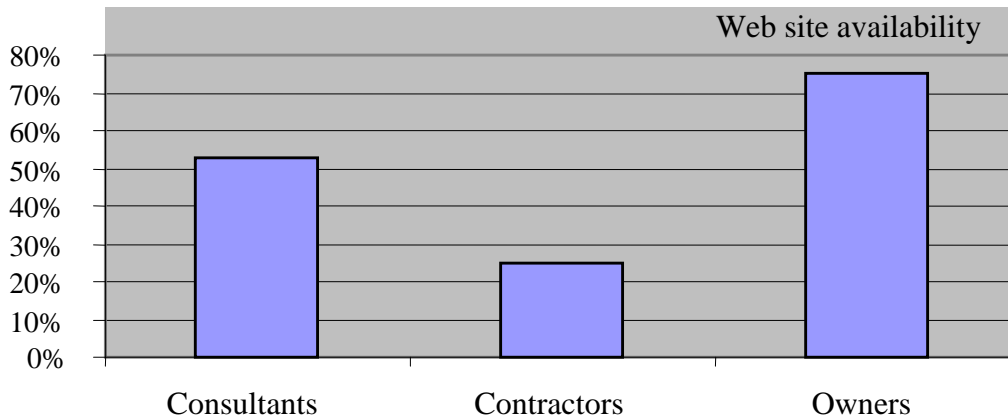


Figure 4.8 Availability of organizations web sites

- **Purpose of having a home page at the web**

This was the second question within this group of questions. Table 4.6 shows the responses to this question. Using web pages for information regarding the organization and projects is the highest among the three categories. Only 10% of the contractors who have a web site are using it for marketing.

Table 4.6 Purposes of having a homepage at the web

Purpose of having a homepage at the web	Consultants	Contractors	Owners
	General organization information	46%	15%
Projects information	53%	15%	50%
Personal recruitment	7%	7.50%	37%
Material purchasing/ marketing	7%	10%	5%
Public feedback	15%	7.50%	25%

- **Availability of Local Area Network (LAN)**

This feature is important for electronic document sharing. 100% of the owners surveyed have a LAN. 84% of consultants have such facility. While only 27% of the contractors have it. Figure 4.9 represents these results.

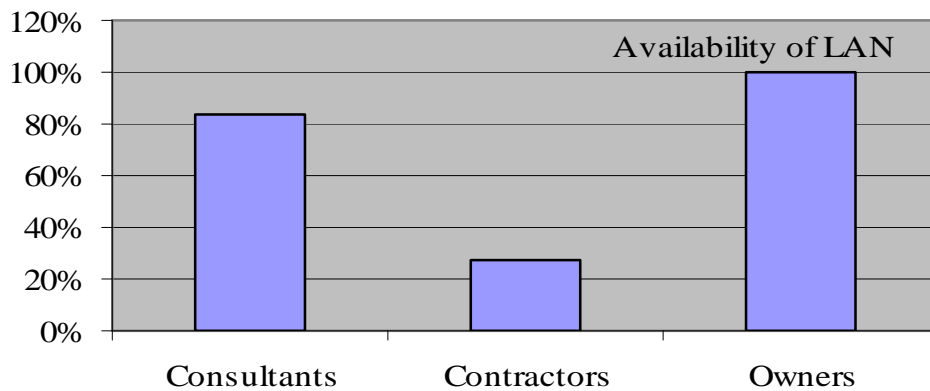


Figure 4.9 Availability of LAN within the investigated organizations

- **Availability of Internet connection**

100% of the investigated owners, consultants, and contractors answered that they have a connection to the Internet.

- **Number of employees connected to the Internet**

Figure 4.10 below represents the average number of employees connected to the Internet. Almost 90% of the owner's, 85% of the consultants, and 56% of the contractor's employees are connected to the internet.

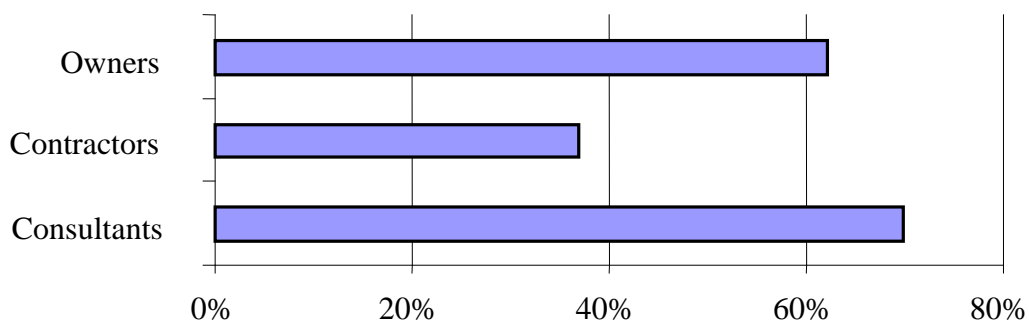


Figure 4.10 Percentage of employees connected to internet

- **Purposes of using E-mail**

This section aims to identify the reasons for using e-mail by the construction organizations in Gaza. Table 4.7 represents the percentage of responses, categorized into consultants, contractors, and owners. Analysis of the answers to this question

shows that the owners don't use e-mail for procurement or to send and receive bidding documents, while contractors and consultants use it in this area. The conclusion is that, consultants and contractors exchange bidding documents via Internet. 100% of the investigated consultants use e-mail for document distribution to other organizations. 88% of the owners use this facility as a carrier for formal messages and documents rather than bidding documents. The three categories use e-mail for informal messages too.

Table 4.7 Purposes of using e-mail

Purposes of using e-mails by the organizations	Consultants	Contractors	Owners
Sending/ Receiving informal messages	85%	78%	63%
Sending/ Receiving formal messages	92%	88%	88%
Distribution of documentation to other organization	100%	43%	88%
Distribution of documentation within the organization	69%	28%	50%
Purchasing/ procurement	77%	35%	0%
Sending/ Receiving quotations	85%	43%	13%
Sending/ receiving bidding documents	54%	40%	0%

- **Factors restricting the use of e-mail**

Answers of this question may justify previous answers. As noticed in Table 4.8, 50% of the investigated owners mentioned that e-mail doesn't have legal standing in legal proceedings, so they don't use it for official documents such as bidding documents. Afraid of losing or leakages of information are restricting the use of e-mail by consultants, contractors, and owners. 46% of the consultants mentioned that problems with Internet service providers might restrict the use of e-mail too.

Table 4.8 Factors restricting the use of e-mail by construction organizations in Gaza

Factors restricting the use of e-mail	Consultants	Contractors	Owners
Afraid of losing information	38%	18%	25%
Afraid of leakage of information	23%	35%	38%
No user training	0%	13%	13%
Cost	0%	15%	0%
Lack of management support	15%	8%	13%
E-mail does not have legal standing in legal proceeding	31%	33%	50%
Problems in providing Internet service	46%	5%	13%

Using Internet for e-procurement

This section aims to measure the level of acceptance to adopt Web applications in procurement process. The idea is to know the participant's feed back regarding the automation of the tendering stages that were identified in Chapter 3. The main question was: to what extent you agree to the following statements? Each statement represents one of the stages. The investigated participants were requested to mark each stage of the process with strongly agree, agree, neutral, disagree, and strongly disagree. The analysis of answers is as follows:

- **Establishing web site for the Palestinian Central Tendering Committee for procurement purposes:** Figure 4.11 shows that 85% of the consultants, 75% of owners, and 32% of contractors strongly agree, 40% of the contractors, 25% of the owners, and 15% of the consultants agree, and 28% of the investigated contractors were neutrals.

In their answers, most of the participants mentioned that this solution will facilitate the communication with the tendering authority. Contractors mentioned that this solution will allow them to deal with one body for searching for new business opportunities, new regulations, and serving as a data bank for construction industry.

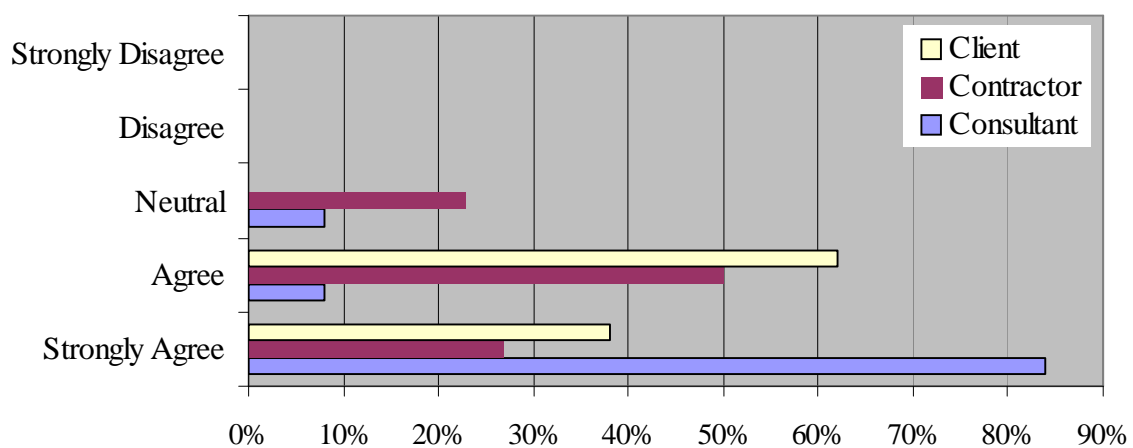


Figure 4.11 Answers to the statement of establishing web site for CTC for e-procurement purposes

- **E-advertisement**

Figure 4.12 represents the response to the statement of advertising project notices online. It shows that 85% of the investigated consultants selected strongly agree to the statement, while 62% of the clients and 50% of the contractors agree. 28% of the contractors and 8% of the consultants are neutral.

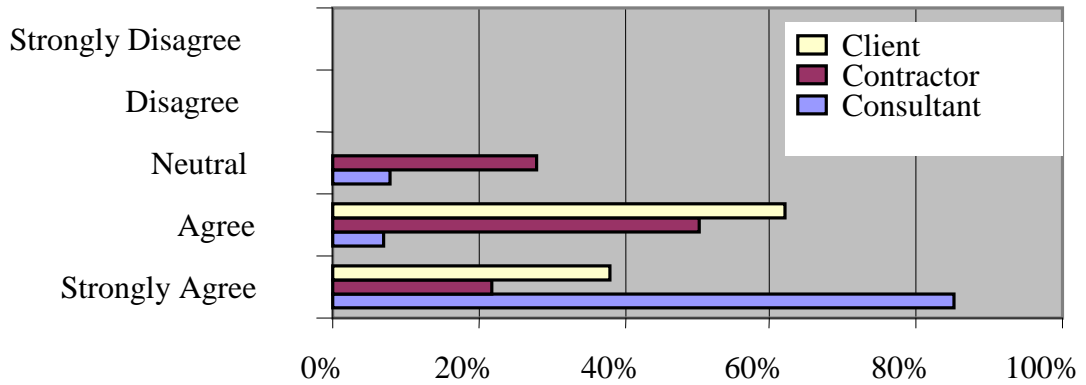


Figure 4.12 Answers of the statement of advertisement of project notices online

The investigated organizations mentioned that this solution will reduce the cost and it will facilitate the searching effort.

- **E-distribution of bidding documents**

The statement of e-distribution of bidding documents via the proposed web site shows that 79% of the consultants and 25% of the contractors are strongly agree. 64% of the clients and 37% of the contractors agree. 12% of the clients disagree and 12% of the contractors strongly disagree.

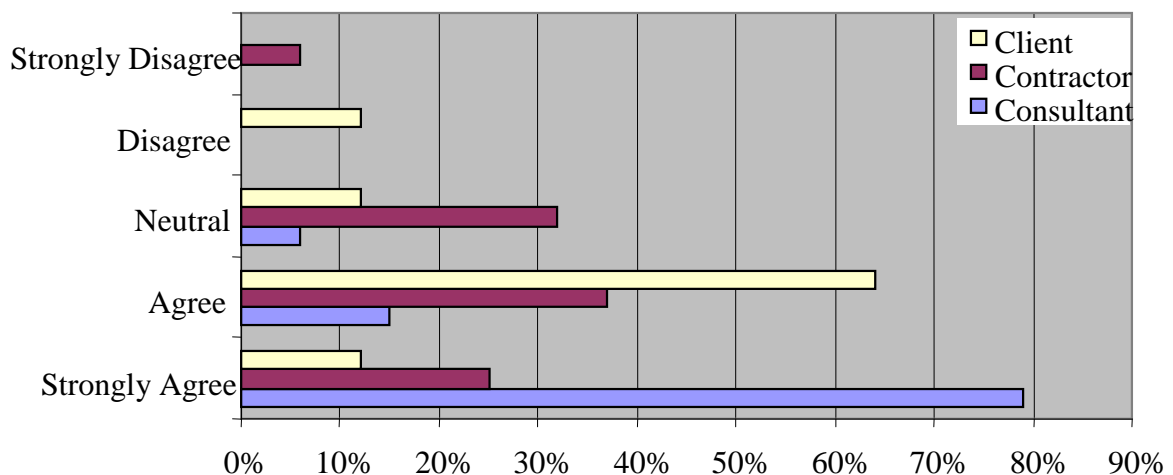


Figure 4.13 Answers of the statement of e-distribution of bidding documents

The organizations that agree to this statement mentioned that this solution will facilitate the distribution of documents, and it will help in reducing the time and efforts needed to convert the documents into electronic copy once again in their offices. In addition to that, this facility can guarantee more accurate and clearer copies of bidding documents.

- **E-request for information**

Electronic request for information during the tendering stage shows that, 77% of the consultants, 22% of the contractors, and 25% of the clients strongly agree with this solution. 75% of the clients, 47% of the contractors, and 15% of the consultants agreed. 3% of the contractors strongly disagree. Figure 4.14 represents the answers to this part.

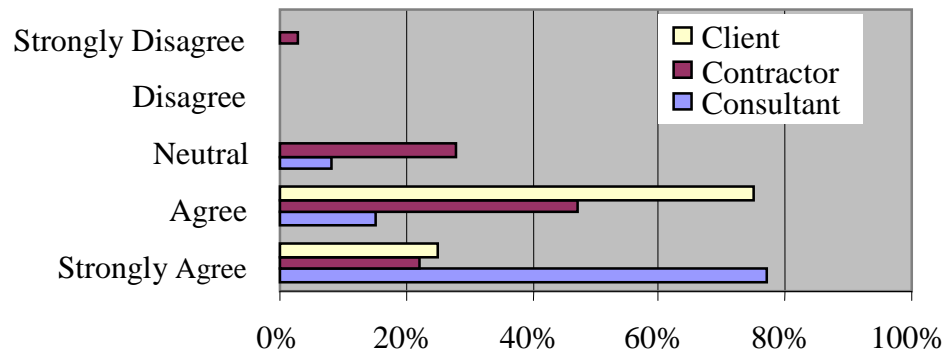


Figure 4.14 Answers of the statement of e-request for information

The respondents mentioned that this solution will make the work easier, cheaper, and faster. Some contractors prefer to deal face to face with clients in this stage.

- **E-prequalification**

Figure 4.15 represents the responses to the statement of prequalification on line. 54% of the consultants, 26% of the contractors and the same percentage of the clients are strongly agreed. 16% of the consultants, 40% of the contractors and 50% of the clients agree. 12% of the clients were neutral and the same percentage disagrees. Only 2% of the contractors disagree.

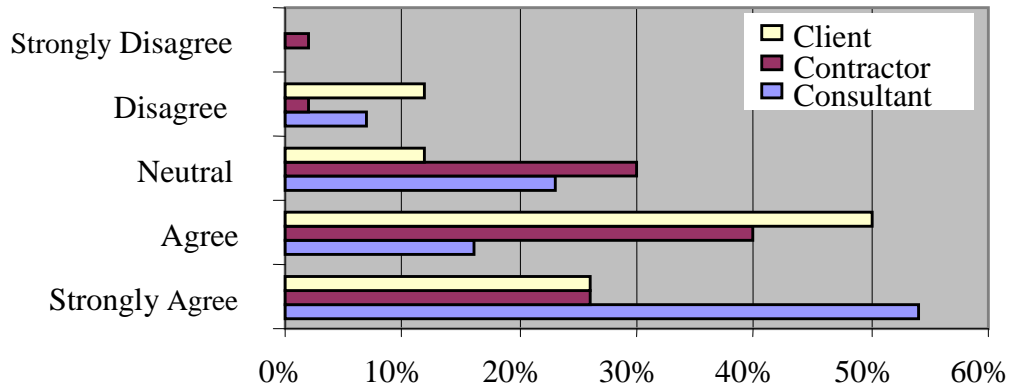


Figure 4.15 Answers of the statement of e-pre-qualification

The consultants mentioned that this facility will help them in reducing the time and efforts required for prequalification.

- **E-meeting (video conference)**

Conducting pre-bid meeting online was also discussed with the investigated organizations. Figure 4.16 represents the percentage of organizations that answered this question. 23% of the consultant's answers were strongly agree, the same percentage of consultants were neutral and disagree. 10% of the contractors strongly agree, 35% agree, and 3% disagree. 64% of the clients disagree.

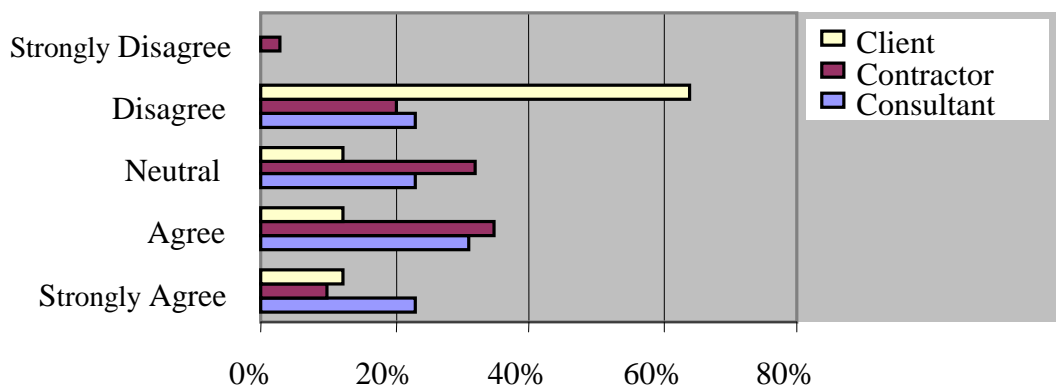


Figure 4.16 Answers of the statement of e-meetings

The investigated participants were reluctant to agree to this solution, most of them answered it is good, but they don't have the equipment to conduct it.

- **E-submission of proposals**

Figure 4.17 shows that 38% of the consultants agree to submit their bids electronically against 6% of the contractors. 30% of the consultants and 20% of the contractors disagreed, while 50% of the clients are neutral. 8% of the contractors strongly disagree and 20% of them disagree.

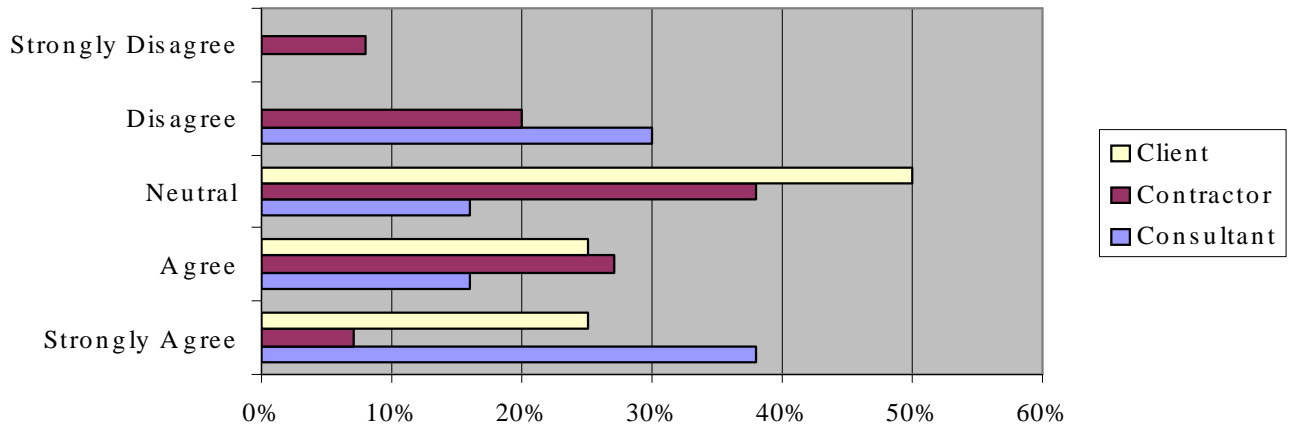


Figure 4.17 Responses to the statement of e-submission of proposals

The investigation shows that all the participants who select agree conditioned it with high security measures, and the others selected disagree due to security measures too.

• **E-payment**

The bidders are requested to pay a bid price before getting the tender documents. Developing e-procurement system calls for the need to establish electronic payment procedures. Regarding this statement, 63% of the clients and 20% of the contractors disagree. 45% of the consultants agree while 35% of them are neutral. Figure 4.18 represents the results.

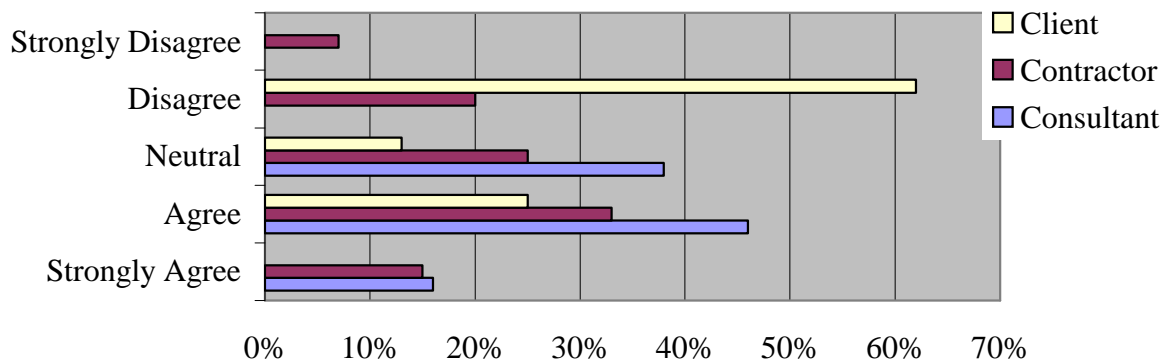


Figure 4.18 Responses to the statement of e-payment for bidding documents

Findings regarding the use of internet in e-procurement stages

Conclusions and recommendations about this chapter will be presented in chapter 6. This section intends to present the reasons that lead the sampled organizations to accept the e-procurement solutions and the precautions that may hinder the organizations from accepting such solutions. Table 4.9 summarizes these findings. The table is presenting the reasons for accepting and the precautions (if any) of each statement based on the responses of the sampled organizations.

Table 4.9 Reasons for acceptance and the precautions that hinder the implementation of the proposed stages of e-procurement

Statement	Reasons for acceptance	Precautions
Establishing CTC for e-procurement	-Facilitate communication - Serve as a data bank for construction industry	
E-advertisement	- Reduce cost - Facilitate searching efforts	
E-distribution of bidding documents	- Guarantee accurate and clearer copies. - Save time to convert document into electronic copies. - Help in archiving issues	
E-request for information	- Work easier, cheaper, and faster	- Contractors prefer to deal face to face with clients in this stage
E-prequalification	- Reduce the time required for prequalification	
E-meeting		- The need for special equipments
E-submission of proposals		-The need for security measurer. -The need for legal legislation to accept e-signature
E-payment		- The need for banking arrangement

Internet usage for purchasing construction material

This part of the questionnaire asked the organizations if they practiced in purchasing construction material through the web site or not. 38% of the consultants and 48% of the contractors answers were yes, while the owners didn't practiced it. 20% of the consultant who practiced purchasing has paid via letter of credit, the others 20% paid via visa cards, and 60% mentioned other methods. The other methods refer to the direct payment to the traders' representatives. 67% of the contractors paid through letter of credits, and 33% via master cards. Figure 4.19 and 4.20 show these results respectively.

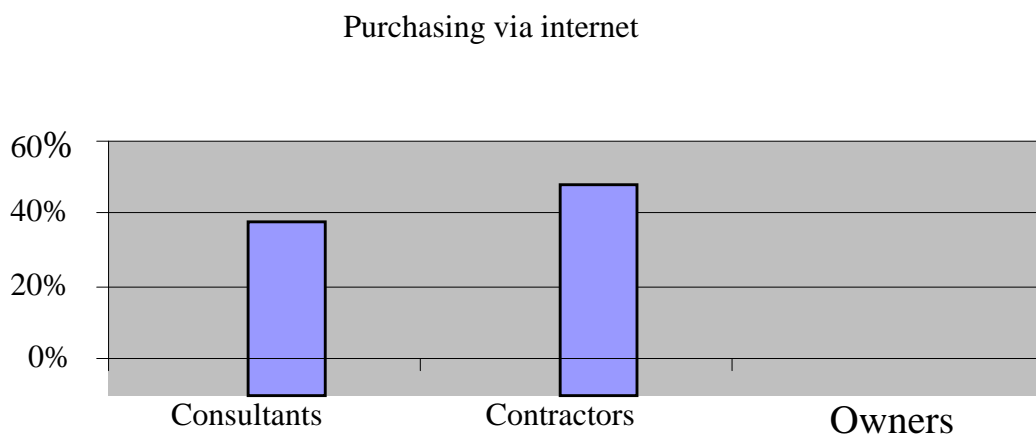


Figure 4.19 Percentages of participants who use Internet for purchasing purpose

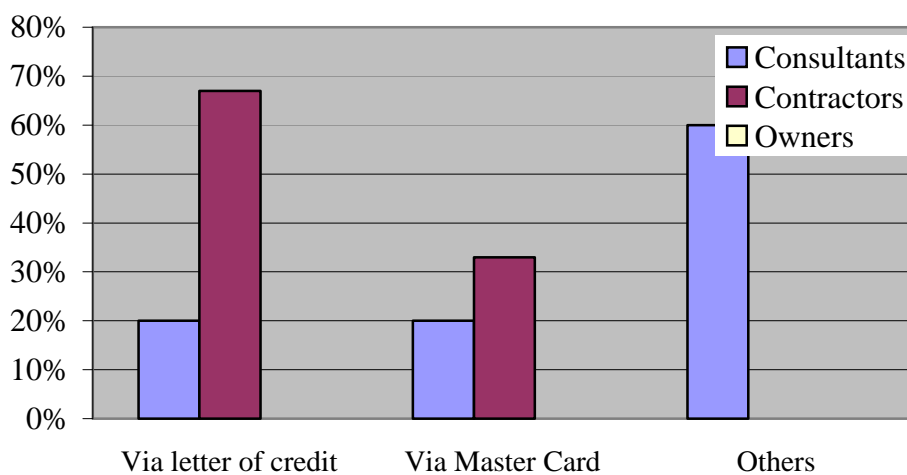


Figure 4.20 Method of payments for the purchased materials

4.3.5 Part 5

Reasons hindering adopting IT solutions

The participants have been asked to identify the reasons hindering the use of IT in their organizations. Reasons were divided into technology, human, and financial.

Tables 4.10, 4.11, and 4.12 show the responses.

Table 4.10 Technology reasons hindering the use of IT

Technology reasons	Consultants		Contractors		Owners	
	Respondent	Percentage	Respondent	Percentage	Respondent	Percentage
Rapid change in technology	5	38%	11	28%	2	25%
Software problems	3	23%	13	33%	3	38%
Hardware problems	0	0%	5	13%	3	38%
Security problems	3	23%	12	30%	3	38%
Integration problems	1	8%	5	13%	3	38%

Table 4.11 Human reasons hindering the use of IT

Human reasons	Consultants		Contractors		Owners	
	Respondent	Percentage	Respondent	Percentage	Respondent	Percentage
Lack of knowledge	5	38%	21	53%	4	50%
Inadequate training	8	62%	12	30%	2	25%
Poor management	2	15%	7	18%	5	63%
Poor teamwork	2	15%	2	5%	2	25%
Poor leadership	1	8%	1	3%	3	38%

Table 4.12 Financial reasons are hindering the use of IT in the organization

Financial reasons	Consultants		Contractors		Owners	
	Respondent	Percentage	Respondent	Percentage	Respondent	Percentage
Lack of available funding	6	46%	13	33%	6	75%
Difficulty in proving that the benefits of IT are greater than the associated cost	4	31%	16	40%	5	63%

4.3.6 Part 6

This part of the questionnaire addressed the future implementation of IT in the construction industry in Gaza Strip. The investigated participants were requested to select whether they strongly agree, agree, neutral, disagree, or strongly disagree to seven statements related to this part. Analysis of the respondents' answers is as follows:

- IT will improve project communication: Figure 4.21 represents the investigated participant's answers to this statement. As noticed, only 16% of the contractors mentioned that they are neutral, the rest of the investigated community stated that they agree and strongly agree. It is clear that most of the respondents understand that IT is essential factor in improving project communication.
- IT will improve project control: most of the respondents agree to this statement Figure 4.22 represents the percentage of answers of the three investigated groups. 8% of the contractors disagree to this statement.

