

Islamic University of Gaza  
Deanery of Graduates Studies  
Faculty of Engineering  
Civil Engineering Department  
Construction Management



الجامعة الإسلامية - غزة  
عمادة الدراسات العليا  
كلية الهندسة  
قسم الهندسة المدنية  
ادارة المشروعات الهندسية

**Developing a web-based system for grants management  
IDB Gaza reconstruction projects as a case study**  
تطوير نظام الكتروني عن طريق صفحات الموب لإدارة المنح  
مشروع البنك الاسلامي للتنمية لإعادة إعمار غزة - حالة دراسية

**Researcher**

Mohammed Shaker Abu Shaaban

**Supervisor**

Prof. Rifat Rustom

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of Science in Civil Engineering- Construction Management*

## Declaration

I declare that:

This dissertation, “Developing a web-based system for grants management IDB Gaza reconstruction projects as a case study” 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.

**Mohammed Shaker Abu Shaaban**

Signature \_\_\_\_\_, Date: \_\_/\_\_/\_\_\_\_

## **Dedication**

I lovingly dedicate this thesis to  
My parents,  
Wife  
& family,

Who supported me each step of the way

## Acknowledgement

This thesis would not have been possible without the guidance and the help of several individuals who in one way or another contributed and extended their valuable assistance in the preparation and completion of this study.

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## Abstract

The assistance IT can provide to complex industry modules can be extremely valuable. By examining the construction industry it can be easily realized that interaction of various parties exist, involving numerous processes. Construction industry is fragmented due to many stakeholders and phases involved in a construction project. Communication and information processing between different stakeholders are serious problems facing Grants managements in construction industry, especially because that Palestinians are considered to be receiving one of the highest levels of aid in the world, this leads to a situation where a huge amount of projects are implemented and managed at the same time. This makes the information scattered and hence complicates the overall grant management, delays grants implementation and generates many problems.

The result of interviews with 70 stakeholders working in the grant management in the construction industry; specially projects managers in international and local organizations, showed that the web-based application system is still a new concept in the construction industry in Gaza strip. Many institutions are working on developing new systems for facilitating their work and the others do not object to use such systems in case of availability and easy to use.

The focus of this research is to redesign traditional working procedures across the grant management life cycle and more specifically, the exchange of data between different stakeholders by taking advantage of the internet technology. A web based management system model is developed aiming to make working procedures more efficient.

Fifteen people working in the field of grants management and system analysis have been interviewed to evaluate the system design; most of them agreed that the proposed system improves the efficiency and effectiveness of information sharing between projects management stakeholders also enhance the ability of managers to control and monitor project progress on time.

## ملخص البحث

صناعة الإنشاءات بشكل عام صناعة مفككة و مترامية الأطراف و ذلك بسبب العدد الكبير من أصحاب العلاقة المشتركين في إدارة المنح والمشاريع. وهذا العدد الكبير يؤدي إلى صعوبة التواصل والإتصال بين أصحاب العلاقة بين جميع الأطراف بطريقة ذات كفاءة عالية والذي بدوره يؤدي إلى التأخير في التنفيذ والتأثير على الجودة.

تعد فلسطين من أكثر المناطق التي تحصل على دعم خارجي لتنفيذ المشاريع المختلفة، والذي بدوره يؤدي إلى تنفيذ مجموعة كبيرة من المشاريع في نفس الوقت حيث تتم إدارتها من خلال العديد من المؤسسات العاملة في إدارة المنح في قطاع غزة بالطرق البدائية للاتصال و الأرشفة الخاصة بالمعلومات، حتى المؤسسات التي تتبع الادارة بواسطة برامج الكترونية لا تتيج التدخل في هذه البرامج لجميع الأطراف أصحاب العلاقة. فالحصول على تقارير سير العمل و الإنجاز وحالات المشاريع المختلفة للمنح التي تحتوي على عدد كبير من المشاريع يحتاج لوقت وجهد كبيرين ليتم انجازها ومن الصعب ان يتم الحصول عليها في نفس اللحظة.

الهدف من هذه الدراسة هو إيجاد حل مناسب لإدارة المنح المختلفة بواسطة جميع أطراف العلاقة المشاركين عن طريق تطوير نظام إدارة إلكتروني يعمل عن طريق صفحات الوب على شبكة الإنترنت يتم من خلاله إدخال جميع المعلومات الخاصة بالمشاريع و الحصول على التقارير و أرشفة لجميع المعلومات. ولغرض هذه الدراسة تم عمل مقابلات مع مجموعة من مدراء المشاريع الذين يعملون في إدارة المنح والبرامج في قطاع غزة بالإضافة إلى دراسة معمقة للملفات والتقارير والنماذج الخاصة بإدارة المشاريع ، وتم عمل تحليل كامل ومفصل لأصحاب العلاقة و علاقات كل منهم بالآخرين بالإضافة لتحليل جميع العمليات الإدارية ودورة المعلومات الخاصة بالمشاريع، وذلك لرسم نموذج مطور لآلية سير العمل، بالإضافة إلى ذلك تم عمل تصميم برنامج إلكتروني ليقوم بجميع هذه المهام و يشارك فيه جميع الأطراف ليقوم بإدارة المنحة من بداية تقديم مقترحات المشروعات مروراً بالآليات التعاقد و انتهاءً بالدفعات و إغلاق المشاريع حيث يعطي أيضاً الصلاحيات للمقاول في إدخال المعلومات اليومية وجداول الكميات المنفذة للنظام.

بعد عمل التصميم الخاص بالنظام تم عرضه على مجموعة من الخبراء في إدارة المنح والخبراء في تحليل وبرمجة الأنظمة وكان رأي الجميع يدور حول أن النظام تم إعداده بشكل جيد و هو قادر على تخفيف الوقت والجهد على جميع أصحاب العلاقة في إدارة المنح والمشاريع بالإضافة إلى أن النظام تم تحليله و تصميمه بشكل مفصل يشمل جميع العمليات والإجراءات الإدارية، ونصح الجميع بالبدء في البرمجة الفعلية والتجربة لهذا النظام على أرض الواقع لما سيكون له من فائدة كبيرة في جودة النتائج.

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## List of abbreviations

BOQ	Bill of quantities
CIB W78	Conseil International du Bâtiment pour la Recherche, l'Étude et la Documentation' or in English 'International Council for Building Research Studies and Documentation
D.R.	Donor representative
EDMS	Electronic Document Management System
EMCC	Engineering management and consultancy center
GDCPP	Generic Design and Construction Process Protocol
GDP	Gross Domestic Product
GNP	Gross National Product
I.A.	Implementing agency
ICT	information and communication technology
IDB	Islamic development bank
ISO 12006-2	Building construction - Organization of information about construction works
IT	Information technology
MDLF	Municipal development and lending fund
NDC	Non-governmental organization development center
NGOs	Non-governmental organizations
PNA	Palestinian National Authority
PRDP	Palestine reform development plan
RIBA	Royal Institute of British Architects Plan
SDLC	Systems development life cycle
WB	World bank
WBMS	Web-based project management systems

# Chapter 1: Introduction

This chapter outlines the background of the research topic, and then provides a brief overview of the Palestinian construction industry. After that, it presents the aim and objectives of this research, the research scope and limitations and finally the structure of the dissertation.

## 1.1 Research Background

This section provides a brief overview of the research context. It discusses the rationale, significance, importance, and justification for undertaking this research.

One of the significant features of the construction industry in Palestine is the dependence of many infrastructure and construction projects on international funding organisations (Enshassi *et al.*, 2006). A serious problem facing these projects and all construction stakeholders is communication and information processing that has contributed to the proliferation of adversarial relationships between the parties to a project. This problem is related to the fragmentation of the construction industry due to the many stakeholders and phases involved in a construction project (Matheu, 2005; Nitithamyong and Skibniewski, 2004).

This problem can be overcome by establishing an Internet-based communication system, which ensures transferring the right information, at the right time, to the right person (Charoenngam *et al.*, 2003). In Palestine, solutions for web-based management system are still under development and facing problems in some institutions.

The improved implementation of information technology (IT) is critical to effective innovation and development at an industry and enterprise level. This is even greater in the construction industry as it has been relatively slow to embrace the full potential of IT-based technologies (Mohamed and Stewart, 2003). For instance, although tender documents for public works produced electronically in Gaza Strip, they still need to be transferred manually. This situation leads to a lot of repetitive work, paper consumption, and loss of time. No work has been done on the national level to automate the communication between parties that are involved in the procurement activities (Thabet, 2006).



In an attempt to understand why the construction industry lags other industries in the uptake and effective implementation of IT, this study reports on an investigation of the Palestinian construction industry, which identifies the impediments or barriers to IT implementation and the most effective coping strategies to overcome them (Mohamed and Stewart, 2003).

What most donors and granters require in terms of project and grant management is the ability to manage and share the project and grant documents. This is achieved by removing certain core applications from individual PCs and running them on a server such as an Electronic Document Management System (EDMS). Such tools should decentralize the information specific to the organisation in an easily accessible environment, allowing users to store, access and modify information quickly and easily (Matheu, 2005).

Quite simply project collaboration applications allow disparate groups of people such as engineers, contractors, clients and sponsors to control access and automate dissemination of information. The most web-based project management systems (WBMS) used in the construction sector are to rent completely developed WBMS from an Application Service Provider (ASP) for a usage fee. The development and operation of this option requires a minimum of technical, financial and human resources.

The suggested remedy for this inefficiency and the aim of this thesis is to create a tool to improve the grant management processes and procedures in the Gaza Strip. Such Web-based Grant Management System (WBMS), or in this research web based grants management system (WGMS), contains a web interface connected to the internet network which allows all the users which are the grant management stakeholders to interact with adding projects information and getting the reports on time and in an accurate way (Matheu, 2005).

To do this, the flow of information between the different parties involved in a construction project is mapped out and a Concept Model for Information Flow is designed to store all the documentation of a construction project and its metadata throughout the life cycle of the project (Matheu, 2005).

Essentially, the potential beneficiaries from this research are all stakeholders within the Palestinian construction industry such as clients, main contractors, consultants, local authorities etc. This is because automating the grant management and utilizing web-based management and

administration techniques eliminates the disadvantages of traditional working methods and creates a win-win situation. Also, international funding agencies may be benefit because they aim to spend the money efficiently for development purposes rather than wasting it in secondary activities without an added value.

## 1.2 Problem statement

IDB (Islamic Development Bank) Representative manages its reconstruction activities with a large number of international agencies and NGOs in Gaza, and adopts a decentralization approach in its interventions management. Obviously, this generates many challenges in the overall management process of the grants. Therefore, there is a special need to redesign traditional working procedures across the grant management life cycle and more specifically, the exchange of data between different stakeholders. This can take advantage of the internet technology, so that working procedures becomes more efficient.

IDB Representative is responsible for the overall management of the grants and for approval/ authorization process that is necessary for all key steps/milestones of grants and sub-projects execution.

The focus of this research is management of grants across many projects within the construction industry. Usually, a single grant is allocated to multiple projects and has many implementation agencies. In addition, the grant disbursements and cash flow is monitored and controlled by traditional methods and communicated to different parties slowly. This makes the information scattered and hence complicates the overall grant management, delays grants implementation and generates many problems summarized below:

- The lack of electronic archiving system that causes delay and reduces the efficiency of information management, searching, retrieval, dissemination etc.  
This delay occurred in the entire project life cycle starting from project preparation, tendering, evaluation, awarding, contact management and delivery of the projects, in addition to the inability of proper follow up and tracking.
- The large number of stakeholders involved in every project and grant makes the coordination and communication between them very difficult, slow, and inefficient.

- The mistakes/errors occur in the documents traditionally submitted (hard-copies) to the donor representative for approval in each is very time, effort and resource-consuming.
- The absence of a unified database for the BOQs for different projects is problematic for the grant management institution. This needs great amount of time to modify and amend the quantities take-off in order to reconcile and match them for tendering.

### 1.3 Palestinian Construction Industry Background

The Gaza Strip is 367 square kilometres in size (Eltalla and Hens, 2010). The population of the Palestinian Territories Figure 1 is estimated by the Palestinian Central Bureau of Statistics to have reached five million in 2014, of whom 1.8 million live in Gaza. This makes the population density to be 5,046 persons per square kilometre in Gaza. This extremely high population density, that is the highest in the world, puts much pressure on the economy to sustain an acceptable standard of living.

The Palestinian economy is weak and small in size, fragmented and subjected to Israeli restrictions. In 2012, the Gross Domestic Product (GDP) was estimated as US\$10.0 billion and the GDP per capita was approximately US\$1,924 in west bank and US\$ 867 in Gaza strip (Washington Institute, 2014). The Gross National Product (GNP) per capita rises to US\$1,800 because of the remittances of Palestinians working overseas as well as the international aid. According to the World Bank classification, Palestine is ranked within the group of lower middle income. The average yearly disbursements by donors between 1994 and 2000 (the year of the Palestinian Intifada outbreak) was US\$ 453 million. The construction industry received 33.5% of the total disbursements (El-Sawalhi and Enshassi, 2004).

The construction industry has significant contribution to the Palestinian economy. It employs more than 16 % of the Palestinian workforce and it accounts for approximately 17 % of the value



Figure 1: Geographical Map of Palestine Showing the Gaza Strip and the West Bank.

added to the GNP (Enshassi *et al.*, 2006). The environment of construction in Palestine is abnormal compared with other parts of the globe. This is because of the Israeli occupation forces which have a strong effect on the Palestinian economy including construction field (Rustom, 2004).

After the Israeli aggression on Gaza in 2008/2009, many infrastructure utilities were destroyed. According to the UNDP report (2010), around USD 527 million are required to just return the Gaza Strip to the state it was in December, 2008. This represents a fraction of the total needs required to “build back better”, that is to ensure that Gazans achieve a measure of well-being that extends beyond the levels of 2008, through large scale construction to address population growth, maintenance and repair to reverse the degradation of public and private infrastructure which has occurred under the blockade of the Gaza Strip.

That Gaza’s recovery efforts benefited from Arab and Islamic donors, international NGOs, United Nations bodies and other international countries (UNDP report, 2010). The Islamic Development Bank (IDB) was one of the most important donors in the reconstruction efforts in the Gaza Strip. IDB provides donations and grants that have a value of more than 1.6 billion dollars for the reconstruction activities. IDB is managing different sorts of programs and interventions, varying between emergency, developmental and reform/capacity building interventions.

The procedures of grants/aids management have a variety of forms with centralized and decentralized approaches at both ends of the spectrum. Since the establishment of the Palestinian National Authority (PNA), the full centralized approach in managing grants was the most common one, in which the funding organization handles all levels of program management, while the responsibility of beneficiaries is limited to some sort of coordination, needs identifications and participation in supervision of projects implementation. The drawbacks of the full centralized system are well known such as inefficient and bureaucratic procedures, slow communication and decision making, and the concerned stakeholders are only kept informed on regular basis (monthly, quarterly, semiannual and annually), without any influencing ability.

Meanwhile, adopting a more decentralized philosophy in the grant management system in Palestine is considered a key milestone in the reform and development, national plans of the Palestinian institutions (PRDP 2008-2011).

IDB adopts a sort of decentralization in managing reconstruction programs and grants, where beneficiaries or implementing agencies are taking key part during the grant life cycle and across all levels. This decentralized system has many advantages; however, it makes the mission of IDB representative in managing the decentralized interventions full of difficulties because the information and documents are generated by many parties and the decision making authority and power is divided between different institutions. As a result, delays and problems may be happen to the grants implementation, monitoring, controlling etc.

From this point arises the importance of developing a web-based management system so that the advantages of both centralization and decentralization are achieved.

#### **1.4 Research Scope, Constraints and Limitations**

The research will focus on Gaza reconstruction grants provided by the Islamic Development Bank (IDB) and its projects implemented by many international institutions working in Gaza strip. This research will cover the following two areas:

- The stakeholders needs (requirements determination) from the system through literature review, survey, and study of current life cycle and procedures of projects.
- Developing a web based system model for grants management linking all stakeholders.

It is necessary to clearly articulate any limitations of the research in order to avoid misreading or misinterpreting of the findings. The following paragraphs outline the main constraints:

1. The geographical scope of the research is mainly limited to the Gaza Strip-Palestine. Despite the fact that most of the research findings and results are valid anywhere, some issues might be applied only to the specific conditions in Palestine.
2. The model will only be focused on the management of the current grant documentation and not the management records/products of previous grants.

#### **1.5 Research Aim and Objectives**

This research aim is to develop a web based project/grant management system model for managing several projects in the Gaza reconstruction grants.

The research also is going to achieve the following specific objectives:

1. Identify the communication problems facing the grant management stakeholders.
2. Analyze the current grant management processes and practices in order to develop a model for the management cycle.
3. Develop a simple and friendly model for a web-based grant management system that deals with funds, project budgeting, payment tracking, cost control, contracting, and implementation. This system is to increase data collection and information sharing efficiency, enable different parties to update and immediately upload data from anywhere

## **1.6 Dissertation Structure/ Organisation**

### **Chapter 1: Introduction**

This chapter introduces a background of the research topic and an overview of the Palestinian construction industry. It also presents the aim and objectives, significance of the research, potential beneficiaries, scope and limitations, as well as the outline of this research.

### **Chapter 2: Literature Review**

This chapter examines the areas of communication, IT, and information management in construction projects context. In addition, it investigates the web-based project management systems (WBMS) concept and how it could facilitate complex construction business processes. Also, it explores various WBMS business models and features, implementation drivers and options, pros and cons, and barriers.

### **Chapter 3: Methodology**

This chapter describes the methodology of this thesis; the main topics included in this chapter are research strategy, research design, population, sample size determination, research location.

### **Chapter 4: System analysis**

This chapter has analyses in-depth the system requirements in terms of two variables; the document that is communicated, and the people communicating (creating, dissemination, sending, receiving, storing, retrieving, editing and approvals etc.) these documents. Then, the information and its documentation, and all stakeholders can be modelled to visually understand the requirements of the WBMS to be developed.

## **Chapter 5: Model Development**

This chapter presents the proposed system design that includes the software user interfaces and the process in each page, also presented a new tracking system for monitoring the grant working process.

## **Chapter 6: System evaluation**

This chapter presents the evaluation and experts' perception about the proposed system model, which summarizes the semi structured interview results which conducted with grants management and system analysis experts.

## **Chapter 7: Conclusion and Recommendations**

This chapter presents the research outputs, outcomes, results and main findings with a view of recapitulating the main aim, objectives and the proposition/hypothesis. The chapter also states how the research has contributed to knowledge, and makes recommendations and suggestions for future research.

# Chapter 2: Literature Review

## 2.1 Introduction

This chapter aims to acquire adequate knowledge on communication, IT, and information management in construction projects context. In addition, it investigates the web-based project management systems (WBMS) concept and how it could facilitate complex construction business processes. Also, it explores various WBMS business models and features, implementation drivers, benefits, barriers, as well as future trends (Nitithamyong and Skibniewski, 2011).

## 2.2 Project communication and information flow

Although communication is of a vital importance in construction projects, the construction industry is confronted with great communication difficulties and an ineffective use of information and communication technology (ICT) systems (Adriaanse and Voordijk, 2005; Dawood et al., 2002; Mohamed and Stewart, 2003; Thorpe and Mead, 2001). In this study, the objective is to analyse obstacles and preconditions for an effective use of ICT by focusing on characteristics of inter-organisational communication in construction projects.

Part of the trouble of poor communication is the way the industry is organized. The project team is made up of people from many different firms see Figure 2. Their contributions vary and a lot of information has to pass among them. This requires a well-organized network of communication. Even when this network exists, communication still breaks down at a personal level, because people fail to keep their messages simple; they pass on too much information or too little; the information they give is inaccurate or misleading (Dawood et al.; Fryer, 2002; Kornelius and Wamelink, 1998; Pietroforte, 1997).



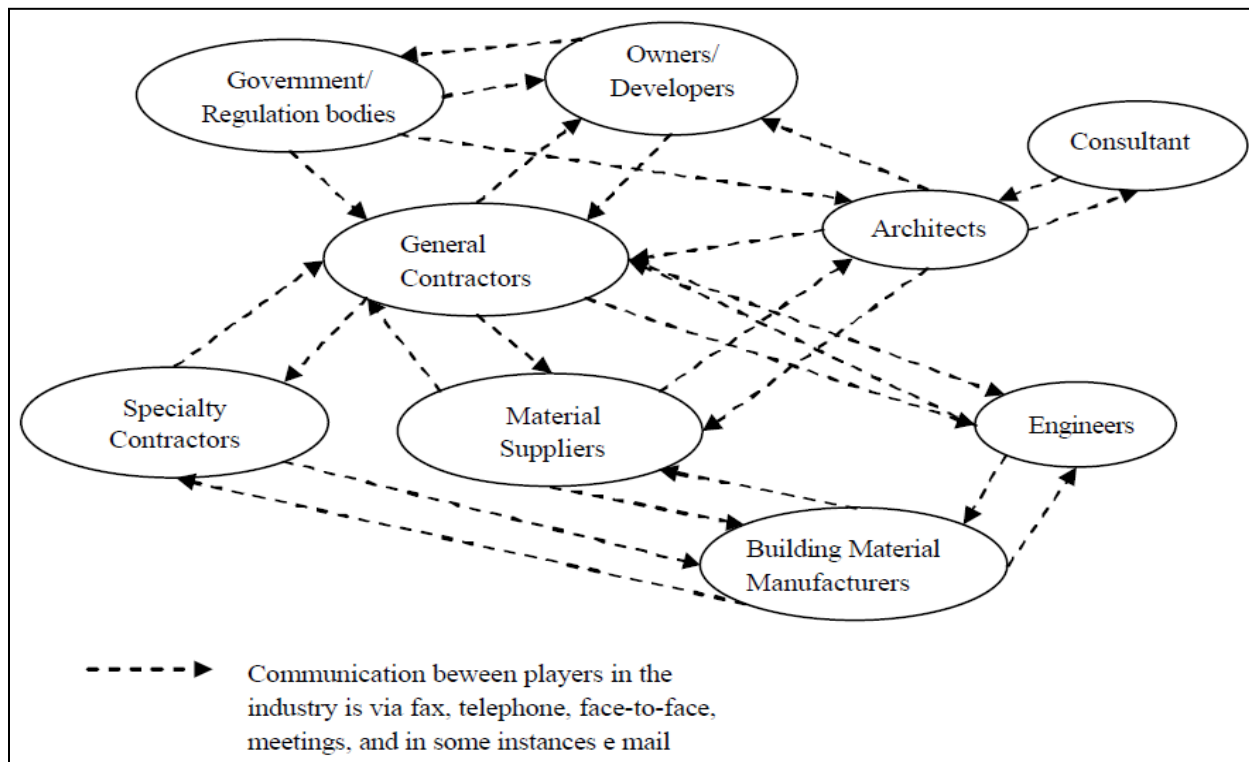


Figure 2: Traditional chaos in the communication and workflow of AEC industry

(adopted from Matheu, 2005)

Coordinating the numerous parties involved to take a project from initiation through construction is often a daunting experience. Owners, donors, architects, engineers, general contractors, subcontractors, material suppliers, government, and regulatory bodies, have all traditionally communicated using methods such as fax, face-to-face meetings, e-mail, etc., to exchange ideas, provide progress updates, schedule labour, deliver documents and make supply requests (Matheu, 2005).

Bearing in mind the number of organisations in a typical project supply chain, two major problems can be inferred:

- The system is inherently challenging in terms of effective communication. Ineffective communication and poor administration lead to bad management.
- The administrative burden is tedious and expensive.

Information flows in construction are numerous, unstructured and very complex. The amount of data flow is exhausting and requires volumes of documentation. It is a wonder how much valuable human effort, time and resources have been spent in major construction projects for

monitoring, tracking and controlling data flows. Retrieving documentations from the racks and racks of project file stores is a daunting and time-consuming task (Ahmad et al., 1995). The disputes arising from improper documentation are numerous and they cannot be amicably or fairly resolved due to lack of substantial documentation or many missing links. The extent and sources of information overload of construction project managers vary throughout the stages of a project. The importance of proper information tracking and document control is paramount in the last phase of the construction, commissioning and final account settlement (Baldwin et al., 1999; Tserng and Lin, 2003).

Accordingly, construction project participants cannot perform effectively without an adequate, accurate and timely flow of information. For this reason, each participant in the construction process has responsibility for transmitting information and communication. Also, the nature, volume, direction, and timing of the flow of information vary considerably and, hence, this demands its effective coordination, control and dissemination to ensure its proper utilization (Ahmad et al., 1995; Baldwin et al., 1999). Generally, information is whatever meaningful data; but, when talking about Project Management, information is basically limited to documentation and communication (Matheu, 2005).

There are special needs to redesign traditional working procedures for the communication and information management. This is to take advantage of the new possibilities of a IT and project web, so that working procedures are better and more efficient.

### **2.3 Information Technology in Construction Industry**

Rapid evolution of information and communication technologies (ICT) offers opportunities to enhance communication between participants in construction projects and to enable more effective and efficient communication (Egbu et al., 2001). The use of such systems in construction projects, however, is relatively limited and ineffective when compared to other sectors such as the automotive and aerospace industries (Anumba and Ruikar, 2002). The effectiveness of utilizing ICT in construction projects may be hindered by the inability to share electronic data between organizations (Adriaanse and Voordijk, 2005; Hassan and McCaffer, 2002; Mohamed and Stewart, 2003).

Communication technologies are the technologies dealing with the transmission of information. They support the process by which information is exchanged. Defining the scope and boundaries

of the use and performance of IT in construction is difficult due to the relatively limited amount of detailed research that has been carried out in the field. Information technology, by definition, is a collective reference to the integration of computing technology and information processing (Al-Hussein and El-Ghandour, 2004; Long and Long, 1997). The Oxford Concise English Dictionary defines IT as: the study and use of systems for sorting, retrieving and sending information. Also, IT is defined as: the use of electronic machines and programs for the processing, storage, transfer and presentation of information (Rivard, 2000; Thabet, 2006). IT is not a single technology but a wide range of technical approaches to a variety of problems (Al-Hussein and El-Ghandour, 2004; Froese, 1999).

To many, IT in construction encompasses the use of all electronic means of information transfer (computer networks, local area networks LAN s, Internet, mobile phones, faxes, etc.) Others see IT as the use of the latest technology, such as, knowledge-based systems, computer based decision support systems and object-orientated CAD, while others see it as part of management strategies and concepts of concurrent engineering, just-in-time production and process reengineering. This diversity has led to a number of different IT definitions. This paper adopts an information-centric definition that encompasses the use of electronic machines and programs for the collection, processing, storage, transfer and presentation of information. This is to demonstrate the key role IT plays in improving the effectiveness of communication and information exchange in the context of managing a construction project (Mohamed and Stewart, 2003).

Information Technology (IT) is starting to be used in the construction industry as a tool to reduce some of the problems generated by fragmentation. Its benefits include an increase in the quality of documents and the speed of the work, better financial control and communications, and simpler and faster access to common data as well as a decrease in documentation errors (Matheu, 2005).

Among all IT applications, Internet is the technology that best facilitates a collaborative working environment in a construction project. Its use as a communication medium can help information transfer occurs faster and more effectively and can provide new opportunities for the development of distributed systems that can cross organization boundaries and provide a unique opportunity for teamwork and workflow automation. The web can also overcome the incompatibilities of data formats through smart browsers and servers; therefore, independent

project participants using different hardware platforms can share the same applications over the web (Matheu, 2005; Rojas and Songer 1999).

Literature indicates that ICT vendors face difficulties in identifying the construction industry's ICT needs and requirements (Hassan and McCaffer, 2002). Before ICT is implemented to support communication, attention has to be devoted to the actual communication processes in construction projects (Adriaanse and Voordijk, 2005).

The uptake of information technology (IT) in construction has lagged well behind most other industries. A number of historical, industrial and market forces have shaped the industry's structure and culture, thus affecting the rate, extent and nature of IT adoption in key business processes. Reasons for the slow uptake of IT have been investigated and are well documented (Betts 1999; Marosszeky et al., 2000; Marsh and Finch, 1998; Stewart et al., 2002). They include the very nature of how the industry constructs one-off projects creating a project rather than a process perspective of production and of investment opportunity, supply chain fragmentation, lack of client leadership, low level of technology awareness and training, necessary up-front investment, ongoing maintenance costs, and resistance to change (Froese et al., 1997; Perera and Karunasena, 2008).

Generally, IT investment appraisal is more difficult than other investment decisions because IT-induced benefits are hard to identify and quantify (Love *et. al*, 2004). This IT productivity paradox prompted calls for new approaches to evaluate IT-related investments (Dos Santos and Sussman, 2000). In the last decade, numerous researchers have studied how IT investments should be evaluated and controlled across diverse industry sectors (Stewart, 2007).

Fortunately, the advent of supply chain management practices presents a key opportunity for construction companies wishing to surpass the IT adoption barrier (Mohamed, 2003). Indeed, some authors have demonstrated how the generic theory of supply chain management can be applied to the construction industry (Green et al., 2005; London and Kenley, 2001) while others have shown how information systems can support such a strategy (Cutting-Decelle et al., 2007). However, empirical studies on the role of IT to support supply chain management in the particular context of the construction sector remain scarce and with a fairly narrow focus (Hadaya and Pellerin, 2010)

## 2.4 Information technology evaluation for management practices in the construction industry

Investment appraisal and evaluating the total cost and benefits of investment in WBMS is the most important thing to be considered by the top table to decide whether or not to go in this way. Unfortunately, determining the total real costs as well as capturing the long-term value creation is very difficult if not impossible tasks.

Generally, IT investment appraisal is more difficult than other investment decisions because IT-induced benefits are hard to identify and quantify (Powell, 1992). As a consequence, more traditional investment appraisal methods such as Return on Investment (ROI), Net Present Value (NPV) or Internal Rate of Return (IRR) have been difficult to apply despite being widely understood by senior managers (Stewart and Mohamed, 2004). The IT productivity paradox prompted calls for new approaches to evaluate IT-related investments (Dos Santos and Sussman, 2000). In the last decade, a number of researchers have studied how IT investments should be evaluated and controlled (Kaplan and Norton, 1992; Willcocks, 1996; Strassmann, 1997; Ballantine and Stray, 1998; Fitzgerald, 1998).

## 2.5 Identification of IT costs

### 2.5.1 Direct costs

Direct costs are costs that can be directly related to producing the products and services, like salaries and hardware's. Direct IT costs are often underestimated (Hogbin and Thomas, 1994; Remenyi and Sherwood-Smith, 1997). They may include unexpected additional hardware and installation and configuration are often classified as direct costs (Love and Irani, 2004).

### 2.5.2 Indirect costs

The indirect costs are more significant than direct costs, so they are indirectly related to products or services like depreciation or administrative expenses. Organisational costs can arise from the transformation from old to new work practices. At first, a temporary loss in productivity may be experienced (Love and Irani, 2004).

Additional organisational costs may be experienced once the basic functions of the system are in place. These are associated with management's attempts to capitalise on the wider potential of the system at the business and project level. Companies with extensive IT infrastructures in place tend to change their corporate shape, by reducing the number of management levels

(Hochstrasser, 1992). The costs of organisational restructuring are expensive, particularly when isolated groups within the company resist change.

Management time has been the most significant indirect cost experienced by construction organisations. Invariably, time is spent leading, planning, and organising the integration of new systems into current work practices. The result of implementing newly adopted technologies may also force management to spend time revising, approving, and subsequently amending their IT strategies. In addition, significant resources are used to investigate the potential of IT and in experimenting with new information flows and modified reporting structures. Another indirect cost may result from employees who have developed new skills requesting revised pay scales or leaving to go to competitors. Clearly, such 'indirect' costs need to be captured and brought into the IT decision-making process (Love and Irani, 2004).

## **2.6 Evolution of Document Management**

Documents in the construction sector have not undergone major changes since the middle of the 20th century. Plans, drawings, bills, specifications, etc., look as they did some decades ago. The technology for producing, managing, duplicating, and distributing such documents has, however, undergone many fundamental changes (Björk 2003).

Firstly, the introduction of photocopying in the 60's reduced the cost of duplicating information. Afterwards, the introduction of technological innovation such as personal computing for the day-to-day work during the 80's, and the mass utilization of CAD-systems, word-processing and other software, helped to reuse information. In the 80's the fax became also a popular data transfer method and was used to handle offers, send graphics, etc., but was not useful for larger drawings or documents. Finally, in the late 80's and early 90's Internet made possible the document transfer via mail which was a great step for document management. Nevertheless, on most sites the receipt, creation, authorization and distribution of incoming, outgoing and internal documents, are handled by a manual system totally dependent on the photocopier, often slow, inefficient and at worst unmanaged, uncontrolled and error-prone (Matheu, 2005).

Based on the internet technology, the most sophisticated currently -applied method is the so called Electronic Document Management Systems (EDMS), where Documents are stored centrally on a web server and users interact with this central repository through interfaces implemented using standard web browsers (Björk 2002).

The development of network technology has nowadays reached a level where companies, for a relatively low cost, can implement Intranet, Extranet or Internet. This development has evidently been taken up. This condition has led to an increasing number of building projects using a project web as a tool to enable and increase the efficiency of the exchange of digital data between the companies in a building project (Matheu, 2005).

Many different names have been used by both service providers and researchers to denote such systems, including Document Management System, Project Extranet, Project web, Project Bank, Project Specific Web Site, Document Pool, Project Information Management System, and Virtual Project. Some authors give these terms slightly different meanings (Matheu, 2005).

Hereafter, the term Web Based Project (or Grant) Management System will be used to refer to all the functionalities of an Extranet as collaborative software and we will use the term Electronic Document Management System to refer to the particular application of document management using whatever support system.

## **2.7 Electronic Document Management Systems**

The standard features of a good EDMS should still include the following functionalities: searching facility, viewing without the use of the original application, red-lining and marking-up feature, printing and plotting, workflows and document life cycles, revision and version control, document security, document relationships, status reporting, issue/distribution management and remote access. The goal of EDMS is to share information by making documents secure, accessible, retrievable, and interchangeable (Matheu, 2005). Figure 3 shows the concept of EDMS.

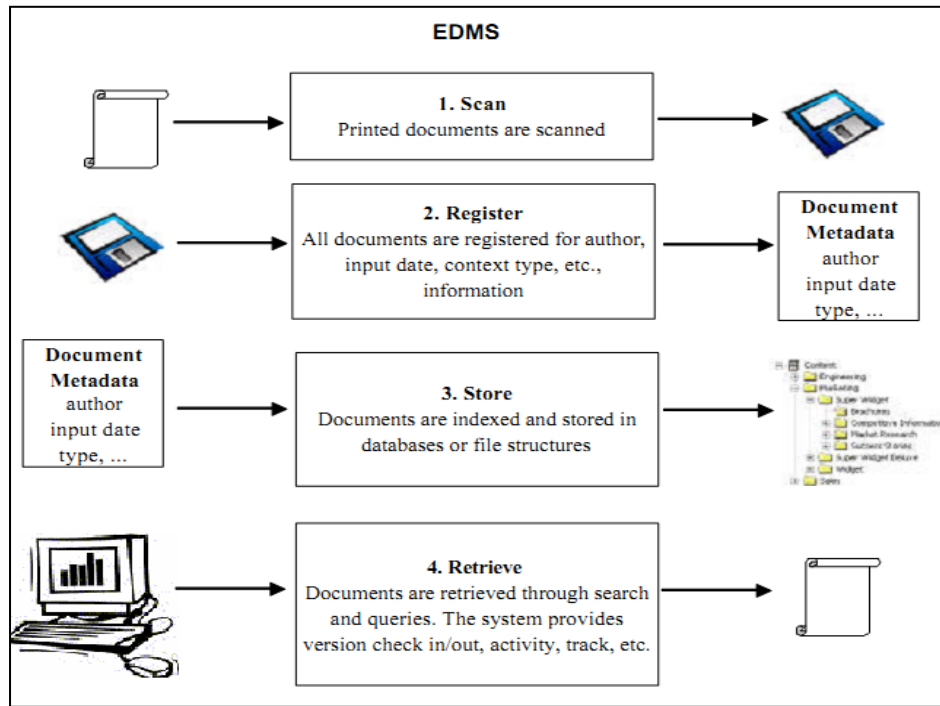


Figure 3: Electronic Document Management Systems (Source: Matheu, 2005)

## 2.8 Types of Web Based Software for the Construction Industry

A WBMS is an electronic project management system conducted through the “extranet”, which is a private network using internet protocols to transmit information and only accessible by authorised users at different pre-defined levels (Abduh and Skibniewski, 2004; Becerik, 2004a; Bjo`rk, 2003; Walker and Betts, 1997).

Many web based services have launched in the construction industry, in line with similar trends across all industries, and generally fall into four categories (Matheu, 2005):

- Information portals
- Enterprise portals
- Electronic marketplaces
- Web based Project Management Systems / Extranets

### 2.8.1 Information portals

A Portal is a web site targeted at specific audiences and communities. In general, Information portals tend to duplicate paper-based catalogues, in several cases to the extent that they scan paper-based catalogues to provide their service. The benefit of this approach is fairly low; the



only added benefit over a paper system (assuming that speed of access to information is fairly comparable) is that updates are immediately visible to all the users.

### 2.8.2 Enterprise portals

Enterprise portals are centred on the operations of an enterprise, offering information and transaction functionality for stakeholders of a single company. The project management features can be also available. This kind of site can be based on Internet, Intranet, Extranet or on a combination of these ones.

### 2.8.3 Electronic marketplaces

An electronic marketplace is a web site which main difference is the supply of transaction functionality between two or more companies. It is usual to offer additional functionalities such as product catalogue management, auctions, reverse auctions, and others. Again, project management can be available in AEC-related e- marketplaces.

### 2.8.4 Web based Project Management Systems / Extranet

Web based Project Management Systems are web-based applications designed to store and manage project information. Systems are designed to improve collaboration between the teams working on a project, reducing potential risks and helping to ensure that the project is delivered on time. They serve as a repository for all the documents, and communications relating to the project and are used by all project participants to access, read, print, and edit material according to authorizations set up by the project administrator.

In Figure 4 situations, traditional project management and WPM are shown. As can be noticed, the basic improvement is the centralization of the information.

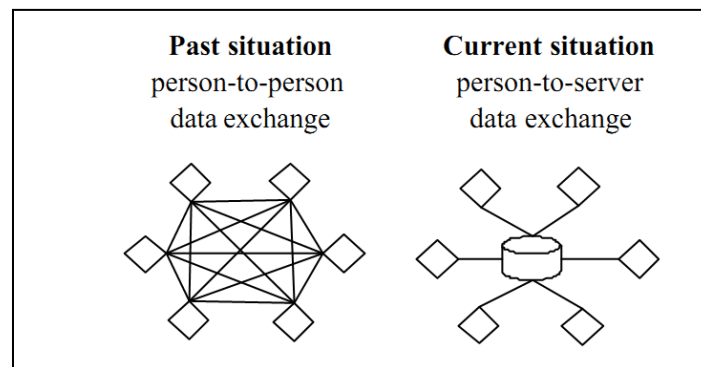


Figure 4: Communication Mechanism between Enterprises (Source: Matheu, 2005)

WBMS services, which are summarized in Figure 5, include:

- Document management: sharing or viewing multiple file formats online, marking-up the documents, downloading and uploading multiple documents, document search or full text search, back up facilities, keeping a document revision history and tracking who accesses what files.
- Team communication (Project Collaboration and Management): real time discussion group, project calendar and event planning, team communication (project email or SMS messaging).
- Business Process Automation: browser compatibility, plotting, third-party viewer, MAC support, PDA and WAP support, server located in a secure data centre, firewall installed, User ID and password required, different access levels, virus protection.

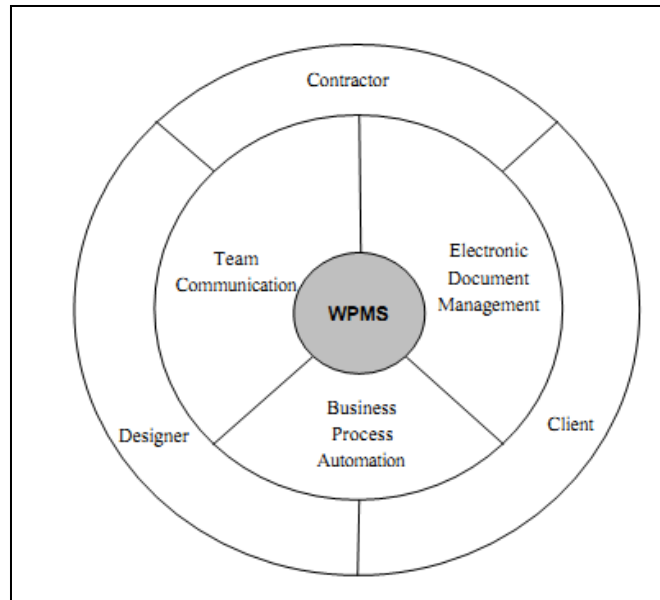


Figure 5: Communication and Collaboration services of WBMS (Source: Matheu, 2005)

## 2.9 Advantages of WBMS

The literature discusses many potential benefits of WBMS such as (Matheu, 2005):

1. Better communication. The information repository can be updated daily to ensure that everyone has access to current information. It enables everyone in the project team to work from the same page, improving productivity, minimize rework due to communications errors.
2. Reduction of costs and wasted time. Printing and postage costs are reduced and also document administration as all documents are stored centrally.

3. Improvement of project control. All actions are recorded to be audited and monitored. Better access to information and reduction of the response time for RFI (Requests for Information), CO (Change Orders) and specifications clarification.
4. Shorten the project life cycle. The fast dissemination of information shortens consultation cycles and speeds up decision making. When you send an electronic document to a website it is immediately available for viewing; likewise, written feedback is available without delay.
5. Reduction of risk and potential errors. The latest information is always available as soon as it is published, minimizing the risk of working on old information.

## 2.10 Limitations of WBMS

There are also drawbacks when an organization decides to work using WBMS (Matheu, 2005).

1. Security. The possibility of sharing information in a WBMS demands security measures. The issue of trust is a major issue in the setting up of such a WBMS - some clients would be completely trustworthy whilst others would need to be checked all the time. There is definitely a need to ensure that people is encouraged to see this technology as a benefit rather than a threat.
2. Infrastructure and difficult Internet access. Companies need to have the infrastructure necessary to support them (i.e. network systems, hardware, etc.). Most companies don't have this infrastructure and don't want to change their organizations. Moreover, there mostly is no Internet access on site.
3. Need for training employees must be familiar with technological solutions; otherwise they need to be trained. Some employees are not keen on using new technologies and think they will need too much time to learn and understand it.
4. Cost currently limits the widespread use of commercial project management software in the construction industry. Providing free or low-cost software is a solution for general contractors who would generally have to purchase or rent software (Liu, 2010).