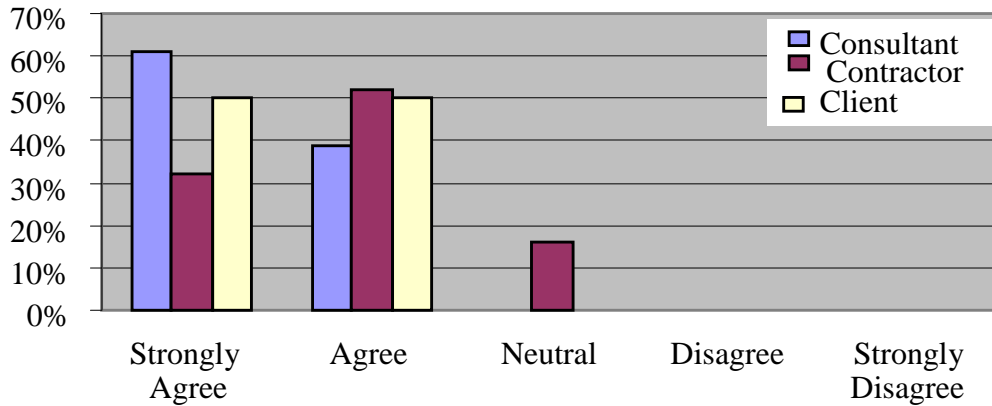


Figure 4.21 Responses to the statement that IT will improve project communication

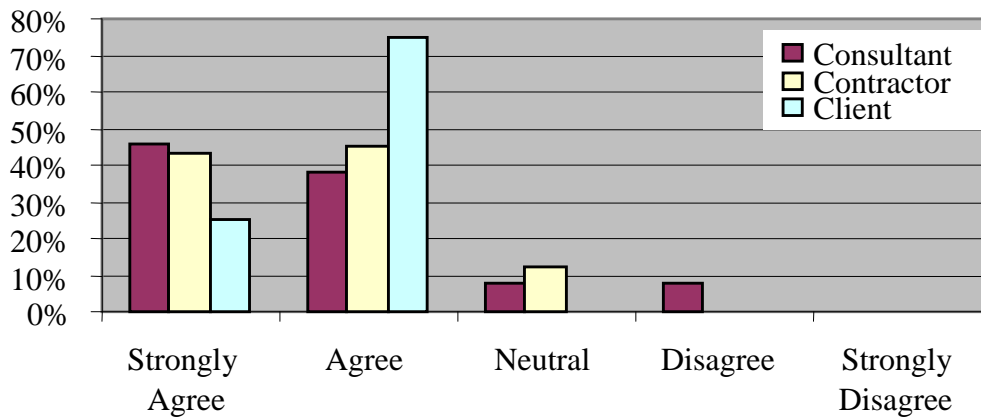


Figure 4.22 Responses to the statement that IT will improve project control

- IT will improve procurement/ purchasing functions: answers of the consultant's category show that the answers are divided into almost three equal groups, they are strongly agreed, agree, and neutral. Most of the contractor's category agree and strongly agree to this statement, only 8% of them were disagreed. 75% of the client's category agreed to this statement. Figure 4.23 show these answers.

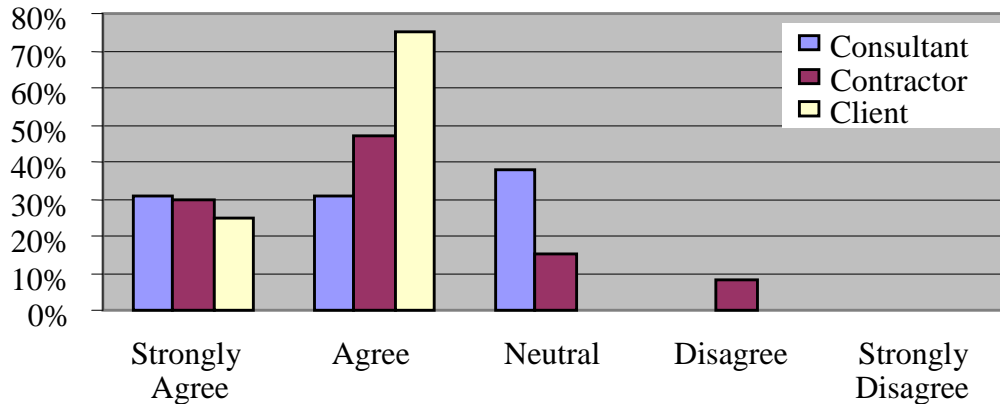


Figure 4.23 Responses to the statement that IT will improve procurement/ purchasing functions

- IT will improve profit: answers of the three groups were almost the same regarding this statement. 13% of the clients, 5% of the contractors, and 7% of the consultants were disagreeing. Figure 4.24 represents the responses.

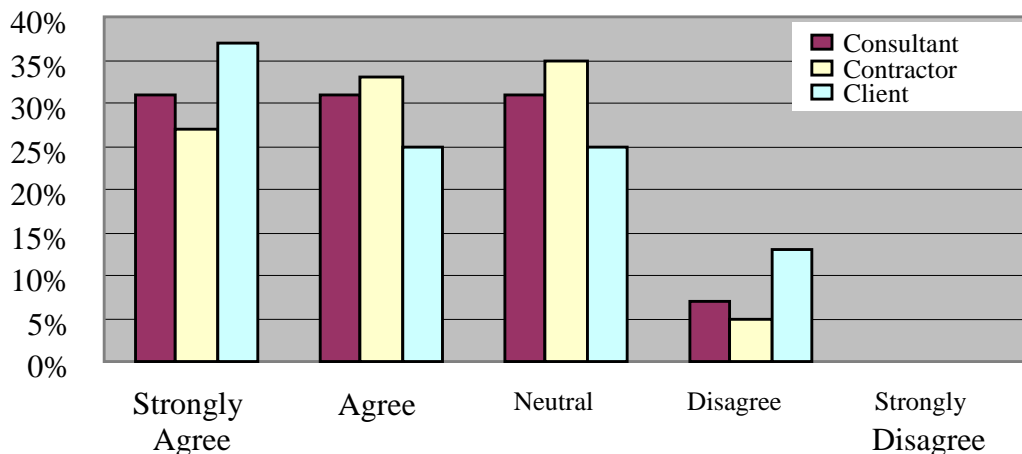


Figure 4.24 Responses to the statement that IT will improve profit

- IT will become prohibitively expensive: answers to this statement were as follows: 24% of the consultants, 14% of the contractors, and 13% of the clients strongly agree. 38% of the consultants, 13% of the contractors, and 62% of the clients disagree to this statement. Figure 4.25 show the respondents answers.

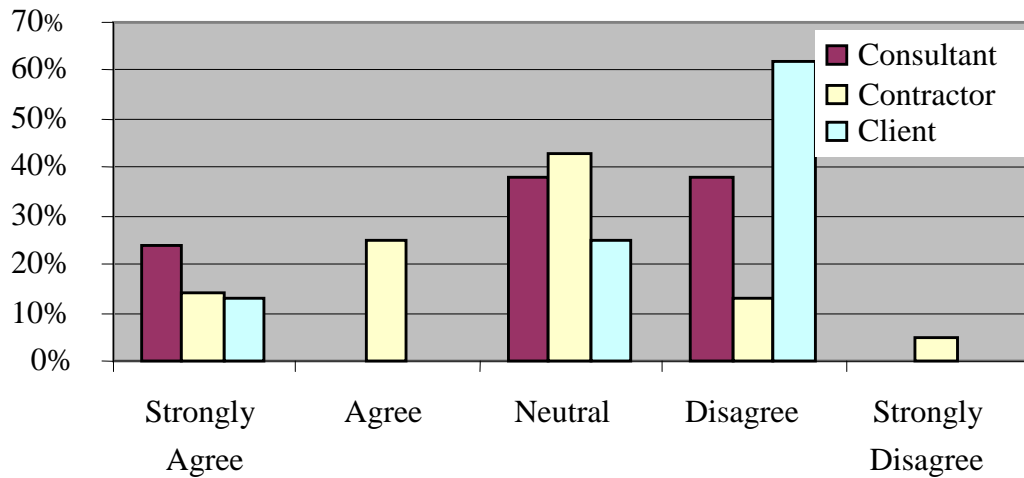


Figure 4.25 Responses to the statement that IT will become prohibitively expensive

- IT will benefit construction research: 54% of the consultants, 30% of the contractors, and 74% of the clients strongly agree to this statement. 64% of the consultants, 50% of the contractors, and 13% of the clients agreed with this statement. 7% of the contractors, and 13% of the clients strongly disagree with this statement. Figure 4.26 represents the answers to this statement.

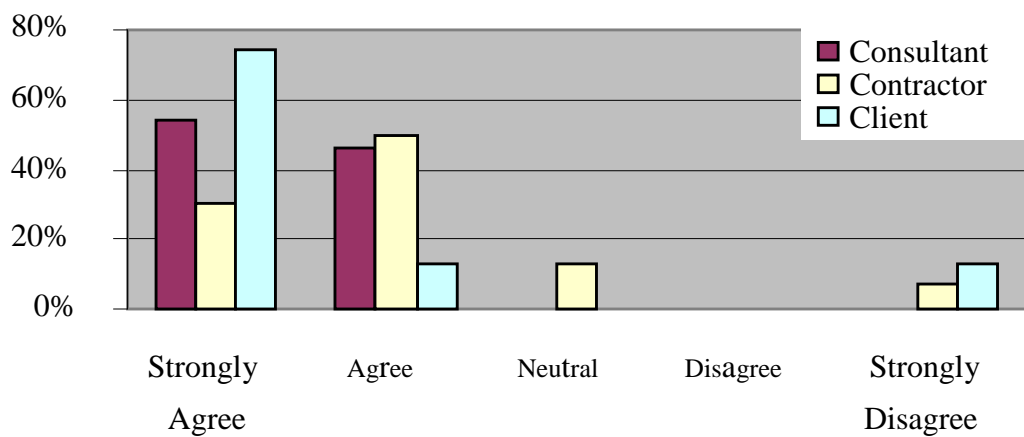


Figure 4.26 Responses to the statement that IT will benefit construction research

- IT requires extensive training: analysis of the respondents regarding this statement shows that 8% of the consultants strongly agree, and 8% of the same group strongly disagrees, while 84% agreed. 87% of the clients agreed to this statement, and 13% strongly agreed. 25% of the contractors strongly agree to this statement, 48% agreed, 17 neutral, 7% disagree, and 3% of them strongly

disagree to this statement. Figure 4.27 represents the responses to this statement.

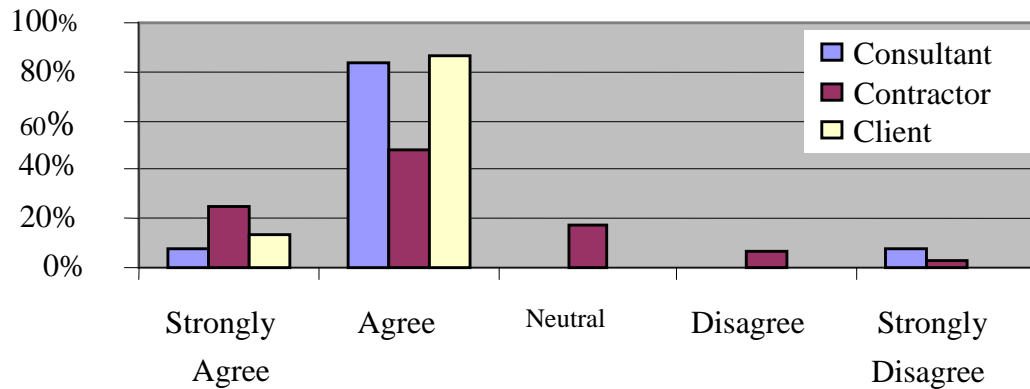


Figure 4.27 Responses to the statement that IT will require extensive training

4.4 Comparison with findings of other countries

Other similar surveys conducted about IT in construction industry in some other countries. There are a limit to the extent of comparison that can be made between different surveys, as there is a variation in both the questions asked and the classification of individuals and firms that supplied answers. From the other side, surveys in other countries were conducted several years ago, the rapidly growth of IT may affect the comparison. So, the comparison will be developed in terms of the year of the survey, profile of respondents, availability of internet connections, availability of LAN, availability of Web sites.

- Respondents profile:

In Canada, (Rivard, 2000) a survey of 1,000 Architectural, Engineering and Construction (AEC) firms was conducted in 1998/99 and the response rate was 22%, (Rivard, 2000). On the other hand, a 31% response rate was achieved in a Random Survey in New Zealand, (Doherty, 1997). That survey was conducted on 150 users in five industry-sectors (Architects/ Engineers, Building Owners/ Developers, Building Officials, Contractors/ Sub-contractors and Manufacturers/ Suppliers). Recently in Malaysia, a survey of 200 developers, contractors and professionals of the local construction industry had a 35% response rate, (Mui et al. 2002). In Sweden, a high answering rate of 49% was recorded in a survey conducted in the year 2000, (Samuelson, 2002). That survey, however, targeted a large selection of more than 1,300 workplaces of the Swedish construction companies.

- Areas of Main Use:

There are three areas where use of computers is very high. These are the areas of office administration, communication and construction drawings production. For administration purposes, activities generally involve the production, alteration and storage of the written words in the form of letters, memos, reports and documents. Therefore, the use of word processors comes at a top priority in practice. Communication is another major area of use. The third area of high use of computers is the use in construction drawings. The area of design though was ranked average and the area of presentations was the least.

- Use of e-mail

In Canada, close to 84% of the architectural offices adopted e-mail in their practices, and 96% of the firms in Malaysia use the Internet mainly for email purposes.

- Use of Internet

In Canada for instance, 27% of the architectural firms reported having a Web Page for their purposes on the Internet. Also in Malaysia, 24% of the firms indicated having their own web-sites. The survey in Sweden indicates a total of 60% of the employees in the industry work at workplaces where the company has its own web-site on the Internet.

Chapter 5

Conceptual model for web-based tendering system

5.1 Introduction

Conceptual model for the proposed e-tendering System will be developed in the scope of this chapter. The proposed system is a web-based public tendering system. It should support tendering activities of the Palestinian Central Tendering Committee (CTC) in Gaza Strip. The proposed system is to be used to facilitate information and documents sharing throughout the tendering stages. CTC, bidders, and government institutions (clients) should be connected to the system; each party is authorized to conduct predefined activities within the system. Figure 5.1 represents the proposed relation between the parties involved in the anticipated system. The Unified Modeling Language (UML) will be used to develop the conceptual model of the proposed system.

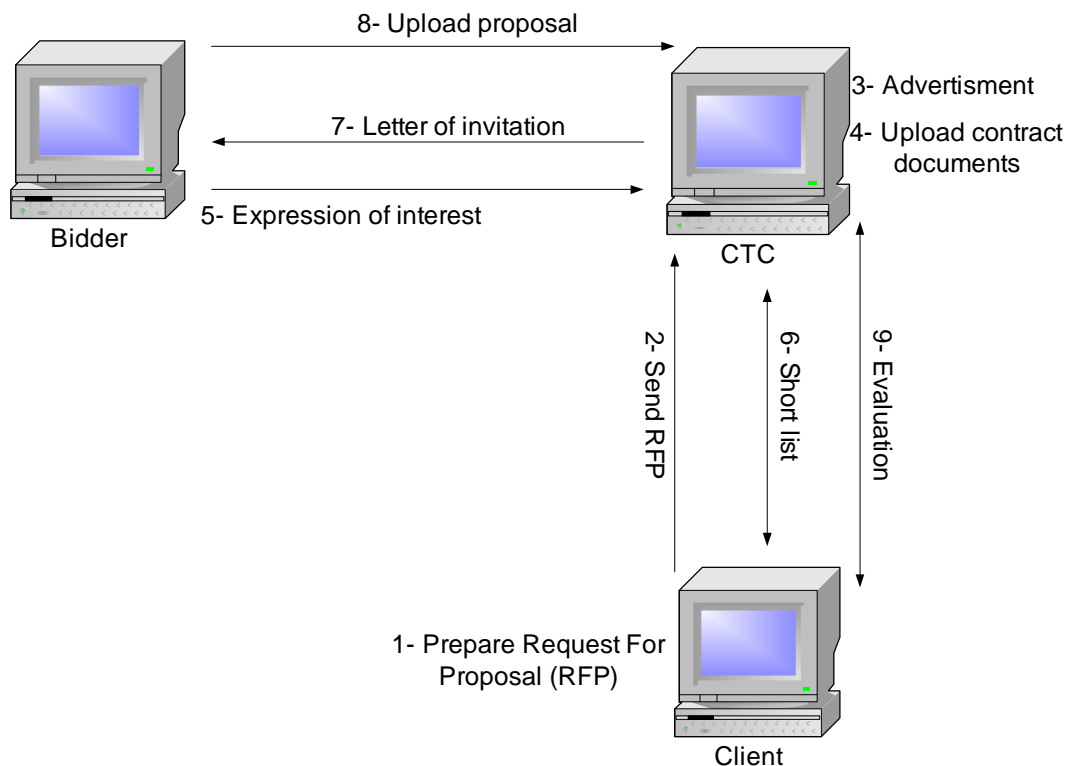


Figure 5.1 Relation between parties in the proposed system (restricted procedures)

As presented in chapter two, this research will adopt the use case approach of the UML to model the proposed system. This chapter will first introduce the terminology of UML, including symbols, structure of a UML model, and modeling strategies. Next, the main use case of the conceptual model will be described.

The graphical model of use cases is supplemented with narrative description and with sequence or collaboration diagrams for individual use cases. These additional descriptions and diagrams define the steps and objects needed for each use case to occur. The conceptual model of this study mainly involves four objects: actor, use case, activity, and package, these objects are described as follows:

Actor: The actor can be a person or a thing that interacts with a system. So actors can be animate (such as people) or inanimate (such as software). An actor can represent a single entity (such as a person) or a category (such as a group of people). In the diagram, the label that says “Actor” is usually replaced with the name of the actor, such as Customer, User, or Analyst, which is always a noun (Edgerton, 2002).

Use Case: describes the sequence of interactions between actors and the system necessary to deliver the service that satisfies the goal of an actor. It also includes possible variants of this sequence. Use Cases capture who (actor) does what (interaction) with the system, for what purpose (goal), without dealing with system internals. A complete set of use cases specifies all the different ways to use the system, and therefore defines all behavior required of the system, bounding the scope of the system (Malan, 2001).

Include: is a relationship between two use cases. Coleman (1998) defined include relationship as: An include relationship between two use cases means that the sequence of behavior described in the included (or sub) use case is included in the sequence of the base (including) use case, (cited by Malan, 2001)

An activity diagram is used to graphically represent the flow of events of a use case. It is a lower level representation for detailed description of the use case. An activity is represented by a round-corner rectangle. An activity diagram shows a start state, activities that the system performs, decisions that determine which activity is performed next, and one or more end points.

Packages serve to partition the model. A package is basically a logical container into which related elements can be placed. A package is represented by a rectangle with a

small rectangle attached on the top left exactly like a folder or directory in an operating system (Ariadne, 2001). Figure 5.2 represents the symbols of the above-mentioned objects.

5.2 Basic notation used for use case diagrams

Symbols presented in Figure 5.2 represent the notations that adopted in this chapter.

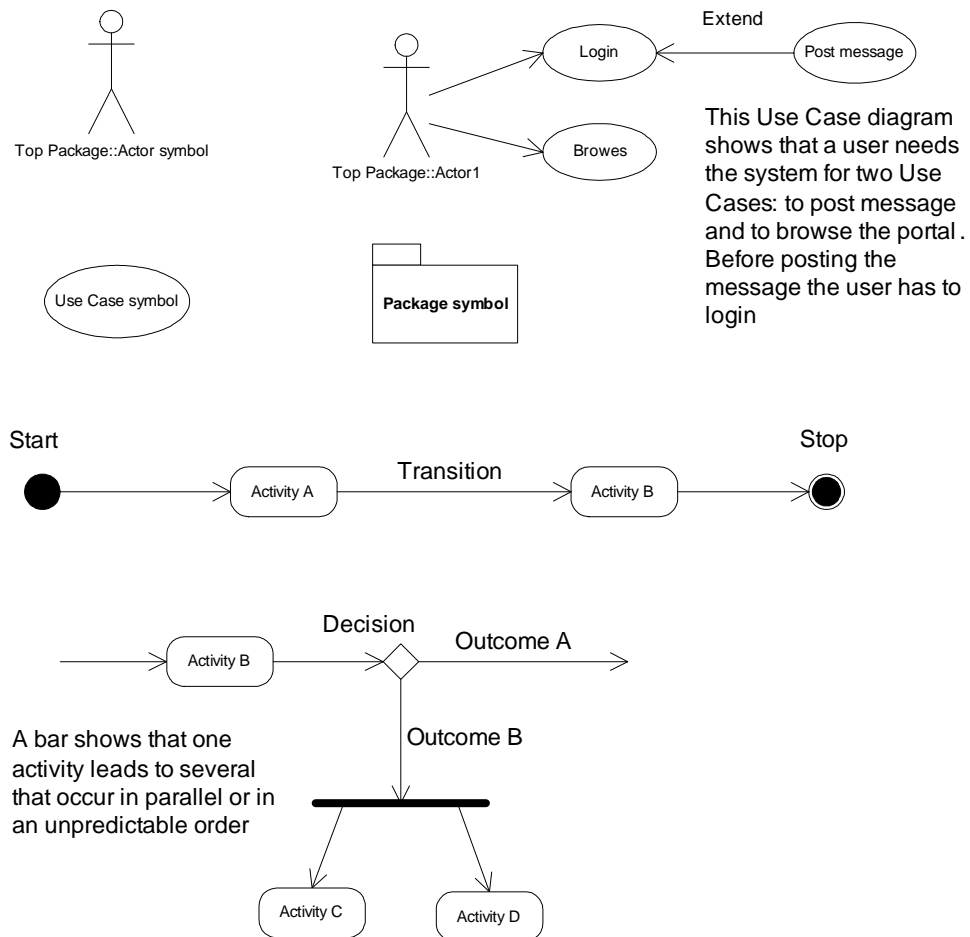


Figure 5.2 Basic notations for use case diagrams, Rafaulu (2004).

5.3 Use Case documentation

Textual requirements of the proposed system need to be translated into use cases. The system contains several use cases. Each top-level use case can be divided into sub-use cases. Schneider and Winters (2001) recommended a typical template to document use cases. This study adopted this template to document the main use cases of the proposed system. Table 5.1 represents the suggested template.

Table 5.1 Use Case document template, source Schneider and Winters (2001), cited by Leung, (2002)

Context Diagram	A small use case diagram showing the use cases and their relationships
Use Case Name	A unique name for each use case.
Brief Description	Usually a paragraph or less. May include the priority and status of this use case
Actors	Lists of actors involved in the use case.
Main Flow	The flow of events that normally takes place to execute the use case.
Alternative Flows	Alternative flow of events, if the main flow is not executed.
Activity Diagram	Diagram represents the flow of events in complex part of the system
Pre-Condition	A list of conditions that must be true before the use case starts.
Post-Condition	A list of events that must be true when the use case ends.
Subordinate use cases diagram	A small use case diagram showing the subordinate use cases of this use case
Subordinate Use Case	A section for each subordinate use case with its flow of events

5.4 Development of the conceptual model

In order to create use cases for a model, Malan (2001) suggested the following outlines:

- Identify all different users of the system.
- Identify all roles the users play that were relevant to the system. For each role identify the users goals that the system will support
- Create a use case for each goal, following the use case template.
- Structure the use cases
- Review and validate with users.

The stated outline will be followed in this research in order to develop the proposed model.

5.4.1 Identification of the system actors and their characteristics

As stated previously, actors represent a role a user can play with regard to the system or an entity, such as another system outside the system being modeled. The total set of actors within a use case model reflects every thing that needs to exchange information with the system. Possible actors of the proposed system are categorized into six groups as follows:

- Visitor: represents any unregistered person to the system.
- CTC officials: represents procurement officers of CTC and the system administrator.
- Opening committee: represents officials who are assigned to open a tender.
- Client: represents any public institution that requests the services of CTC.
- Bidder: represents the registered contractor / consultant, who have been registered in the system.
- Other systems: such as other banking systems.

Characteristics of the proposed actors:

- Persons who mightn't be experts in Informatics, but generally are familiar with computers and Windows environment.
- People who have managerial positions in construction/ consultancy firms.
- Trained employees from CTC.

5.4.2 Role of actors and the goals that the system will support

Roles associated with actors for this system were derived from different sources i.e. the model of the WB guidelines, discussions with a procurement specialist from government side, visits to other e-tendering sites, informal interviews with bidders and IT specialists. As a result of the mentioned discussions and consultations, role of actors were identified. This section will present these roles and the goals of each role that the system should support. Actors with their associated roles and goals that the system should support can be described as:

- 1- Visitors: any unregistered person to the system. They should be able to perform the following roles:
 - Visitors should be allowed to register online to the system and to have user account, (the goal is registration)
 - Visitors should be given access to the publicly available information, such as CTC bulletin, Standard Bidding Documents (SBDs), useful links, laws and regulations, awarded projects, expected projects for next six months. This function is not included in the use cases because it is not directly related to tendering activities.

- 2- CTC staff (procurement officers and system administrator): this group includes procurement officers from CTC who will operate the system and act as procurement officers and; the system administrator who maintains and keeps track of changes of existing, already registered users, and enables users to have the required level of authorities in the proposed system. CTC staff should be able to perform the following functions:
 - System administrator should be able to set up a users account, the goal is to set up new users accounts based on the level of authority to each of them.
 - CTC staff should be allowed to access the system, (the goal is login and logout the system)
 - CTC staff should be able to configure their default settings in the system, (the goals are change password, user name, and update profile)

- CTC staff should be allowed to manage the tenders, (the goals are create new tender, prepare tender file, upload tender file, publish clarification, cancel tender, call for meeting, prepare notifications, publish/ cancel notifications, and prepare/ publish tender summery).
- 3- Opening committee: tender opening committee should be authorized to perform the following activities:
- System access and manage profile: the goals are log in and log out the system.
The system administrator is requested to set up the level of authorities for this actor
 - Open and download proposals, (the goals are open and download proposals).
- 4- Client: this group of actors should have auditory roles. They should perform the following functions:
- System access and manage profile: The system administrator is requested to set up the level of authorities for this actor.
Access to the questions raised by bidders, (the goal is to answer clarifications and to follow the progress of the tender).
- 5- Bidders: this group of actors is registered to the system. They should be authorized to perform the following functions:
- System access and manage profile: The system administrator is requested to set up the level of authorities for this actor.
 - Have access to the tender documents, (the goals are view tender documents, Apply for tender, download documents, request clarification, and submit proposals).
- 6- Other systems: such as the banking systems, this group of actors performs functionalities such as Bank Guarantees and electronic payment. (This use cases are out of the scope of this thesis since it relates to other systems)

5.4.3 Structure of the use cases

This section intends to document the goals of the proposed system's actors into use cases based on the template of table 5.1. Figure 5.3 represents the context diagram of the proposed system, the diagram divided the system into three packages according to the captured goals of the system actors. The three packages include the main use cases of the anticipated system. As presented in figure 5.3 the system administrator is responsible to set up the users account. Set up users account is a use case that allows actors to have a user account and pass word based on their roles in the system. The system administrator belongs to the CTC group of actors but he is not in charge of the procurement process.

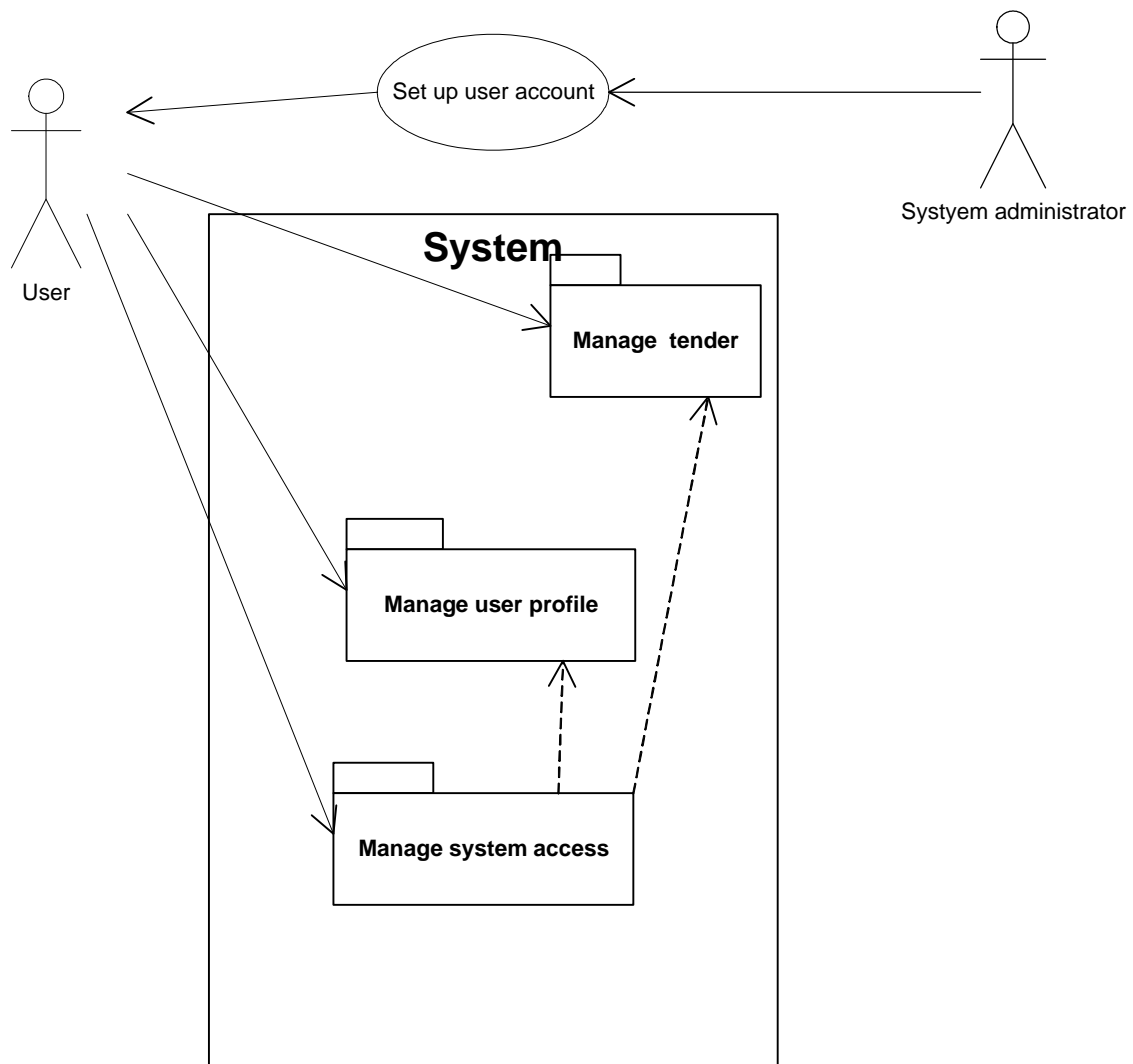


Figure 5.3 Context diagram of the proposed system

Each one of the mentioned packages includes related main and sub use cases. Figure 5.4 represents the main and sub use cases of manage tender package of use cases.

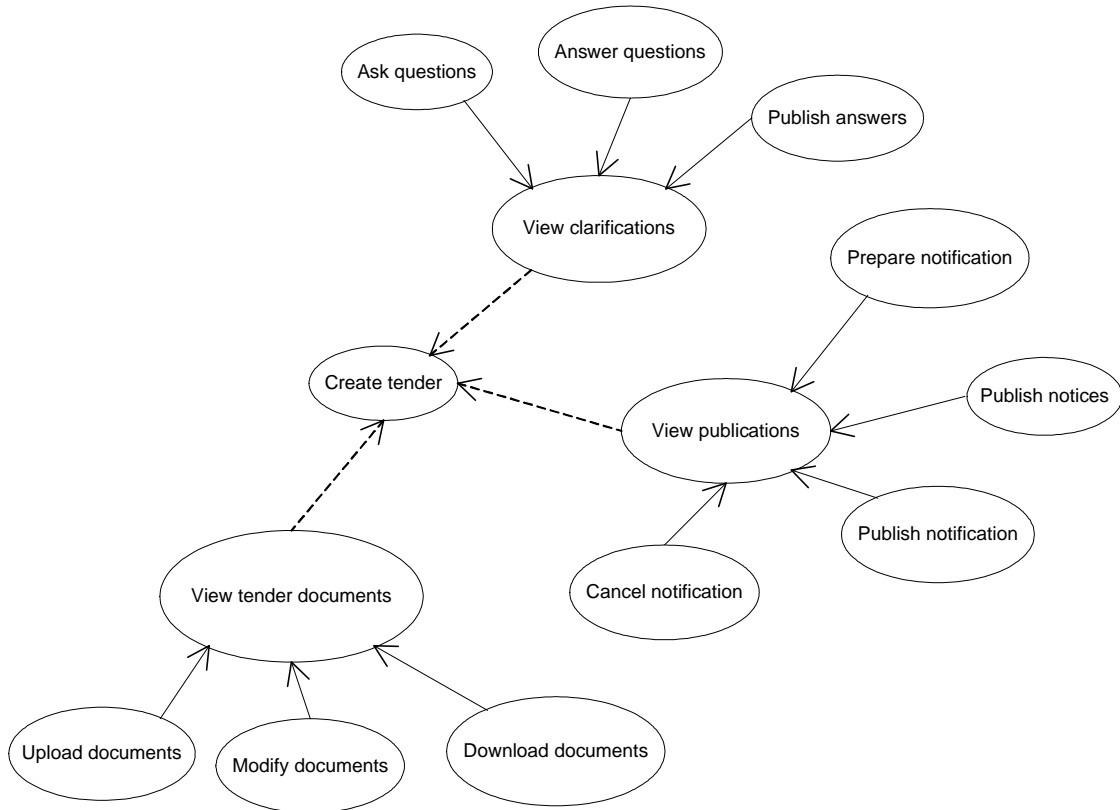


Figure 5.4 Use cases related to the package of manage tender

As noticed, the three main use cases (manage tender documents, manage publications, and manage clarifications) are to be managed through the tender work space that was created via create tender use case. Each one of the three main use cases is linked to some sub use cases i.e. in order to down load documents user should view tender documents and so on.

Figure 5.5 represents the use cases related to the procurement officer (PO) actor. Use cases associated with the PO allows him to create a work space for new project (assignment). The work space allows actors to communicate during the tendering process.

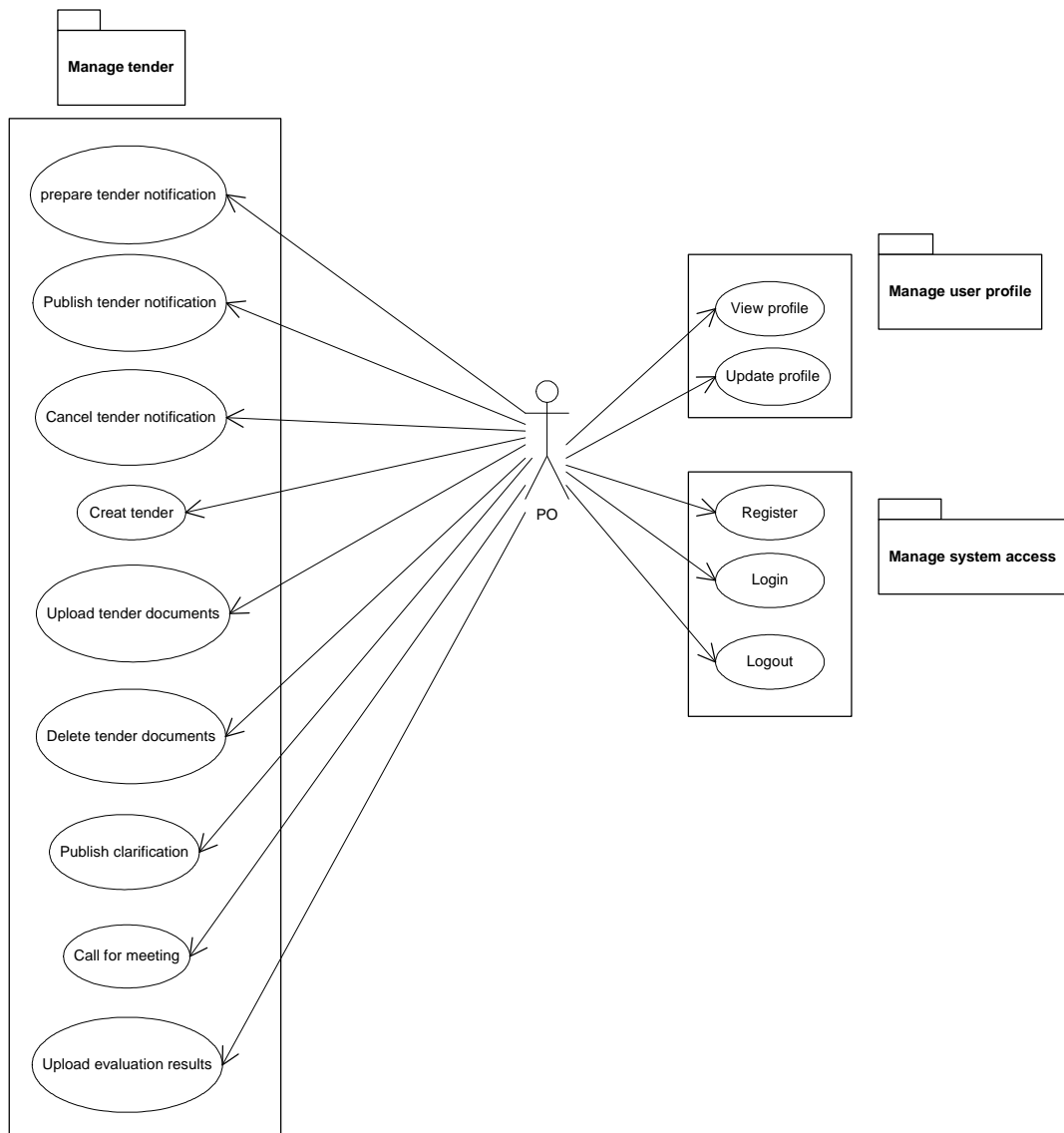


Figure 5.5 Use cases related to the procurement officer.

The bidder is an actor in the proposed system, the bidder is interested in applying for tender and submits his proposals. Figure 5.6 represents the use cases associated with the bidder actor.

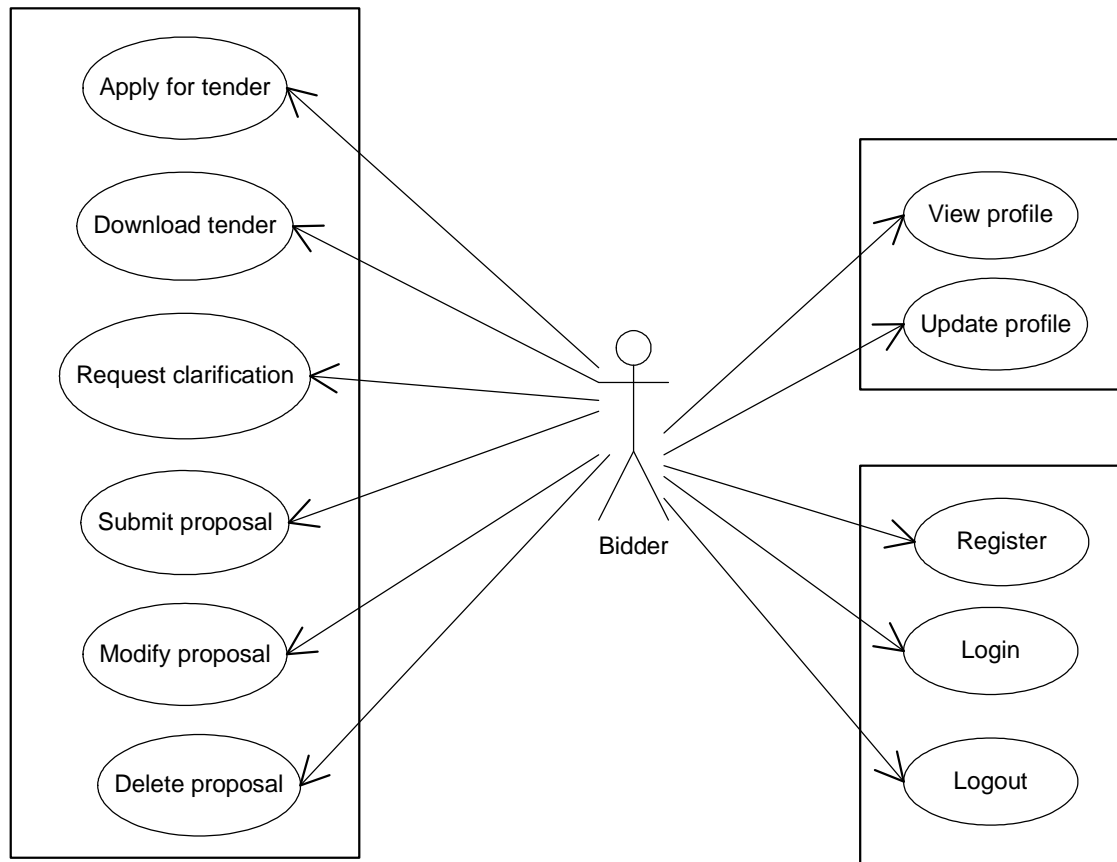


Figure 5.6 Use cases associated with the bidder actor

The client is another actor, his goals are to follow up the progress of his project and to answer the questions of the bidders. Figure 5.7 represents the set of the main use cases that are related to the client. Figure 5.8 represents the use cases associated with the visitor actor. The bid opening committee is another actor who supposes to unlock the bidder's proposals; the use cases associated with this actor is presented at figure 5.9.

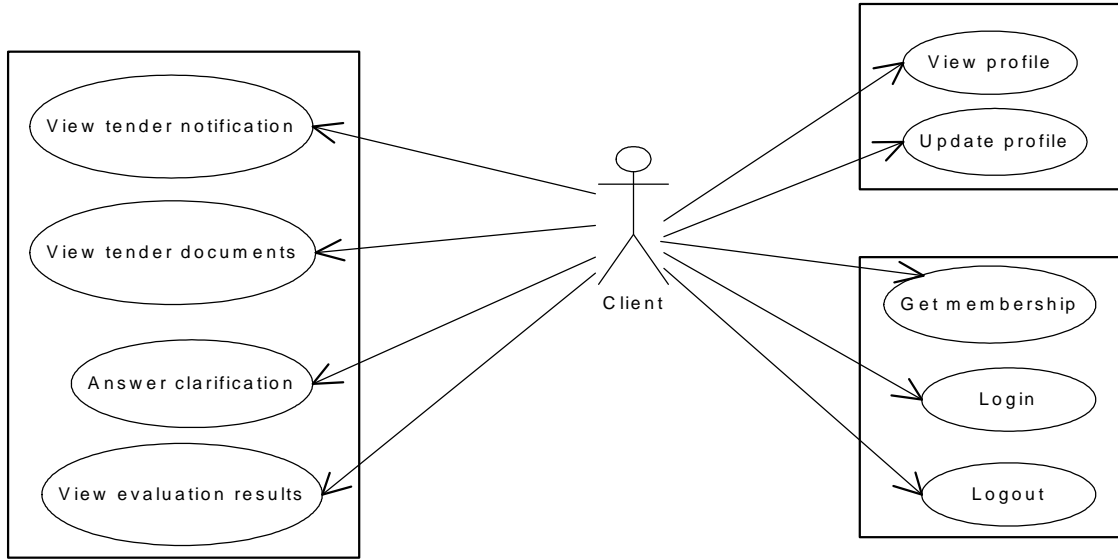


Figure 5.7 Use cases associated with client actor

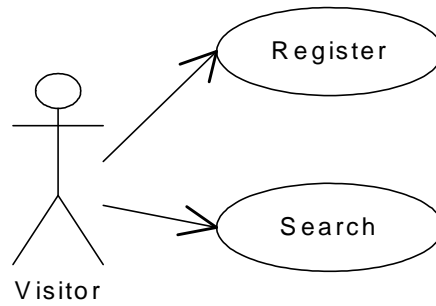


Figure 5.8 Use cases associated with the visitor actor

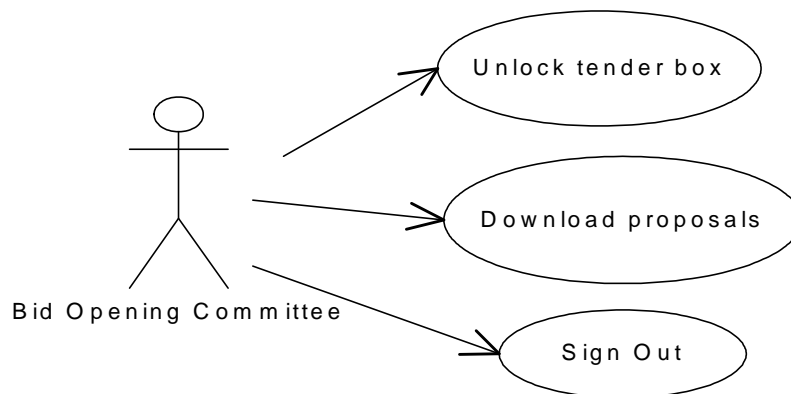


Figure 5.9 Use cases related to the bid opening committee

5.4.4 Documentation of the use cases

This section intends to document the main and sub use cases related to the tendering process one by one. The context diagram of the main and sub use cases is presented in figure 5.4.

Use Case 1 Register/ Get Membership to the system:

Brief Description: this Use Case is to register a user to the system, and to provide him with user account. After registration, user is allowed to access the system and get detailed information about any project; it also allows the user to apply to any invitation to tender. government institutions and banks that wish to work through the system are requested to apply for membership. To have a membership, they should follow the registration procedures.

Actors: any unregistered person, who wish to be registered/ or to have membership with the system.

Main flow: the Use Case begins when an interested visitor clicks register now button or when government institution/ or commercial banks clicks get membership button at the site home page. By clicking one of these buttons, the system requests the user to fill a registration form. The form requests basic information from the user. This information is important because it will allow the user to identify him self to the system in the future, and consequently the system will provide the user with the appropriate data. The form encloses personal information about the person and the user name and password he preferred. This form is to be validated by the system for completeness, then it should be kept in secure place; no one is authorized to have access to it. After completing the application form, the user clicks the buttons save then send. If the submitted information is correct and complete, the system will generate automatic message to the user e-mail containing his login information.

Alternative flows: if the user has been registered before, or mandatory fields were not filed, an error message will be display with the reason that alters the registration process.

The unfilled fields will be highlighted and the system will redirect him to the registration page.

Activity diagram: Figure 5.10 represents the sequence of activity to register or to get membership to the system.

Precondition: User should have connection to the Internet

User didn't register before.

Post condition: 1- user's personal information is saved within the user profile of the system.

2- Confirmation message from the system to the user account informing him that his registration is succeeds. The user name and password is part of this message.

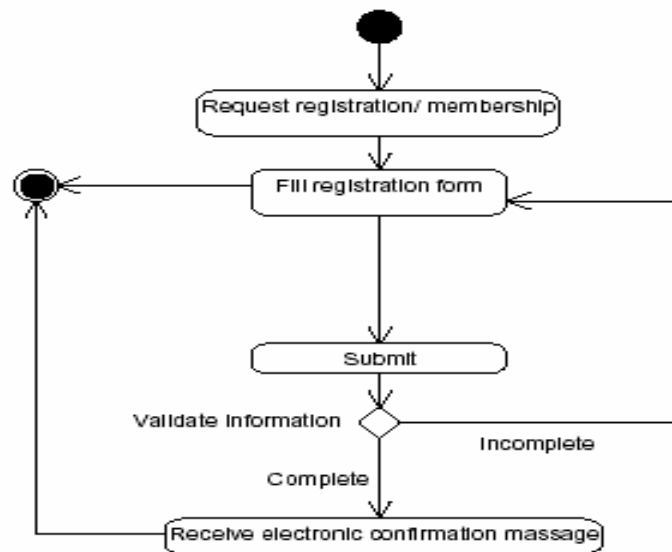


Figure 5.10 Activity diagram for registration use case

Use Case 2 Login:

Brief description: this Use Case aims to verify the user in order to provide him with proper data to complete his tasks.

Actors: registered user

Main flow:

User initiates this Use Case by providing the system with his user name and password, and then clicks submit. The system is to verify the submitted information if they are correct, the user interface to the system will be displayed.

Alternative flow:

If the information provided by the user regarding his user name and password are incorrect, the system will ask him to try again for defined number of trials. If the user forgot his password, the system will e-mails it to his e-mail account after answering the hint questions correctly. If the user fails, he may ask the system administrator for help in recovering his user account.

Activity diagram: Figure 5.11 represents the activity diagram for login use case.

Preconditions: the user has a user name and password.

Post condition: the user interface with the system will be displayed

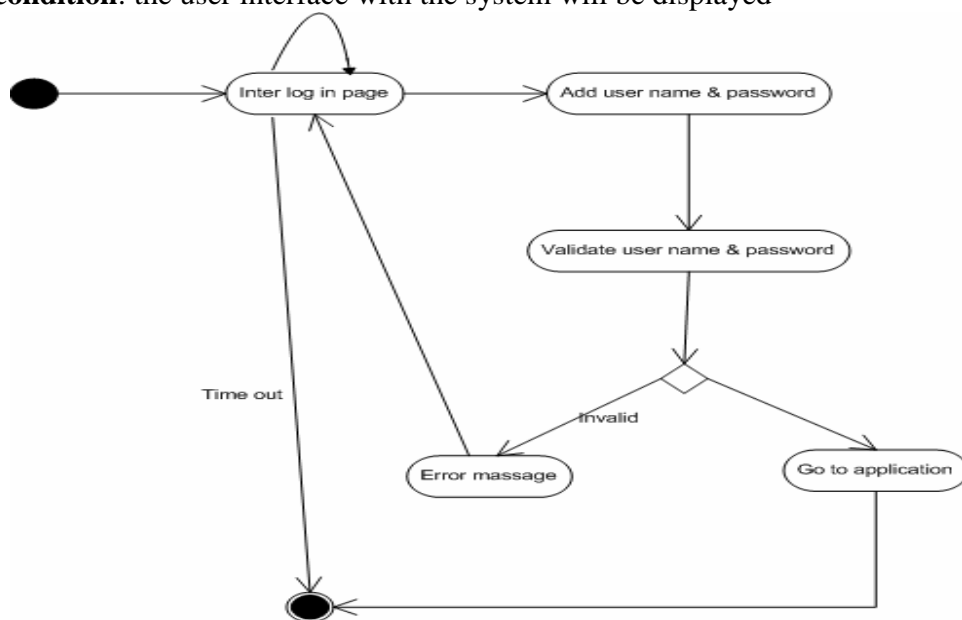


Figure 5.11 Activity diagram for log in use case

Use Case 3 Create new tender:

Brief description: this Use Case aims to create workspace for new tender. The workspace will be used to store all information related to this particular assignment. All activities regarding the assignment will be hosted in this workspace.

Actor: Procurement Officer (PO)

Main flow: PO initiates this Use Case by requesting the system to create workspace for new tender, the system will display a form to be filled by the PO. The form includes information about the assignment such as: the client, duration, financing agency,

expected cost, location, type of the assignment, names and e-mail addresses of the opening committee. As the form is completed, the PO presses the button submit, the system will validate the information, if it is complete the new tender will be created with the name of the assignment, (we will name it her assignment's folder)

Alternative flow:

If the submitted form was not complete, the system will display a message to the PO and highlight the unfilled fields. the PO is requested to fill all mandatory fields and submit the form again.

Activity diagram: Figure 5.12 represents the activity diagram for create new tender use case.

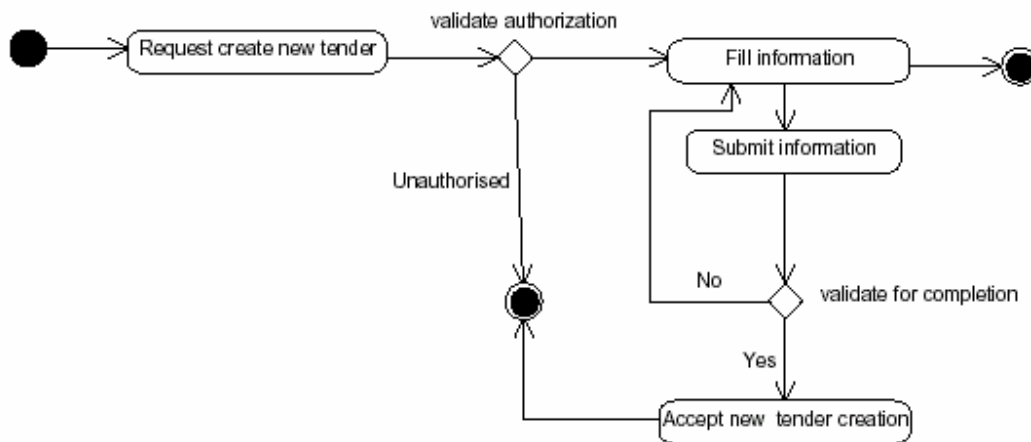


Figure 5.12 Activity diagram for create tender use case

Precondition: The actor should log in the system

All mandatory fields are filled.

Authorization from the supervisor to create new tender.

Post condition: new tender workspace is created with the name of the assignment.

Use Case 4 Prepare / Publish tender notification:

Brief description: This Use Case is to announce the new assignment to the public. The system may help in drafting the notification by offering a template, or notification wizard.

Actor: PO

Main flow: the PO starts this Use Case by entering the assignment's folder, and then drafting the announcement. The PO may use the existing information about the assignment, which was provided during the tender creation Use Case. Some mandatory information should be filled such as the tender closing date, amount of the bid security (if any), contracting authority, classification of the requested bidder, contract fee (if any), and a brief description about the assignment. After completing this information, PO is requested to draft notification summery. Approval from higher level before publishing the notification may be requested. After the approval, the PO can submit the notification. The system will publish the assignment's notice after validation.

Alternative flow: if any of the mandatory fields in the notification form was not filled, the form will not be submitted, and the fields will be highlighted. If the higher level doesn't approve the assignment notification, PO is requested to keep it in draft position.

Activity diagram: Figure 5.13 is the activity diagram for prepare/ publish notification.

Precondition: The actor should log in the system

A space for new tender was created.

Approval form higher level.

Post condition: -The name of the assignment will appear at the home page.

-The assignment summery will come into view by clicking the assignment's name at the home page.

-The tender file at PO interface will be activated

- Copies of the notification should be sent automatically to the owner, and opening committee.

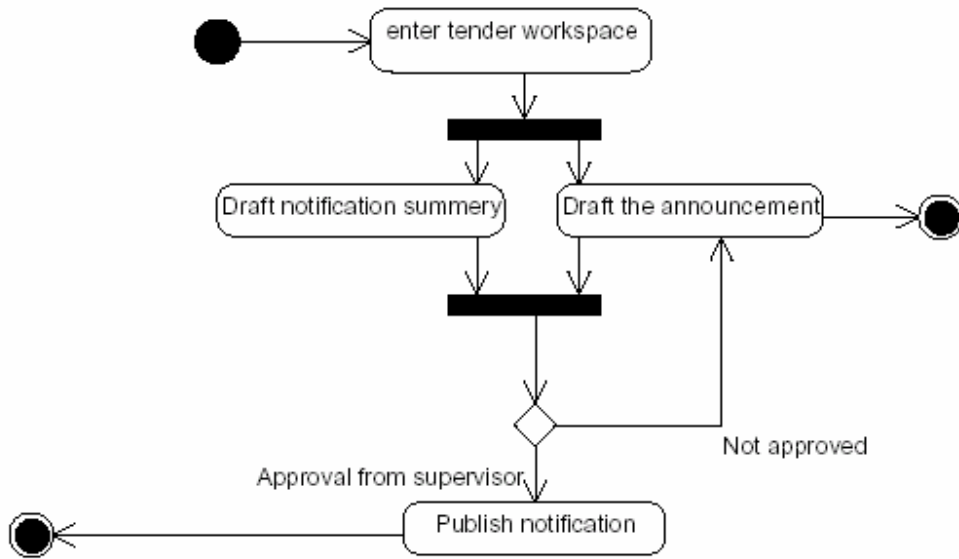


Figure 5.13 Activity diagram for prepare/ publish notification

Use Case 5 Amend/ Cancel tender notification:

Brief description: this Use Case aims to allow PO to amend or cancel the tender notification.