## 2.11 The implementation of web-based project/grant management systems

A systems development life cycle (SDLC) is composed of a number of clearly defined and distinct work phases which are used by systems engineers and systems developers to plan for, design, build, test, and deliver information systems. Like anything that is manufactured on an

assembly line, an SDLC aims to produce high quality systems that meet or exceed customer expectations, based on customer requirements, by delivering systems which move through each clearly defined phase, within scheduled time-frames and cost estimates (Foldoc, 2014).

Web-based project management systems (WBMSs) have gained considerable attention in the construction industry since the concept was introduced in the mid-1990s, with many professionals expecting them to facilitate or even transform how construction businesses operate

Project data are stored on centralised servers, and a standard web browser is used as a gateway to access, exchange, and share information from remote locations at any time, eliminating the problems that occur in linear communication schemes (Thorpe and Mead, 2001). A basic WBMS is typically aimed at supporting project collaboration and information sharing, but advanced WBMSs also enhance users in searching for specific information (e.g. codes/permits, economic trends, product information, cost data, etc.) or conducting business transactions completely online (e.g. electronic bidding and procurement) (Nitithamyong and Skibniewski, 2011).

As project information changes, the database on the server can be easily updated with new data. Members of the project team can then access the updated information via a digital user ID and password from remote locations at any time, eliminating the problems that occur in linear communication schemes (Thorpe and Mead, 2001). Since a closed network is used where no one is allowed to access the system without permission and everyone is identified (through an individual user ID and password), the system can automatically track who has seen what, and what comments or changes if any, they made. It is also possible to introduce a project hierarchy into the system, which allows documents or are as of the project to be restricted to only people at certain levels of responsibility, etc. Hence, the mistakes caused by poor communication and the delays due to the time it takes to move documents and people around for approvals and meetings would be minimized. WBMS is predicted to significantly improve the speed and quality of communication among project participants and promotes collaboration and coordination in construction projects (Doherty, 1999; Nitithamyong and Skibniewski, 2004; Thorpe and Mead, 2001).

Although WBMSs may be deemed helpful and promising, several recent studies conducted to investigate the actual uptake of such systems have consistently shown that their usage in the

construction industry is still limited and practitioners remain hesitant about permanently adopting this new project management approach (Nitithamyong and Skibniewski, 2011).

Despite how advanced or attractive WBMSs may seem, their application will not be as effective as expected if there remains a lack of understanding of the factors that influence their performance. The lessons learned from the case studies are that a number of factors are integral to the success of a WBMS application. As a minimum requirement, a project seeking to employ WBMS must be equipped with the following (Nitithamyong and Skibniewski, 2011):

- An adequate level of resourcing;
- An appropriate duration to promote the system; and
- A sufficient level of the team's computer literacy.

Without these factors, it is highly likely that an application will be counterproductive and, therefore, employing WBMS in such a project is not recommended.

## **2.12 How to implement WBMS?**

Currently, there are three options in regard to WBMS implementation. The first option is to develop customized WBMS in-house by hiring either a consulting company or programmers to create a system. The second is to develop WBMS by purchasing commercial web-enabled packaged software and installing it on a company's internal server. The third is to rent/lease completely developed WBMS from an Application Service Provider (ASP) for a usage fee, which is normally charged per project, per the amount of computer storage space required, and/or per user.

Among these three options, the third, referred to hereafter as a "Project Management System Application Service Provider (PM-ASP)", is becoming popular because it requires minimal technical, financial, and human resources to develop and operate (Nitithamyong and Skibniewski, 2004; Thorpe and Mead, 2001).

Since PM-ASP is outsourced to an ASP, it requires no effort to develop and maintain the system in-house, involves comparatively low initial investment and overhead cost, and is convenient for keeping up with cutting-edge technology. Although PM-ASP is a topic of increasing importance to practitioners as well as researchers in construction, it is still relatively new and its optimal

styles and extensions of use have not yet been thoroughly investigated. According to Kraker (2000) , there is still a debate among A/E/C firms whether or not to move permanently to PM-ASPs. Most companies have used PM-ASPs either because their competitors are influencing them or they are being forced to adopt it by their clients (Doherty, 1999; Nitithamyong and Skibniewski, 2004; (Abduh, 2004))

Presently, the most widely used WBMSs are provided by application service providers who offer all the computing power, storage, security, backup, network infrastructure, and technical staff required to manage the platform. Such systems require minimal technical, financial, and human resources to operate; therefore, they are deemed practical for firms without in-house expertise or resources to develop systems for exclusive company use. Figure 6 shows the generic system architecture of a WBMS (Nitithamyong and Skibniewski, 2011).

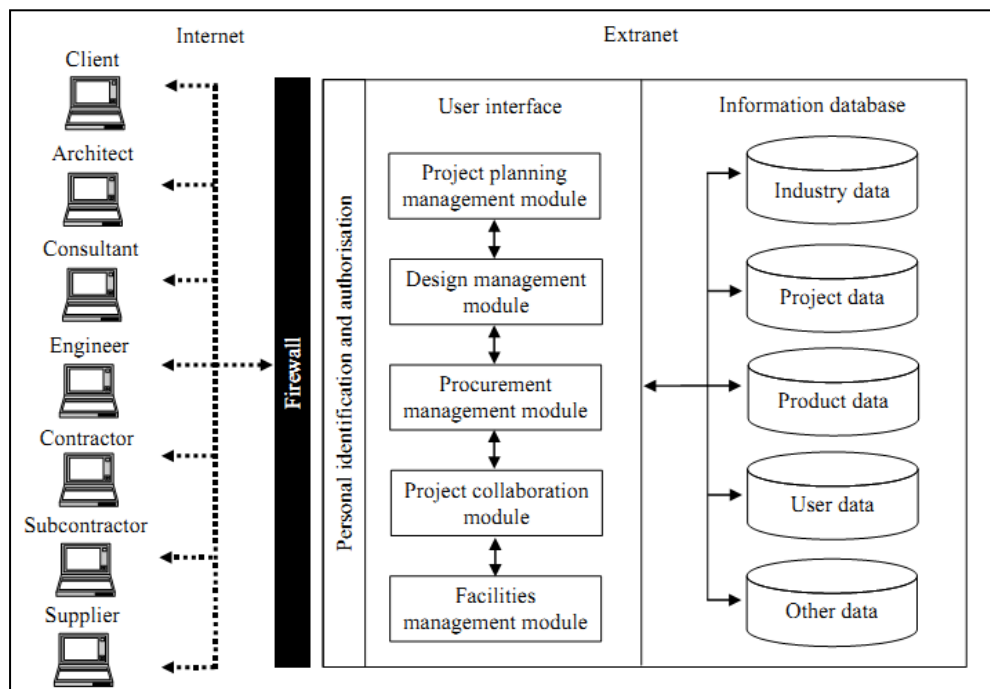


Figure 6: Generic System Architecture of WBMS (Source: adapted from Nitithamyong, et al., 2004)

With the rapid increasing in the information technology there are a hundreds of web based project management systems providers via the internet, some of these are open source and free to use and the others are commercial and need a license, so the user need to pay for use. Examples of WBMS developed by software service providers are shown in Table 1.

Table 1: Examples of Web based Project Management Systems (Source: Matheu, 2005)

Web based Project Management Systems	Access
<b>Aconex</b>	<a href="http://www.aconex.co.uk">http://www.aconex.co.uk</a>
<b>Autodesk</b>	<a href="http://www.buzzsaw.com">http://www.buzzsaw.com</a>
<b>ProjectNet</b>	<a href="http://www.citadon.com">http://www.citadon.com</a>
<b>BIW</b>	<a href="http://www.biw.co.uk/">http://www.biw.co.uk/</a>
<b>Buildonline</b>	<a href="http://www.buildonline.com/">http://www.buildonline.com/</a>
<b>Business Collaborator</b>	<a href="http://www.businesscollaborator.com">http://www.businesscollaborator.com</a>
<b>Cadweb</b>	<a href="http://www.cadweb.co.uk/">http://www.cadweb.co.uk/</a>
<b>Causeway</b>	<a href="http://www.causeway.com/">http://www.causeway.com/</a>
<b>Constructware</b>	<a href="http://www.constructware.com/">http://www.constructware.com/</a>
<b>e-Builder</b>	<a href="http://www.e-builder.net/">http://www.e-builder.net/</a>
<b>IronSpire</b>	<a href="http://www.IronSpire.com/">http://www.IronSpire.com/</a>
<b>Primecontract</b>	<a href="https://app.primecontract.com">https://app.primecontract.com</a>
<b>ProjectGrid</b>	<a href="http://www.ProjectGrid.com/">http://www.ProjectGrid.com/</a>
<b>Projectmates</b>	<a href="http://www.projectmates.com/">http://www.projectmates.com/</a>
<b>ProjectTalk</b>	<a href="http://www.projecttalk.com/">http://www.projecttalk.com/</a>
<b>ProjectVillage</b>	<a href="http://www.ProjectVillage.com">http://www.ProjectVillage.com</a>
<b>The-project</b>	<a href="http://www.the-project.co.uk/">http://www.the-project.co.uk/</a>
<b>Unifier</b>	<a href="http://www.Skire.com/">http://www.Skire.com/</a>
<b>Viecon</b>	<a href="http://www.bentley.com">http://www.bentley.com</a>
<b>VISTA 2020</b>	<a href="http://www.marketstreet.com/">http://www.marketstreet.com/</a>
<b>4 Projects</b>	<a href="http://www.4projects.com/">http://www.4projects.com/</a>

Industry practitioners must consider not only the technology, but also give equal prominence to processes and people who are involved in the system in order to successfully embrace PM -ASPs and achieve business benefits (Alshawi and Ingirige, 2002; Bjo'rk, 2002).

Nevertheless, technically related factors have often gained sole attention while nontechnical factors are considered separately, overlooked, or even ignored completely. Research studies conducted to date still either aim to solve the existing technical problems of PM-ASPs or to

introduce some new advanced techniques to improve the current systems, ignoring the fact that technology push is not the only critical success factor for effective implementation of a new technology such as PM-ASP (Nitithamyong and Skibniewski, 2004).

Unlike other technologies, PM -ASPs are very much concerned with the exchange of information across the project life cycle. Their successful implementation therefore will not only require a state of readiness within one organization, but also within all organizations involved in the construction processes. This makes the successful implementation of PM-ASPs difficult to be planned and managed (Nitithamyong and Skibniewski, 2004).

In order for a construction organization to successfully embrace PM-ASPs, factors such as technology, process, people, procurement, legal issues, and knowledge management must be considered equally. Although there have been some studies conducted to identify factors that can foster the successful development and usage of PM-ASP in a construction project, all of them are still based solely on either individual case studies using interview techniques or anecdotal evidence provided by success stories reported in the trade press . There has been no empirical research to date on a large scale conducted on this topic, and it is obvious that a gap still exists in our understanding of what factors, technical and nontechnical, significantly affect the PM-ASP (Nitithamyong and Skibniewski, 2004)

## **2.13 Potential benefits of PM-ASPs**

PM-ASPs offer A/E/C firms numerous advantages over the current inter-organizational information infrastructure by providing access to project data and communication that is platform and application-independent. All that is required is Internet access and a Web browser. PM-ASPs are also location-independent since the systems can be accessed wherever there is Internet access and a Web browser (Nitithamyong and Skibniewski, 2004. PM-ASPs also provide several potential advantages over in-house WBMS. Following are two of the advantages repeatedly cited in literature:

- 2.13.1 Cost advantage:** Experts predict that individuals and corporations will own very minimal software and will rent most of what they need from Internet Service Providers (ISPs) and other network operators (Eisenmann and Pothen, 2001). Therefore, PM-ASPs potentially provide savings in time and resources compared to



in-house solutions, which can be costly, time consuming, and maintenance-intensive, and many require a high degree of expertise by the system administrator and user to implement.

**2.13.2 Outsourcing advantage:** in industries like large-scale process manufacturing or, in this case, the construction industry, IT plays only a support role. It is much more of a commodity and hence, although necessary, it is not central to the firm's competitive position. By this reasoning, many computing functions in the construction industry are good candidates for outsourcing. ASP's competition A/E/C firms will also benefit from the intense competition in the PM-ASP market. As PM-ASP providers attempt to differentiate their products from those of their competitors, they continue to expand their internal feature packages. Björk (2002) postulated that competition among PM-ASP providers will continue to drive down costs and enhance product quality and performance, translating into value for the construction industry.

In addition, outsourcing has several potential benefits such as: Cost reduction- Reduce time to market- Improve quality- Focus on Core Business- Knowledge -Cost restructuring - Access to talent and skills-Capacity management -Catalyst for change and innovation - Risk management - Tax Benefit

## **2.14 Potential barriers to PM-ASP implementation**

Besides the benefits that PM-ASPs may provide, some important barriers to implementation still exist and should not be overlooked. These barriers need to be addressed in order to increase public confidence in adopting PM-ASPs in construction projects. The literature shows that these barriers include a wide range of issues (Nitithamyong and Skibniewski, 2004). The researcher summarises the most important barriers, in his opinion, as follows:

### **2.14.1 Difficulties in quantifying costs and benefits:**

It is difficult to persuade every organization participating in a construction project to make the necessary level of investment to fully implement a PMASP, which is due in part to the fact that there is still no reliable data on the economic impact of PM-ASPs for projects or firms (Back and Moreau, 2001). Many of them are still taking a “wait and see” approach to the use of PMASPs

until more definitive cost and benefit data are available (Bishop, 2001; Chinowsky and Goodman, 1996)

#### **2.14.2 System reliability**

Ideally, a PM-ASP should be available to users at all time to ensure its high reliability. However, this is rarely the case Berning and Coyne, 2000. When servers are down, users become disconnected and unable to work online. Data can also be lost if the system is not backed up or is improperly housed.

#### **2.14.3 System security**

Although most PM-ASPs currently employ a “user name and password” scheme to protect an unauthorized access to their sites, this scheme is too simple and still inadequate in satisfying the security requirements. Competitors' access and mutual trust between parties are still an important issue.

#### **2.14.4 Resistance to change**

An information system implementation can cause considerable organizational change that people tend to resist (Markus, 1983). Practitioners in the construction industry generally resist change and need to know how to use a PM-ASP effectively or how the system can facilitate their work tasks.

#### **2.14.5 Density of communication channels**

The density of communication channels in a construction project poses challenges for the use of a PMASP. Since other channels exist, it is easy for a project team member to bypass a PM-ASP with more familiar technologies such as a telephone, a mobile phone, a fax machine, and a beeper.

#### **2.14.6 Technical Difficulties and challenges**

Such as Lack of software interoperability, Internet access and bandwidth problems, and Password barrier. Actually, successful implementation is still hindered by barriers, for the most part nontechnical. Yet, research conducted to date still either aims to solve the existing technical problems.

## 2.15 New trends in using web based system in construction

The growing interest in knowledge management is being fueled by a number of development trends such as globalization and virtualization. Such trends make it difficult for one method to represent a knowledge management system that can meet not only the needs of the construction industry, but also the requirements of the end-user (Khalifa, et al., 2013)

Some researchers argued that the usage of IT in A/E/C industry has become an international trend in building construction research. Meanwhile, according to the data surveyed by the Engineering News Record (ENR), IT spending in A/E/C firms has increased 16% within the past two years, and will still increase twice in the following 6 months, which indicated that A/E/C firms are increasing their interests in IT application to facilitate the construction project. Among all IT applied in A/E/C industry, the Internet is the technology that best facilitates a collaborative working environment in an A/E/C project. Its use as a communication medium which can help information transfer occur faster and more effectively and enable new opportunities for the development of distributed systems that can cross organization boundaries and provide a unique opportunity for teamwork and workflow automation (Liu, et al., 2012).

Khalifa et al., 2013 propose a conceptual framework that elaborates the combination of quantitative, qualitative and system design approaches to create a web-based knowledge management system for construction industry activities that can be evaluated by system end users.

Liu et al., 2012 were developed and implemented, a new Web-based Project Integrated Management Information System (PIMIS) in Architecture/engineering/construction (A/E/C) industry. The main purpose of the PIMIS is to help project managers in controlling the project cost which is usually seen as a key factor of the project success criteria, they used an Earned Value Management (EVM) module to integrate cost, schedule and technical performance, and to measure and communicate the real physical status of a project. It allows the calculation of cost and schedule variances and performance indices and forecasts of project cost and schedule duration to provide early indications of project performance for the purpose of highlighting the need for eventual corrective action, and is proved effective and reliable. Liu, et. al impended

their system on 3 A/E/C project and the results showed that the acceptance and implement of the PIMIS can significantly improve the performance of the project cost control, and successful implementation of the PIMIS, in terms of leading to better outcomes for the A/E/C project, coordination improvement among participators and reduction of contract disputes, (Liu, et. al 2012).

Nontarak and Leelawat, 2012 were developed and evaluated a securely web-based application for construction material testing using object-oriented technology and parameterized queries for SQL command queries. Databases of the web-based application were designed to support appropriate information for all of the parties involved and to encrypt password for registered authentication users of every transaction prior to being verified and accessed to the system management. Whereas parameterized queries were modified by removing malicious characters that could possibly modify the actual SQL query structures and changing contexts relating to the execute commands in order to prevent the queries from manipulating the server to return records other than those intended. Evaluation of the SQL injection vulnerability conducted by the expert indicated that modifying object-oriented technology and parameterized queries could prevent SQL injection penetrating through both authorization bypass and execute commands of the web application being tested. Whereas two web scanning tools detected that the SQL injection vulnerability was significantly reduced to 62 and 84%, compared to the web-based application using non-parameterized queries.

Shiono, et al. 2010 tried to solve the problem which eliminates the troublesome task of writing and retyping input data from mobile phones for the Forman's in the construction sites, therefore, they developed a construction site work management system that reduces the burden of input from mobile phones in cooperation with construction companies from the viewpoint of user-centered design. The system's main features are easy data input from mobile phones and functions for authentication, data input, data retrieval, data update/deletion, and graphic representation of work progress reports. Input data is stored in a database over the Internet, enabling the shared data to be used to carry out work smoothly.

Leung et al., 2008 presented a cost-effective construction site monitoring system integrating a long-range wireless network, network cameras, and a web-based collaborative platform. The

system supports simultaneous user access, therefore project team members could view real-time captured images or video of a construction site, discuss and exchange ideas with gadgets such as video conference, text and shared whiteboard at a distance via the Internet., The system was tested in actual construction sites and the results of image quality and reliability were more than satisfactory.

## 2.16 Conclusion

Studies of information technology in the construction industry have until now mainly focused on topics such as diffusion of IT (Samuelson, 2002, 2008); the development of general frameworks for understanding the diffusion and adoption of IT (Peansupap and Walker, 2006); contextual influences on its adoption and use (Croker and Rowlinson, 2007; Jacobsson and Linderoth, 2010); or prescriptive advice on how different ICT applications should be implemented (see e.g. Succar, 2009; Adriaanse et al., 2010).

There are three options for a construction company when deciding how to implement a web-based project management system, i.e. in-house development or using IT services available from the market (project hosting services) from an Application Service Provider. An ASP is an organisation that hosts software applications on its own servers within its own facilities. Customers rent the use of the application and access it over the Internet or via a private line connection.

By reviewing the literature there is no trend around improving and implementing a web based system dealing with grants management where there is a donor and implementer and other parties. All the studies dealing with the A/E/C (architect, engineer and contractor combination, also sometimes dealing with improvement some systems for the contracting companies' staff. Web-based construction project management system has grown rapidly in some developed countries, including America, the EU, etc. There are Project Collaboration Network (PCN), such as Buzzsaw<sup>TM</sup> and e-Builder<sup>TM</sup>, to facilitate the current construction project management; Project Information Portal (PIP), such as Building.com and HomePro.com, to deal with the information processing and communication among project stakeholders; and Project Procurement Exchange (PPE), such as BidHost<sup>TM</sup>, to streamline the procurement cycle of construction materials and services. And there are also some project management application service provider (PM-ASP)

can provide software products to solve all of 3 problems talked above in A/E/C project, for example, the Bricnets<sup>®</sup> (Liu, et al., 2012).

# Chapter 3: Methodology

This chapter discusses the methodology which was used in the research. It includes information about the research strategy, research design, population and sample size, research location, data collection, validation, and the method of system analysis and design.

## 3.1 Research Strategy

Research strategy is a general plan which shows that how this research will go and how researcher will answer the questions that has been set by the researcher. It will contain clear objectives, derived from research question specify the source from which researcher intend to collect data and consider the constraints that researchers will inevitably have such as access to data, time, location and money (saunders et al. 2000). There are two types of research strategies: quantitative research and qualitative research.

(Naoum, 2007)

In this research, a combination of quantitative and qualitative approaches will be used to build a web based grants management system by exploring the system users and their requirements, by conducting a semi structured interview with grants management stakeholders and by reviewing many of grant management documents and files. Then start building and designing a web interfaces and data base for this system. After that a final web model will be validated by conducting another semi-structured interview with grants management experts to explore their satisfaction about this product.

## 3.2 Research design

The purpose of this research is to explore the current practices of grants management and developing a model for managing all the activities by electronic web based system. This research consists of seven phases:

**First phase:** Finalize the proposal that identifying the problem and establishment of the objectives of the study and development of research plan.

**Second phase:** Includes comprehensive literature review about web based management system and their use in the construction industry worldwide

**Third phase:** Collect Data about grants management in Gaza Strip (IDB case study) using semi structured interview with stakeholders to be used in system analysis and modeling.

**Fourth phase:** System analysis to define the system stakeholders, working process and operations needed to build the model.

**Fifth phase:** System development by developing the model to utilize all the data collected to be used by stakeholders for grant management.

**Sixth phase:** Evaluation of the system model by making a new semi-structured interview with grant management experts and system analysis and design experts.

### 3.3 Target Population

The target population of this research is the people who works in projects and grants management in The Gaza Strip. A case study of Islamic Development Bank (IDB) reconstruction project has been taken in this research as a sample. Projects managers, area engineers, projects coordinators and site engineers will be interviewed for gathering information about research topic. Also, other institutions like municipalities and NGOs staff will be interviewed to build a strong background about the usage of web based systems in projects management in Gaza.

The study population consist of 70 employees working in different institutions as mentioned above, Table 2 shows the classifications of the population among different institutions.

The potential population for this study will be as follow:

- IDB representative staff (projects managers, area engineers, procurement manager, ...)
- International organization working with IDB as implementing agencies
- Municipal development fund staff (as donor representative working infrastructure and construction projects) to generalize the finding.
- Government like (ministry of local government, Municipalities projects managers and engineers, and ministry of planning).

These methods will describe the current information management practices in the grant management life cycle, observe particular deficiencies, and identify the user needs and



requirements of an efficient web-based information management system, taking the IDB grant program in Gaza strip as a case study.

Table 2 Research population

<b>Institution</b>	<b>Frequency</b>
IDB representative office	10
UNDP	4
Municipal Development Fund	9
Qatar Charity	2
NDC	2
ILO	1
25 Municipalities in Gaza strip	30
World vision	1
Oxfam	1
Contracting Companies	10
<b>Total</b>	<b>70</b>

### 3.4 Case Study Islamic Development Bank Grants

This research adapts the Islamic Development Bank reconstruction project of Gaza as a case study. This grant is a multi-projects program with a huge number of stakeholders and information. This research will analyse the current situation, define the users, draw the flow of work model, and gather the user requirements for the proposed system. The information and data to be analyse will gathered by studying all the work documents and reports also by conducting semi-structured interview with some of grant management stakeholders.

### 3.5 Methods of Data Collection

#### 3.5.1 Semi-structured interview

In this research, the semi-structured interview has been used. This form of interview uses ‘open’ and ‘closed-ended’ questioning but the questions are not asked in a specific order and no schedule is used (Naoum, 2013).

These interviews will be conducted to determine the grants management stakeholders, flow of information between stakeholders, grants management operations, and arrangements of reporting and documents needed to facilitate the work. The questions asked in the interviews were listed in appendix 1.

### **3.5.2 Reviewing the grant management documents:**

This process is main part of data collection, it is a paper work process which done to categorize all the needed information and reports to facilitate the build of the model. This process contains reviewing all the daily reports, daily memorandums, projects lists, status reports, procurement planes, bidding documents, litters of approvals and no-objections between stakeholders, and final reports for projects and grants.

The review of all these documents were needed to draw the flow of information and modelling of the cycle of grant and projects management as an easy process.

### **3.6 System Design:**

After collecting all the required data, all the operations and processes of the grants management life cycle will be drew and a web interfaces will be designed using Adobe illustrator CS6; Illustrator is a vector graphics editor developed and marketed by Adobe Systems. It is considered as a best vector graphics editor and it is fully compatible with all web and data base systems like adobe dream weaver. The web interfaces which will generated by illustrator will exported as PDF format files and inserted inside the research text for comments and explanations of each one. The PDF interfaces will be an open source file for Illustrator and can be edited easily at any time and ready to be programed as a real web site to be published on the internet.

### **3.7 System evaluation**

The development of any web based system requires the System's requirements which need to be expressed as correctly as possible to avoid any failings in the system that is to be produced. We refer requirement as a condition or capability needed by a user to solve a problem or achieve an objective. So the model has to be valid and reliable to be programed and used by stakeholders without any problems.

### 3.7.1 System validation

Validation criteria can be either qualitative or quantitative. Qualitative criteria employ subjective comparisons of performance, while quantitative criteria employ statistical methods to compare system performance to real world or human expertise. Qualitative validation criteria do not mean informal validation. It is possible to develop a highly formal qualitative validation. Some common qualitative validation criteria are: Generality, adaptability, compatibility, visual interaction and usefulness. All these validation criteria's will be defined in the context. Also face validity is used as a test for model evaluation. Face validity is asking well experienced people about the system whether the model and or its behavior are reasonable (Sargent, 2010).

Other semi-structured interviews will be conducted to validate the grant management website interfaces, 9 experts in grant management from inside and outside the case study will be interviewed to validate the web interfaces generate as a result of this study, also 3 experts in IT and system analysis experts will be interviewed to evaluate the system from the side of completeness of pages and analyses to be programed in the future.

Questions for Grants management experts

- Is the system's scope well-defined?
- Is the system useful and easy to use?
- Is the user interface will design and friendly for users?
- Have all the stakeholders of the system been identified?
- Are there any general areas omitted?
- Are Phases/Stages well defined?
- Are Activities/Sub activities well defined?
- Are types of contract well defined?
- Are types of process of work well defined?
- Are the relations between stakeholders well defined?
- Is the web system reducing the time of work flow?
- Is the system adding a value to the project documentation?
- What is your general perception about the system?

Questions for IT experts:

- Are the system friendly user interface?
- Are the relations between pages will defined?
- Are there any problems will face the programmers?
- Are there missing or additional information needed to start programing?
- Are the System Requirements understandable?

# Chapter 4: System Analysis

Several research efforts have dealt with the use of web based systems for improving the efficiency of the construction process. Among various recent enhancements, it is believed that more emphasis should be given to information modeling in order for an information management system to be reliable. Information modeling is the procedure of developing an information model, which is an abstract yet formal representation of entities in data, including their properties, relationships and the operations that can be performed. The main driving force behind the development of an information model is to provide formalism to the description of a problem domain without constraining how the description is mapped to an actual implementation in particular software. An information management system is reliable when it can guarantee, among others, consistency and absence of data redundancy. This can only be done when the information is strongly structured. To provide an example, an information management system based on the exchange of information through emails can guarantee that information is transferred rapidly and economically but there is little or no information about the information contained in the emails. As a result, it is possible that information inconsistency (contradictory information in different emails referring to the same subject) or data redundancy (same information repeated in different emails) may appear (Chassiakos and Sakellaropoulos, 2008).

In every country and for all researchers and developers, the life cycle of a project is similar; there are some distinctions that make it harder to reach a global agreement. In order to define the life cycle of the 'Model for Information Flow', (Mathue, 2005) analyzed and classified a different theories defining the life cycle of a construction project, the stakeholders roles of the partners involved in a project, the documents generated in each stage of the life cycle (Process Model), and other additional information of each document (Descriptive Information Model) that can be useful for a better management of the project and a better organization of all the companies that take part in a construction project.

## 4.1 System Specifications

The primary goal for the thesis is to make a complete web based system for daily use by the grant management stakeholders, which should confirm to all requirements. The demands and requirements for the system come from the system structure used in our institutions. The project specifications of the system are described in Figure 7.

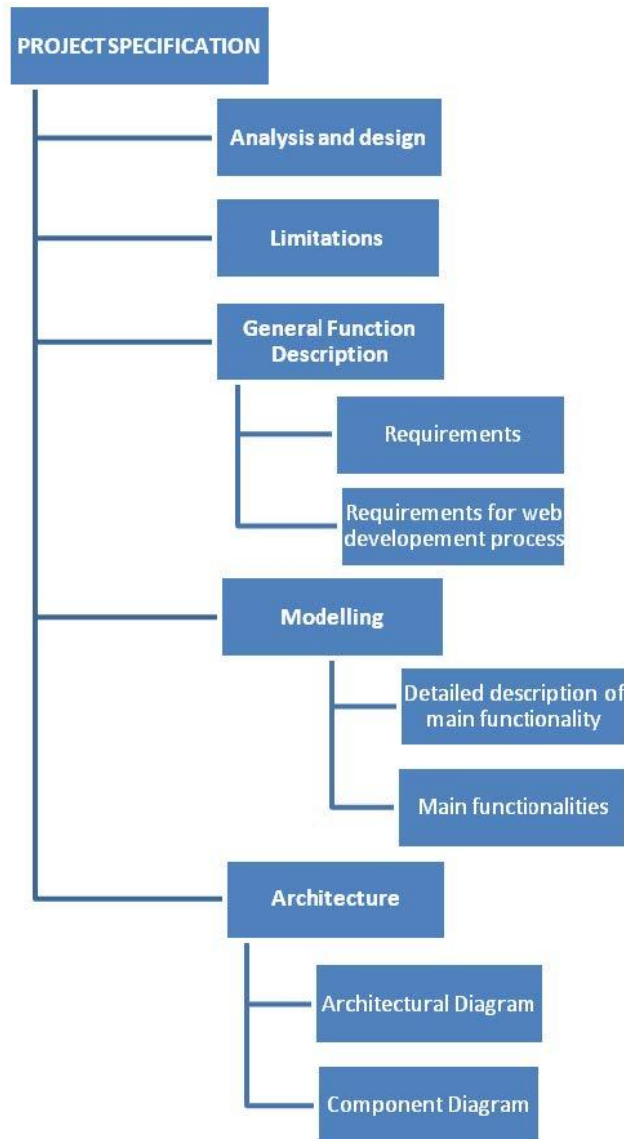


Figure 7 Structure of the project specification

Analysis is the process whereby we break down a complex entity into its simpler components parts. The section describing the aim and the method of the system illustrates the process which led to the final method and aim of the study. Analysis of the design and the general functions description are also described.

## 4.2 System analysis steps

According to our methodology we adapted a process for analyzing the system shows in Figure 8:

Figure 8: analysis process of system

Studying the project life cycle	<ul style="list-style-type: none"> <li>• To understand the project life cycle in different projects</li> <li>• To identify the stakeholders and responsibilities of each system user</li> <li>• To identify the matrix of responsibilities between users</li> </ul>
Reviewing projects management forms and documents	<ul style="list-style-type: none"> <li>• For drawing the life cycle of the grant management</li> <li>• Modeling the process of data transition between stakeholders</li> <li>• Determining the flow of information</li> <li>• Determining the process of approvals</li> <li>• Determine the required forms and reports for developing the user interface</li> </ul>
Interviewing project management stakeholders within our case study	<ul style="list-style-type: none"> <li>• To determine the system users</li> <li>• To determine the users requirements</li> <li>• To determine the system features</li> </ul>

The following paragraphs will show each step in the system analysis adapted to reach the final model for web based application.

### 4.2.1 Studying the project life cycle

In order to implement the powerful and widely used business software systems for managing projects, programs, and their portfolios, we must have integrated information models of those projects and programs. The full benefits from application of these powerful information systems can only be achieved through development of fully integrated project life cycle model, (Archibald, et al., 2012).

Each phase of project life cycle contains critical decision points; by reviewing literature about the project life cycle there are many ways to describe it so the phases of the project life cycle differ from project to another also from institution to another. Different models and methods were analyzed by (Mathue, 2007). A summary of the classification of phases and stages in a construction project from the different classification methods used by different researchers are shown in Figure 10. Our grants life cycle can be illustrated as shown in Figure 9.



Figure 9: Grant life cycle

RIBA	GDCPP	PM theories	ISO-2 12006	CIB W78				
	Demonstration of the need Conception of the need	Perceived needs Conceptual planning	Inception / Procurement	Conception of needs	Conceptual definition	CONCEPTION	<i>Includes: demonstration the need and conception of the needs</i>	
Appraisal of Client's requirements  Strategic Briefing Preparation	Outline feasibility  Substantive feasibility Study Outline Financial Authority	Feasibility study	Feasibility		Feasibility study			
			Team selection		<i>not necessary</i>			
Outline proposal	Outline Conceptual Design		Outline proposal / programme preparation	Briefing and design	Outline proposal	TECHNICAL DESIGN		
Detailed proposal			Schema design / costing		Detailed proposal			
Final proposal	Full conceptual Design	Design and Engineering	Detail design / costing		Final proposal			
	Coordinated Design, Procurement & Full financial Authority						<i>included in the other stages</i>	
Production of information	Production information		Production information preparation		Production of information for tender	PURCHASE AND CONTRACTINGS	<i>The Production of information Stage is divided into two: For tender and For construction, because of the different needed and produced information of each stage of the project</i>	
					Production of information for construction			
			Bills of quantities preparation					<i>included in the other stages</i>
Tender documentation					Tender documentation			
Tender action			Tender action		Tender action			
Mobilization		Procurement			Contractings			
Construction to practical completion	Construction	Construction	Construction operations on site	Construction	Construction	EXECUTION	<i>It could be part of the construction stage but, due to the great quantity of information generated, we have separated it into a different stage</i>	
					Construction delivery			
After practical completion	Operation and Maintenance	Operating and Maintenance  Disposal of facility	Start-up for Occupancy  Completion  Feedback	Facilities management	Main tenance	DESACTIVATION	<i>Includes: Desactivation, Maintenance and Facilities Management</i>	

Figure 10: Analysis and classification of a different theories defining the life cycle of a construction project



#### 4.2.2 Interviews with construction managers

Semi-structured interviews were held with 15 people who work in the field of projects and grant management in different institutions, among them were top management staff like project managers, procurement specialists, area engineers, supervisor engineers, municipality engineers, and projects coordinators. The reason of making such interview is to investigate the process of managing grants and the availability of electronic systems in their respective institutions, also to gather information about the formation of each institution staff and the relation between each employee in the institution to generalize the system beyond the selected case study.

The main questions asked in the interviews were as follow:

- Is there a web-based management system used for projects management?
- What is the degree of interactivity with the system?
- Who are the system users?
- What is the work flow process in the institution?
- In case of lack of web based system? Do you prefer to deal with such systems?
- What are your requirements and potentials for such system?

The results of the interviews can be summarized in the following:

- Some of the institutions that were interviewed and that work as a representative of some donors began to seriously consider the introduction of electronic systems for the management of the web grants and projects, but these programs are still under development.
- Some other institutions which are working in projects management have actually dealing with their own electronic systems for project management, but these systems are limited. Some of them are using these systems as a tool of electronic archiving for some files and reports, also these systems are dealing with limited users and are only for the internal staff without any external interference or other partners and stakeholders interfaces.
- There are 25 municipalities in Gaza strip none of them using web-based systems for projects management, although most of them totally agreed to use such systems in case of that they have a friendly user interface.
- International organizations have their own web-based systems which make reports on the projects status to their higher management; the researcher could not access their systems

to take a look of the functions and modules because of security reasons and inability to obtain permits to do that. But from the interviews it seems that the systems only for reporting and entering projects status and photos, in addition to computability with procurement and financial system for purchase orders and payment request tracking.

These interviews conducted to show the general situation related to using web-based systems in projects and grants management in working institutions in the Gaza strip, the interviews showed that such systems are not used or still under development, and showed that the majority of related people have a good perception to deal with these systems in future to facilitate the flow of work.

### **4.3 Developing an electronic grant management system needs**

To start thinking in developing an electronic grant management system there are a number of options in software packages. That's good, but it can make the decision difficult. What questions should you ask to narrow down the choices to focus on the packages likely to work best is:

If the stakeholders want an online system that staff can access from anywhere, in this case the process of web hosting has to be determined and prioritized. Organizations that value control of infrastructure should consider systems that can be installed on in-house hardware. In our case and due to scattered worksites and locations of implementing agencies organizations, a web based system will be adapted to work from any location, only we need a computer and internet connection. All what we need a web browser without installation of any additional software packages.

We will see through the description of system functions in this research of what grants management systems can do, and think through how much of the more-advanced functionality described is necessary for us. The tasks analysis will show us the complexity of functions to be modeled for developing a system.

It's important to try to align our processes with grant making best practices before start developing a new grants management system—tailoring a system to idiosyncratic processes is, at best, expensive, and may be impossible. We have to take care before deciding because we have unique needs. It's quite common to think our processes are unusual in an important way, but in

many cases these processes can be tweaked to match best practices without sacrifice. However, if we have truly unique needs, we'll need to look for a system that can be substantially customized.

#### **4.4 IDB Grants Case Study**

This research adapts the Islamic Development Bank reconstruction project of Gaza as a case study. This grant is a multi-projects program with a huge number of stakeholders and information. The following sections will summarize the analysis of the current situation, defining the users, drawing the flow of work model, and gathering the user requirements for the proposed system.

The analysed information is gathered by studying all the work documents and reports also by conducting another interview with some of grant management stakeholders.

##### **4.4.1 Islamic Development Bank (IDB)**

Islamic Development Bank (IDB) is an international financial institution established in 1975 in pursuance of the declaration of intent issued by the conference of finance ministers of muslim countries held in Jeddah in 1973. The main objective of IDB is to foster economic development and social progress of member countries and Muslim communities in non-member countries in accordance with the principles of the Shari'ah Islamic law, (IDB report 2013).

##### **4.4.2 Trust Funds Program**

There were two (2) trust funds, namely Al-Aqsa Fund and Al Quds Fund established in 2000, as per an Arab Summit decision, with the aim of providing immediate response to the needs of occupied Palestinian people. With the IDB's increased intervention in emergency situations in the member countries, the Palestine-related trust funds together with the other fragility trust funds have subsequently been managed and supervised by a dedicated department known as Trust Funds Department (TFD) since 2009. As of first quarter of 2013, the value of almost 300 approved programs and projects from the trust funds with more than USD1.8 billion, of which, over 95% was mainly allocated for various sectors of developmental projects in Palestine.

## 4.5 Current practice of grants administration

The management of each grant passes through many levels starting of signing a grant agreement to finalizing each project and making down the final payment. Each step of these levels has different actions and different stakeholders. At the beginning, the interactions between stakeholders is limited to the upper level management staff, and in the implementation stage all the stakeholders have an interaction and input in the process.

The following points show the stages of grant management:

- Country strategy and grant identification,
- Grant preparation,
- Grant appraisal,
- Grant approval,
- Grant implementation,
  - Call for proposal
  - Project proposal submission
  - Project proposal evaluation
  - Project proposal approval or rejection
  - Sign of grant implementation agreements
  - Bidding document preparation
  - Tendering process
  - Getting no-objection to tender
  - Awarding
  - Start implementation
  - Supervision
  - Payments
  - Handing over
  - Evaluation

Our system will deal with the grant implementation stage starting from project proposal submission to finalizing the project and handing over.

## 4.6 Projects stakeholders

The first step towards understanding organization management is to agree on a common vocabulary. Our system defines Organization (*Stakeholder*) as Stakeholders which are anyone who has an interest in the project. Project stakeholders are individuals and organizations that are actively involved in the project, or whose interests may be affected as a result of project execution or project completion. They may also exert influence over the project's objectives and outcomes. The studying of documents and interviews with stakeholders of grant management showed that the main stakeholders and actors of the grant have many aspects since the organizations in our system are four types:

1. Donor which is the financial organization (IDB).
2. Donor representative (IDB-RP)
3. Implementing agencies
4. Contractors (Individuals or Companies)

So each organization type or organization has different information to be maintained in the system and differs from another organization type.

### 4.6.1 Stakeholders' relations

The relationships between users mainly centered on the system operator who is the donor representative. Donor representative works as a focal point between the donor and all other users (project management and implantation stakeholders). Donor representative receive all information, documents, correspondents, make decisions and approvals or rejections then send a final and conclusion reports to the donor.

**The donor:** In our case study the donor is the Islamic Development Bank (IDB), the IDB is the grant financer, its role in the web based system proposed to be limited to getting information and reports about all over grand status, also making information inquiries to the donor representative about any required information and inquiries.

**Donor representative:** The donor representative is playing an important role in grant management lifecycle, he acts as a grant manager who receives the projects proposals for revision and approval, reviews the tender documents before tendering and gives no-objection to tendering, reviews the tender evaluation reports before giving no-objection to award also checks out the payments requests and participates in handing over process. So the Donor representative plays an auditor role for all projects life cycles.

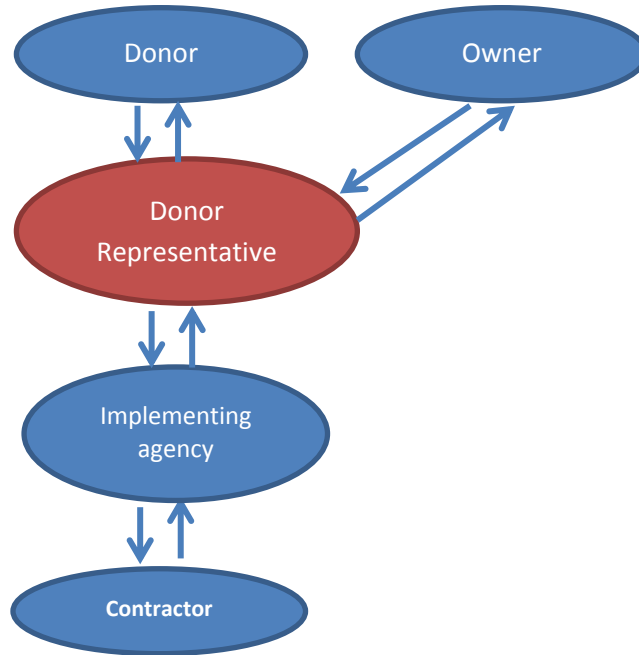


Figure 11: Stakeholder relations (result form interviews)

IDB representative for the Gaza reconstruction project is granted to Engineering and Management Consulting Centre (EMCC). EMCC is one of the Palestinian's well known Consulting companies. EMCC was established in Gaza and West Bank in 1993 as a consulting firm to meet the need for professional engineering, management and institutional capacity building services. Donor representative role including but not limited to:

- (i) Assisting in the reviewing and commenting on the designs and estimated costs (priced BOQ).
- (ii) *Subproject implementation and supervision*: build the capacity of implementation agencies to implement the subprojects and assist them in the supervision including reporting on progress of implementation, monitoring of indicators, and compliance with the standards.
- (iii) *Ensuring compliance with technical aspects*: build the capacity and provide guidance to implementation agencies on technical and fiduciary aspects of sub-project preparation and implementation to ensure compliance with donor procurement,

financial, social and environment safeguards (including provision of mitigation measures) procedures.