Actor: PO

Main flow: the PO is to enter the assignment’s folder, and then to the notification page where he can add, amend, or cancel the notification. Any modification to the notification should generate a message from the system to the applied bidders, client, and the opening committee.

Alternative flow: None

Activity diagram: Figure 5.14 represents the activity diagram for amend/ cancel tender notification.

Precondition: The actor should log in the system

Post condition: Electronic messages to the bidders, client, and the opening committee about any modification.

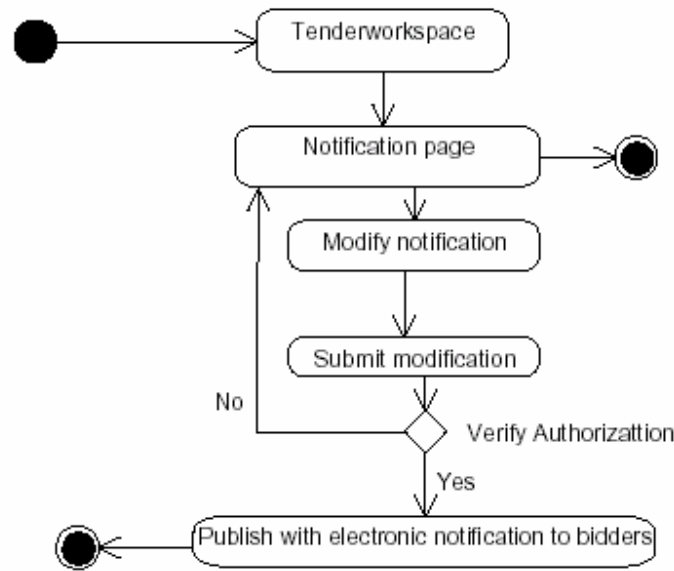


Figure 5.14 Activity diagram for amend/ cancel tender notification

Use Case 6 Upload tender documents:

Brief Description: this Use Case allows PO to upload tender documents, which may include specification, condition of contract, drawings, request for proposal, and information to bidders. The preparation and approval lifecycle of tender documents is to be made offline. The system may offer a library containing different types of bidding documents. After the publication of tender documents, it should not be possible to any one to delete and/or modify these documents.

Actor: PO

Main flow: PO is to log in, enter the assignment's folder, display tender sub screen, and locate the file/s to be uploaded, upload them, and then submit. This will make the file/s available to any registered user.

Alternative flow: if the file volume is too large, the system will generate error message requesting PO to separate the file into packages.

Activity diagram: Figure 5.15 represents this use case.

Preconditions: The actor should log in the system

Tender notification should be published.

Post condition: files are uploaded to the system

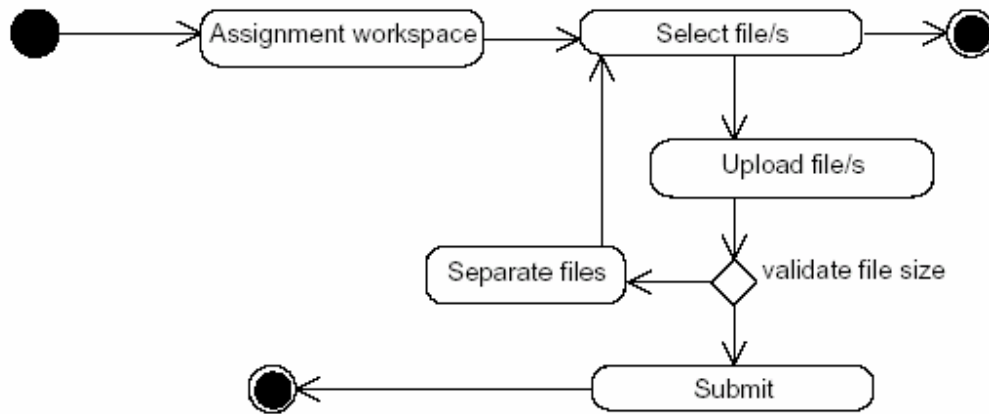


Figure 5.15 Activity diagram for upload tender documents use case.

Use Case 7 View tender documents:

Brief description: this Use Case allows bidders to view, download, and print tender documents. The tender document includes all documents regarding this particular assignment, which was mentioned in Use Case 6 in addition to the related notifications, amendments and notices.

Actor: any registered user

Main flow: The interested bidders enter the assignment's folder, then the tender screen, select the requested documents, view, print, read, and or download the documents.

Alternative flow: None

Activity diagram: Figure 5.16 represents this use case.

Pre condition: The actor should log in the system

Bidder should be registered to the system.

Post condition: the requested documents are visualized to the actor.

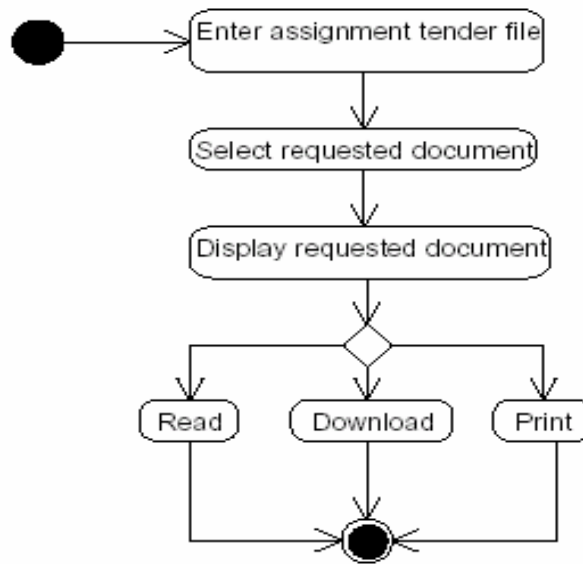


Figure 5.16 Activity diagram for view tender documents use case

Use Case 8 Apply for assignment:

Brief description: This Use Case allows the registered bidder to apply for any assignment he wishes, as long as he has the minimum requirements that were identified in the assignment’s notification.

Actor: Any registered bidder

Main flow: Applying for assignment enclosed the following activities: interested bidder clicks the button apply within the assignment’s folder; this will activate an application form. The bidder is requested to fill this form, attach any documents and then submit them. The system will validate the information for completeness. For some assignments (mainly construction works), the bidders are requested to pay fee amount in order to apply for this particular assignment. If such amount is requested, the bidder’s bank can send a bank guarantee (upon the bidder's request, alternative method of payment should always be guaranteed) to the system regarding the fee amount. As the system receives the payment and validate the submitted information, the system should generate an electronic letter to the bidder informing him that his application is accepted.

Alternative flow: if the application form is incomplete and/ or the payment was not made, the system will redirect the bidder to the application form.

Precondition: - applicant was registered to the system.

- applicant log in the system

Post condition: - The actor should log in the system

A confirmation letter from the system regarding the receipt of his application, (we will name him the applicant)

- Clarification and proposal screens are activated

Activity diagram: Figure 5.17 is the activity diagram for apply for assignment use case

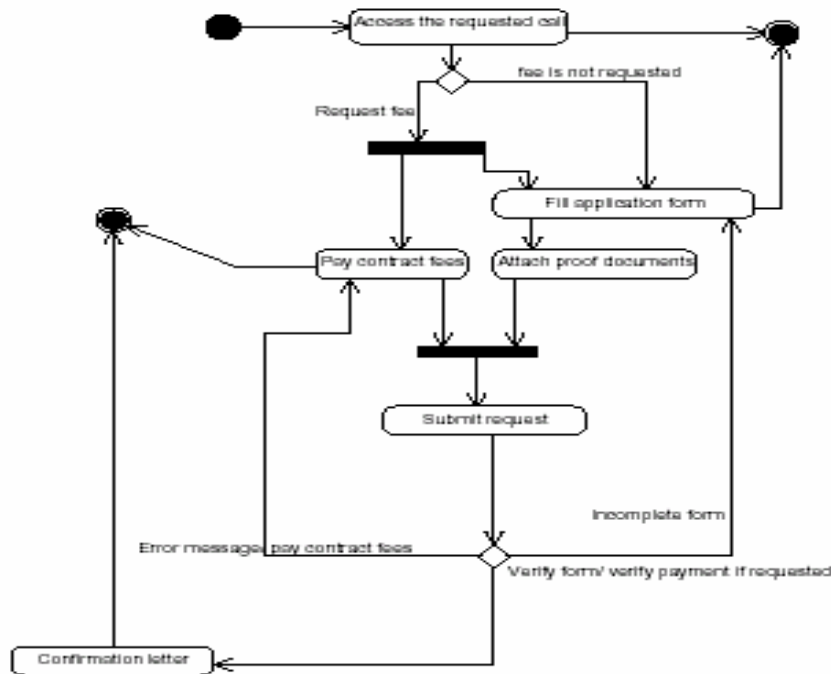


Figure 5.17 Activity diagram for apply for assignment use case

Use Case 9 Request Clarification:

Brief description: this Use Case aims to allow users to ask questions about the assignment. Questions and answers should be available to all bidders who apply to this assignment, without any restriction.

Actor: The bidder

Main flow: The user displays the assignment's folder, enters clarifications sub screen. In this sub screen, the user views all previous questions and answers related to this

assignment. The user can add his question/s to the questions part of the screen, and submit it.

Alternative flow: Pre-bid conference is requested in some assignments; in this case the PO should prepare an appropriate notice. The system should dispatch the notice to all applicants. The meeting may be conducted online via closed circuit or offline.

Activity diagram: Figure 5.18 represents request clarification use case

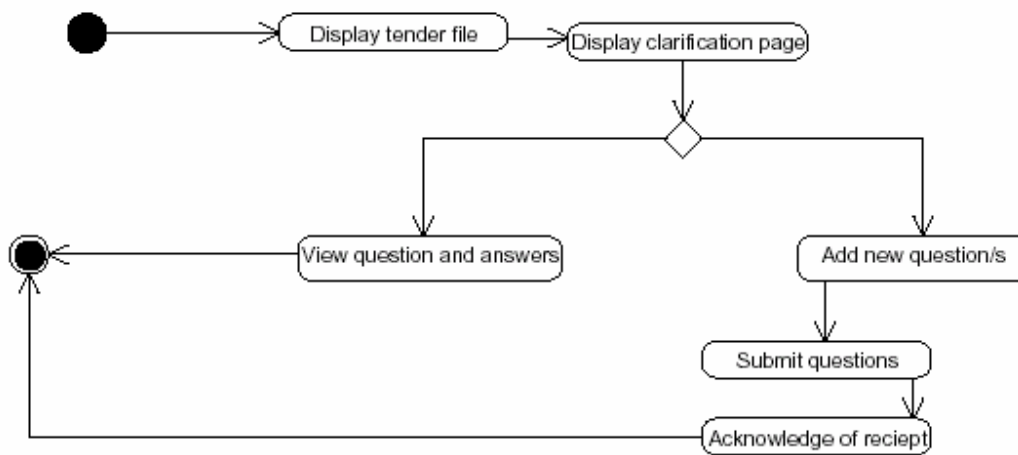


Figure 5.18 Activity diagram for request clarification use case

Precondition: The actor should log in the system

The system accepts the user application for assignment.

Post condition: the question/s should appear at the questions screen

Use Case 10 Answer clarifications:

Brief description: this Use Case allows the client to answer the applicant's clarifications. The client is to answer the clarifications and send them to PO, who will publish them. It is important to note that, the assigned PO is the only authorized person for publishing any material.

Actor: the client

Main flow: the client login to the system, display clarification page, pick any question, answer it, and then send it to the assignment's PO for publication. It is important to note that the PO is the authorized person for the publication of any material.

Alternative flow: none

Activity diagram: Figure 5.19 is the activity diagram for answer clarification use case.

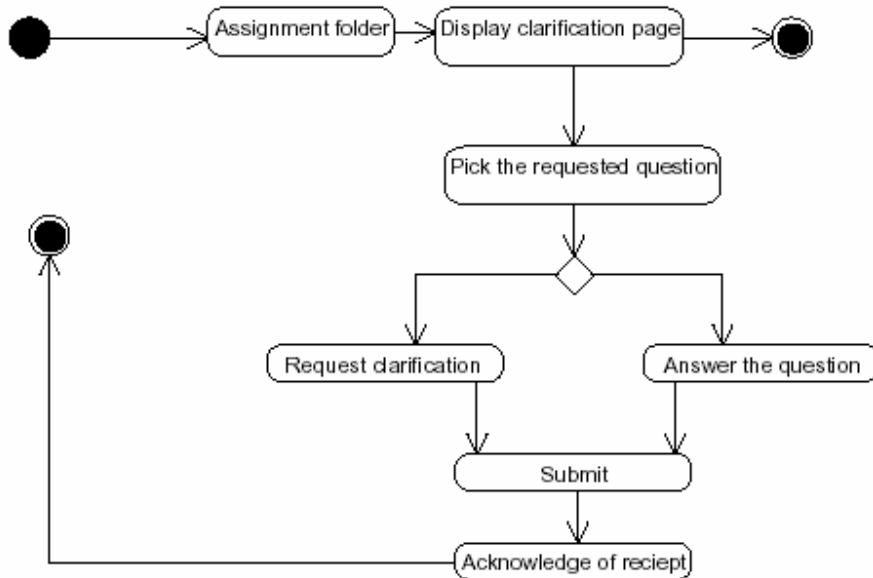


Figure 5.19 Activity diagram for answer clarification use case

Precondition: The actor should log in the system

Post condition: acknowledge receipt from the system.

Use Case 11 Upload proposal:

Brief description: this Use Case allows the applicants to upload their proposal/s to the system. Proposals may be sent in two separate files upon the notification request. This Use Case allows the applicants to send their proposals in separate files.

Actor: The bidder

Main flow: the applicant may choose to prepare his proposal offline. In this case, he is requested to display proposals sub screen, select upload file, locate the requested file, give it a name and ID number and mark it as technical or financial proposal, and then submit it.

Alternative flow: The system will display error message if (a) the file size is too large or (b) the file doesn't have a name and ID

Activity diagram: presented in figure 5.20

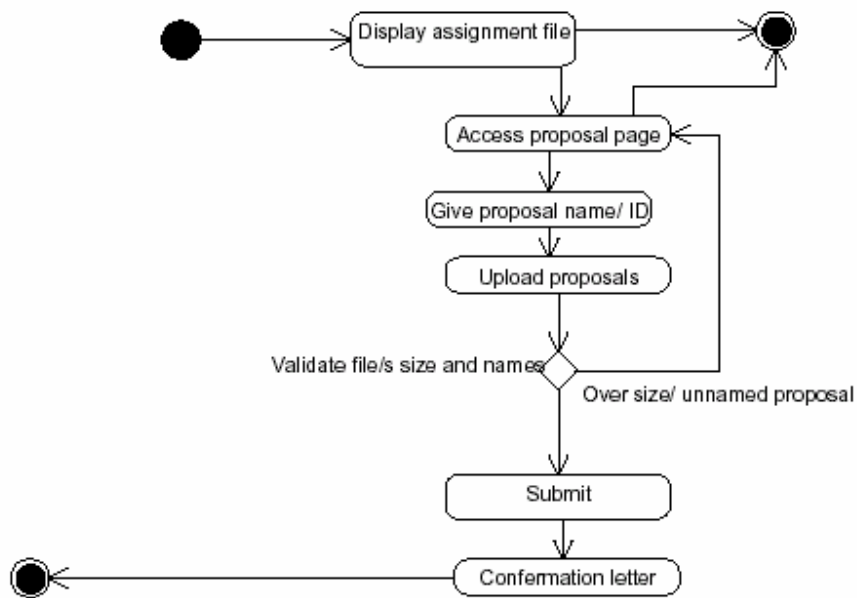


Figure 5.20 Activity diagram for upload proposals use case

- Precondition:** -The actor should log in the system
 -The user was accepted as an applicant
 - Before the closing date of submission.

Post condition: acknowledgment receipt from the system.

Use case 12 Cancel/ modify proposal:

Brief description: this Use Case allows the applicant to cancel or modify his proposal. The applicant can cancel or modify his proposal by adding amendments to the original proposal.

Actor: The bidder

Main flow: the applicant enters the assignment’s folder, display the proposal screen, select add amendment, the amendment page will appear with the name of the assignment, the name and ID number that he selects for his proposal, he can add any modification he needs, then submit the amendment. All events should be stamped by the date and time of sending.

Alternative flow: None

Activity diagram: Figure 5.21 represents cancel/ modifies proposal use case.

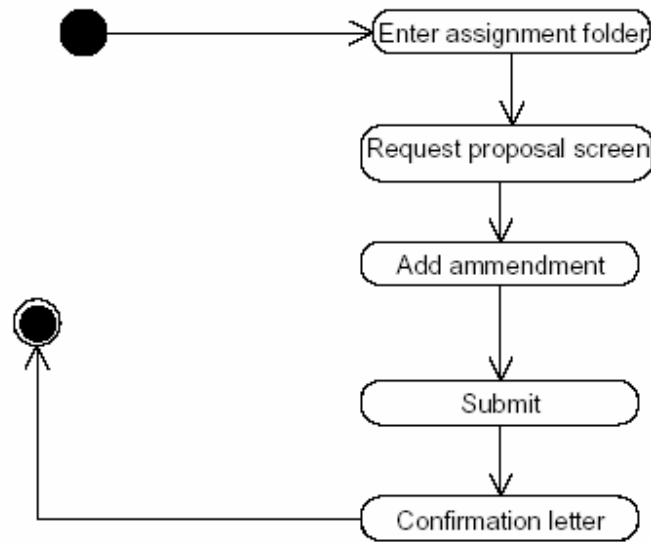


Figure 5.21 Activity diagram for cancel/ modify proposal use case.

- Pre condition:**
- The actor should log in the system
 - The applicant has a proposal.
 - Before the closing date of the assignment.

Post condition: acknowledgment receipt from the system

Use case 13 Open the proposals:

Brief description: This use Case allows the opening committee to open, and download the proposals and amendments.

Actor: the opening committee

Main flow: After the closing date of submitting proposals takes place, the proposals sub screen at the PO interface will be active. Members of the opening committee are requested to use their passwords to login to this sub screen, and unlock the proposals box. By this action they can download the proposals and amendments. Any modifications to the electronic copy of the proposals are prohibited. In case the proposal consists of technical and financial offers, then the financial proposal box will not be active before

completing the evaluation of the technical proposals. The duration should be set during the tender creation stage.

Alternative flow: in case one of the evaluation committee members doesn't attend the meeting for any reason, the PO can change the settings of the created tender and replace this member by any authorized person.

Activity diagram: Figure 5.22 represents this use case

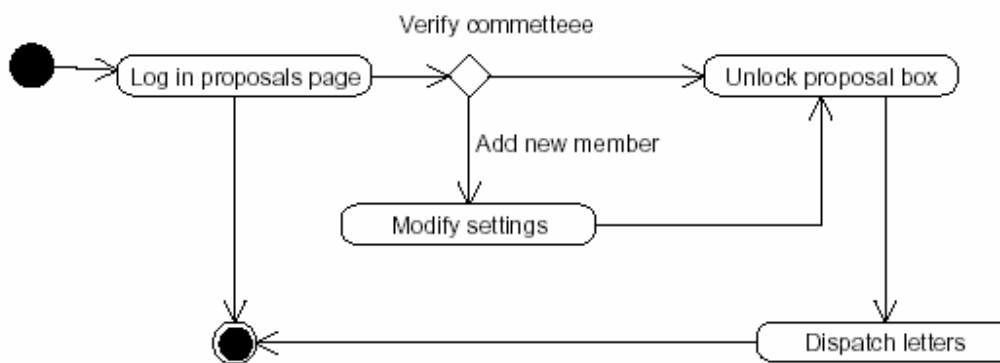


Figure 5.22 Activity diagram for open proposals use case

Precondition: - Members are log in the system

Members of the opening committee attends the meeting

Within the specified time of tender opening.

Post condition: tender box is unlocked

Electronic messages to all related parties.

Use Case 14 Logout:

Brief description: this use case allows the user to logout the system from any page.

Actor: Users who login the system

Main flow: The user clicks logout button, then the system redirect the user to the home page.

Alternative flow: if the user closes the web without logout action, the system will automatically log him out after defined period of time

Precondition: the user login the system

Post condition: the user logout the system

Use Case 15 manages profile:

Context diagram:

Figure 5.23 represents the context diagram for manage profile use case

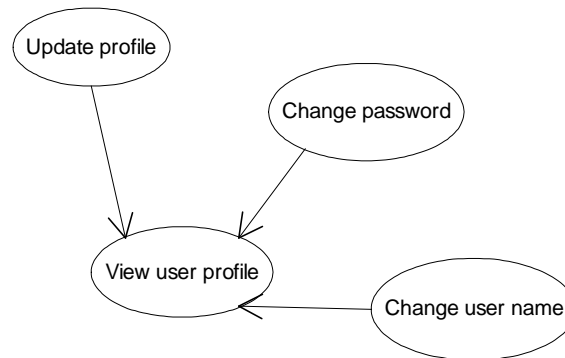


Figure 5.23 context diagram for manage profile use case

Brief description: this Use Case allows the user to manage his profile that was saved in the system.

Actors: any registered user

Main flow: User is to request manage my profile, configure his settings, save the changes, logout the system

Alternative flow: if the user fail to login to his profile, he may ask the system help such as pass word recovery.

Precondition: The user login the system

Post condition: the user configures his settings.

Aliases words

The described use cases include some aliases words. Table 5.2 includes the used aliases words that have the same meaning for the purpose of this thesis.

Table 5.2 Aliases words

Applicant	The bidder who apply for certain assignment
Apply for assignment	Apply for tender
CTC staff	Procurement officer

5.4.5 Workflow within the system

The previous section identified the actors and their requirements from the system to perform their duties. The requirements were presented in form of Use Cases. This section, will describe the workflow within the system. Workflow of any activity initiated by one of the system users. In order to facilitate the workflow description, an imaginable example will be introduced and the user's interfaces with the system will be proposed.

The example presumes that the Palestinian Industrial Estates and Free Zones Authority (PIEFZA) request the help of CTC to nominate a qualified consultant to design infrastructure works for a new industrial area. PIEFZA sends the TOR for the needed assignment with confirmation letters regarding the availability of fund and land to CTC. The CTC manager approves PIEFZA's request and assign it to one of the infrastructure committee procurement officers (PO) with recommendation to start the tendering process. The procurement officer was registered to the system, so he started the process as follows:

5.4.5.1 Procurement Officer (PO) interface with the system

1- The PO logs in to the system, enters to the **CTC staff screen**, clicks **Create New Tender**. This step aims to create workspace for storing all information related to this particular assignment such as: the assignment's name, name of the client, location, duration, estimated cost, etc. All documents related to this assignment should be store in this workspace. Documents may include: notices, tender documents, amendments, and proposals from bidders. Names and e-mail addresses of the assignment's opening committee should be registered for any new project. Creating new tender should allow the PO, clients, and bidders to communicate through this workspace. Figure 5.24 shows PO interface with the system after creating the new tender.

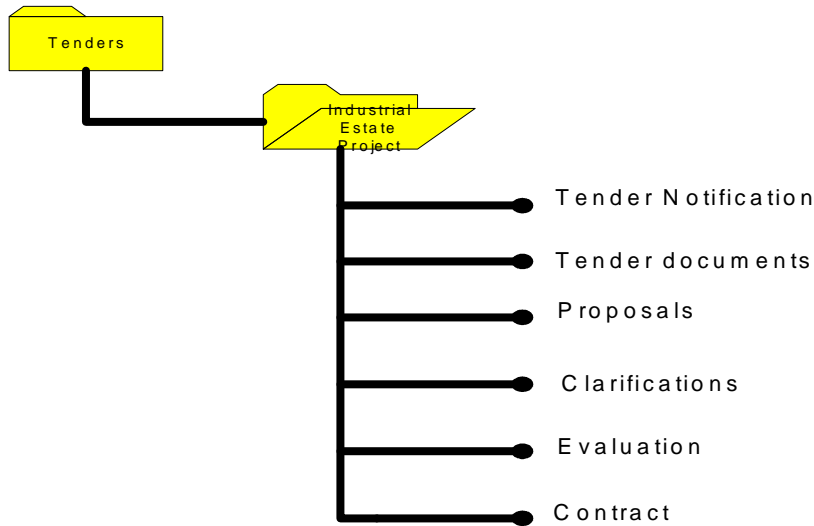


Figure 5.24 PO proposed interface with the system

- 2- After creating the new tender, the PO enters to the **Tender Notification** sub screen. This sub screen allows the PO to perform three activities, namely: (i) write notification summary; (ii) prepare tender notice; and (iii) Publish/ cancel tender notice. Notification templates; electronic standard forms; and Notice wizard may be used to help the PO to complete this task.
- 3- By the end of step 2, the tender notice will be ready for publication. The PO may need further approval from his supervisor (depends on CTC procedures) to publish the Notice. As soon as he gets the approval, he can publish the Notice.
- 4- Publishing the tender notice activates the tender file, so the PO locates PIEFZA's assignment documents and uploads it to the system, (the assignment documents were prepared offline and saved at PIEFZA files)
- 5- The tender file sub screen allows PO to upload or delete documents. All events regarding the tender should be recorded. Electronic messages should be sent to PIEFZA and the bidders who applied for this assignment after publication.
- 6- Publication of the assignment Notice is the initiation of the project. By this time, interested bidders can apply for the assignment, and consequently prepare and send proposals.

7- Clarifications sub screen allows the PO to follow the bidders questions, the client answers the questions and send them to the assigned PO who is authorized to publish these answers.

8- Evaluation of the proposals is performed offline. The evaluation results will be published on the evaluation sub screen. Any information about the evaluation process should be published on this Page.

9- At the contract sub screen, the name of winning bidder will be registered with the bid price. Copies of the assignment summary, name of the winner, bid price, and any other useful information should be kept at the system archive with link to a search engine.

5.4.5.2 Bidder interface with the system

Consultant X (the bidder) is connected to the Internet; he visits CTC web site and read the Notice, found himself qualified to apply for this assignment, so he clicks the button (apply) next to the name of the assignment. An automatic message from the system comes into view. The message consists of two parts: the upper part is summary about the assignment, while the lower part inform him that if he is registered to the system, he can immediately log in. If he is not, then he should register in order to be able to login to the system. Accordingly, he clicks the button (Register now) and starts the registration process. After completing the registration with the needed approvals, the system sends a message to his account informing him that his registration is accepted; the user name and password is part of this message. Registration to the system allows the bidder to (i) apply for any advertised assignment; and (ii) configure his settings to the system. Figure 5.25 represents the registered bidder interface with the system. This interface allows the registered bidder to see the names of all advertised assignments, read the summaries, and to apply also (from the bidder interface screen) for any assignment. The active assignment is the only one he applies for. After completing the registration and the assignment's application processes, the bidder can start the following activities:

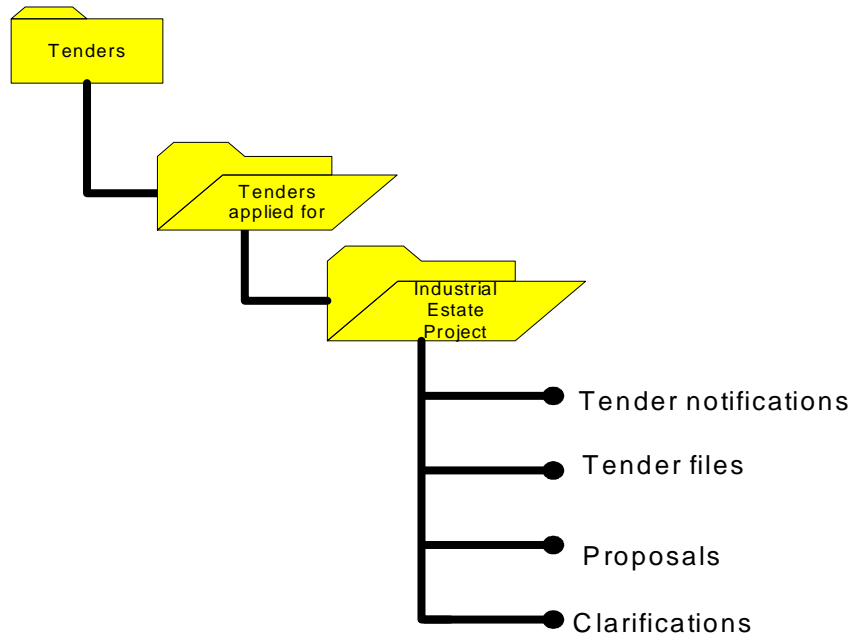


Figure 5.25 -Bidder interface to the proposed system

- 1- He clicks the Tender Notification to get further information about the assignment. Any changes in the assignment should be added to this page. From this page consultant X applies for the assignment by filling a special application form.
- 2- He clicks on the Tender File, by this the tender documents, amendments, and any other related documents appear at the screen. He can read, print, and download the documents.
- 3- At this stage the only active sub screen is the tender documents one. Activation of Proposals and clarifications sub screens will start after paying the contract fees. The bidder can ask his bank to send an electronic bank guarantee regarding contract fees to the system.
- 4- As the clarifications sub screen is in active position, the bidder can enter it. At this sub screen the bidder can post his questions, read, print, and download other questions, and answers.