**Implementation agencies:** dealing directly with the contractors/suppliers and acting as a focal point between them and the donor representative.

After grant approval and budgets allocation for the projects from the IDB representative and getting the approval from the IDB itself to the whole grant to be implemented, the representative distribute the projects according to sectors and objectives to the suitable and more efficient international implementing agency considering their experience in implementing similar projects. The first step between the IDB representative and the implementing agency is signing a memorandum of understanding containing terms to control the relation and to make things clear between the two parties and it also shows an important element which is the admin fees for the implementing agency and usually it is a percentage from the project budget. After signing the memorandum of understanding and before starting the implementation of the project, an advanced payment request is sent from the implementing agency to the IDB representative. Meanwhile, the implementing agency appoint a staff for the project which is usually consists of project manager, project coordinator, and project accountant, this staff may work in more than one project in the agency if they can handle the work. The implementation of the project starts directly after signing another memorandum of understanding between the beneficiary and the implementing agency showing the budget of the project and all the items that will be implemented and also to control the relation between them. After that the agency prepares the bidding documents and makes it ready for tendering but before that, they have to send it to IDB through the IDB representative for reviewing, if there are any notes they should correct them and resend the documents for getting no-objection to tendering. After getting the approval “no-objection to tender” the implementing agency do all the tendering process activities and before signing the contracts and issuing a purchase order for the contractors or suppliers, they have to get a no-objection to award, the agency should send all the related documents to the IDB through the IDB representative to review, making any changes needed then get a no-objection to award. After that the contractors or suppliers can sign a contract to start implementation. During the project life cycle the agency follows up the daily work with the contractors to ensure that the work is done according to the terms of contract and as specified in BOQ and specification.

**Contractor:** the contractor is the last cycle of the process who is responsible for the actual implementation. The direct contact will be with the implementing agencies. The contractor submits working reports and payments requests to the implementing agencies that revise and approve the request as per the actual works done on the ground according to the BoQ and drawings, then the request is sent to the donor representative for final approval and making the payment down.

#### 4.6.2 Matrix of responsibilities

Table 3 summaries the responsibilities of each stakeholder over the project life cycle

Table 3 Matrix of responsibilities

	Owner	Donor	Donor representative	Implementing agency	Contractor
<b>Planning</b>			No action	No action	No action
<b>Proposal</b>	Preparation of proposal	Approval	Revision and approval	Preparation of proposal	No action
<b>Procurement</b>	No action	No action	Revision and approval	Preparation of bidding Doc.	Submitting bid
<b>Procurement Evaluation</b>	No action	approval	Revision and approval	Tendering process	No action
<b>Construction</b>	No action	Receiving progress reports	Higher supervision & contract administration	Supervision	Implementation
<b>Delivery</b>	Final delivery	Receiving progress reports	Participate in handing over	Participate in handing over	Delivery

#### 4.7 System users

The analysis phase involves gathering requirements for the system. At this stage, system needs are studied with the intention of making management processes more efficient. The system analysis phase focuses on what the system will do in an effort that views all stakeholders, as viable sources of information. In the analysis phase, a significant amount of time is spent talking with stakeholders and reviewing the stakeholder's input. According to the local survey on Gaza strip projects and implementation agencies the potential users for the web based systems were



divided into groups according to their relation to the project management , starting from the donor, Donor representative staff, Implementing agency staff , ending with the Contractor/supplier staff.

Once stakeholders have been recognized, the gathering and analysis of the requirements can begin. The following matrix shows the users who will have an input and output from the web-based management system. The system users have been listed in Table 4 .

Table 4: System users from each organization

Donor	Donor representative	Implementing agency	Contractor
Team leader	General manager	Project coordinator	Contractor
Projects manager	Financial manager	Site engineer	Site engineer
Financial Manager	Procurement manager	Project manager	Project manager
	Area engineers	Accountant	
	Procurement officer		
	M&E officer		
	Media officer		

## 4.8 User requirements

Understanding user requirements is an integral part of information systems design and is critical to the success of interactive systems. It is now widely understood that successful systems and products begin with an understanding of the needs and requirements of the users. As specified in the ISO 13407 standard (ISO, 1999), user-centred design begins with a thorough understanding of the needs and requirements of the users. The benefits can include increased productivity, enhanced quality of work, reductions in support and training costs, and improved user satisfaction. Requirements analysis is not a simple process. Particular problems faced by the analyst are:

- Addressing complex organizational situations with many stakeholders.
- Users and designers thinking along traditional lines, reflecting the current system and processes, rather than being innovative.
- Users not know in advance what they want from the future system (Olphert & Damodaran, 2002).
- Rapid development cycles, reducing the time available for user needs analysis.
- Representing user requirements in an appropriate form.

## 4.9 Survey of users requirements

The purpose of this research is to develop a model for a comprehensive web based grant management system which provides complete management, tracking and collaboration platforms. The system will provide better coordination with project initiation, project assignment, scope, requirements, time reporting, and internal & external collaboration. Areas that will be covered include but are not limited to project management, customer work flows for electronic submittal of project requests, timesheet submittal, and collaboration of documents and calendars.

The user's requirements identification is a complicated process, due to large number of grant management stakeholders, it appears that the stakeholders do not have a clear perspective for the needs of each user, and also this perspective differs from one user to another according to his role in the management process. According to the survey conducted with stakeholders a large number of requirements were made clear; also other requirements were developed from the revision of documents and information flow involved, this methodology of finding requirements led to the general requirements for the system users which are defined below.

- **Linking grant information:** All information for each grant project is linked together through its entire lifecycle
- **Tracking by grant status:** easily retrieve grant information and status.
- **Tracking by cycles:** Can track by program cycle or board meeting date.
- **Updating grant information:** Lets you easily update basic grant information like project names or codes throughout the process.
- **Attaching files to grants:** Lets you easily attach files to grant records, including Word documents, Excel spreadsheets or PDFs.
- **Searching grants:** Grants and applications are searchable by a number of criteria, including implementing agency name, proposal name, sector, program and grant cycle.
- **Handling paper documents:** documents received in paper form can be entered into the system, by scanning and attaching to the grant record.
- **File attachment method:** The system stores attached documents in the database as objects rather than links.

- **Batch Updates:** Lets the system batch updates of defined coding and other fields like sub-projects codes.
- **Multiple logins for grantees:** Supports multiple logins for grantees on a single application—for example, allows separate people to complete financial sections and proposal sections.
- **Viewing status online:** users can view the status of each project in each page of the online system.
- **Custom confirmation messages:** Lets the users to customize a confirmation message to be sent upon submission of information or notes on the system.
- **Saving incomplete page:** incomplete page can be saved partially completed and return to them later.
- **Printing grant summaries:** Reviewers can easily print grant summaries or full grant information.
- **Emailing individuals and groups:** Lets you send email through the system to a single individual or group that meets particular criteria.
- **Tracking grant history:** Tracks organizations separately from individual grants to allow you to see a history of all grants to an organization.
- **Grant deadlines:** stakeholders can view grant requirement deadlines online for each sub-project and overall grants and packages.
- **Progress report tracking:** Can track both that progress reports have been received and that they have been approved by staff.
- **Online progress report submission:** Lets stakeholders submit progress report and daily reports information through online data fields, which can then summarize across grantees in reports.
- **Viewing payment schedules:** Lets the users see what scheduled payments are upcoming and whether the grantee has met the requirements linked with that conditional payment.
- **Automated payment approval process:** Supports an automated payment approval process with configurable workflow steps, the approval from the implementing agencies to the contractor and the approval from the donor representative to the implementing agencies.
- **Multi-currency support:** supporting grants in multi-currency like US dollar, Euro and Shiqel.

- **Budget reporting:** Lets you enter a budget amount for each grant program and report on that information with actuals (approved and pending).
- **Searching and filtering:** Lets you search or filter to find a particular set of grants based on status, program and cycle.
- **Report modification:** Can make small updates to standard reports—for example, to change the columns displayed, or the grouping—to meet slightly different needs, like adding or removing project code or project status, Etc. to be suitable for printing in different paper size.
- **Users task lists:** Provides users a “task list” when they sign onto the system.
- **Data export:** Lets you export all data visible to users into another file format, such as .xls
- **Dropdown fields:** Lets you customize dropdown values for fields such as program or grant code.
- **Status notification:** allows for automatic notification when reviews are completed and pending requests for no objections are required.

## 4.10 Stakeholders users analysis

After all the users and stakeholders who may influence or be impacted by the system have been identified, the first step in user requirements analysis is to gather background information about the users, stakeholders and the processes that currently take place.

### 4.10.1 Donor Staff

Donor monitoring of funded projects is a way of enhancing quality and accountability. The donor is the financier of the projects and the entity who pays the money to get the outputs and outcomes which indicated in the grant appraisal documents. Sometimes more than one donor participates in financing one program. No interviews were held with donor's staff, but the requirements of donor staff have been gathered from the reports submitted to the donors also by information taking from donor representative staff. The donor main requirements are to receive an on time reporting on the overall grant status related to:

- Allocated and unallocated budget from the entire grant amount,
- Status of the projects and the overall completion percent ,
- Overall disbursement for all projects,

- Output indicator achievements.

Also the donor has the privileges on the system to enter the detailed report to take a look on the projects separately without make modifications.

The role of the donor is very important in the fund lifecycle, not all of their functions are required for our system but the role of the donor includes the following responsibilities:

- Fund raising from the donation bodies
- Concept papers review
- Order for call of proposals
- Signing of grant implementation agreements
- No-objection to tender
- No-objection to award
- Approval for money disbursement

#### **4.10.2 Donor representative Staff**

The donor representative acts as a system administrator who manages all the operations related to the grants administration in case of absence of governmental or central unit for grants management.

The donor representative receives inquires and documents and gives approvals to complete the work process. Each donor representative in a various institution has a different staff with a different job titles, these staffs will have different privileges and roles in the system to interact with others for monitoring the work process. In our case study, the working staff in the donor representative team will be as follows:

- General Manager
- Financial Manager
- Procurement Manager / officer
- Area Engineer/project coordinator
- System Administrator

The staff may be extended or reduced according to the available resources, the work will not be effected because the system allows transferring the privileges from one user to another to facilitate the working process.

#### **4.10.2.1 System administrator**

A system administrator, or sysadmin, is a person who is responsible for the upkeep, configuration, and reliable operation of computer systems; especially multi-user computers, such as servers. The system administrator seeks to ensure that the uptime, performance, resources, and security of the computers he or she manages meet the needs of the users, without exceeding the budget. To meet these needs, a system administrator may acquire, install, or upgrade computer components and software; automate routine tasks; write computer programs; troubleshoot; train and/or supervise staff; and provide technical support.

The system administrator is responsible for following:

1. User administration (setup and maintaining account)
2. Maintaining the system
3. Verify that peripherals are working properly
4. Quickly arrange repair for hardware in occasion of hardware failure
5. Monitor system performance
6. Create file systems
7. Create a backup and recovery
8. Monitor network communication
9. Update system as soon as new version of OS and application software comes out
10. Implement the policies for the use of the computer system and network
11. Setup security policies for users. A sysadmin must have a strong grasp of computer security (e.g. firewalls and intrusion detection systems).

The system administrator role can be attributed to the IT specialist or officer under the supervision of the general manager.

#### **4.10.2.2 General Manager**

The general manager has all privileges to access the system and data base to preview all the inputs/outputs and reports Table 5. The general manager role on the system is to make approvals and electronic sign on some documents which need to pass through the GM before sent outside the institution. The general manager functions and reports needed from the system.

Table 5: Donor representative manager functions and required reports

Functions	Required reports
Projects list approval	Status report (cumulative / detailed)
No-objection to tender letters	Project report
No-objection to award letters	Disbursement report Filtered by (project / IA / Sector /)
Payment requests final approval	
Change order approval	
Adding and defining new grants to the system	
Adding and editing grants information	
Adding packages to the main grants	
Adding implementing agencies allocations	

#### 4.10.2.3 Financial Manager

Financial management contains key elements such as *financial planning* and *financial control* which is important in order to know whether the objectives are met or not and whether the grants are being expended in compliance with the donor guidelines and restrictions or not. Since Financial management includes a mechanism for controlling and planning for the financial and technical aspects of the grants. Financial management is an essential process for managing the grants raised from the donors and for controlling the grants expenditures and the expected returns on those grants. Financial management process overlaps with the organization operations, since each one of these provides an important data source for the other. The finance department depends on its payments to the contractors - those executed or still executing projects on the recommendations and the reports from the technical department that supervise the projects of the implementing agencies. The finance department provides a source of information for the technical department in approving the payments based on the balances of the projects.

Since the sources of funds that the organization obtains come from the donors donations and since financing all the projects are funded from those donations and since the donors are requesting their donations to be spent in compliance with the restrictions they had set in the financing agreements with the organizations and since the donors are requesting proofs about this compliance, there should be a financial management process and assures the compliance with the donors conditions, and that assures that the projects are not exceeding the allocated

budgets, and there should be a financial management process that monitors the right times to send the request to the donors for cash transfers in order to cover the being implemented and finished projects. The financial manager is the person who administrates the financial department.

- Financial procedures that follows the financing agreement signing
- Feed the system with banking information
- Checking the projects budgets according to the total budgets of the grant.
- Review the bank statements on a daily basis to determine any receipts.
- Record the completed Cash Receipt Slip with all backup into the accounting system.
- Final review of the payment request with the supporting documents.
- Compare the payment request to the budget.
- Prepare Payment Order.
- Record the payment in the accounting system.

#### **4.10.2.4 Project coordinator/Area Engineer**

Area engineer, supervisor engineer or project coordinator, this title may change from organization to other depending on their system. This person is the direct responsible for acting with the implementing agencies to supervise and approve all the technical and the financial issues in addition to revising the projects proposals and making an initial approval before the general manager approval. In a detailed process he will involve in:

- Revising the bills of quantities technically and made modification on items
- Screening the items of BOQs from the un fundable items
- Primary review of the bidding documents before approval from the procurement department.
- Site visits to the work locations and making site visit reports.
- Revising the payment requests including invoices and the related documents.
- Revising the change orders and funds reallocations.



#### 4.10.2.5 Procurement Manager / Officer

- The procurement officer is a person who provides procurement support during project preparation, and project implementation, reviews and handles the technical, commercial and legal aspects of procurement.
- The procurement officer receives the bidding documents from the area engineer, and makes a procurement review then make an approval on the documents before tendering.
- Review the bidding documents before giving a no-objection to award for the contractors
- Developing and updating a procurement plan for all projects.
- Revising the variation orders received from the area engineer and give approval.

#### 4.10.3 Implementing agency (IA)

The implementing agency is the entity which is responsible for direct management and supervision of the projects on the ground. **IA** may be international institutions that have an experience in projects management and implementation. In other situations the implementing agencies may be local institutions or municipalities. The IA plays a main role in the grant management which works in a decentralized environment to make all the bidding and awarding processes and get an approvals in some stages to complete the process. In some cases the IA may be the project beneficiary itself as the municipality when dealing with Municipal development fund but in other cases the beneficiary does not play an important role in our study so there are no interactions for him in the web-based system at this point.

For example: the municipalities may be an implementing agency when they take the project and making all the tendering process so it will be a beneficiary and IA at the same time. Sometimes an international organization playing the IA role, so the municipality in this case only has an additional supervision on the project on the ground but without any interaction in the system.

##### 4.10.3.1 Implementing agencies Roles

- Sending projects proposal for approval.
- Preparing the bidding documents including drawings, BoQ's and all needed documents and send it for approval to get no-objection to tender.

- Making the tendering process, making the evaluation process and recommending a contractor to be awarded the project.
- Send the awarding documents to the donor representative including the bids and the evaluation report for getting the no-objection to award.
- Issuing a letter of acceptance, purchase order and signing the contract with the lowest bidder contractor or supplier.
- Supervising the implementation on the ground and preparing a site visits reports.
- Revising the time schedule and the daily reports.
- Check and approve the quantity surveying for the actual work done.
- Revising the payment requests and sends it to the donor representative for making payments down for the contractors.
- Preparing monthly reports.

The implementing agencies staff varies according to the size of the IA, for the purpose of research the most important key staff have been selected to be as a system users, according to their direct dealings with the donor representative.

- Project Manager
- Projects coordinator
- Site Engineer

#### **4.10.3.2 Projects Manager**

The projects manager is the main person in the IA staff, which is the person who approves the documents and makes the correspondent to the donor representative. All contacts to the donor representative will be sent by the projects manager. He collects all the reports and documents from his staff and sends them after revision and approval.

The main activities of the projects manager are:

- Preparing the projects proposals, and supporting documents.
- Preparing the bidding documents.
- Preparing the awarding documents.
- Preparing the change orders documents.

- Payment requests.
- Replenishment requests.

#### **4.10.3.3 Projects coordinator**

The project coordinator is the link between the IA projects manager and the donor representative who prepares the documents and makes the entries on the system for the manager approvals before sending to the donor representative. Also collect the reports from sites engineers.

#### **4.10.3.4 Site Engineer**

each project has a site engineer who is the main supervisor on the ground. The site engineer approves the daily reports made by the contractor, approves the quantity surveying for the actual works done and reports on any issue in the work site.

### **4.11 Tasks analysis**

It involves the study of what a user is required to do in terms of actions and/or cognitive processes to achieve a task. A detailed task analysis can be conducted to understand the current system, the information flows within it, and the problems for people, and opportunities that indicate user needs. There are many variations of task analysis and notations for recording task activities. One of the most widely used is hierarchical task analysis, where high level tasks are de-composed into more detailed components and sequences.

### **4.12 System Functions**

According to the different stakeholders that will use the system, there are more than one user interface for the working environment. So we can divide the web-application into multi interfaces. For simplicity, we can use one interface which contains all the needed information but with limitation for each user to enter the specific locations according to his privileges and roles on the system.

Table 6 defines the system functions result from the system analysis.

Table 6: Summary of system functions during the grant life cycle

phase	Operations	Stakeholder	users
System initiation	Adding and identifying users	Donor representative	System administrator General manager
	Allocating the grants to the IA	Donor representative	General manager
	Defining projects sectors	Donor representative	General manager
Proposal and planning phase	Adding projects lists for approval	Implementing agency	Project manager
	Approving the projects lists	Donor representative	General Manager Area engineer
	Adding procurement plan	Implementing agency	
	Procurement plan revision and approval	Donor representative	General Manager Area engineer
	Preparing the bidding documents	Implementing agency	Project manager
	Uploading project files/drawings	Implementing agency	Project manager Project coordinator
	Adding BoQ to the system	Implementing agency	Project coordinator
	Notes on the bidding documents	Donor representative	Area engineer
	Approval of the bidding documents	Donor representative	General manager Procurement manager/officer Area engineer
	Issuing no-objection to tender	Donor representative	General manager Donor
Tendering and awarding process	Issuing bidding documents	Implementing agency	Project manager Project coordinator
	Bids opening	Implementing agency	Project manager Project coordinator + committee
	Bids evaluation	Implementing agency	Project manager Project coordinator + committee
	Issuing No-objection to award	Donor representative	Project manager
Implementation phase	Issuing the purchase order	Implementing agency	Project manager
	Daily reports	Contractor	Site engineer
	Daily reports approval	Implementing agency	supervisor engineer
	Site visits	Donor representative	Area engineer
	Adding payment request for sub-projects	Contractor	
	Payment request 1 <sup>st</sup> revision	Implementing agency	supervisor engineer Project manager
	Payment request 2 <sup>nd</sup> revision and approval	Donor representative	Area engineer Financial manger General manage
	Variation order submission	Contractor	Contractor
	Variation order 1 <sup>st</sup> revision	Implementing agency	supervisor engineer project coordinator Project manager
	Variation order 2 <sup>st</sup> revision and approval	Donor representative	Area engineer Financial manger General manage
	Fund reallocation	Implementing agency	Project manager
	Fund reallocation approval		Financial manger General manage

### 4.12.1 Adding users

This is the function needed to identify the stakeholders' users. User definition requires many data for each one like name, code, contact information and others. The following Table 7 to Table 9 show the main information needed for donors and donor representative. Any other information can be added by customizing the system.

Table 7: Adding new donor to the system (required information)

Add new Donor	DONOR Name	email	website	Tel	fax	contact person
	IDB					
	KFW					
	AFD					
	World Bank					

Table 8: Adding new donor representative to the system (required information)

Add donor representative	D. R. Name	Email	website	Tel	fax
	EMCC				

Before defining the donor representative staff we have to identify the donor representative institution itself, this step is very important in case if more than one D.R. using the system.

Table 9: Add donor representative Staff to the system

Add donor representative Staff	Name	Position	user name	pass	email	mobile	Other info
		General Manager					
		Office manager					
		Area Engineer					
		Accountant					
		Financial manager					
		Procurement manager					

### 4.12.2 Registering Implementing agencies

The second step within adding users to the system is defining implementing agencies and their staff, the required information about the implementing agencies to be dealt with through the project management process is divided into two groups, input data and calculated data. The input

data Table 10 is information required to be filled by the system administrator but the calculated data Table 11 are generated automatically by the system.

**Table 10: implementing agency information**

Name	Total Allocated budget
Contact information	Total unallocated budget
Implementing agencies allocation	Total Disbursed
Fund Start Date	Total undisbursed
Proposals submission dead line date	
Contracts sign dead line	
Fund Closing Date	
Admin fees	

**Table 11: implementing agency definition information**

Add implementing agency
Implementing agency Name
Implementing agency ID
Implementing agency type
Implementing agency Location
Address
Phone
Fax
Mobile
contact person
Classification
Website
Email

### 4.12.3 Adding new grant or program to the system

Fund, grant or program are the same meaning in our system, it is an amount of money allocated by donor to make project/s under a signed agreement within a time frame. The first step towards understanding program/fund management is to agree on a common vocabulary. The program or grant is a portfolio of projects and those projects belong to a specific component of those program is consisted of. The program can be defined, also, as a container that is full of projects and divided into more than one sub-project.

Simply, program management is:

- A systematic approach to electing, organizing, tracking and documenting the programs in the system.

- A process that establishes and maintains agreement between the clients and the program's team on the supporting and organizing that program.

The following module describes all the setup functions in Grant Management. We will cover basic Program initializing, defining program general information, defining program objectives, linking all the donations to the program, setting up the procurement method, setting up the procurement packaging, distributing the funds over the *program* sectors. The programs will be managed through its creation, planning, implementation, to its closure phase.

In our case study the most important information for each program/fund to be dealt with in the system is shown in Table 12 and Table 13.

Table 12: Fund needed Information

• Program name	• Management fees for donor representative
• Program Code	• Disbursement Categories
• Donor	• Sectors
• Donor code	• program effective date
• Total Fund Amount	• Program finish date

Table 13: Add New Program/ Grant to the system

Add New Program/ Grant
Edit Grant

Name			
Donor name	Budget	Tax	Code
<b>Total Program Budget</b>			

Start Date	
completion date	

<b>program description</b>  
------------------------------------

<b>upload files</b>
---------------------

<b>Donor representative</b>		EMCC
Management fees %		7%
Management fees amount		

<b>Sectors</b>	enter
	calculate

<b>Program Sectors</b>
Roads
Water and wastewater
Solid waste
Electricity
Public facilities
Health
...
...

<b>Subsectors</b>
....
....

#### 4.12.4 Allocating budgets to the implementing agencies

As described before, the implementing agency is an entity specialized in projects management and implementation which is selected by the donor or the donor representative to take the responsibility of managing a group of projects in a specified sector. Each IA signs an agreement with the donor. The fees is calculated as a percentage of the program funds.

The distribution of allocations among the IAs is the next step after adding and defining the users on the system; the donor representative has a pre conception about the transfer mechanism of the fund in addition to the working sectors, the system will not interact with the transfer mechanism and will take the amount of money for each institutions as an input for the system.

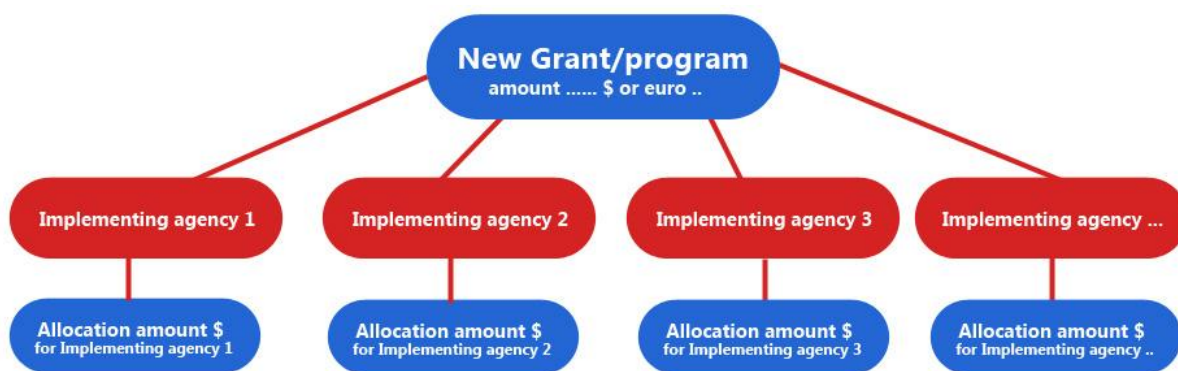


Figure 12: Allocating grant to the IA

The donor representative can deal with more than one implementing agency which is working on the same time; each agency will works on specific projects and will take a different budget for their work Figure 12.

Sometimes the program has a multi-donor, this mean than more than one donor will invest money in the same program to achieve the same objectives; this will be as a co-financing between donors for the same program. At this point each implementing agency can take fund from multi donors as shown in Figure 13.



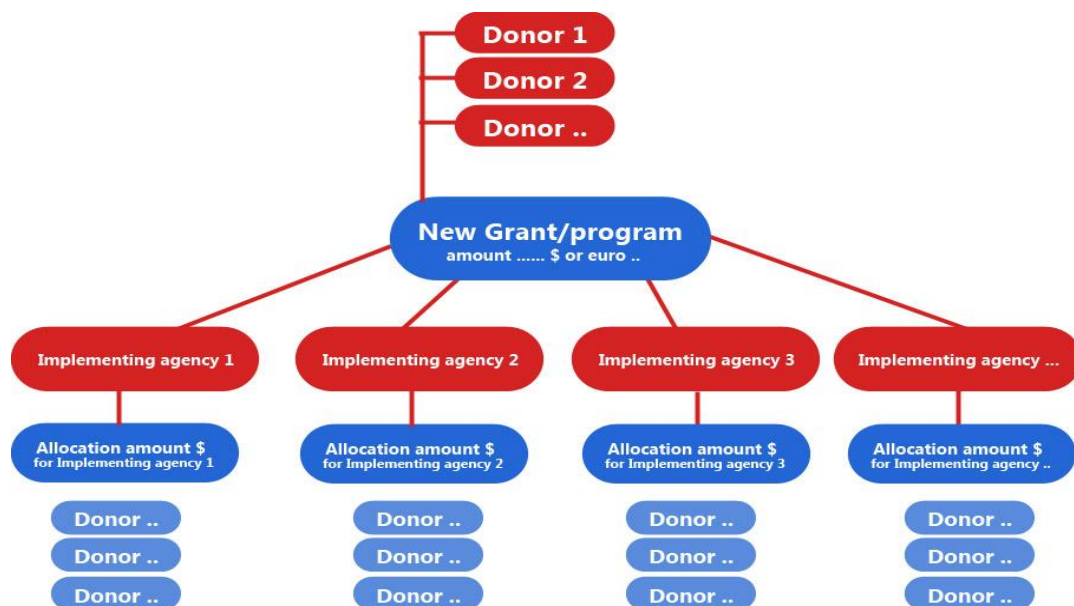


Figure 13 Allocating multi-donor grants to the IA

#### 4.12.5 Adding allocation to the implementing agency

This process belongs to the donor representative who can allocate funds to IA to start proposing projects to works on, the donor representative need to define the amount of money, the sectors, the management fees and other information showed in Table 14.

Introduction use this screen to add allocation for specific IA  
 Precondition adding new grant to the system, registering IA on system  
 Users' system administrator or general manager

Table 14: Adding allocations to the IA page

Add allocations			
Program name			
<b>Implementing agency Name</b>	<b>allocated budget</b>	<b>admin fees</b>	
<b>Total allocated</b>		<b>SAVE</b>	
Allocation per donor			
Implementing agency Name	Agency approved budget	IDB	Total
UNDP			
Unrwa			
<b>Allocated budgets</b>			
Sector allocation			
Implementing agency Name	budget	sector	amount

#### 4.12.6 Projects list

Each implementing agency will propose different projects to be implemented under a certain fund or program, primary information for each implementing agency projects has to be declared as follows:

- No. of projects.
- Projects description.
- Projects names.
- Projects codes.
- Planned start date.
- Planned finished date.
- Project estimation cost.
- Total disbursed.

Also the implementing agency may be bound by working sectors to allocate the fund within, like roads sector, water sector, health sector, educational sector...etc. In case of the IA allocations have done successfully, each IA project manager can login into the system and see the total allocation and the sector they will work on. Also he is asked to begin adding projects names and estimated budgets for primary approval. Projects proposals have to be prepared and submitted as attachment to the project information, also any document needed in this step has to be attached to the project record on the system.

**Inputs:** project name, project code, estimated cost, sector, planned start date, planned finish date, attachments like (drawings, general site plan, priced BoQ, etc..)

**Privileges:** Implementing agency privileges.

**User:** Project coordinator, or project manager.

**Next step:** saving the work and sending by the system for approval.

Before approval, the user can login and add new projects until the counter of allocated budget reaches to the total budget and the unallocated budget becomes zero. Adding more information or editing the attachments is allowable until the approval of the donor representative staff **Figure 14**. In case of any changes, some rejected projects the area engineer of the donor representative will send comments by the system to be modified and resend.

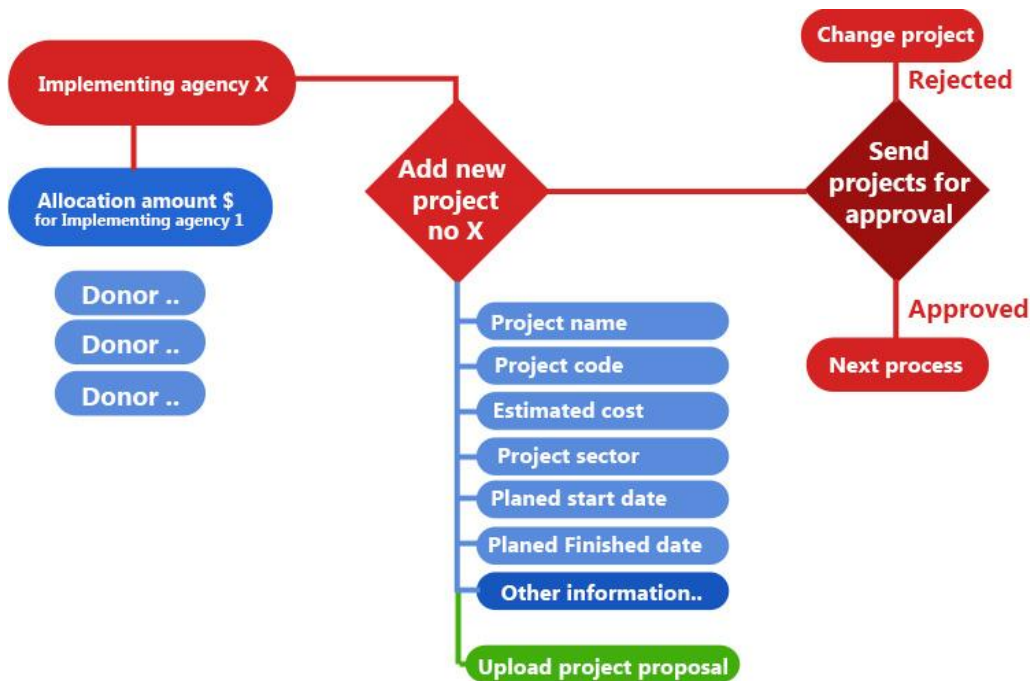


Figure 14: defining new project to the system

Table 15: IA Allocations page (adding projects list)

**implementing agency page**

Grants | Allocations | projects | Procurement plan | tendering | Awarding | ongoing projects | completed projects

Implementing agency Name	Notifications (2)
--------------------------	-------------------

Program name / Grant	Approved budget	start date	end date	allocated	unallocated
....					

Add projects list					planned dates		uploaded files	date
project name	project code	estimated cost	sector	category	start	finish		
...							upload	
...							upload	

upload files	project application / proposal general site plan photos others	status for each project generated by the system	send projects list for approval
--------------	---	---	---------------------------------

### 4.12.7 Projects list approvals

Each allocated fund from the total fund for specified implementing agency will be divided into sub-projects, in different sectors and different categories. The implementing agency has to submit a project proposal on a pre-prepared form to get an approval before starting the bidding process. Before the submission of the project proposal, the IA has to submit a list of projects for

the preliminary approval of the projects names and budgets. In a project approval level, a primary data is needed for each project like:

- Beneficiary.
- Project name.
- Project code.
- Allocated budget.
- Estimated cost.
- Procurement method.
- Category.
- Project sector.

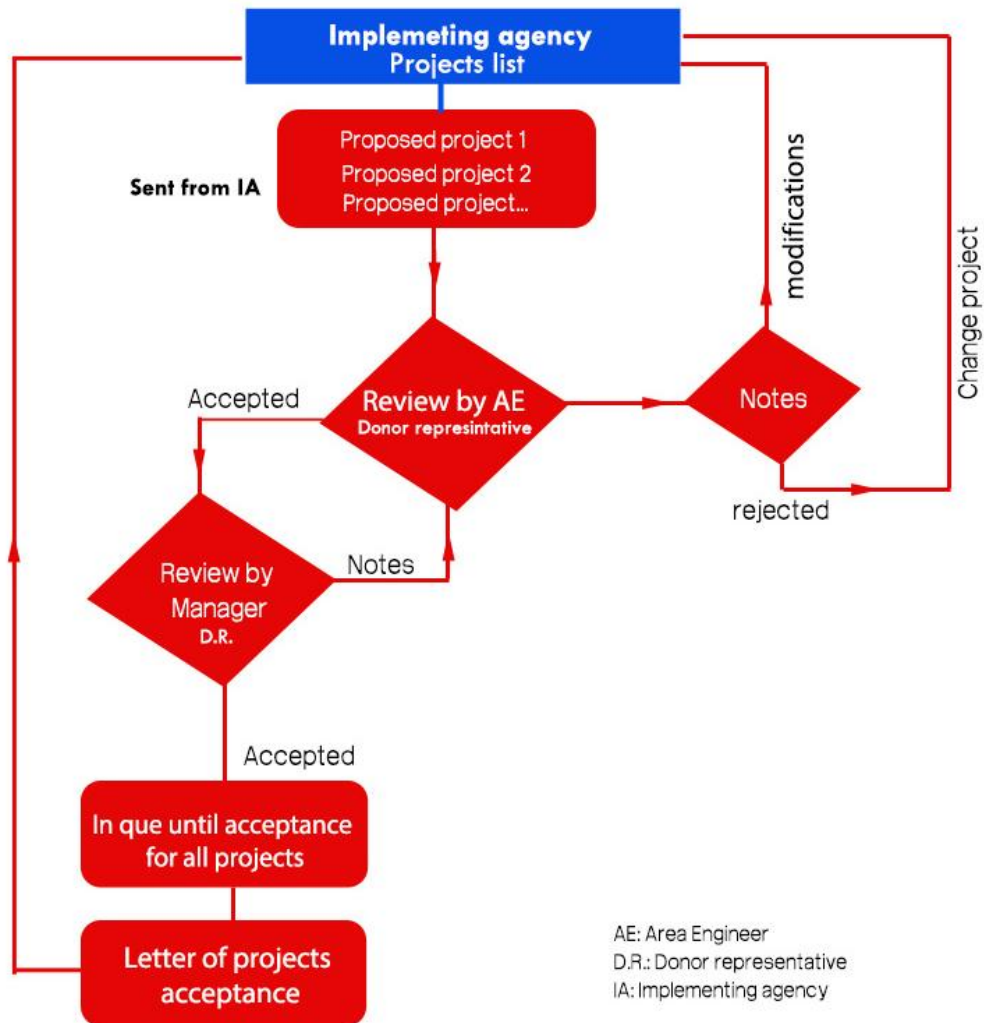


Figure 15: Projects list approval process

The project list approval will pass through a system process starting from sending the list by implementing agency staff, this process is illustrated in Figure 15.

**Inputs:** project name, project code, estimated cost, sector, planned start date, planned finish date, attachments like (drawings, general site plan, priced BoQ, etc.)

**Privileges:** Donor representative.

**User:** the list will be approved by area engineer then by general manager.

**Next step:** entering the bidding documents for no-objection to tender.

#### 4.12.8 Receiving the approved project lists

The approved projects lists Table 16 will be available for the implementing agencies to start the next process; each I.A. can login from his portal and start entering the information and uploading files needed for the bidding process like, bidding documents, drawings, BoQs and any other information. Some sub-projects will still be pending for approval or rejected or need more clarifications and noted modifications. The system will show a notification with the sub-project status requesting action from the IA staff.

Table 16 : Approved projects information

Project name	Project code	Estimation cost	Sector	Category	Planned start date	Planned finished date	Duration

**Inputs:** project name, project code, estimated cost, sector, planned start date, planned finish date, attachments like (drawings, general site plan, priced BoQ, etc..)

**Privileges:** implementing agency staff.

**User:** project coordinator and project manager.

**Next step:** sending the files to get no-objection to tender.

#### 4.12.9 Procurement Process

**Procurement** is the acquisition of goods, services or works from an outside external source. It is favorable that the goods, services or works are appropriate and that they are procured at the best possible cost to meet the needs of the purchaser in terms of quality and quantity, time, and

location. Each donor has his own procurement guidelines for procurement procedures to deal with tenders and bids, like World Bank procurement guidelines and Islamic Development Bank procurement guidelines. The procurement process is a core process in our system which needs significant tracking procedures. A lot of information is needed to manage and track the procurement process but the main information is listed below:

- Project name
- Project code
- Project allocation
- Donor
- Owner
- Implementing agency
- Procurement method
- Project sector
- Project status
- Project sub-status
- Proposal submission
- Proposal reviewing
- Proposal notes clarification
- Proposal final review and acceptance
- Submitting a bid for review
- Notes on tender documents
- Tender documents amendments
- Final review and no objection to tender
- Tender date
- Tender opening date
- Modified opening date
- Bid opening sheet
- Price comparison sheet
- Evaluation report date
- Receiving evaluation report to acceptance
- Evaluation report notes
- evaluation report modifications
- Final review and no-objection to award
- Bid acceptance letter
- Contract date
- Project start date
- Project end date

#### **4.12.9.1 Procurement plan**

The preparation of a realistic procurement plan for a project is critical for its successful monitoring and implementation. As part of the project preparation, the implementing agency shall prepare a preliminary procurement plan Table 17, however tentative, for the entire scope of the project. The IA shall prepare a detailed and comprehensive procurement plan including all contracts for which procurement action is to take place in project lifetime. The IA shall update procurement plans throughout the duration of the project at least monthly by including contracts previously awarded and to be procured in the next month. All procurement plans and their

updates or modifications shall be subject to the donor representative prior review and no objection before implementation.

Procurement plan is a document prepared for each project and then collected in a one sheet for all projects, it is considered as a work plan and time schedule for the project management life cycle, which shows all dates starting from submitting the project proposal ending with the project handing over date. The initial dates entered in the procurement plan will be considered as a planned date and baseline for the work process, and then another two dates have to be added or calculated by the system which are the revised date (the amended Planned date in case of delay) and the actual date which is the exact date of executing the task.

Table 17: Adding Procurement Plan to the system

Grants | Allocations | projects | Procurement plan | tendering | Awarding | ongoing projects | completed projects

Implementing agency Name		<a href="#">previous project</a> <a href="#">next project</a>				
<b>Procurement plan</b>						
Program name / Grant	Approved budget	start date	end date	allocated	unallocated	no of projects
....						
<b>Project information</b>						
project name	project code	estimated cost	sector	category	approval date	status

Dates	Proc Method	Donor Rev. Prior/Post	Prep. of Bidding Docs	No Objection to tender	Issue of Bidding Docs	Bids submission/ Opening	Evaluation Report	DONOR No Ob.to award
Planned								
revised								
actual								

Contract Amount	
Contractor	
Comments	

Dates	Contract Award	Contract Sig.	Start Date	Completion Date
Planned				
revised				
actual				

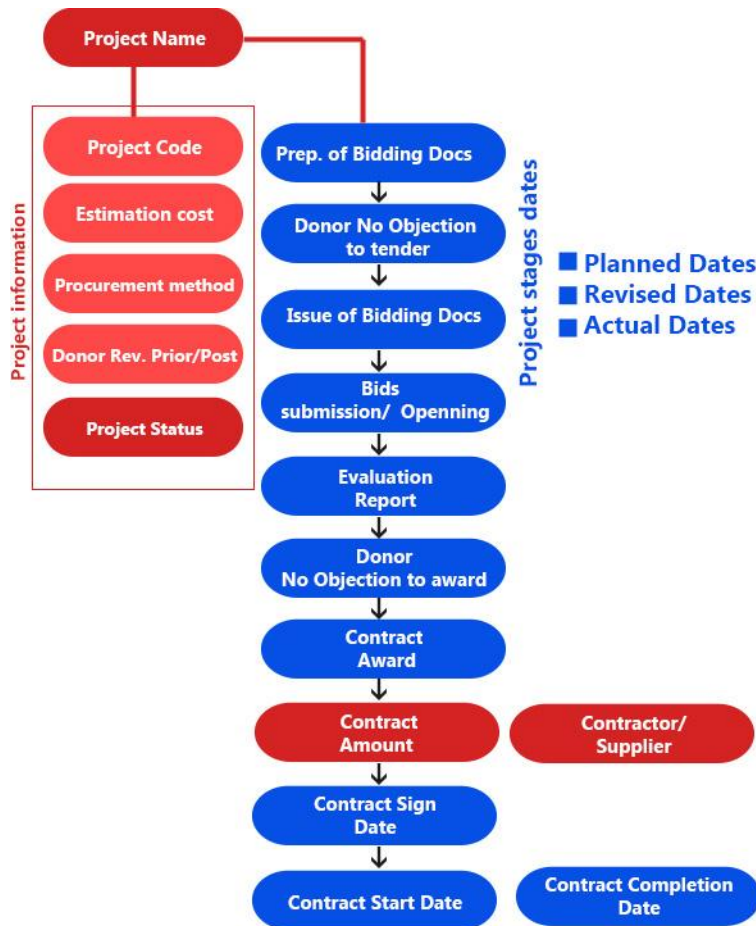


Figure 16: Procurement plan process

The procurement plan has to be prepared before the preparation of the bidding documents and the donor representative has to give approval on it before starting this process.