- 5- After completing his proposal, the bidder enters proposals sub screen and upload his proposal/s. this sub screen allows the bidder to upload, send, delete, or modify his proposal.

5.4.5.3 Client interface with the system

PIEFZA, as a government institution is member in this system (application for the system membership is to be filled first). Authorized person from PIEFZA can login to the system. He can view summaries about the advertised projects. The only active projects are those belonging to PIEFZA. Figure 5.26 show PIEFZA's (the client) interface with the system.

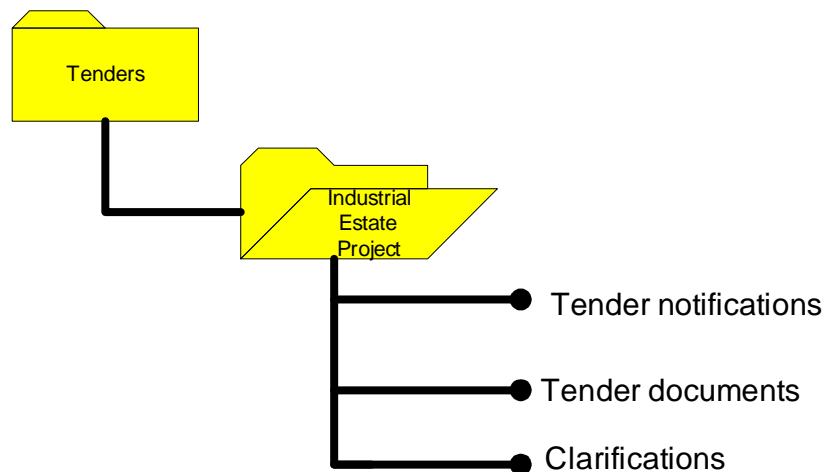


Figure 5.26client proposed interface to the system

The client is authorized to have access to the tender files to read and download any document. Clarifications sub screens allows the client to pick any question and answer it. Client can send the answers to the assignment's PO for publication.

5.4.5.4 Opening committee interface with the system

The opening committee may consist from representatives of the client, CTC, and any other auditor from related government institutions. After the closing date of the assignment, an automatic message from the system should be delivered to the pre-defined opening committee e-mails. The message informs the opening committee that the system

will not receive any new proposals. The proposals sub screen of the assignment's PO is active, and the same message enclosed ID numbers that enables the opening committee to enter this sub screen. The opening committee is authorized to unlock the proposals box and to download proposals. Changing in the electronic proposals is prohibited.

5.4.5.5 Banks interface with the system

Reputable Banks can be members of this system (against annual fee). Banks with membership can interact with the proposed system via interface allowing them to see advertised assignments, and send bank's guarantees, and tender fees upon the bidders requests. Analysis of the banking system is out of the scope of this research.

5.4.6 Collaboration between actors

The previous section described the interaction between the users and the system to complete an assignment. This section is presenting the collaboration between parties to complete an activity. Collaboration diagrams will be implemented to describe these relations.

- **Collaboration during pre-qualification stage**

Pre-qualification is a process adopted in the restricted procurement procedures, in which a client requests the services of a qualified bidder (can be consultant or contractor). The client prepares the criteria that will be used to evaluate the interested bidders. In the proposed system, the process includes three parties; CTC, the client, and the bidder. The collaboration diagram of figure 5.29 represents the flow of activities between these parties to complete the e-pre-qualification process. The activity labeled evaluate prequalification application is a joint activity between CTC and the client; it will be performed manually by a joint committee. Figure 5.27 is the collaboration diagram for the pre-qualification stage.

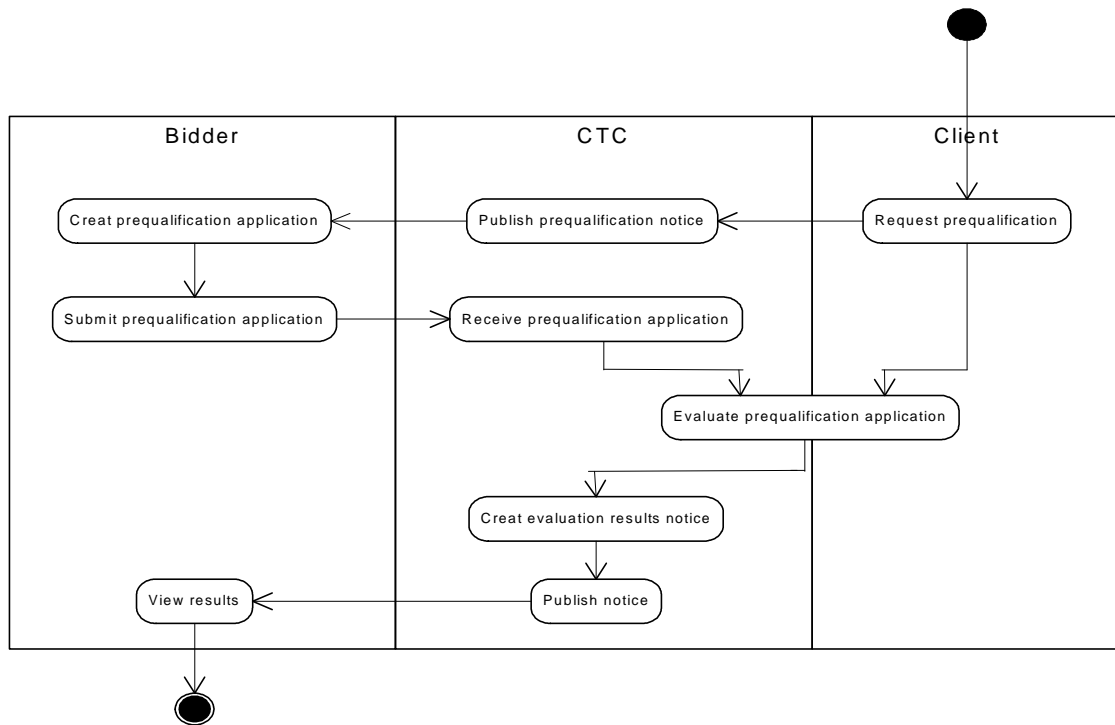


Figure 5.27 Collaboration during pre-qualification stage

- **Collaboration during invitation to tender activity**

Invitation to tender is also a joint activity between the three parties, in which the client initiates the process by requesting a service from CTC. Accordingly, CTC is to decide whether to go for restricted procedures (pre-qualification) or open procedures. At the end of this process, an invitation to tender should appear at the system site. Figure 5.28 represents the activities taking place to complete this process.

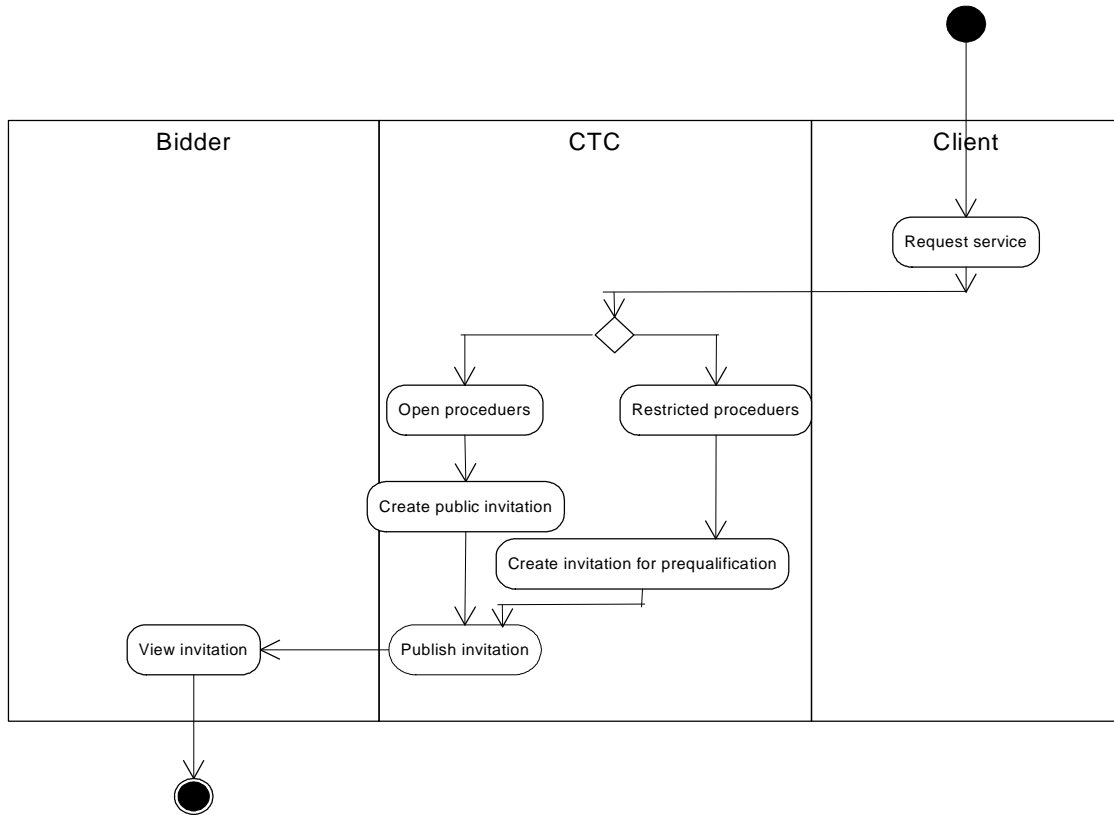


Figure 5.28 Collaboration during invitation to tender

- **Collaboration during request for clarification**

This process is usually initiated by the bidder, where he posts his question/s on the site. The CTC as well as the client view these questions. The client answers the questions and sends them the PO who is authorized to publish these answers. Figure 5.31 represents the collaboration between parties during this process.

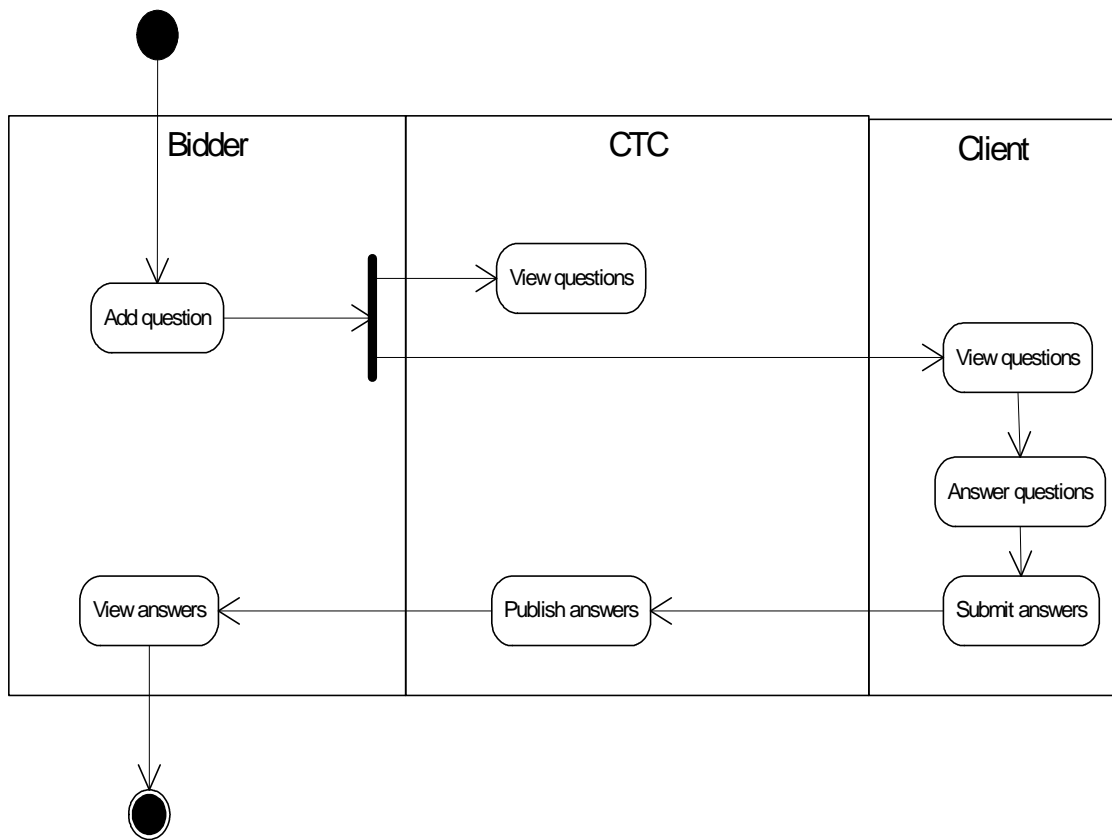


Figure 5.31 Collaboration during clarification stage

5.6 Requirements from the system

The anticipated system should be designed in a way that allows actors to perform their duties and responsibilities accurately and securely. Accordingly, the system designers should guarantee some system requirements. System requirements are divided into two groups, functional and non-functional (Chandran, et al. 2003). This section will propose some of the functional requirements and some of the non-functional requirements for the proposed system. At the end of the section a tractability matrix will be developed, the matrix will compare the described Use Cases with the proposed system requirements; each use case should meet at least one of the requirements that the system should guarantee.

5.6.1 Functional requirements

Functional requirements are essential to allow users to perform their duties. The proposed system is to be designed to guarantee the following requirements:

ID	Name	Brief description	Related use cases/ sub use cases	Source
1	Language	The system should offer bilingual support; the content should be in Arabic and English languages.	Register, Generate reports	Author
2	Registration	The system should allow users to register online; the system must assure the confidentiality of all personal information of the users. Users include procurement officers, clients, bidders, and banks.	Register	World Bank
3	Registration conditions	The system shall require the user to accept the terms and conditions of the system.	Register	World Bank
4	Registration form	the system registration form shall include mandatory fields	Register	Author
5	Registration feed back	The system shall send the registered person ID and password to his e-mail.	Register	Author
6	Users authorization	The system shall be able to control which activities a user can perform, as well as, what data a user shall have access to.	Log in, View user profile, Create tender, Notify for tender	Functional requirements under EU framework
7	Log out accessibility	The system shall allow a user to log out from the system at any screen.	Log out	Dept. of administrative reforms and public

				grievances
8	Users authentication	The system shall only grants users access to their own profile.	Log in, Update user profile, View user profile	Functional requirements under EU framework
9	Users profiling	The system shall allow a user to manage/ modify his profile online.	Update user profile	World Bank
10	Reporting about the system users	The system shall allow CTC officials to generate reports about the users.	Generate report	Author
11	Tracking of the users' activities	The system shall be able to record all users' activities; all activities should be subject to date and time stamped.	Log out, log in, Update user profile, Register, View user profile, Create tender, Notify for tender, Cancel notification, Request/ view clarification, Answer / publish clarifications, Apply for tender, Upload documents/ amendment, Download tender documents, Upload proposal, modify/ cancel proposal, Download proposals, Open proposals	Functional requirements under EU framework, World Bank, Dept. of administrative reforms and public grievances
12	Automated notification	The system shall be able to send messages to all users.	Register	Author

13	Tender workspace creation	The system shall guarantee that only CTC officials can create new tender.	Create tender	Functional requirements under EU framework
14	Notice preparation	The system shall guarantee that only PO can prepare tender Notice	Notify for tender	Functional requirements under EU framework
15	Notice publication	The system shall guarantee that only PO can publish tender Notice.	Publish tender Notice	Functional requirements under EU framework
16	Notice cancellation	The system shall guarantee that only PO can cancel tender Notice	Cancel notification	Functional requirements under EU framework
17	Document distribution	The system shall guarantee that only PO can upload tender files to the system	Upload documents, amendment	Author
18	Documents modification	The system shall prevent any user from modifying the tender documents after publication.	Upload documents/ amendment	Author
19	Type of tender route	The system shall require from PO to identify the type of tender process before publication, i.e. restricted or open	Create tender, Notify for tender, publish tender notice	Author
20	Apply for tender	The system shall guarantee that the bidder is allowed to apply online for assignment;	Apply for tender, Upload proposal	World Bank, Dept. of administrative

		bidder cannot apply twice for the same bid.		reforms and public grievances
21	Screens arrangements	The system shall activate the clarifications and upload sub screens in the bidder interface only after sending the bid security.	Request/ view clarifications, Upload proposal	LEEDS City Council
22	Proposals modifications	The system shall allow bidders to cancel/ modify their proposals	modify/ cancel proposal	LEEDS City Council
23	Request clarifications	The system shall alert the client and PO about any new question.	Request/ view clarifications	LEEDS City Council
24	View clarifications	All bidders should view questions and answers at the same time.	Request/ view clarifications	World Bank
25	Answer clarifications	Clients should be allowed to answer questions and send them to PO.	Answer / publish clarifications	Author
26	Clarification's publication	PO should be allowed to publish answers	Answer / publish clarifications	Author
27	Proposals tracking	The system should generate message to the bidders informing him that his proposal was successfully delivered	Upload proposal	LEEDS City Council
28	Late proposals	The system shall reject any late proposal.	Upload proposal	World Bank
29	Download arrangements	If specialized software is needed to download	Download tender documents	World Bank

		documents (in the bidder side), the software shall be downloadable from the site free of charge.		
30	Virus scanning	the system shall virus scan all downloaded documents	Download proposals	World Bank
31	Amendment tracking	The system shall automatically inform all bidders in case of any amendment to the bidding documents.	Upload amendments	LEEDS City Council
32	Documents distribution tracking	The system shall track receipt by bidders when distributing pre-bid amendments and clarification online.	Upload amendments	LEEDS City Council
33	Proposals submission	Proposals submitted to CTC should be kept in secure online bid box.	Upload proposal	World Bank
34	Time tracking	The system shall be able to register the time and date of all events	Download proposals, Open proposals	LEEDS City Council
35	Proposals confidentially	In case the proposal contains financial and technical offers, the system shall be able to keep the financial proposal close and in secure place.	Download proposals, Open proposals	Functional requirements under EU framework
36	Modifications after the closing time	The system shall not allow any modification to the electronic copy of the proposals after the closing time	Download proposals, Open proposals	World Bank

37	Reporting	The system shall allow PO to generate reports.	Generate reports, Download proposals, Open proposals	Author
38	Evaluation tracking	The system shall send automatic messages to all bidders about the evaluation results.	Notification	Author
39	System templates	The system should include templates to help in preparing of notifications.	Register, Create tender	LEEDS City Council

5.6.2 Non-functional requirements

None functional requirements are to be made to differentiate between one product from another the following non-functional requirements are supposed to support this system:

- 1- Security: Even though security is a non-functional requirement but still more critical than any other functional requirement. The system should integrate all the measures to guarantee high level of security.
- 2- The system should include a site map.
- 3- PNA and CTC logos should appear at the web site.
- 4- CTC organization chart is to be included in the web site.
- 5- The system should offer learning tour to the visitors.
- 6- Search engine should be linked to the site, for previous projects.
- 7- Links to another similar sites.
- 8- Library and bulletin.

5.7 Proposed development stages

Due to the absence of legislative arrangements for the e-business concept in Gaza strip, it becomes unrealistic to apply e-procurement in the construction industry in Gaza in one stage, accordingly the research recommends the following stages for the proposed site development.

- 1- First stage in the system development is the public awareness; this step can be executed via workshops for the system potential users. The workshops aim to verify the proposed functional requirements.
- 2- Second stage: This stage is a public awareness stage, it aims to introduce the site to the public by using it for advertisement for the new projects, publishing the laws, regulations, forms, and to introduce CTC as a department dealing with public procurement issues
- 3- Third stage: At this stage bidders can start downloading bidding documents from the proposed site.
- 4- Fourth stage: issuing an e-business law in Palestine and approving the e-signature legal statues are preconditions to start this stage, where bidders can send their proposals to CTC.
- 5- The system development should adopt incremental method of development.

Related works

Several studies were developed regarding e-tendering issues, this section of the thesis aims to highlight the differences between this thesis and the work of other researchers. Accordingly, two studies were selected for this purpose.

As presented previously, this research is the first attempt to build a model for web-based tendering system for public works in Gaza. The thesis was prepared by system user rather than IT specialist, so it focuses on the user requirements and the surrounding environment of the public tendering business in Gaza.

The model was structured to help bidders, procurement officers from the CTC, and owners to fully communicate during the tendering process. Several models were produced worldwide; this one is different in the methodology and the details.

A thesis submitted by Turan (2004) described the public e-procurement system in turkey, the thesis was written by IT specialist and it was built upon previous studies about the situation in Turkey. Even though, the author selected the UML as an approach to for system analyses, still he didn't describe the use cases.

The European Commission (1997) developed a study with the objective to study the information flow between public purchasers and suppliers and elaborate proposals for the transition to electronically based exchange of information. One of the tasks of this group is to study how the existing UN/EDIFACT messages can be used to support the procurement processes with the intention to develop guidelines, as appropriate, for the use of the messages that fit the requirements of the procurement sector and modify messages, or develop new ones, if existing messages do not satisfy the needs.

Chapter 6

Conclusions and recommendations

6.1 INTRODUCTION

This chapter discusses major conclusions of the research, findings, research limitations, and recommendations.

6.2 GENERAL CONCLUSIONS

As discussed in the first chapter, this research aims to propose a web based tendering system for public works in Gaza. The proposed system is able to serve as a platform for communication between parties involved in the procurement process namely: CTC, Bidders, and clients. In light of that, this study answers the following questions:

- 1- What is the current legal and procedural arrangements regarding procurement activities in Gaza Strip (Chapter 3)?
- 2- What is the level of IT utilization by construction industry stakeholders in Gaza Strip (chapter 4)?
- 3- What are the requirements of construction industry participants towards web-based tendering management system (chapter 4)?
- 4- What are the futures that the proposed system should have to meet user's requirements (chapter 5)?
- 5- How should tendering management system develop in future (chapter 5)?

The study of current legal and institutional framework of public tendering in Gaza identifies serious weaknesses in these areas. Following are our recommendations

- 1- Clear, and comprehensive unified procurement law to regulate the procurement of works and consulting services is needed.
- 2- National standard bidding documents for works, and services is needed.
- 3- There is a need to empower the Central Tendering Committee (CTC) in order to take its role as the core agent for public procurement activities in Palestine. CTC should

belong to the office of prim-minister; it should not be part of any ministry. In addition to that, a separate committee should be established to develop the national policy in procurement, and to develop the regulations and laws in regard.

4- Training and capacity building for the staff that will work in procurement operations is essential.

Modeling current procurement procedures (World Bank procurement procedures) identify four potential areas to be automated namely: Project announcement, pre-qualification, distribution of bidding documents, and receiving of proposals.

The survey, enriches the research, and serves it in two directions (i) it measures the readiness of participants to adopt such solution; and (ii) it extracts the feed back of construction community in Gaza about the idea of establishing web-based e-procurement system. The survey major findings show that:

- Consultants are more familiar with IT applications than clients and contractors.
- Contractors and consultants practiced buying material though the web site.
- Contractors and clients are reluctant more than consultants to adopt e-payment solutions.
- Financial difficulties, lack of managerial support are important reasons that hinder clients of improving their IT capacity.
- User friendliness, and past experience are significant factors in selecting new software.
- In general the three categories agree to adopt IT solutions in the four mentioned areas.
- Consultants are strongly agreed to adopt such solutions.
- The three categories recognized the importance of IT in construction industry in the future.

Based on chapters three and four, a conceptual model is built up. The model consists of three major packages: manage system entrance, manage user profile, and manage tender.

Each package contains some major use cases, such as: register user, create new tender, upload tender documents, upload proposals, ask questions, and open tenders.

6.3 Research Outcomes

The research outcomes can be discussed in two aspects: the research result, and the research methods. The research is meaningful since it introduces the basics for e-procurement system, which will find solutions to the fragmentation of data regarding construction business in Gaza. E-procurement solutions will reduce the time and efforts to complete procurement operations; minimize expenses of paper works; improve transparency; and increase competition.

The methods of this study, UML modeling, also deserve discussion. UML is still new to project modeling researches in the construction sector worldwide. Adopting the UML approach will facilitate the collaboration between construction industry professionals and IT experts. IT experts can easily understand a conceptual model developed using UML; it erased the need for model translations from one language to another.

6.4 LIMITATIONS AND RECOMMENDATIONS

There are many limitations of this research due to data unavailability. Three limitations and recommendations are discussed here: depth of user requirements, completeness of the conceptual model, and implementation of the system.

The user requirements obtained from the survey are good but, in practice, more specific requirements are to be obtained by the efforts of a software development team consisting of users, construction domain experts, and IT experts.

The conceptual model is not a complete one. It only contains use cases most relevant to the development of e-procurement system. Nevertheless, a complete model can be built based on the current features studied in this research.

Phases in the lifecycle of software development include requirement analysis, system design, implementation and evaluation. The research focuses mainly on requirement analysis. Actual development of the system will involve much more than an individual's effort. Value of the conceptual model is not fully realized until the whole system is actually built and tested.

Finally, we should remember that, traditional method of procurement should always be acceptable.

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الأخ الكريم
السلام عليكم ورحمة الله وبركاته

الموضوع: استبيان بخصوص تطبيقات تكنولوجيا المعلومات في صناعة الإنشاءات في قطاع غزة

كما تعلمون فقد شهدت العقود الثلاث الأخيرة تطوراً كبيراً في مجال تطبيق تكنولوجيا المعلومات في القطاعات الصناعية المختلفة وعلى الرغم من التطور الهائل في علوم الكمبيوتر والتطبيقات المصاحبة له فلقد جاءت استجابة صناعة الإنشاءات لهذا التحول أبطأ من غيرها من الصناعات هذا من ناحية ومن ناحية أخرى فإن هذه الاستجابة اختلفت من بلد لآخر تبعاً لمدى الاستفادة المتوقعة من تبني هذه التطبيقات.

وفي هذا السياق نستطيع القول أن مرحلة التحضير للمشروع قد استفادت من هذه التطبيقات إلى حد كبير حيث يتم تحضير جميع وثائق المشروع (تقريباً) إلكترونياً وعلى الرغم من ذلك فإن تبادل هذه الوثائق يتم في الغالب يدوياً وخصوصاً في مرحلة تبادل وثائق العطاء بين صاحب العمل والمقاول و/ أو الاستشاري.

ونظراً للأهمية المتنامية لهذا الموضوع ولحجم وأهمية التبادل السريع والدقيق للمعلومات وأثر ذلك في اتخاذ قرارات مهمة في هذه المرحلة من العمل بدت الحاجة ملحة إلى طرح مسألة الاستفادة من تطبيقات تكنولوجيا المعلومات في مرحلة تبادل وثائق العطاء للدراسة والبحث العلمي.

بناءً على ما تقدم نضع بين أيديكم هذا الاستبيان الذي ستستخدم نتائجه في معرفة مدى الاستفادة من تطبيقات تكنولوجيا المعلومات لدى المعنيين في قطاع الإنشاءات في قطاع غزة (ملاك, مقاولين, استشاريين) ومقارنة هذه الاستفادة مع الدول الأخرى هذا من ناحية ومن ناحية أخرى يهدف الاستبيان إلى معرفة مدى استعداد العاملين في قطاع الإنشاءات في غزة لتطبيق هذه

التكنولوجيا في مجال التبادل الإلكتروني للوثائق في مرحلة العطاء تمهيداً لوضع تصور لذلك يأخذ بعين الاعتبار مدى جاهزية المعنيين في هذا القطاع لهذا التحول. سيتم استخدام نتائج هذا الاستبيان لأغراض البحث العلمي فقط وستكون هذه النتائج جزء من دراسة بعنوان (الاستفادة من تطبيقات تكنولوجيا المعلومات في قطاع الإنشاءات في غزة) وذلك لاستكمال متطلبات الدراسة لنيل درجة الماجستير في إدارة المشاريع من كلية الهندسة - الجامعة الإسلامية - غزة.

إن مشاركتكم معنا في هذا العمل هو إثراء له ونشكركم جزيل الشكر على هذه المشاركة القيمة.

والسلام عليكم ورحمة الله وبركاته.