#### 4.12.10 No objection to tender

After the preparation of projects list and procurement plan for all the projects, the IAs start preparing the bids using standard bidding documents forms according to the project estimation cost and procurement threshold.

The following documents have to be prepared:

- Bidding documents which contain general conditions, special conditions, Bill of quantities, technical specifications, etc.)
- Newspaper advertisement (if needed according to the estimation cost)
- Priced bill of quantities



- Technical drawings
- Any other documents according to the project requirements

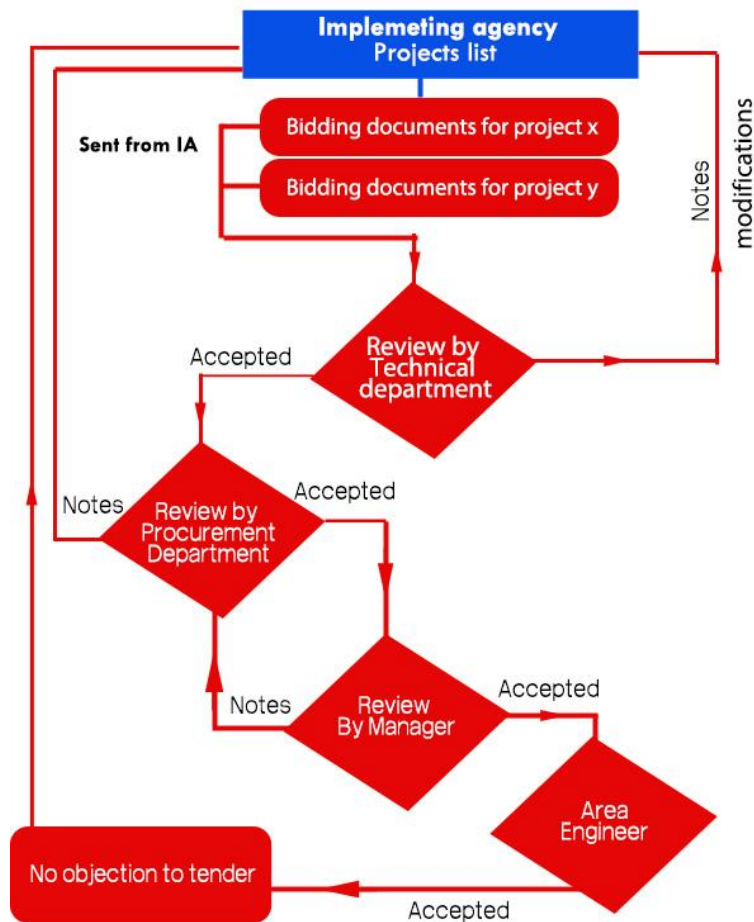


Figure 17: No-objection to Tender Process

After documents preparation completed, they will pass through a long cycle of checks and approvals Figure 17, it will be sent to the donor representative for revision and approval. Sometimes the donor needs to check the documents and give approval before donor representative sends the no-objection to tender to the IA. The system will deal with this point by making the approval as a privilege which can be attributed to donor and may be transfer to donor representative as required. The cycle starts with the area engineer who receives the documents from the system then add comments and sends it to the procurement department, then will be sent to the IA for making modifications. After making modifications the documents will be sent one more time to the donor representative to final revision and issuing a no-objection to tender letter.

By issuing the no-objection to tender letter, the following will be done:

- The system record the date of receiving the bidding documents in the procurement plan as an actual date.
- No-objection to tender actual date will be added to the procurement plan and will be a reference point.
- The project status will be changed from (pending in Donor representative for revision) to (tendering).
- The IA staff has to record the issuing bidding documents in the system as an actual date.
- IA can at this point start distribute the bidding documents to the bidders.

Table 18: Getting no-objection to tender process

Grants | Allocations | projects | Procurement plan | **tendering** | Awarding | ongoing projects | completed projects

Getting no objection to tender | tendering projects list

Implementing agency Name					previous project	next project
choose program/grant						
Program name / Grant	Approved budget	start date	end date	allocated	unallocated	no of projects
....						

Choose Project						
project name	project code	e. cost	sector	category	approval date	status

upload files
drawings
Bidding documents
estimated cost BOQ
others
others
others

Add BOQ to system				
Bill no	Item	unit	Qty.	e. cost
..				
..				

Save	Edit	Delete
send project documents for approval		

by sending project files for approval, status changes to pending in D.R. for no objection to tender

#### 4.12.11 Tendering process

Tendering process is a period of time between issuing the bidding documents by advertises in the newspaper or any other mean, in which the bidders start received the bidding documents and

prepare their tenders, and spanned to the opening date mentioned in the documents. During this period, some projects need a site visit from the contractors. Also a pre-bid meeting will be conducted and documented in the system.

The system Table 19 allows the users to filter the projects by status to facilitate listing tendering projects also make notifications before bid opening date for attending opening bid meeting.

Table 19: Tendering project list

implementing agency page

Grants | Allocations | projects | Procurement plan | **tendering** | Awarding | ongoing projects | completed projects

Getting no objection to tender | [tendering projects list](#)

Implementing agency Name

choose program/grant

Program name / Grant	Approved budget	start date	end date	allocated	unallocated	no of projects
....						

Tendering Projects list								
project name	project code	budget	sector	category	approval date	No objection to tender	Issue of Bidding Docs date	Bids Opening

by adding bid issuing date status change to **tendering**

#### 4.12.12 Bid opening

The bid opening is the date mentioned in the bidding documents, which the bidders have to submit their offers on a public opening meeting. After this meeting, a bid opening minutes of meeting has to be prepared and documented in the system and has to contain the following information:

- Date and time.
- Grant information (program name – donor name).
- Project name and code.
- Bid opening committee names and positions.
- Numbers of bids sent and received.
- Names of bidders and the total amount of the bid received.

- Any notes or modifications on the bidding documents.

### 4.12.13 Prices comparison sheet

It is a sheet prepared after bids opening Table 20, a project coordinator or an accountant from the IA staff feeds the system with contractor's names and prices for all items. This process can find if there are arithmetic errors in the contractor's total sum and getting the actual lowest price bidder.

Table 20: Price comparison sheet

Implementing agency Name								
choose program/grant								
Program name / Grant	Approved budget	start date	end date	allocated	unallocated	no of projects		
....								
<b>Choose Project</b>								
project name	project code	e. cost	sector	category	approval date	No objection to tender	Bids Opening	
						<b>bid opening committee</b>		
No of bids sent				name		position		
No of bids received								
<b>bid opening sheet</b>								
contractor name	total amount	notes						
by interring the bids opening date the status change to								
<b>Awarding</b>								
					<b>contractor 1</b>		<b>contractor 2</b>	
Bill no	Item	unit	Qty.	es. cost	unit price	total	unit price	total
					Total		Total	
lowest bidder name				lowest bidder amount				save

### 4.12.14 Evaluation report

This is a report prepared by a specific committee formed by the IA which revised all the received bids to looking over the eligibility of the contractors, financial situation of the contractors, previous works, and specifications of items in case of supplies projects.

The evaluation process is out of the scope of our system, so the IA can make the evaluation and recommend a bidder for awarding in an external report which will be uploaded to the system as attached file.

**Inputs:** bids opening sheet, price comparison sheet, uploading evaluation report.

**Privileges:** implementing agency staff

**User:** project coordinator and project manager

**Next step:** sending the files to gen no-objection to award

**Consequences:** Adding bid opening date in the procurement plan as actual date

Adding the evaluation report date on the procurement plan

Changing the project status from tendering to awarding

#### **4.12.15 No-objection to award**

After bid opening and preparing the evaluation report, the implementing agency collects all the documents and sends it to the donor representative to get a no-objection. The awarding often make to the lowest evaluated bidder. These documents passes through a long cycle of approvals Figure 18 before no-objection to award is issued. The documents which need to be sent are summarized as follows:

- Recommendation letter for award to a specific contractor or supplier
- Bid security (in case of it is requested in the documents)
- All tenders with their envelopes
- Bid opening minutes of meeting
- Price comparison sheet
- Technical and financial evaluation report

In the donor representative side, they receive all the above mentioned documents, compare it with the information entered to the web-based system, make notes if there are any mistake in the awarding mechanism and send it to IA for amendment.

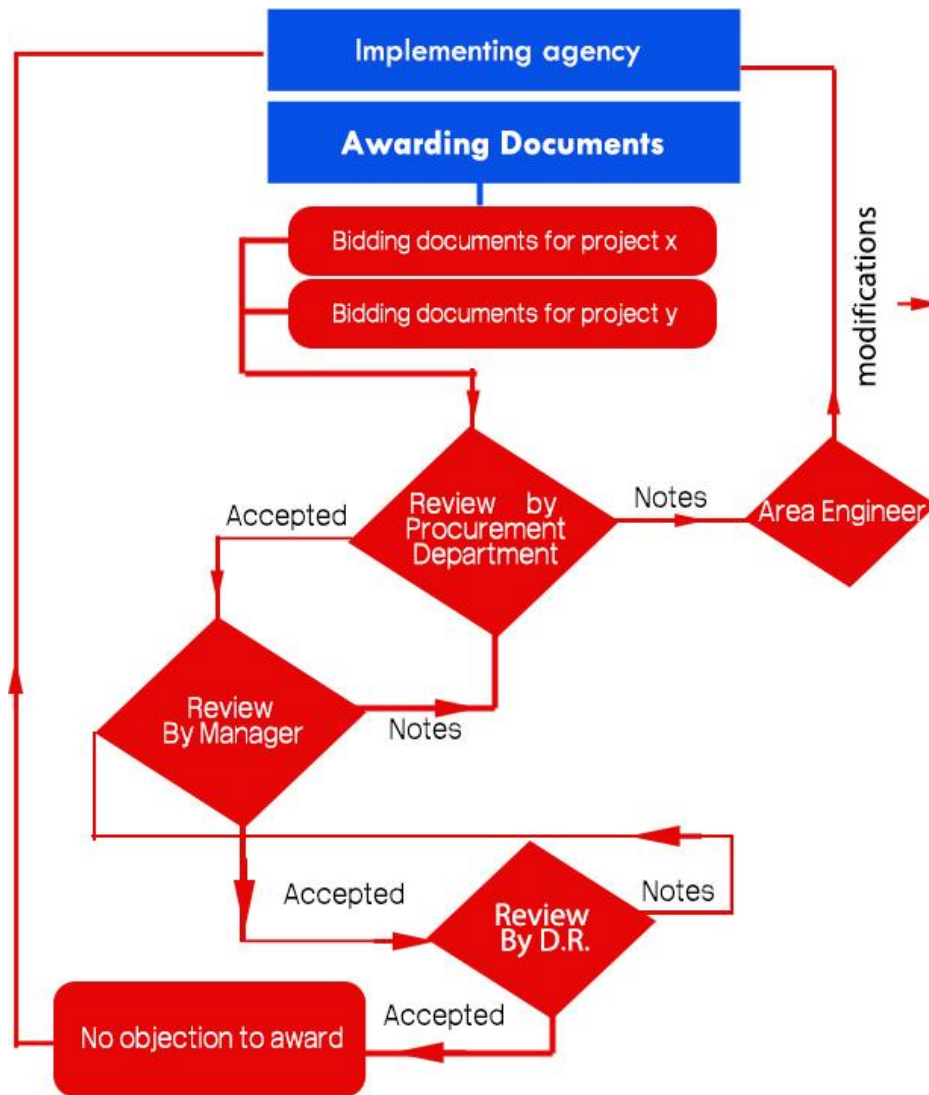


Figure 18: No-objection to award process

**Inputs:** accept the awarding process,

**Privileges:** Donor representative.

**User:** Area engineer – Procurement officer – General manager.

**Next step:** issuing no-objection to award.

**Consequences:**

Changing the project status from awarding to ongoing

Adding contractor name to procurement plan and projects list

Adding contract amount to procurement plan and projects list

Adding no-objection to award date – start date and finished date to procurement plan

Table 21: Awarding process

Implementing agency Name

[Previous project](#) [next project](#)

choose program/grant

Program name / Grant	Approved budget	start date	end date	allocated	unallocated	no of projects
.....						

**Choose Project**

project name	project code	estimated cost	sector	category	No objection to tender	Bids Opening	contractor	amount

upload evaluation report

send for approval

by sending project for approval

the status change to

Awarding / review by D.R

#### 4.12.16 Projects implementation phase

This phase starts from the issuing of no-objection to award from the donor representative to IA, then signing the contract between the IA and the contractor.

In this phase, a new party has an interaction in the web-based system (the contractor). To keep the process simple the contractor will be represented as a one user in the system and he has the following roles:

- Entering the daily reports on a daily report form.
- Entering a quantity survey for performed works.
- Entering the payment requests Table 24.
- Making the change orders requests Table 23.
- Sending internal memos Table 22.

The contractor will fill on a daily basis a daily report form which contains all the information about the conducted works on the site and collected much information like working staff on the site, working and non-working days and site obstacles.

Internal memo forms Table 22 also are attached to the system for sending and receiving information between the contractor and implementing agency. This form will be as an electronic mail system instead of paper correspondents.

Table 22: Internal memo form

implementing agency page

Grants | Allocations | projects | Procurement plan | tendering | Awarding ongoing projects | completed projects  
memo | site visits | variation orders | payments | daily reports

Memo

To	
Subject:	
Regarding project No.	
Project name	

**Type of correspondance**  
request of information  
notes on implementation  
notes on payment  
others...

send

Table 23: Variation order request form on the system

Grants | Allocations | projects | Procurement plan | tendering | Awarding ongoing projects | completed projects  
memo | site visits | variation orders | payments | daily reports

**Variation Order Request**

Implementing agency Name

date

choose program/grant

Program name / Grant	Approved budget	allocated	unallocated	no of projects
....				

chose project

project name	project code	approved budget	contract amount	contractor	duration

Variation Order type

within approved budget	
over approved budget	

Variation order amount

items type

from BOQ	
new Items	

description



additional time required	
--------------------------	--

no	item	unit	Unit Price	original Qty	additional Qty	total of new	grand total
						save	send for approval

Table 24: Payment request form on the system

implementing agency page

Grants | Allocations | projects | Procurement plan | tendering | Awarding ongoing projects | completed projects

memo | site visits | variation orders | payments | daily reports

Program Name	
Donor Name	
Imp. Agency	
Total Allocated budget for IA	
Total Disbursed for IA	
Remaining	

Project Name	
Project Code	
Project Sector	
Category	

No objection to award date	
Project start date	
Project planned finished date	
Actual finished date	

Contractor banking information

Name	
account no	
account name	

Contractor Name	
Contracted	
V.O. amount	
<b>Project Amount</b>	
Payment No.	
Previous Payments	
<b>Current Payment</b>	

Total Disbursed	
Remaining	

Send for approval

## 4.12.17 Site visits reports

Implementing agency staff and donor representative staff will make sites visits during the implementation phase, these visits have to be documented in the system as a site visit report Table 25 with the attached photos and all information on a site visits form.

Table 25: Site visits report on the system

Grants | Allocations | projects | Procurement plan | tendering | Awarding ongoing projects | completed projects  
memo | site visits | variation orders | payments | daily reports

Site visit	<a href="#">previous project</a>	<a href="#">next project</a>
Date		Project budget
Program name		Contract amount
Project name		Contractor
Project code		Actual Start date
		Planned finished date
		MAN POWER
		Project Manager
		Engineer
		Surveyor
		Unskilled Labor
		Skilled Labor
activities		
Obstacles and Comments		
Save	<a href="#">upload photos</a>	Engineer name

# Chapter 5: Model development

Conceptual model for the proposed grants management System will be developed in the scope of this chapter. The proposed system is a web-based grant management system. It will support all grants life cycle activities; the proposed system is to be used to facilitate information and documents sharing throughout the grant life cycle stages.

The modeling of the construction process into an information model is an arduous, yet necessary procedure. The experimentation with information management systems that are based on information models is expected to provide valuable knowledge about their feasibility and contribution to efficient construction management, even if only a part of the construction process has been modeled. Due to the large amount of information generated and exchanged throughout the construction process, modeling the whole construction process into a model would go beyond the scope of this work. The scope of this research is focusing on the management of the life cycle of the projects from managerial view, which includes the approval of the projects, allocating the budgets, and the procurement process. Also the financial process will be appeared in the system to show the disbursement amounts of the budgets for each project.

A survey was conducted prior to the model development within the Palestine construction industry with semi-structured interview outlining the current information, management practices in the construction industry, observed particular deficiencies, and identified the user needs and requirements of an efficient web-based information management system. The construction implementation agencies that participated in the survey agreed that the efficient communication among project participants constitutes a vital element for project success. However, the construction industry is not well acquainted to and does not widely use advanced information management systems and this is partly due to the limited efficiency and reliability of existing approaches and systems, which have not provided a clear cost-effectiveness potential indication. According to the practitioners, an effective information management system should mainly include information about project planning, activity execution and project progress, allocations, procurement and inventory management, and construction company information.

The development of the proposed system involved two types of analyses, project information analysis, which identifies the type of information that will be stored in the database and project

organizational analysis, which determines the end users of the system along with their particular information needs and responsibilities. The large amount and wide dissimilarity of the information circulated in the construction process make arduous the task of information analysis. As a starting point, the work presented in this thesis has identified information that is considered as the most significant for construction monitoring, which is an important element of efficient construction management. Such information concerns projects, construction sites, activity progress, problems encountered, financial payments, procurement cycle etc. In the direction of establishing the end users of the system, the typical stockholders organizational structure was sketched and the personnel employed by third party or involved in a project were determined. External strategic project participants were further identified.

## **5.1 The proposed system design**

In systems design the design functions and operations are described in detail, including screen layouts, business rules, process diagrams and other documentation. The output of this stage will describe the new system as a collection of modules or subsystems. The design stage takes as its initial input the requirements identified in the approved requirements document. For each requirement, a set of one or more design elements as produced as a result of interviews, and document revisions. Design elements describe the desired system features in detail, and generally include functional hierarchy diagrams, screen layout diagrams, tables of rules, process diagrams, and a complete entity-relationship. These design elements are intended to describe the system in sufficient detail, such that skilled developers and engineers may develop and deliver the system with minimal additional input design.

Several research efforts have dealt with the use of IT for improving the efficiency of the construction process. Among various recent enhancements, it is believed that more emphasis should be given to information modeling in order for information management system to be reliable. Information modeling is the procedure of developing an information model, which is an abstract yet formal representation of entities in data, including their properties, relationships and the operations that can be performed on them. The main driving force behind the development of an information model is to provide formalism to the description of a problem domain without

constraining how the description is mapped to an actual implementation in particular software (Chassiakos and Sakellaropoulos, 2008).

The proposed system will be a working environment of electronic web based system on the internet network, which allows a group of users to login with a username and password to add input and getting output as a report related to the projects they working on. Any user can login into the system and only need a computer or tablet device with an internet connection in addition his authentication information. The rules of each user differ according to his position and administrative degree in the institution.

## 5.2 System interfaces

The topic of Interfaces is at the heart of the multi-disciplinary nature of Systems Engineering. This area covers what is necessary in order to connect the individual pieces of the System together into a working System. To accomplish the connection the relevant properties and behavior of each part of the System must be specified. It is also necessary to specify the particular connections between each part and the nature of those connections in terms of limitations, protocols, and various operational conditions or scenarios (Fosse and Del, 2012).

The following sections will demonstrate in details the model of the web-based system for grants management, as all the analysis conducted in the previous chapter the result of this analysis will be illustrated bellow:

### 5.2.1 System login

The first interface of the system is a login page which requires a username and password from each user to enter the system Figure 19: **System login page**.



The screenshot shows the login interface for the 'GRANTS MANAGEMENT Web based system'. At the top, there is a logo of three stylized figures and the text 'GRANTS MANAGEMENT Web based system'. Below this is a horizontal navigation bar with four tabs: 'Donor', 'Donor Representative', 'Implementing Agency', and 'Contractor'. The main content area contains a login form with two input fields: 'User Name' and 'Password', and a 'Login' button.

Figure 19: System login page

The registration of external user is not allowed, each user can get his user name and password from the system administrator from the donor representative which act the administrator role.

## **5.2.2 Website interface**

The web application interface is divided into four sections; each section will be a portal for a group of users from the stakeholders. The sections related to, donor, donor representative, implementing agency, and contractor. The privileges of the system prevent each user to access the other users pages for editing or previewing information. The following paragraphs will explore in details each section and the functions of the system which can make through.

## **5.2.3 Donor representative portal**

The donor representative page has a sub menu for all functions and report required by the D.R. which include (Programs – Packages – Allocations – Projects list – IA – Projects)

### ***5.2.3.1 Donor representative / programs***

The first tap is (programs) which show all programs summaries as shown in Figure 20 If there is more than one program in progress they will be listed below the first one. This tab contains a sub menu for adding and editing programs, these links will be used in case of adding new program or grant to the system or editing the information of existing grant.