لغرض هذا الاستبيان عرف (Bjork, 1999) تكنولوجيا المعلومات على أنها (استخدام المعدات الإلكترونية لأغراض معالجة، تخزين، نقل، وعرض المعلومات)

للاستفسار يرجى الاتصال على:-

م. بكر ثابت

هيئة الدن الصناعية

جوال (٠٥٩٩٤٨٣٢٧٤)

أو b.thabet@piefza.org

Introduction

Over the last three decades, there have been many signs indicating that the construction industry is increasingly becoming aware of Information Technology (IT) applications and is adopting many such applications.

However, the evolution of the computer science and the advanced technologies in the construction industry has been much slower than other manufacturing and services industries. On the other hand, the increasing use of IT in construction differs from one country to another. That depends on the extent to which IT importance and needs have been perceived.

This survey is part of a Master Degree research study aiming to provide a well-structured analysis of the current and potential use of IT in the construction industry in Gaza strip.

The survey is designed for organizations dealing with construction industry in Gaza strip (contractors, consultants, and public owners); you will be asked to answer on behalf of your organization.

The questionnaire is divided into six sections and may take about 30 minutes to complete. The first section collects general information about the organization, the second section aims to identify the software used by the firm, the third section about the hardware owned by the organization, the fourth one about the communication and internet adoption by the organization, section five collects information about the factors hindering the IT applications in Gaza construction industry, and the sixth section seeks to assess the future plans to adopt the IT by the questioned firms.

Your contribution towards this study is greatly appreciated, as it will add significantly to the value of the research.

Your responses will be kept securely and will remain confidential.

For any further information kindly contact me at b.thabet@piefza.org
Or 059-483274

- Less than one million
- Between one million and three millions
- More than three millions

1.14 The **majority** of your completed projects in the past five years were financed by (select one of the following financing agencies)

- The World Bank (WB)
- The Islamic Development Bank
- The European Investment Bank (EIB)
- The USAID
- Others (Identify)

Section 2: This section intends to identify the software used in the organization

2.1 Software for project planning, cost estimating, and finance are currently used by the organization (select the ones used)

- MS project
- Microsoft Excel
- Power point
- Primavera
- Accounting (identify)
- Others (Identify)

2.2 Software for general administration are currently used by the organization (select the used ones)

- MS-Word
- MS-Excel
- MS-Access
- Personnel system (identify)
- Others (identify)

2.3 Design software currently in use by the organization (select the ones used)

- Auto CAD
- Micro station
- Graphics Design (Identify)
- Air conditioning (Identify)
- Water system (Identify)
- Sewer system (identify)
- Structures (identify)
- Others (identify)

2.4 Operating systems currently in use by the organization

- MS- Windows 95

- MS- Windows 98
- MS- Windows XP
- MS- Windows 2000
- Others (identify)

2.5 The most significant factors considered in selecting computer software

- Cost
- User friendliness
- Past experience in the software
- Software integration
- Flexibility of report generation
- Others (identify)

Section 3: This section intends to identify the hardware used by the organization

3.1 How many computers currently in use by your organization?

(For public owners please identify the number of computer units used by the staff related to the construction project designs and implementation)

3.2 How many printers currently in use by your organization?

3.3 Information technology (I.T) hardware currently in use

- Plotters
- Photocopiers / Large Photocopiers
- Mobile phones
- Wire less phones
- Fax machine
- Scanners
- CD writer / backup instruments
- Videoconference equipment
- Servers
- Others (identify)

3.4 Does your organization allocate budget for hardware renewal?

- Yes
- No

3.5 If the answer is yes what is the allocated budget/ year \$

Section 4: This section intends to identify the Internet and communication technology applied by the organization as well as the ability to implement the web-based procurement management system.

4.1 Do you have a web site for your Company / Organization?

- Yes
- No

4.2 If the answer is yes what are the organization primary purposes of having an organization web site?

- General organization information
- Projects information
- Personal recruitment
- Material purchasing/ marketing
- Public feedback
- Others (identify)

4.3 Does your organization have a Local Area Network?

- Yes
- No

4.4 Is your organization connected to the Internet?

- Yes
- No

4.4 Number of senior employees connected to the Internet

4.5 Purpose of using e-mail by the organization

- Sending/ Receiving informal messages
- Sending/ Receiving formal messages
- Distribution of documentation to other organization
- Distribution of documentation within the organization
- Purchasing/ procurement
- Sending/ Receiving quotations
- Sending/ receiving bidding documents
- Others (identify)

4.6 Factors restricting the use of e-mail system by the organization

- Afraid of losing information
- Afraid of leakage of information
- No user training
- Cost
- Lack of management support
- E-mail does not have legal standing in legal proceeding
- Problems in the local network
- Others (identify)

4.7 If the Palestinian Central Bidding Committee decide to construct a web-site in order to computerize the bidding process and to electronically share the bidding documents, then to what extent you agree to the following statements?

4.7.1 Establishing a web-site for the Palestinian Central Bidding Committee

- Strongly agree Agree Neutral Disagree Strongly disagree

Kindly explain why (You may explain in Arabic or English)

4.7.2 On-line advertisement for tenders
 Strongly agree Agree Neutral Disagree Strongly disagree
Kindly explain why (You may explain in Arabic or English)

4.7.3 On-line distribution for bidding documents
 Strongly agree Agree Neutral Disagree Strongly disagree
Kindly explain why (You may explain in Arabic or English)

4.7.4 On-line request for information
 Strongly agree Agree Neutral Disagree Strongly disagree
Kindly explain why (You may explain in Arabic or English)

4.7.5 On-line prequalification
 Strongly agree Agree Neutral Disagree Strongly disagree
Kindly explain why (You may explain in Arabic or English)

4.7.6 On-line (video conference) meeting for pre-bid and tender opening meetings
 Strongly agree Agree Neutral Disagree Strongly disagree
Kindly explain why (You may explain in Arabic or English)

4.7.7 On-line submission for your technical and financial proposals
 Strongly agree Agree Neutral Disagree Strongly disagree
Kindly explain why (You may explain in Arabic or English)

4.7.8 On-line payment for the price of the bidding documents
 Strongly agree Agree Neutral Disagree Strongly disagree
Kindly explain why (You may explain in Arabic or English)

4.8 Did you ever purchase construction supplies through the web?
 Yes No

4.9 If the answer is yes how did you pay the supplier?

- Via letter of credit
 Via Master Card
 Others (identify)

Section 5: This section intends to identify the different reasons hindering the Implementation of Information Technology (I.T) in the organization

5.1 What reasons are hindering the use of IT in the organization?

- Rapid change in technology
 Software problems
 Hardware problems
 Security problems
 Integration problems

Others (identify)

5.2 What human reasons are hindering the use of IT in the organization?

- Lack of knowledge
- Inadequate training
- Poor management
- Poor teamwork
- Poor leadership
- Others (identify)

5.3 What are the financial reasons are hindering the use of IT in the organization?

- Lack of available funding
- Difficulty in proving that the benefits of IT are greater than the associated cost
- Others (identify)

Section 6: This section intends to identify the future of I.T implementation in construction industry in the next five years

To what extent do you agree with the following statements?

6.1 IT will improve project communication

- Strongly agree Agree Neutral Disagree Strongly disagree

6.2 IT will improve project control

- Strongly agree Agree Neutral Disagree Strongly disagree

6.3 IT will improve procurement/purchasing function

- Strongly agree Agree Neutral Disagree Strongly disagree

6.4 IT will improve profits

- Strongly agree Agree Neutral Disagree Strongly disagree

6.5 IT will become prohibitively expensive

- Strongly agree Agree Neutral Disagree Strongly disagree

6.6 IT will benefit construction research

- Strongly agree Agree Neutral Disagree Strongly disagree

6.7 IT will require extensive training

- Strongly agree Agree Neutral Disagree Strongly disagree

ANNEX B

Procurement process model

B-1 Introduction

This annex introduces a model for WB procurement procedures, WB procurement procedures are adopted by several public Palestinian institutions. This model aims to document the relation between procurement activities, actors of the activities, inputs, outputs, and constraints effects these activities. IT specialists and system analysts need such information in order to identify external entities and to allocate data stores to the system for further analyses. IDEF0 activity modeling technique was selected by this research, this technique usually used for analyzing whole systems as a set of interrelated activities or functions separated from objects (functional oriented modeling system). The technique combines a graphical notation (boxes and arrows) with a text to improve the quality of the completed model.

IDEF0 allows the hierarchal decomposing of activities down to the required level of detail. Figure 1 represents the basic concepts of the IDEF0 method

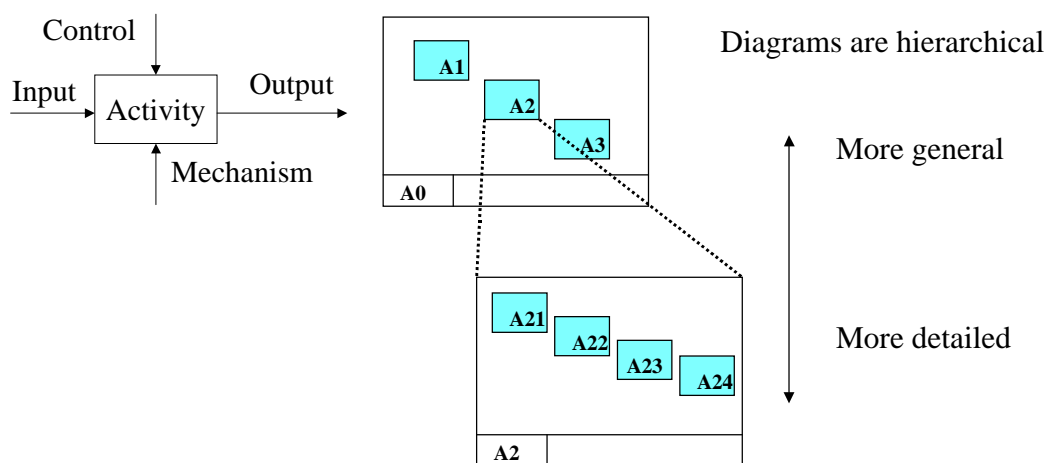


Figure 1. The basic concepts of the IDEF0 method. Source (Karhu 2000).

The main elements of this method are the activity and the flow. The flow will be in the form of input, output, control and mechanism (ICOM). Different forms of flow can be described as follows:

- An input represents something, which in an activity is consumed to produce an output. Typical inputs could be raw materials, energy, human labour, and information when the purpose of the activity is to transform the information to provide added value.
- Outputs can be reused as inputs to further activities, and feedback loops are possible.
- Activities are controlled by controls. Typical examples could be laws, guidelines and instructions for carrying out an activity etc.
- Mechanisms, which point at activities from below, are persons, organisations, machines, software etc. that carry out the activities.

B-2 Related researches

IDEF0 has been used to model several construction processes Karhu et, al (1997) have modeled the overall construction process utilizing this methodology. The model covered the design and construction of a building project from the conception of the project in a client's mind to its completion for handover and use..

L. Chao and G. Bee (2002) utilized IDEF0 to model the procurement process from the contractor point view in Singapore.

M. Kromker (1998) developed a reference model and software support for bid preparation in supply chains in the construction industry.

J.Zabel and F.Weber (2000) developed a process re-engineering and e-business models for efficient bidding and procurement for the Austrian tile supply chain

B-3 Development of the model

This model was developed by first understanding the mentioned procedures and transforming it into a graphical model, second a graphical representation was extended

with textual description. As mentioned earlier in this chapter the purpose of this model is to identify the details of each activity and the role of parties to the activity, and to understand how activities are interrelated to each other. While the model subject is the whole procurement procedures for consultant hiring and contractor employment from the beginning to the contract awarding. This discussion will be presented from the client (owner) point view.

B-4 Model consultant hiring procedures

As mentioned previously, the model presented in this chapter is the World Bank procurement procedures. The information was derived from the Guidelines for selection and employment of consultants by World Bank Borrowers, January 1997, The guidelines procurement under IBRD loans and IDA credits 1999, the training workshop held by the World Bank in Gaza, May, 27-28, 2001 on procurement of works, goods, and services, and a procurement training course held in India, January, 20-31, 2003 about the procurement procedures for World Bank aided projects. The Palestinian law no 6 for the year of 1999 for public works and the UNCITRAL model law were also reviewed for the purpose of this model.

It is important to understand the legal relationship between the WB and the borrower because it is reflected in the procurement process. In this paragraph the research will highlight some important issues regarding this relationship. WB guidelines mentioned that, the relationship between the Bank and the borrower regarding procurement issues starts in early stages (rarely before the loan signed in certain circumstances, clause 1.11 of procurement guidelines). The legal relationship between the WB and the Borrower governed by the Loan Agreement L.A, which is an international agreement, so, it's a treaty subject to international law, therefore it takes precedence over local law. Accordingly, a procurement rule of the L.A applies even if the borrower's domestic law provides for different rules.

In addition to the L.A the following documents also organize the procurement relationship between the Bank and the Borrower:

- Annex-6 of the Project Appraisal document (procurement and Disbursement arrangements)
- Procurement Plan
- Procurement Capacity Assessment.
- General Procurement Notice (GPN)

While the L.A governs the legal relationship between the Bank and the Borrower, the signed contract between the borrower and the bidder governs the relation between them.

A-0 Model Scope

Consultant selection process can be seen as a matter of transferring information from one form to another useful form by adding value to this information. The mentioned information should answer major questions such as who are we? What do we need? How can the consultant present his proposal? And what is the legal relationship between us. Figure B-1 represents the model scope.

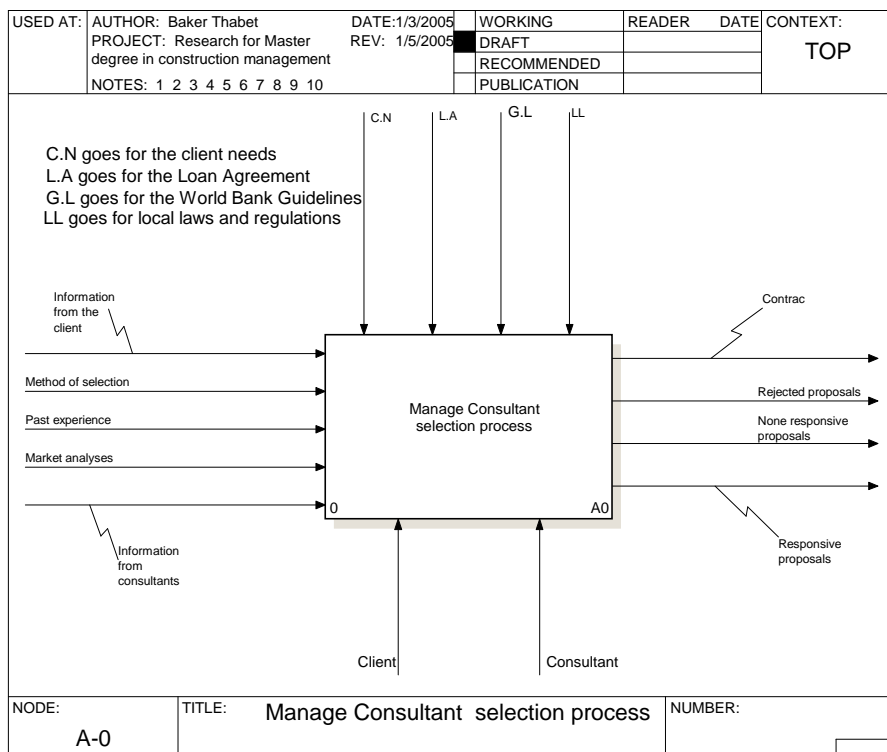


Figure B-1 Model scope

As illustrated in Figure 1 the reason for consultant hiring is to solve specific problem (engineering, financial, environmental, studies and so forth) so the main input to select a consultant is information. This information may include: (i) information from the client about the client, the specific problem (the assignment), the financing agency, (ii) proposals from consultants (iii) market analyses, (iv) past experience and, (v) methods of selection.

The activity (A0) will consume this information (the input) in order to identify the best-evaluated proposal (the output) in addition to the best evaluated proposal, output will include, another responsive proposals, rejected proposals, and non responsive proposals. Great efforts should be made to present enough and correct information in order to insure getting the needed services with high quality, economy, and efficiency.

The whole process controlled by the client needs to the assignment, the World Bank guidelines and the Loan Agreement in case the assignment financed or co-financed by the Bank, and (the local regulations and laws when available). The main mechanism to this process is the owner (client), for the World Bank (W.B) aided projects the W.B usually review and approve some activities (will be identified) but still yet not part of the selection process, the consultant may act as a mechanism in some stages of the process (will be identified later).

Model A0

As presented the model scope (A-0) was decomposed into four interrelated activities. Each activity forms a control or input to the next activity, for instance activity A1 (prepare for assignment) controls activities A2, A3, and A4.

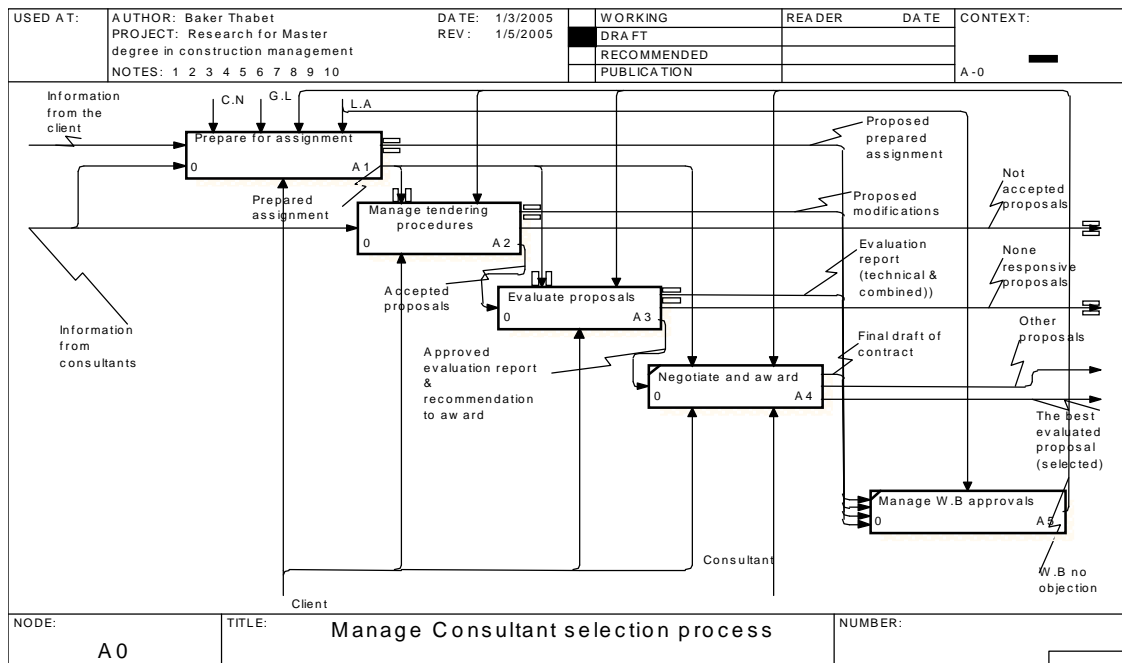


Figure B-2 Manage consultant selection process

First stage of figure B-3 above is the assignment preparation package of activities, during this stage the client performs some activities that end up with:

- Description of the requested assignment; and
- The names of qualified consultants who can perform the assignment.

Inputs for the first stage of activities are:

- Information from the client about the assignment, the client, the location, the financing agency, etc.
- Information about the consultant regarding his capacity to perform this particular assignment.

Control or constraints can be seen as:

- The client needs to this assignment.
- Local regulation and laws.
- The WB guidelines for consultant selection.
- The loan agreement between the Bank and the client.

Outputs are:

- Assignment's Terms Of Reference (TOR).
- Tender documents (Information To Consultants, General condition of contract).
- A short list of qualified consultants.

Mechanism: entities that perform this package of activities are:

- Client who prepare most of the job during this stage of activities.
- Consultants who express his interest in participating in this job, and consequently send his company profile and past experience.

Second stage (A2) represents the tendering stage where the client invites short-listed consultants via Letter Of Invitations (LOI) and receives the consultant's proposals. This stage is a communication stage where client and consultants are communicated via different means.

Inputs to this stage are:

- Assignment's TOR.
- Current market prices

Controls are:

- Tender documents.
- Laws and regulations (local, and WB guidelines)

Outputs are:

- Proposals from consultants.

Mechanisms for this stage are interested consultants and client.

Third stage (A3), is the proposals evaluation stage, the proposals that were submitted during the second stage are the input. Evaluation criteria of the tender documents control this stage. An output is evaluation report. Client is the mechanism of this stage.

Final stage is the negotiation and contract awarding stage.

Model A1 (prepare for assignment)

Further decomposition to activity A1 (prepare for assignment) ends up with five interrelated activities, Figure B-3 represents the decomposition of activity A1 (prepare assignment).

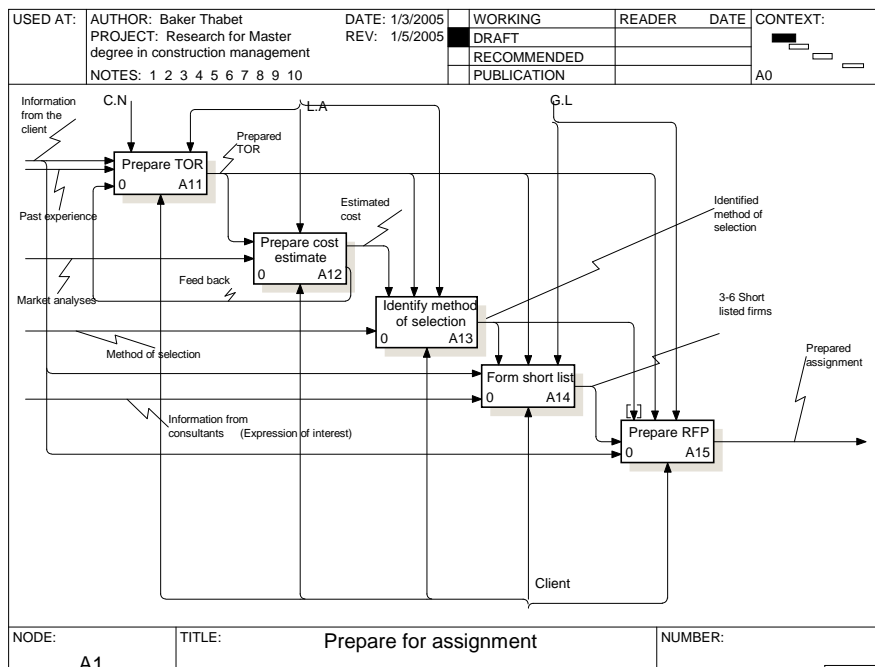


Figure B-3 Prepare for assignment

In order to prepare for the assignment, the client should carry out five activities namely:

- 1- **Prepare Terms Of Reference (TOR) activity A11:** TOR's are the client instructions to consultants for carrying out a particular assignment. TOR's should not include any references to the preparation, submission, and evaluation of proposals. They are prepared to allow consultants to submit proposals and the method of to carrying out the assignment and they regulate the work content and the relationship between the client and the consultant. TOR drafters should be familiar with the technical aspects of the assignment, the lessons learned from

previous assignments, the area of the assignment, and the relation with other institutions, the working environment, and the social and environmental aspects.

A number of activities have to be carried out to draft a well-constructed TOR. Figure 4-represent model A11 (Prepare TOR).

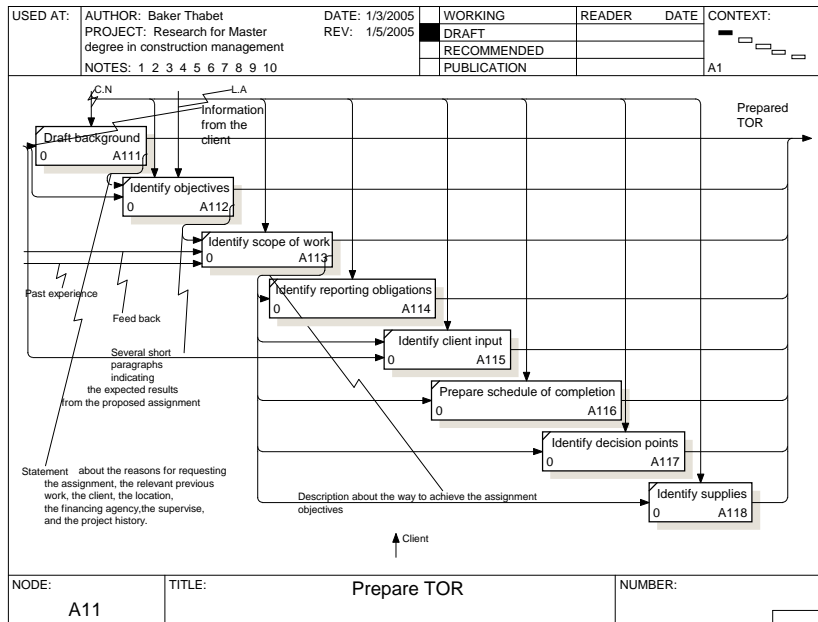


Figure B-4 Activities to Prepare TOR

First activity is drafting background about the assignment where the input to this activity is information about the client, financing agency, and relevant assignments. Drafting the assignment background can be seen as answering the following questions: why do we need this assignment? For home is the assignment needed? Where is it located? What is the project history? What types of activities to be carried out? Who will supervise the assignment? Who will finance the assignment? What current issues are to be resolved? The output of this activity is a statement answering the above-mentioned questions and covering the reasons for requesting the services, states the needed results, and give indications on any relevant previous work.

Second activity is indicating the assignment's objectives. This activity is answering the question what results are expected from the proposed assignment. The activity outputs are several short paragraphs describing the expected results from the assignment. These paragraphs may start with terms like determination, preparation, recommendations, design, develop, supervision, train, maximize, reduce and so forth. Objectives should be understandable by all parties, and it shouldn't exceed the limit of the agreed upon projects in the loan agreement.

Third activity is identifying the scope of services by answering the question how the assignment objectives may be achieved? TOR Drafters should always keep in their minds the assignment's allocated budget and they should not propose a methodology to achieve the objectives, consultants should be allowed to propose their own methodologies. Clients usually divided the scope of services into tasks and they use to write at the beginning (the assignment includes but not limited to the following tasks) that means while the client expects certain main tasks from the consultant they should also carry other tasks that in their professional judgment may be required to achieve the assignment objectives.

Fourth, Fifth, and sixth activities can be considered as tasks of the scope of services where the client propose a schedule for completing the assignment tasks based on his needs and judgment. The client should also point out his contribution in the assignment. For instance the client can provide previous reports, studies, or providing an office and transportation to the consultant staff. Client should point out the decision points for example the consultant can't proceed with the training courses before the client approval to the training material.

The last activity in this package is identifying the supplies needed from the consultant (if any) such as computers or equipments. These supplies should be identified and their cost should be fraction of the total assignment cost.

2- Prepare cost estimate A12

As the TOR prepared and the scope of services identified, the client can assess the resources needed to carry out the assignment. Accordingly, the client starts preparing the assignment's cost estimate based on his assessment. Figure B-5 model activity A12 that represents the activities to carry out cost estimation.

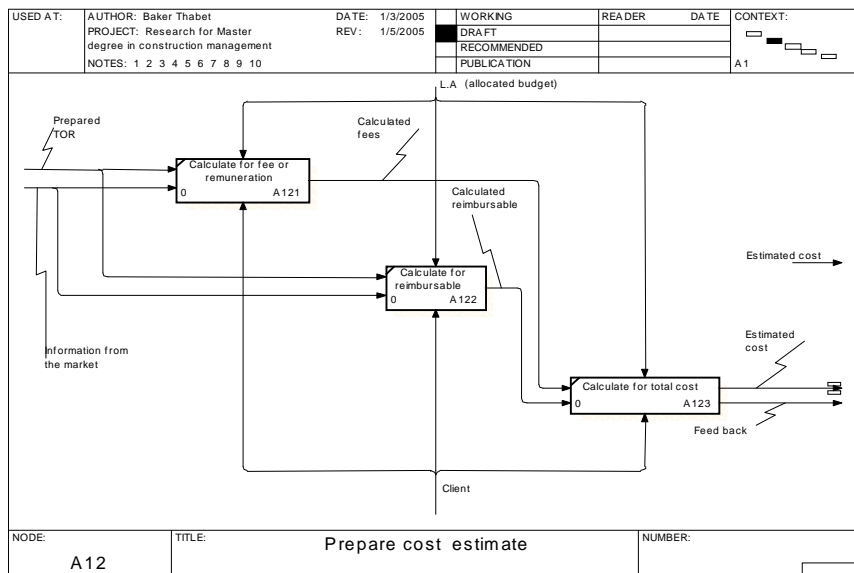


Figure B-5 prepare cost estimate

WB guidelines divided the cost estimation activity into two categories. The first one represented by activity A121 that explains the calculation for fee or remuneration based on the contract type (lump sum or time based). The second activity A122 represents the calculation for reimbursable such as the cost of surveys, equipments, office rent, supplies, international and local travel, mobilization and demobilization, insurance, etc.

As shown in model B-5, inputs to these activities are the scope of work of the prepared TOR and information about the item's costs from the market. The allocated budget of the assignment is the control of these activities. The outputs are the prepared cost estimate with feed back to the TOR. The feed back aims to reduce the scope of work or increase

the allocated budget in case of high differentiation between the allocated budget and the assignment cost estimation.

Increasing the assignment allocated budget will be easier with well-structured TOR and well-prepared cost estimate.

3- Identify method of selection A13 :

As the nature and the level of complexity of the assignment was identified by preparing the assignment's TOR and the estimated cost was prepared, the client can define the best rout to select a consultant taking into account that QCBS method of selection is always recommended but under some circumstances clients can use other method of selection if its more appropriate and if they were stated in the L.A. Figure B-6 model activity A13 that presents some of selection methods.

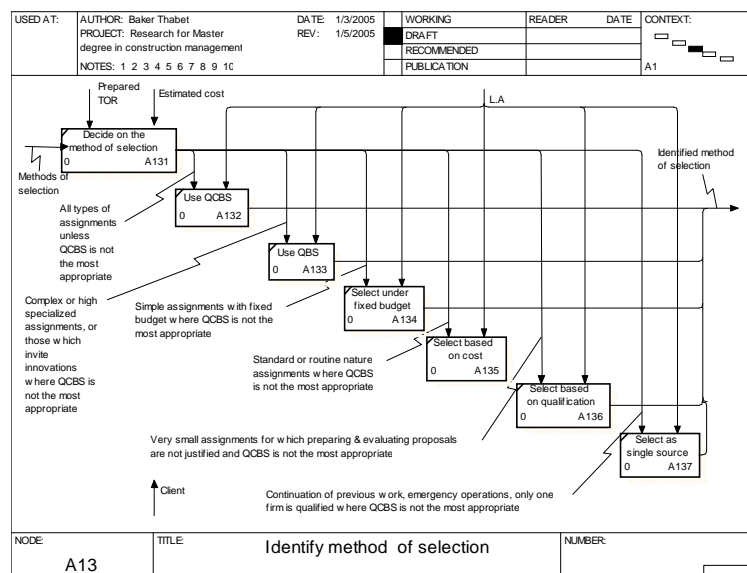


Figure B-6 Methods of consultant selection

As noticed in this model the rout of consultant selection controlled by the nature and cost of the assignment as well as the L.A, the client is the mechanism to this activity, methods of consultant selection presented in the L.A are the input to this assignment.

4- Form consultants shortlist A14:-

Based on the identified method of selection the client can decide to call for consultant's short-listing or not. If the client decides to go for QCBS, then the client should form a short list from interested qualified consultants. The activities to form a short list are modeled in figure B-7 that represent model A14.

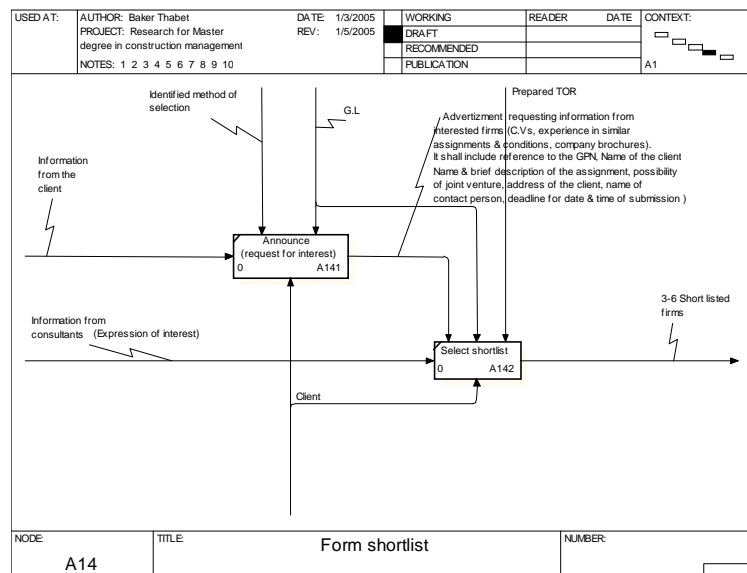


Figure B-7 Form a short list

A report about the short-listed firms and procedures should be sent to the WB for approval and getting the Bank no objection. For W.B aided projects, advertisement may be conducted by several means such as contacting embassies, contacting firms that show interest in the general procurement notice (GPN), online advertisement in the United Nation Development Business (UNDB), or requesting the Bank DACON list. The minimum advertisement period for the EOI is 14 days; the selected firms should be between 3-6 firms with suitable geographical distribution (not more than two firms from one country). In addition, the Bank encourage the involvement of consultants from development countries.

WB guidelines, method of selection, the TOR and the W.B no objection control this activities, information about the client and assignment are the inputs for activity A141. Consultant's profiles are the input for activity A142.

5- Model A 15 Prepare RFP:-

The prepared TOR and the consultants' short list should be incorporated into the assignment Request For Proposal (RFP), Figure B-8 represents the activities to form the assignment's RFP.

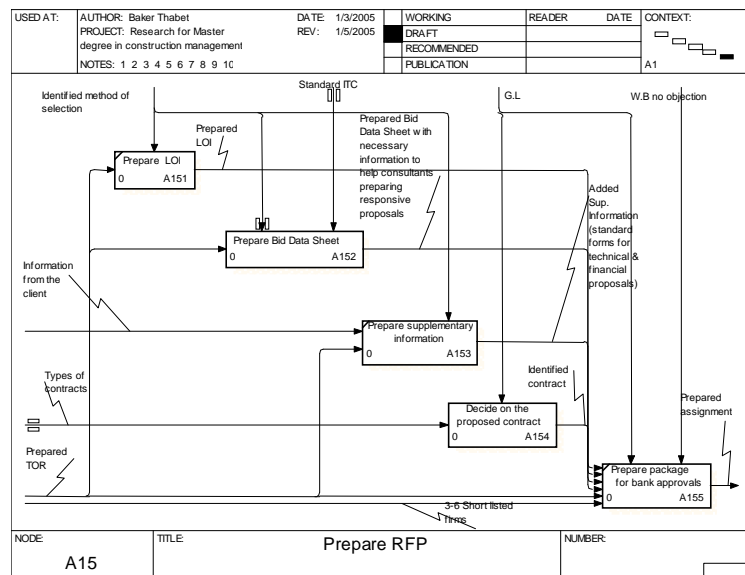


Figure B-8 activities to prepare RFP

For W.B aided project a standard RFP is available to be used by clients. Standard RFP consist of:

- 1- Letter Of Invitation (LOI) in which, clients invite short listed consultants to submit their proposals for this particular assignment. LOI includes basic information about the client (name and address), the financing agency, names of the short listed consultants, method of selection, and acknowledge of receipt from the invited consultant. LOI should give enough time to the invited consultants to prepare and send their proposals. For Bank aided projects not less than 4 weeks and not more than three months.
- 2- Information To Consultant (ITC): the W.B standard ITC consist of eight clauses to help consultants preparing responsive proposals. Any modifications to these

clauses shall be introduced only through the bid data sheet. As noticed in figure 9 this activity (preparing bid data sheet) controlled by the identified method of selection and the standard ITC. Input to this activity is the assignment's prepared TOR. Output is ready bid data sheet (for instance the level and complexity of the assignment transferred by this activity into evaluation scores). Figure B-9 represents model A152 (activities to prepare bid data sheet for QCBS assignments)

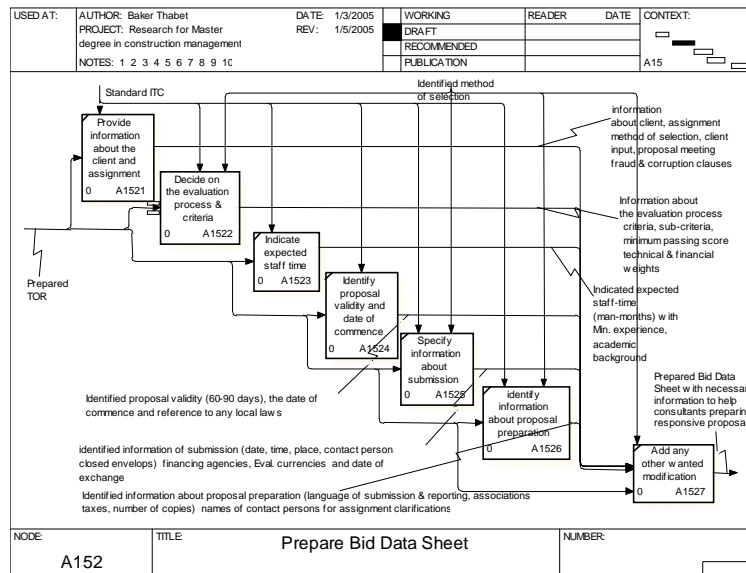


Figure B-9 prepare Bid Data Sheet

All the activities in this model aim to convert data from the TOR into organized form to give consultants equal opportunities in preparing and submitting responsive proposal. The output of each activity is presented in the model. Standard ITC published by the W.B and the identified method of selection control these activities.

Model (A 1522) presented in figure B-10 is a decomposition to activity A 1522 (decide on the evaluation process and criteria), where the client shall produce the evaluation criteria by applying it.

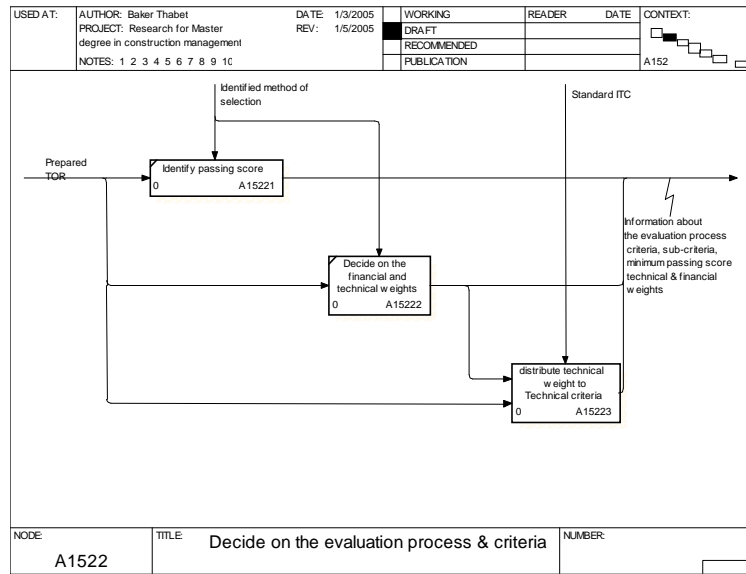


Figure B-10 Decide on the evaluation process & evaluation criteria

First activity of figure 10 ends up with identifying the minimum passing score (the threshold) to allow consultants to proceed for further evaluation activities. Second activity aims to identify the technical and financial weights for evaluation purposes based on the type of the assignment. Third activity aims to identify technical criteria and to distribute the technical score based on this identification. The decomposition of this activity will be presented later (under the evaluation activity).

3- Prepare supplementary information A153 As the client completed preparing the bid data sheet, some supplementary information should be added. These information presented in the standard ITC as appendixes to be used for future negotiations under other method of selection.

4- Identify standard form of contracts A154: several standard forms of contract were developed by the W.B, each form of contract dedicated to certain type of assignment. Figure B-11 models the types of contracts and the conditions to use them represent these forms with the suitable type of assignments.

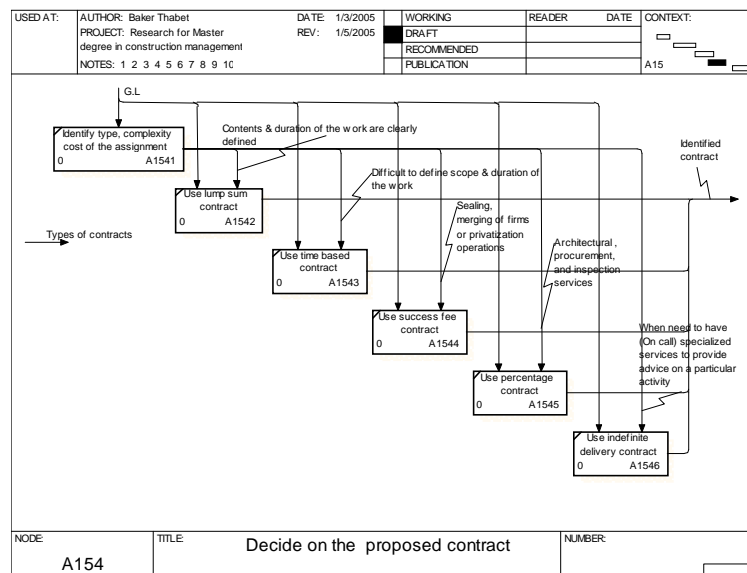


Figure B-11 Types of contract forms

As the client indicates the type and complexity of the assignment he can identify which form of contract to use. For instance lump sum contract can be used for feasibility studies, environmental studies, and detailed design for standard structures. Time based contracts are good for preparation of data, complex studies, supervision of construction, training assignments, and advisory services. Percentage contracts are suitable for architectural services, engineering services, procurement services, and inspection agents.

By indicating the type of contract the client will have complete ITC as well as RFP. The completed RFP should be sent to the Bank to get no objection and to proceed to the next stage of activities which is Manage tendering process (A2).

2- Model Manage tendering stage A2

By completing the first activity Prepare for assignment A1, the client can proceed to the second activity A2, (manage tendering stage). In order to model activity A2 it was decomposed it into three activities. Figure B-12 represents the model

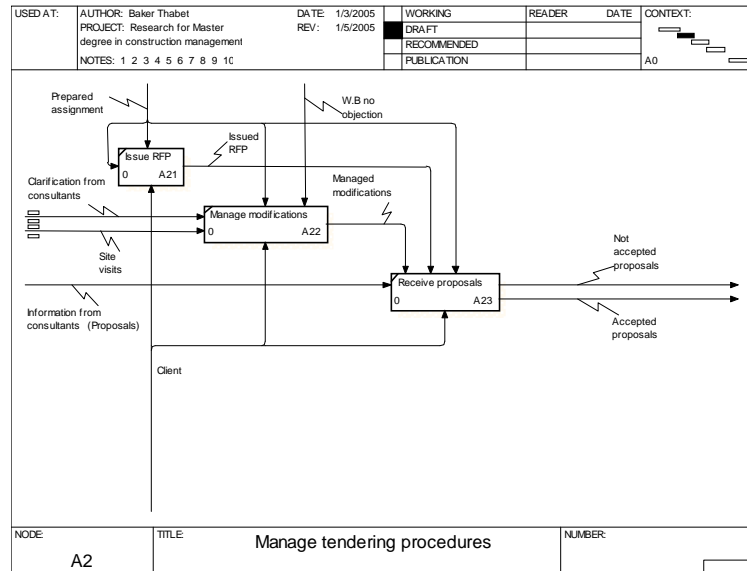


Figure B-12 manage tendering stage

As noticed in model A2 the prepared assignment A1, which generates several documents, will serve as a control to govern some of the tendering activities such as the date of submittals, the short listed firms, and the forms for submission. At the same time some of these generated documents will serve as an input to other activities (such as the RFP). For instance, the generated RFP is an input to Activity A21 (issue RFP), and the output of this activity is an issued RFP to the concerned consultants. The generated short list of consultants governs this activity since the client can't issue the RFP to consultants out of this list without prior approval from the Bank.

Second activity of the same model A22 is managing the clarifications. Inputs to the activity are the clarifications raised by the invited consultants as a result of reviewing the TOR, visiting the site, or pre-bid conference.

The client should respond the clarifications in writing and send them to all participated consultants. Any modifications to the prepared assignment should be made available to all invited consultants.

Before the deadline of the time of submission (as pre-determined in the prepared assignment or modified in the modification stage) all invited consultants must submit their proposals in the way indicated in the RFP (sealed financial and technical separate envelops). All submitted proposals will be accepted if they follow the rules indicated in the RFP (which control this activity among other controls such as the G.L, the prepared assignment, and the modifications), any late submission will not be accepted (returned unopened). The client should form a committee to receive the submitted proposals. After the closing time no modifications are allowed.

3-Model the evaluation stage A3

An evaluation committee designated for this purpose will evaluate the accepted proposals. The evaluation committee shall consist from appropriate departments and not less than three specialists in the field of the assignment. Figure B-13 represents the evaluation proposals model

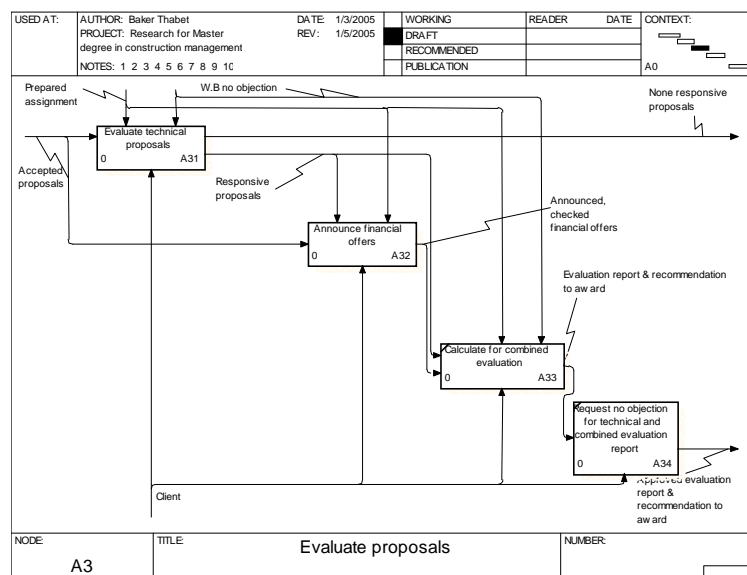


Figure B-13 evaluate proposal model

As noticed in figure B-13 the proposals evaluation process consists of 4 activities (for prior review assignments). The activities controlled by the prepared assignment (the bid data sheet) and by the WB guidelines (guidelines request the W.B no objection for prior review assignments). Inputs to these activities are the accepted proposals. WB review to the technical evaluation report should be made before proceeding to the next stage (financial evaluation stage).

Technical envelopes should be opened immediately after receiving the proposals from the consultants (after the closing time) while financial proposals should be kept sealed in a safe place.

Model A 31 of figure B-14 represents the activities to be taken to complete the technical evaluation process.

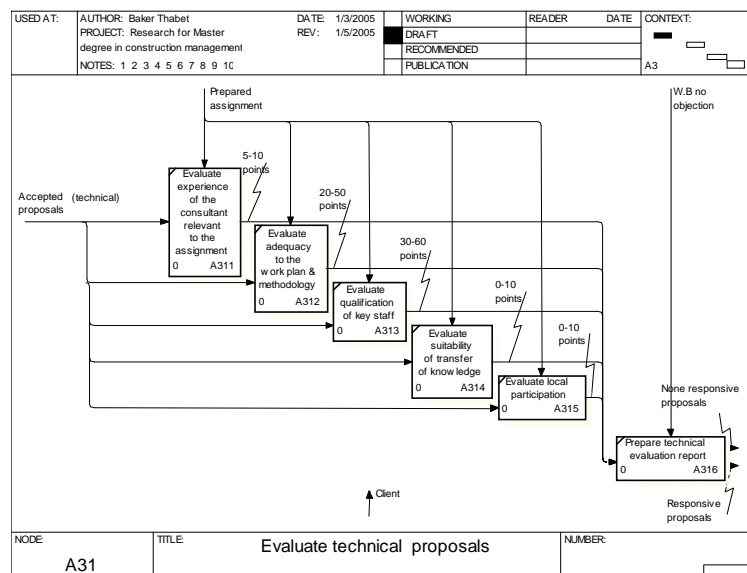


Figure B-14 evaluate technical proposals

1- Evaluate the consultant specific experience related to the assignment (A311);

Inputs to this activity include information about the firm. This criteria may be divided into several sub criteria such as reputation and References, Experience in similar projects,

similar areas, similar conditions, training, age of firm, capacity and capability, specialization, quality assurance, legal disputes, quality of projects completed. Client may use some of this sub-criterion (about 3) depending on the nature of the assignment.

According to the WB guidelines this criteria weights 5 to 10 points of the technical score.

2- Evaluate the firm's adequacy of the proposed work plan and methodology

(A312); Input for this activity is information about the firm's adequacy to perform the assignment. This information derived from the firm's proposal, it could be divided into several sub criteria for simplification. These sub criteria may include understanding, responsiveness, completeness, creativity, innovations, quality and clarity, resource utilization, technology, flexibility, timeliness, reliability, and transfer of skill in responding to the TOR This criteria weight 20-50 points of the tech. Score.

3- Evaluate the qualifications and competence of the key staff for the Assignment

(A313); Input for this activity based on the firm key staff CVs, sub criteria for this activity may include: general education, length of experience, positions held, time with the firm, and experience in similar countries. This criteria weight 30-60 points of the tech. Score.

4- Evaluate the suitability of the transfer of knowledge (A314); Input for this activity also derived from the firm history, experience, and references in the matter of transforming the knowledge in similar projects. This criterion weights 0-10 points depending on the type of the assignment.

5- Evaluate the local participant (A315). This criterion refers to the participation of local staff in the working team and weight 0-10 points based on the nature of the assignment and the availability of local staff to the type of the work. The mentioned scores are not mandatory to all projects; it could be changed based on the type of the assignment. As the technical evaluation completed, the evaluation committee (that consist of experts in the field) is requested to prepare technical evaluation report and to sends copy of this report to the Bank for review and approval (and request for no objection if needed).

For QCBS method of selection, client proceeds in opening the financial proposals (activity A34) in the presence of the consultant's representatives. Financial offers for consultants who didn't exceed the minimum passing points in the technical evaluation

will not be opened. Consultants should be informed about the technical evaluation results before proceeding in the financial offers opening.

For QBS method of selection, financial offer of the only highest ranked technical proposal will be opened. For selection under a fixed budget assignments, offers exceed the allocated budget will be rejected. For least-cost method of selection, the lowest price will be selected.

For selection based on qualification, the client should establish a short list as presented previously then the client would ask the most appropriate qualifications and references consultant among the short listed firms to submit a combined technical- financial proposal for further negotiations.

Forth step in model A3 is the combined quality and cost evaluation, as the weighting scores for technical & financial proposals were identified in the preparation stage of the assignment then it will control this activity, inputs are the technical and financial scores of each firm. Table B-1 is an actual example illustrates the combination process.

Table B-1 Example of QCBS: Two-Step Procedure

Step 1:

TECHNICAL EVALUATION (GO/NO GO POINT: 65 POINTS)

Company:	A	B	C	D
Tech.Score: (Max 80)	72	70	78	62

Step 2:

FINANCIAL EVALUATION

	A	B	C
Price:	\$475,000	\$500,000	\$625,000
	475,000	475,000	475,000
Relative Weight	———— = 1	———— = 0.95	———— = 0.76
	475,000	500,000	625,000
Financial Score (Max 20)	1 X 20 = 20	0.95 X 20 = 19	0.76 X 20 = 15.2
Total Score	72+20 = 92	70+19 = 89	78+15.2 = 93.2

Company C in this example is the best-evaluated bidder.

Activity A4 Negotiate and award the contract

As mentioned in the prepare for assignment model, appendixes shall be attached to the ITC to be used as a basis for future negotiations with best-evaluated consultant. The attached appendixes are not part of the proposal. If negotiation fails with the best-evaluated bidder, the client can start negotiation with the second evaluated bidder.

Negotiation with the selected consultant doesn't mean bargaining. In order to start negotiation the client should nominate a team with a team leader and defined authorities. The nominated team should study the proposal and identify the points to be negotiated that may include

- 1- Negotiate technical issues: such as the methodology, work plan (activity schedule, staffing schedule, and reporting schedule), decision points, consulting firm output, training, staffing (consultant should not be allowed to substitute key staff, unless both parties agree that undue delay in the selection process makes such substitution unavoidable or that such changes are critical to meet the objectives of the assignment) and the client contribution.
- 2- Negotiate financial issues: Where QCBS procedures are followed, proposed unit rates for staff-months and reimbursable shall not be negotiated (since these have already been factor of selection) unless there are exceptional reasons. For selections, which have been made on the basis of technical proposals only, client can negotiate the prices including man-month rates, the international travel cost, the payment schedules, the tax liability (if any) and the local costs.
- 3- Negotiate special condition of contract such as the Joint ventures, the taxation, and the provisional liability insurance.

3.7 Model contractor selection procedures

This section intends to model the contractor selection procedures based on the WB guidelines as these guidelines represents (for the purpose of this study) the traditional selection procedures in the absence of unified local procedures. This model can be also used to identify potential activities that could be automated by IT vendors, foundation for future local contractor selection procedures, and as a training material to give general idea about the W.B procurement procedures.

Contractor selection process is usually conducted by clients. In some cases, consultants are involved in this process due to the fact that most of construction projects in Gaza follow the design-bid-build rout of contracting. WB involvement in this process is similar to its involvement in the consultant selection process. The same principle governs the relation between the client and the WB and the same considerations guide the WB's policy in the selection process (transparency, economy, efficiency, and so on....). Figure B-15 shows A-0 Model scope that reflects the above-mentioned involvement.

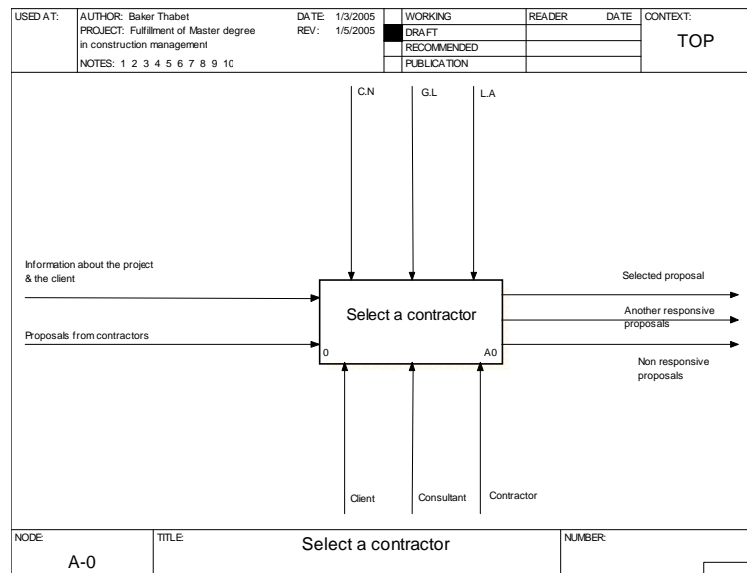


Figure B-15 selects a contractor

As noticed in the model, the client needs to build a facility (C.N), the W.B guide lines (GL), and the loan agreement (LA), govern the selection activities. Inputs to this

activity are information from the client about the project that will be identified in the decomposition of this activity, and information from the contractors that may include proposals, documents for pre-qualification, and clarifications. The main mechanism to this activity is the client. Consultant may help in some cases, and the contractor will perform some activities.

As this model will be also treated (the same as the consultant selection model) in terms of highlighting the activities that are suitable for future software supporting development, the selection process model was decomposed into four different stages to reflect this considerations. The stages are: prepare for the project, manage tendering stage, evaluate proposals, and award the contract.

Figure B-16 is presentation for model A0 (Manage contractor selection process) that shows the relation between different stages as well as the controls, mechanisms, inputs, and outputs of the activities.

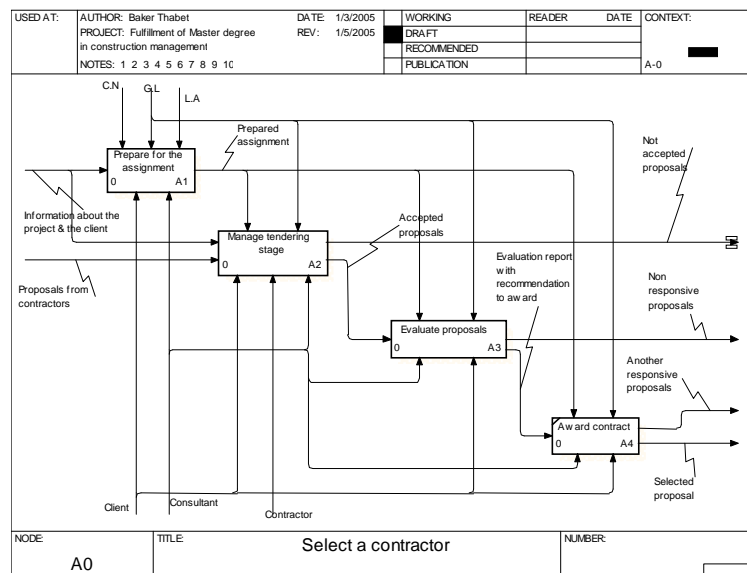


Figure B-16 A0 model (Manage contractor selection process)

The output of stage 1 (prepared assignment) controls the other three stages in addition the G.L and the L.A. Outputs of stage A2 include accepted proposals that feed stage A3 as an input and unaccepted proposals such as late proposals. Stage A3 models the

bids examination, and evaluation activities. Output of this stage will be non-responsive proposals and responsive proposals that will be subject for further evaluation. At the end of the process there will be a selected firm to award the contract to him (the lowest responsive evaluated bidder) and other responsive evaluated firms.

Model A1 prepare for the assignment

Figure B-17 shows the decomposition of stage A1 (Prepare for assignment model) that was divided into four activities, which represent the client work to prepare for the needed job. During this stage the consultant may help the client in preparing for the assignment (based on the contract with the consultant)

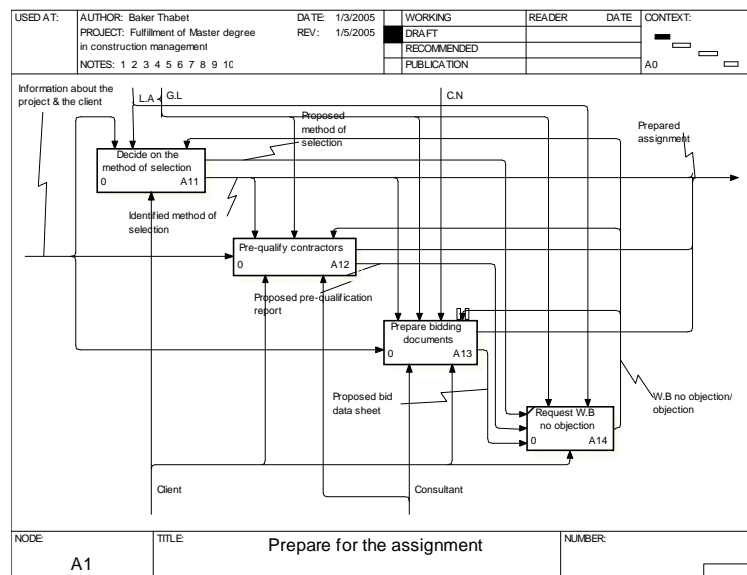


Figure B-17 prepare for the assignment model

As noticed in the model, activity A14 goes for obtaining the W.B no objection (since this assignment is a prior review assignment). Each activity of the first three activities has two outputs arrows; first one represents the prepared output (after obtaining the Bank no objection) that forms part of the prepared assignment, while the second arrow (the proposed output) forms an input to the fourth activity. Output of the fourth activity is a feedback that controls the first three activities in addition to the L.A and

the G.L. Type and complexity of the assignment (part of information about the assignment) controls the method of selection A11, while the identified method of selection controls (among others) activities A12 and A13.

Consultant may help the client in preparing activities A12 and A13.

Model activity A11 method of selection

Figure B-18 represents a model for the methods of contractor selection based on the World Bank guidelines. This model presented six methods of selection with brief description to the nature of assignments appropriate to each method of selection (taking into consideration that these methods are subject to the W.B no objection and they should be stated in the loan agreement as the actual threshold limits for each method of selection are indicated in the legal agreement)

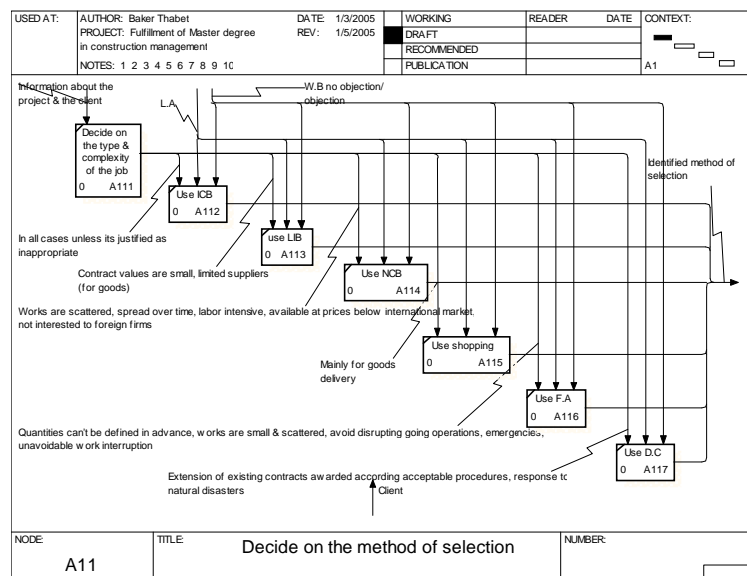


Figure B-18 methods of contractor selection

As mentioned in the model ICB goes for International Competitive Bidding that is appropriate for all contracts in which foreign firms can be expected to participate. LIB is the Limited International Bidding that is essentially ICB by direct invitation to selected

bidders of proven capacity and capability from at least two different countries without open advertisement. NCB goes for National Competitive Bidding that is advertised nationally but foreign bidders are not to be precluded from participation. A115 goes for shopping (national/ international) that based on comparing price quotations. F.A goes for Force Account method of selection in which the client uses his own personnel for construction activities. D.C is the Direct Contracting that is appropriate for extension of existing contracts or responding to natural disasters.

Model A12 pre-qualify contractors

The pre-qualification stage (A12) usually launched by clients to restrict the entries to those contractors who (according to the client's technical standards) have the technical and financial capabilities of executing the project. Consequence only contractors who have proven (through the prequalification stage) their potential to fulfill their contractual obligations are allowed to enter the tendering stage. For W.B aided projects prequalification is usually necessary for large or complex works, where the high cost of preparing detailed bids could discourage competition, such as custom-designed equipments, industrial plants, specialized services, and contracts to be let under turn-key, design-build, or management contracting .

Contractor's profiles are the input for this activity, client with the help of the project consultant usually evaluates the inputs. This activity controlled by the identified method of selection due to the fact that contractor's pre-qualification is not appropriate for some methods of selection. The output represents the pre-qualified contractors. Figure B-19 represents model A12 (pre-qualify contractors)

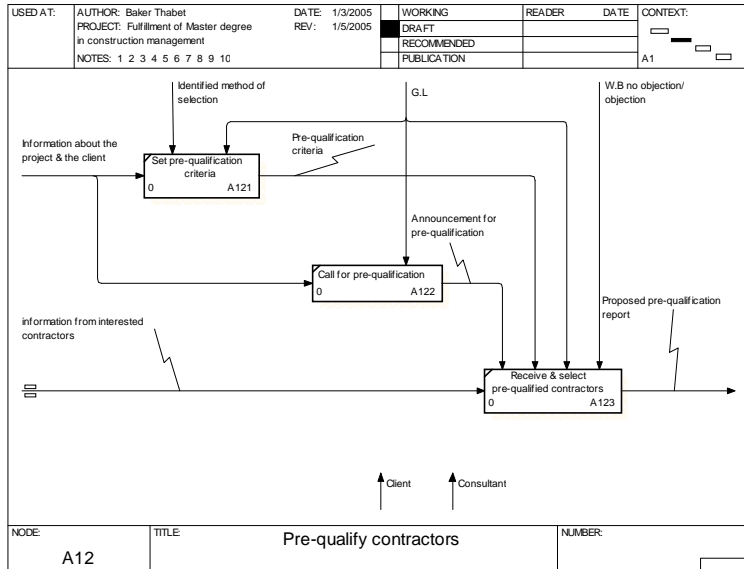


Figure B -19 pre-qualify contractors

The pre-qualification stage (A12) includes several interrelated activities that may be divided into:

Set pre-qualification criteria (A121): The client is requested to identify the qualification criteria that are appropriate to his particular project. Criteria may include the contractor's bid capacity (work experience and past performance in similar type, size and under similar conditions), financial capacity (past performance, liabilities, and financial turn over), legal statues (ownership, registration, and joint venture arrangements), key staff qualifications, equipments (description, location, condition, and ownership arrangement), history of claims, arbitrations, litigations, General Works Experiences. Scope and magnitude of the needed works are the inputs to identify the pre-qualification criteria, these criteria controlled by the identified method of selection (tacking into considerations that higher criteria means higher cost), the output of this activity is a set of pre-qualification criteria. It is worth to notice that pre-qualification is not mandatory in all the projects, in case pre-qualification is not requested then the tender will be open to the contractors' community.

In case pre-qualification is required the client should call contractor for pre-qualification A122, by means of advertisement in a wide spread news paper (method of advertisement were described in the consultant selection model), the information in the invitation letter

should include description of works, scope of contract, source of finance, eligibility, language, procedures, and prequalification requirements.

Activity A123 is the selections of qualified contractors. Pre-qualification criteria control this activity, the outputs is a report about the qualified contractors; client usually perform the selection process with the help of the project consultant if needed.

Model A13 prepare bidding documents.

The bidding documents shall provide the contractors with all needed information to prepare and submit responsive proposals. Prepare project's bidding documents model is presented in figure B-20. The activity was decomposed into five sub-activities these activities are controlled by the W.B guidelines (standard bidding documents for small assignment was referenced in the G.L), the client needs, and the identified method of selection. Output of these activities is a prepared bidding document.

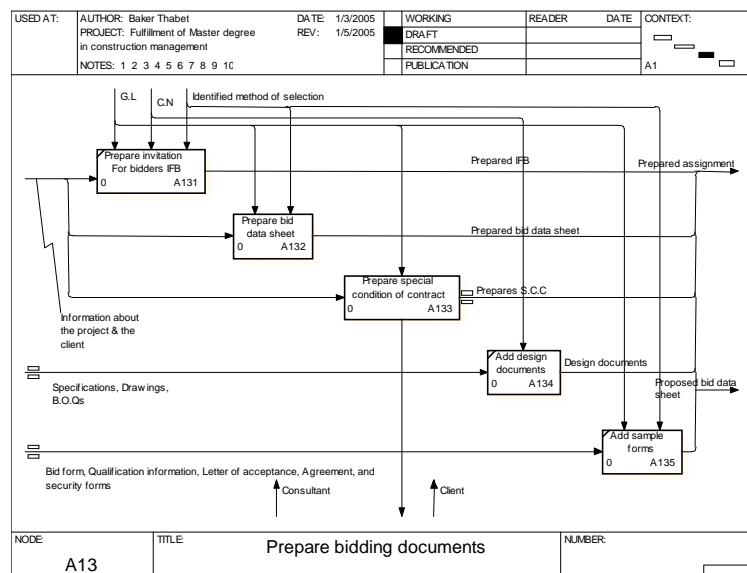


Figure B-20 prepare bidding documents

Prepare Invitation For Bidders (IFB) is the first activity, the prepared IFB should include information about the client and the project so, inputs to this activity are the identified method of selection (that will be referenced in the IFB) and information about the client and the proposed project.

Second activity is the preparation of bid data sheet; input to this activity is the Information about the client and assignment, the SBDs issued by W.B contains all the needed information to prepare responsive proposals, any acceptable modifications (regarding this particular assignment) to this document shall be introduced through the bid data sheet Figure B-21 shows some of the important information (among others) that should be presented in the bid data sheet preparation model

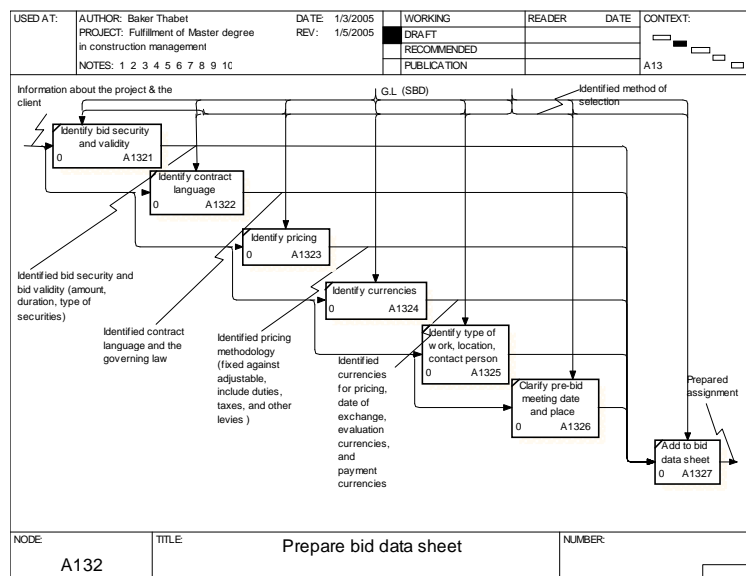


Figure B-21 prepare bid data sheet

Third activity is the preparation of the special condition of contract, input to this activity is the general condition of contract; Figure B-22 models some types of civil works contracts and the conditions to use them.

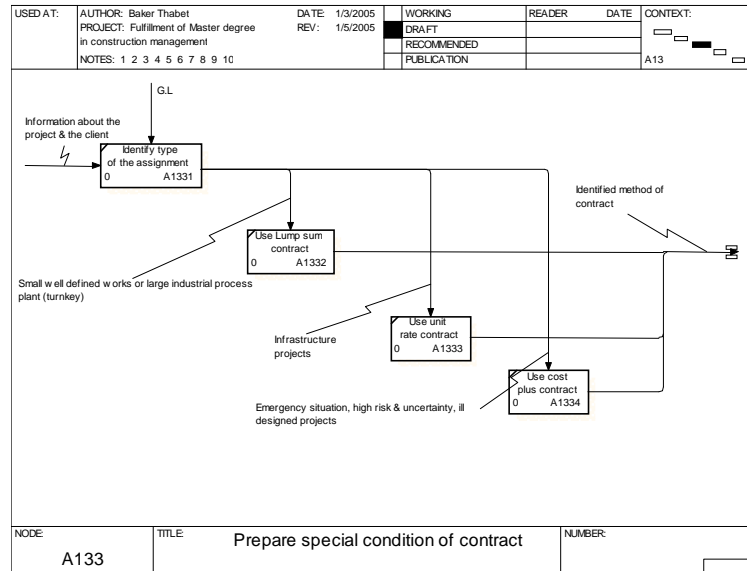


Figure B-22 types of civil works contracts

A2 model tendering stage:

This stage of activities starts by inviting pre-qualified bidders to compete for the project (if pre-qualification was requested otherwise the competition will be advertised). For civil works assignments client should set a price for the bidding documents, the price should not be so high as to discourage contractors to participate. The invitation to bid should give enough time to the proposed contractor to prepare and submit their proposals (6 weeks in minimum). Figure B-23 represents the model for the tendering stage. As noticed activities are controlled by the prepared assignment and the G.L

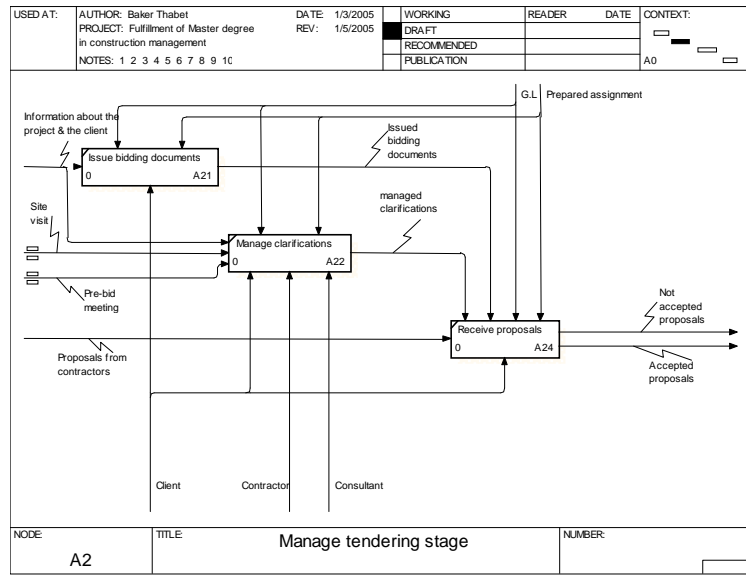


Figure B-23 manage tendering stage

Manage clarifications A22: is the second activity of this model, as a result of the pre-bid meetings and the site visit contractors usually needs clarifications to some unclear issues. The client with the help of the consultant should clarify these issues and make it available to all bidders.

Receive tenders A23: After the client issues the tender documents and the clarifications to the prospective contractors the later starts preparing their proposals. Under the tender, contractors are required to submit bid security payable to the client in case the contractor withdraws his offer (after the bid opening) or refuse to enter into contract.

In order to carry out this activity (receive tenders) the client should make sure that received documents are closed, sealed, and to register the time of receiving these documents.

Model A3 Examine & evaluate proposals:

As the client receives proposals he should open them at the time, date, and place specified in the bid data sheet. Bid opening should perform publicly in presence of the contractor representatives. Figure B-24 models stage 3

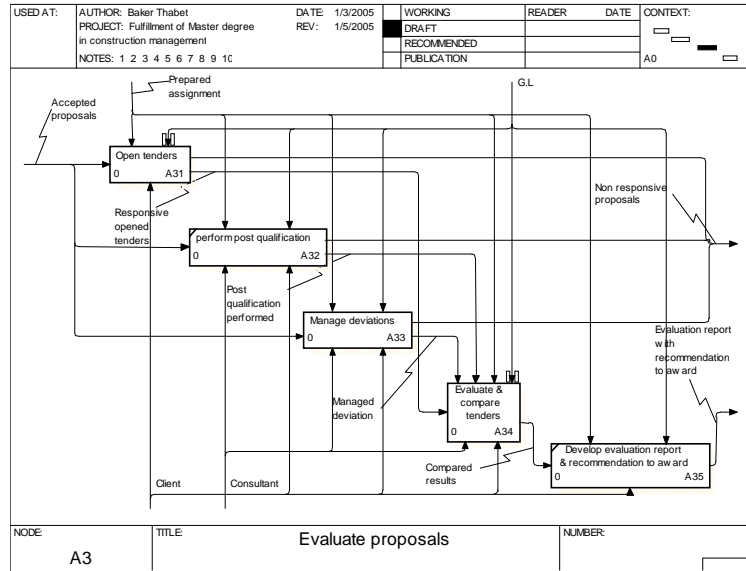


Figure B-24 Evaluate proposals

By the time of bid opening, Bid opening committee (assigned by the client) held and start the procedures for public bid opening at the date and time that were predetermined in the invitation for bid (any late tenders should be registered and return unopened to the bidder) Figure B-25 models the bid opening activities.

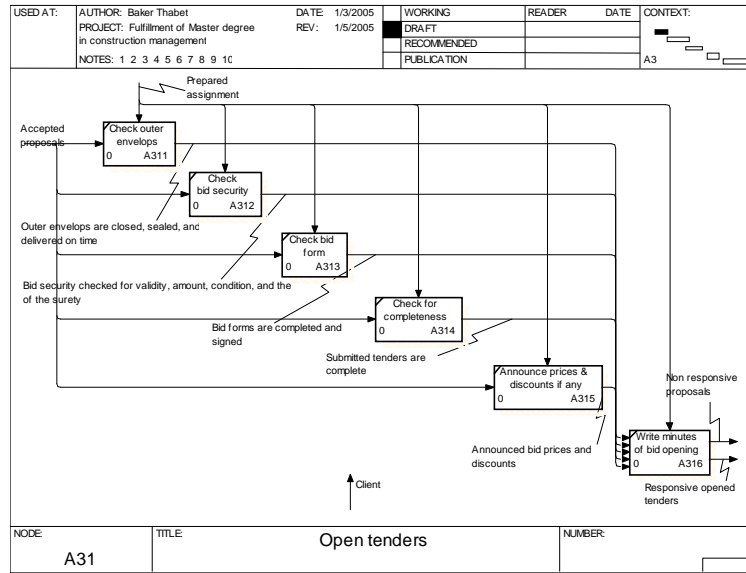


Figure B-25-bid opening

Checking the outer envelopes is the first step in this activity. The committee starts opening the envelopes one by one to check for bid security.

Bid security usually requested in order to protect the client against the bidder in case the latter refuse to fulfill his obligations; it should not be so high as to discourage bidders; the bid security should be valid for four to six weeks beyond the bid validity and amounted 1-3% of the bid value (fixed amount or approximate percentage (e.g. not less than 2%) is recommended to avoid possibility of bid price leakage). Bid security value and validity should meet the client's requirements in addition to that the bid security should be issued from (reputable Bank).

Client is requested to check the bid forms (A313) that should be completed, signed, and stamped. Bid form treated as the contractor's offer (contract is an offer and acceptance), which is the only binding document in this stage.

Bidders should complete the bidding documents as requested by the client in the instruction to bidders; the committee should check for tender completeness (A314).

Further more bid prices and any discount should be announced during the bid opening (A315). The aim of this stage is to publicly announce the prices, withdrawals, and modifications (if any) in order to assure transparency and to avoid corruptions (no decision regarding awarding should be made in this stage).

Finally the bid opening stage should be registered and documented. The following information may enclose in the bid opening minutes of meeting:

Introduction, names of Bidders (withdrawals, and modifications if any), bid Prices (alternative bid prices if requested, and discounts offered if any), bid Security (presence/absence, value, validity, and name of surety), other appropriate details (late Bids), and signatures of participants.

As the bids been opened the client starts with the help of the consultant the identification of responsive bidders in order to evaluate and compare their bids, Figure B-26 models the management of bids deviation in order to identify responsive bidders.

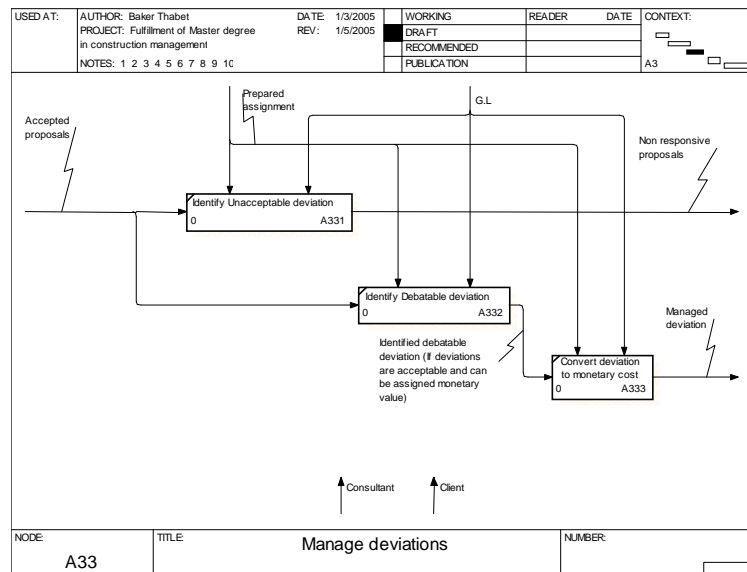


Figure B-26 Manage deviations

Deviation can be classified into debatable deviation and unacceptable deviation. Unacceptable deviation may include (late bid submission, unsigned bid, bidder not as pre-qualified, unacceptable alternative design, material deviation, unacceptable subcontracting, deviation from critical provisions (applicable law, taxes & duties, defect liability, functional guaranties, patent & indemnity, limitation of liability) price adjustment against fixed price, and ineligible bidders.

Debatable deviation may include (different payment terms, non compliance with local regulations (labor, import, duties), completion/maintenance period, special method of construction, questionable subcontracting, omission of minor works/ item, limited liabilities, different codes/ standards (materials, workmanship, design) and modified liquidated damages.

Bids with deviation may be considered substantially responsive if

Deviations can be assigned monetary value to be added as penalty for evaluation purposes, and such deviations are acceptable.

Compare tender prices is the last step in this stage. It is usually performed to responsive and substantially responsive bidders after completing the post qualification and identifies the deviations. Before the bid comparison takes place several important activities should be made Figure B-27 models these activities.

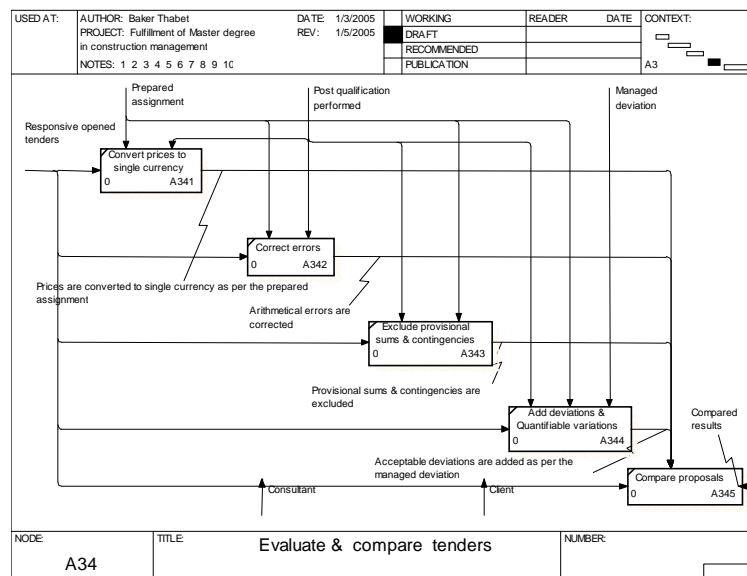


Figure B-27 Compare tenders

- Bid prices should be compared in single currency. The comparison currency and the date of exchange rate should be mentioned in the bidding documents.
- Provisional sums and contingencies should be excluded.
- Client should check for arithmetical errors and correct the prices (figure/ word, unit rate/ total rate, misplacement of decimal point).

- Add monetary cost of quantifiable variations and acceptable deviations.
- Add value of benefits forgone for longer times of completion
- Identify the deviation between the bidding documents and the tender documents.

Table B-2 is an example to illustrate bid comparison with deviation adjustments

In order to examine the effect of the deviation adjustment and the date of exchange rate on the evaluation process; the following example is introduced.

Ministry Of Health calls for competitive bidding to build a clinic in Gaza, accordingly,

Four bids were received; the following deviations were noticed:

- 1- Firm D didn't submit the bid security as required
- 2- Firm A didn't sign the bid form.
- 3- Firm C reported that the completion date will postpone for another two months.
- 4- Firm B omitted one item with price of 20,000 \$ (as in the original estimates) in addition to that the same firm requested the following adjustment:
 - A) An adjustment in the advance payment to be 20% instead of 10% in the original bidding document.
 - B) An adjustment in the liquidated damages to be 5% instead of 10% in the bidding documents.

The above-mentioned data were reflected in the table B-2 as part of the evaluation process with the following notices:

- 1) The liquidated damages is 800 \$/day with max. ceiling of 10% of the bid price.
- 2) The exchange rate will be calculated according to the rate published by the Palestinian monetary authority 15 days before the bid opening.
- 3) The interest rate was not calculated. Adjustments were made for evaluation purposes only

Table B-2 Example for bid evaluation with deviation adjustments

	A	B	C	D
Bid price	500,000 \$	560,000 \$	450,000 Euro	490,000 \$
Exchange rate Day of bid opening 1.30 \$			585,000 \$	
Ranking	2	3	4	1
Exchange rate 15 days before bid opening 1.20 \$			540,000 \$	
Ranking	2	4	3	1
Deviation				
1- Bid security	As required	As required	As required	Not included
Ranking	1	3	2	Not responsive
2- Bid form	Not signed	As required	As required	
Ranking	Not responsive	2	1	
3- Adjustment for late completion			+ 45,000 \$	
4- Adjustment for omitted item		+ 20,000 \$		
5- Adjustment for liq. damages		+ 28,000 \$		
6- Adjustment for advance pay.		+ 56,000 \$		
Bid prices after adjustment		664,000 \$	585,000	
Ranking		2	1	

Detailed tender evaluation should be made for responsive and substantially responsive bids. The above-mentioned activities performed by the client assigned committee (the mechanism), tender proposals form the input for this activity, and the output is an evaluation report with recommendation to award the contract to the lowest responsive evaluated bidder. It is worth to mention that in this stage a post qualification may take place to:

1. The pre-qualified contractors for verifying purposes
2. The responsive contractors (in case pre-qualification was not requested).

Tenders evaluation and contract awarding should be made within the bid validity period; in case the evaluation committee fails to award the contract within the bid validity period; client can postponed this period for the first time without any implications to the bid prices; contractors can change their bid prices in case any other extension.