Donor	Donor Representative	Implementing Agency	Contractor
<a href="#">Programs</a>   <a href="#">Packages</a>   <a href="#">Allocations</a>   <a href="#">Projects list</a>   <a href="#">IA</a>   <a href="#">Projects</a>			
<a href="#">New Program</a> <a href="#">Edit Program</a>		<input type="text" value="Search"/>	
<b>Program name / Grant:</b> Gaza reconstruction Program		<b>Status:</b> Ongoing	
Donor: برنامج دول مجلس التعاون لإعادة إعمار غزة Grant Code: GCC-xxxx Start date: 01/01/2010 م End date: 05/01/2015 م Total Budget: 1,400,000,000 \$ Approved Budget: 287,000,000 \$ Packages: 5		Allocated budget Un allocated budget No. of projects Completed Projects Ongoing Projects Payments to date:	
		Save  Delete	
<b>New Program</b>		<b>Status:</b>	
Donor: <input type="text"/> Grant Code: <input type="text"/> Start date: <input type="text"/> End date: <input type="text"/> Total Budget: <input type="text"/> Approved Budget: <input type="text"/> Packages: <input type="text"/>		Allocated budget: <input type="text"/> Un allocated budget: <input type="text"/> No. of projects: <input type="text"/> Completed Projects: <input type="text"/> Ongoing Projects: <input type="text"/> Payments to date: <input type="text"/>	
		Save  Delete	

Figure 20 Donor representative page (programs tab)

The user can preview the programs status and information from this page and he can add a new program to the system from the next page as we will explain later, Figure 22.

### 5.2.3.2 Donor representative / Packages

Each program or grant have many packages which is an additional financing for the same grant, each package is a new amount of money added to the program to start implementing projects and sub-projects. From the packages tab Figure 21 the user can list all the packages within one grant and show the total allocated budget for each and the total disbursement amount as a general report other information for each package also will be appear in this page. Also from the same page the user can preview the grants sectors and the allocated and unallocated budget from each sector, in this way the donor and donor representative can evaluate the progress of each sector in case of allocations and which sectors still un defined or did not received a proposals.

Donor Donor Representative Implementing Agency Contractor

Programs | Packages | Allocatios | Projects list | IA | Projects

New Package Edit Package Search

Program name / Grant: Gaza reconstruction Program Status: Ongoing

Donor: برنامج دول مجلس التعاون لإعادة إعمار غزة  
 Grant Code: GCC-xxxx  
 Start date: 01/01/2010 م  
 End date: 05/01/2015 م  
 Total Budget: 1,400,000,000 \$  
 Approved Budget: 287,000,000 \$  
 Packages: 5

Allocated budget  
 Un allocated budget  
 No. of projects  
 Completed Projects  
 Ongoing Projects  
 Payments to date:

Program name / Grant: Gaza reconstruction Program

Package No.	Allocated Budget (M\$)	Disbursement	Remaining	Activation date	No. of Projects
Package No.1 :	30	26.7	3.3	July 2010	
Package No.2 :	50	33.3	16.7	Jan 2011	
Package No.3 :	67.2	18.7	48.5	Aug 2011	
Package No.4 :	80	13.7	66.3	Dec 2011	
Package No.5 :	60	0.94	59.06	Mar 2012	
Total	287.2 USD	93.34	193.86		

Sectors

Sector	Allocated Budget (M\$)	Percentage %
الإسكان	76.1	26%
التعليم	50.4	18%
الزراعة	14.3	5%
الصحة	47.7	17%
البلديات والأشغال العامة	35.4	12%
المياه والصرف الصحي	19.8	7%
الصناعة	3.0	1%
الكهرباء	13.3	5%
الاجتماعي والتنمية البشرية	15	5%
الدراسات والدعم الفني	1.1	0%
الاختياطي	11.2	4%
Total	287.2 USD	100%

Figure 21 Packages page in donor representative portal

### 5.2.3.3 Donor representative / Packages / Add new program

This tab is a page from which the D.R. can adding a new grant to the system, as shown in Figure 22 the user have to add all new grant information to be defined and valid on the system for the others to start working on, firstly the name of the new grant, the total budget of the grant, the grant code and deadline dates have to be added then the donors, some grants may be a multi-donors programs so each donor name and budget have to entered separately. Sometimes the programs have bound by sectors as a requirement of donors form the beginning of the grant



definition, so the sectors will be filled and the amount of each sector from the total budget of the grant amount. The user can add a new field to the donor list also for the sector list from a pre-defined lists added by the system administrator. Edit program button on the sub-menu will allow the D.R. staff to enter at any time and redefine the input data for any modifications and changes required for any field.

The screenshot shows the 'Add New Program' form in the Donor Representative page. The form is organized into several sections:

- Program name / Grant:** A text input field with the placeholder 'Add Program Name'.
- Donor:** A text input field with the placeholder 'Add Donor Name'.
- Grant Code:** A text input field with the placeholder 'Add Program Code'.
- Start date:** A date input field with the placeholder 'Add Strat Date'.
- End date:** A date input field with the placeholder 'Add End date'.
- Total Budget:** A text input field with the placeholder 'Add total grand budget'.
- Approved Budget:** A text input field with the placeholder 'Add total Approved budget'.

Below these fields is a section titled 'For Multi Donors Programs' which contains six rows, each with a 'Donor' text input field and a 'Total Budget' text input field, both with placeholder text. At the bottom right of this section is a '+ Add donors' button.

The final section is 'Sectors Allocation', which contains two rows, each with a 'Sector' text input field and a 'Sector Amount' text input field, both with placeholder text. At the bottom right of this section is a '+ Add Sectors' button.

Figure 22 adding new program in donor representative page

### 5.2.3.4 Donor representative / Packages / Add new package

In this page the users can add a new package to any program Figure 23 and defining all the required data like, package number, budget, and sectors.

The screenshot shows a web interface for adding a new package. At the top, there are navigation tabs: Donor, Donor Representative (active), Implementing Agency, and Contractor. Below these are sub-tabs: Programs, Packages (active), Allocatios, Projects list, IA, and Projects. A search bar is present. The main content area is titled 'Add New Package' and contains the following sections:

- Program name / Grant:** Gaza reconstruction Program (with a 'Chose Program' button).
- Add New Package:** A form with five input fields: Donor (Add Donor Name), Package Code (Add Package Code), Start date (Add Strat Date), End date (Add End date), and Total Budget (Add total grand budget).
- For Multi Donors Programs:** A table with six rows, each containing a Donor (Add Donor Name) and Total Budget (Add total grand budget) input field. A '+ Add donors' button is at the bottom right.
- Sectors Allocation:** A form with two rows, each containing a Sector (Add Sector) and Sector Amount (Add Sector) input field. A '+ Add Sectors' button is at the bottom right.

Figure 23 adding new package to the grant in donor representative portal

### 5.2.3.5 Donor representative / Allocation / add allocation

This is an important tab in the system Figure 24 which can be access only from the donor representative general manager to allocate budges for each implementing agency. The amount of fund for each agency and the allocation mechanism is a process beyond our scope of research, so

we also take the allocation amount to be the main input as budget for each agency. The upper part of this page preview the main information stored in the system which entered in the earlier stage of defining grants on the system, the left hand side list a small status description which generated automatically by the system and contains the total allocated budget from the allover grand or package to implementing agencies and the remaining unallocated, this numbers give the donor and donor representative at the earlier stage of money allocation a fast perspective on the progress of allocations.

The donor representative user can start entering I.A. names and adding the amount of allocation and the package number, the start adding sectors for each agency. After saving this page each implementing agency can login to its portal and start adding projects Figure 33 and interacting with the system as we will see later.

Donor	Donor Representative	Implementing Agency	Contractor
<a href="#">Programs</a>   <a href="#">Packages</a>   <a href="#">Allocations</a>   <a href="#">Projects list</a>   <a href="#">IA</a>   <a href="#">Projects</a>			
<a href="#">Add Allocations</a>   <a href="#">New Allocation</a>   <a href="#">Edit Allocations</a>   <a href="#">Allocations List</a> <input type="text" value="Search"/>			
<b>Program name / Grant:</b> Gaza reconstruction Program		<b>Status:</b> Ongoing	
Donor: برنامج دول مجلس التعاون لإعادة إعمار غزة Grant Code: GCC-xxxx Start date: 01/01/2010 م End date: 05/01/2015 م Total Budget: 1,400,000,000 \$ Approved Budget: 287,000,000 \$ Packages: 5		Allocated budget Un allocated budget No. of projects Completed Projects Ongoing Projects Payments to date:	
Package No.: <input type="text" value="4"/>		Total Package Allocated: 10,000,000 \$	
Total Package Amount: 80,000,000 \$		Total Package Unallocated: 70,000,000 \$	
<b>Implementing Agency Name</b> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	<b>Allocated budget</b> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	<b>Package No.</b> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	<b>Sectors</b> <input type="button" value="+ Add Sectors"/> <input type="button" value="+ Add Sectors"/> <input type="button" value="+ Add Sectors"/> <input type="button" value="+ Add Sectors"/>
<input type="button" value="+ Add Allocation"/>			
<b>Implementing Agency Name</b> <input type="text"/>	<b>Allocated budget</b> <input type="text"/>	<b>Package No.</b> <input type="text"/>	
<b>Sector Name</b> <input type="text"/> <input type="text"/>	<b>Budget</b> <input type="text"/> <input type="text"/>	<input type="button" value="+ Add sector"/>	

Figure 24: Defining allocation to implementing agency

#### 5.2.3.6 Donor representative / Allocation / add new allocation

This page will be used from the D.R. general manager in case of adding additional amount of fund from a new package to any implementing agency, the same process as the adding first amount of money will be done then save the form.

Donor	Donor Representative	Implementing Agency	Contractor
Programs   Packages   <b>Allocations</b>   Projects list   IA   Projects			
Add Allocations          New Allocation          Edit Allocations          Allocations List <input type="text" value="Search"/>			
Program name / Grant: Gaza reconstruction Program		Status: Ongoing	
Donor: برنامج دول مجلس التعاون لإعادة إعمار غزة Grant Code: GCC-xxxx Start date: 01/01/2010 م End date: 05/01/2015 م Total Budget: 1,400,000,000 \$ Approved Budget: 287,000,000 \$ Packages: 5		Allocated budget Un allocated budget No. of projects Completed Projects Ongoing Projects Payments to date:	
Implementing Agency Name <input type="text"/>			
Allocated budget <input type="text"/>		Package No. <input type="text"/>	
Add New Allocation			
Package No.: <input type="text"/>		Amount: <input type="text"/>	
Sector Name <input type="text"/>		Budget <input type="text"/>	
<input type="text"/>		<input type="text"/>	
<input type="text"/>		<input type="text"/>	
		Save  Delete	

Figure 25: Adding additional allocation from a new package to implementing agency

### 5.2.3.7 Donor representative / Allocation / allocation list

The allocation list tab will display all implementing agencies names and allocations, and all related information as a summary report about the allocations distribution, also the number of projects send from the I.A. will be displayed in the same table. The allocated and un allocated budget columns here is different from the allocations in the status bar, in these columns the system will calculate automatically the amounts of budgets where allocated by I.A. to a specific projects names as a total estimation cost and the un allocated referring to the remaining and still

under processing without defining projects from the I.A. specific allocation. These columns are a requirement by D.R. staff to evaluate the I.A. capacity to preparing the projects lists and proposal in a specific time.

The last column of the table is a notification filed, which will display any notification for .D.R regarding receiving proposal or any documents for tendering and awarding for any project, this notification enables the user to access any project to finalize any pending issues quickly.

Donor	Donor Representative	Implementing Agency	Contractor			
<a href="#">Programs</a>   <a href="#">Packages</a>   <a href="#">Allocations</a>   <a href="#">Projects list</a>   <a href="#">IA</a>   <a href="#">Projects</a>						
<a href="#">Add Allocations</a> <a href="#">New Allocation</a> <a href="#">Edit Allocations</a> <a href="#">Allocations List</a> <input type="text" value="Search"/>						
Program name / Grant: Gaza reconstruction Program			Status: Ongoing			
Donor: برنامج دول مجلس التعاون لإعادة إعمار غزة Grant Code: GCC-xxxx Start date: 01/01/2010 م End date: 05/01/2015 م Total Budget: 1,400,000,000 \$ Approved Budget: 287,000,000 \$ Packages: 5			Allocated budget Un allocated budget No. of projects Completed Projects Ongoing Projects Payments to date:			
IA name	Total IA budget	Package	No. of projects	Allocated	Unallocated	Notifications
Total						

Figure 26 list of all allocation in the donor representative portal

### 5.2.3.8 Donor representative / Project list

This is the main page of the projects Figure 27, which enables system users to deal with any project on the system, the projects can be filtered by IA, status, sector and packages. From this page the user can print any project list or all projects also can see the status for projects tracking, also can search a specific project by adding project name or part of the name in the search field. At the first stage of the grant no all the information are needed in the list such as contractor column which not be allowable before awarding the contract, so the user can customize this list and add or remove any field to the table Figure 28 .

Donor	Donor Representative	Implementing Agency	Contractor				
Programs   Packages   Allocatios   <b>Projects list</b>   IA   Projects							
Projects Filter All projects By IA By Status By Sector By Backage <input type="text" value="Search"/>							
Customize report							
IA name	Project Name	Es. Cost	Project Code	Status	Sector	Package	Notifications
Total							

Figure 27: list of all projects in the donor representative page

**Customize report**

Received for tender No objection to tender date Invetation to tender date Opening date Recived to award No objection to award Contractor No. offers sent No. offers recived Contract amount Remaining Budget Project Duration Project Planed start date Project actual Start Date Planned finsh date Handing over date Actual finsh date No. of beneficiaries Payment No. Payment recived date Payment amount Total disbursement Total remaining	▶▶ ◀◀	IA name Project name Project allocation Estimated Cost Project Code Status Sector Package
--	----------	--

Figure 28 customizing the project list table page

**5.2.3.9 Donor representative / IA**

This page related to implementing agency in the donor representative portal, the system users can preview any information related to any I.A., by searching the name or choosing from drop down menu all the information will appear like the packages which I.A. working on and all the projects and their information.



Donor
Donor Representative
Implementing Agency
Contractor

[Programs](#) | [Packages](#) | [Allocatios](#) | [Projects list](#) | [IA](#) | [Projects](#)

Implementing Agency Name

Implementing Agency Description

Allocated budget

Allocated budget

Allocated budget

Package No.

Package No.

Package No.

Projects list

Project Name	Es. Cost	Project Code	Status	Sector	Package	Approval

Figure 29: Implementing agency tab in donor representative portal

### 5.2.3.10 Donor representative / Projects / proposal

The projects tab dealing with all process related to each projects and sub-projects in case of proposal, tendering awarding and implementation process. Each tap in the upper of the page has a small notification circle which can flash automatically when the system received any modification in any project page or any new interaction from any I.A. in any phase which needs approval and review. The first link in this sub-menu related to proposals. The notification bar will show any proposal send by any I.A. which need review and approval. This page will show the list of projects which sent from I.A. and need an approval for proposal, not all project information needed to be appear in the columns on this table at this step so the important information have been adapted and configured.

The next part of the page allow the system user to choose a project for proposal to start working on, the user can download all related files which uploaded by I.A., review and write comments if any in the notes text box, then press on send notes button to send the notes to the I.A., after that this notes will appear as a notification in I.A. portal to be deal with and resend the revised version. By receiving the final modified proposal, the area engineer make an electronic approval, then a general manager make an approval and press the send approval button which result an approval letter generated automatically by the system in the I.A. page.

Donor Donor Representative Implementing Agency Contractor

Programs | Packages | Allocatios | Projects list | IA | Projects

Proposal<sup>3</sup> | Tendering<sup>3</sup> | Awarding<sup>5</sup> | Implementation<sup>10</sup>

List of projects waiting for proposal approval

IA name	Project Name	Es. Cost	Project Code	Status	Sector	Package

Choose Project for proposal approval or comment

I.A. name:  Project name:

Projects Proposals approval

Project name:  Code:

Project proposal

Notes on project proposal

Projects proposal approval

by sending approval: status of project changes from (Waiting for proposal approval) to (Pending in implementing agency)

Figure 30: projects proposal page in donor representative portal

### 5.2.3.11 Donor representative / Projects / Tendering

This page Figure 31 display the list of projects which received from I.A. and need a no objection to tender, the donor representative have to prepare a bidding documents and filling the projects information and send them for approval, after that a notification will appear in this page for the D.R. to start downloading all documents and making a review. If there are any comments on the bidding documents the D.R. write the comments in the comments text box and send them to the I.A. to take action and make modifications. All the project information will appear in this page like duration, Planned start date, Planned finished date and project description. This page also will save the dates of approval of each document like drawings, bidding documents and bill of quantities. The dates of notes and modifications and the notes text will save in the database as a project log for better tracking of the project lifecycle. Before issuing the letter of no-objection to tender the documents have to be approved from area engineer, procurement department, and finally by the general manager, after that the I.A. will receive a notification as an approval letter to start tendering process and invitation to tender.

The system user also can display all the projects in tendering for tracking of bid opening dates and participating in bid opening meeting if need. This list displays only the needed information at this step which is invitation to tender date and bid opening date. If any other information needed, the user can go to another place in the system.



The screenshot shows a web application interface. At the top, there is a dark red navigation bar with the following items: Programs | Packages | Allocatios | Projects list | IA | Projects. Below this is a teal navigation bar with the following items: Proposal<sup>3</sup> | Tendering<sup>3</sup> | Awarding<sup>5</sup> | Implementation<sup>10</sup>. Below the navigation bars, the text "List of projects in tendering" is displayed. Underneath, there is a table with the following columns: IA name, Project Name, Es. Cost, Project Code, invetation to tender, and Bid opining date. The table body contains two empty rows, represented by light blue bars.

Figure 31: List of projects in tendering process

List of projects waiting for no objection to tender

IA name	Project Name	Es. Cost	Project Code	Status	Sector	Package	Package

Choose Project for revision of bidding documents

I.A. name:  Project name:

Project Name <input type="text"/> Es. Cost <input type="text"/> Project Code <input type="text"/> Sector <input type="text"/> Package <input type="text"/>	Status <input type="text"/> Approval Date <input type="text"/> Proposal Submission Date <input type="text"/> No-objection to tender date <input type="text"/>
--	--

Project description   	<table border="1"> <thead> <tr> <th>Approval Dates</th> <th colspan="2">Project Files Download</th> </tr> </thead> <tbody> <tr> <td><input type="text"/></td> <td><input type="button" value="Download"/></td> <td><input type="button" value="Approve"/></td> <td><a href="#">Biddind Documents</a></td> </tr> <tr> <td><input type="text"/></td> <td><input type="button" value="Download"/></td> <td><input type="button" value="Approve"/></td> <td><a href="#">Priced Bill of Quantities</a></td> </tr> <tr> <td><input type="text"/></td> <td><input type="button" value="Download"/></td> <td><input type="button" value="Approve"/></td> <td><a href="#">Drawings</a></td> </tr> <tr> <td><input type="text"/></td> <td><input type="button" value="Download"/></td> <td><input type="button" value="Approve"/></td> <td><a href="#">Others</a></td> </tr> </tbody> </table>	Approval Dates	Project Files Download		<input type="text"/>	<input type="button" value="Download"/>	<input type="button" value="Approve"/>	<a href="#">Biddind Documents</a>	<input type="text"/>	<input type="button" value="Download"/>	<input type="button" value="Approve"/>	<a href="#">Priced Bill of Quantities</a>	<input type="text"/>	<input type="button" value="Download"/>	<input type="button" value="Approve"/>	<a href="#">Drawings</a>	<input type="text"/>	<input type="button" value="Download"/>	<input type="button" value="Approve"/>	<a href="#">Others</a>
Approval Dates	Project Files Download																			
<input type="text"/>	<input type="button" value="Download"/>	<input type="button" value="Approve"/>	<a href="#">Biddind Documents</a>																	
<input type="text"/>	<input type="button" value="Download"/>	<input type="button" value="Approve"/>	<a href="#">Priced Bill of Quantities</a>																	
<input type="text"/>	<input type="button" value="Download"/>	<input type="button" value="Approve"/>	<a href="#">Drawings</a>																	
<input type="text"/>	<input type="button" value="Download"/>	<input type="button" value="Approve"/>	<a href="#">Others</a>																	

Planed Start Date:  Planed Finish Date:  Planned Duration:

Notes on tender documents  
Date

by sending approval: status of project changes from (Pending in implementing agency) to (PIA-notes)

No-objection to tender	<input type="button" value="Area Engineer Approval"/>	<input type="button" value="Procurement Approval"/>	<input type="button" value="GM Approval"/>	<input type="button" value="Send no objection"/>
	<input type="text" value="Date"/>	<input type="text" value="Date"/>	<input type="text" value="Date"/>	<input type="text" value="Date"/>

Figure 32: tendering projects page in donor representative portal

## 5.2.4 Implementing agency portal

### 5.2.4.1 Implementing agency / Home

This portal is an implementing agency side in the system which can access as described before with a username and password to start adding input and taking output from the system. This portal has an upper menu which facilitates the reach of all information and reports needed which is divided into (Home, project proposal, projects status, tendering, awarding, and implementation). At the home page the I.A. will see a summary about all programs he is working on, all the grant or program information will show at this page also a small status description about number of projects and ongoing projects with payments amounts.

Donor	Donor Representative	Implementing Agency	Contractor
Home   Project proposal   Projects Status   Tendering   Awarding   Implementation			
Program name / Grant: <input type="text" value="Gaza reconstruction Program"/>		Package No.: <input type="text"/>	
Implementing Agency Name: <input type="text"/>		Approved budget: <input type="text" value="1,000,000"/>	
Start date: <input type="text" value="01/01/2010 م"/>		Allocated budget: <input type="text"/>	
End date: <input type="text" value="05/01/2015 م"/>		<input type="text"/>	
Donor: برنامج دول مجلس التعاون لإعادة إعمار غزة			
Sectors		Status: Ongoing	
Sector: <input type="text"/>	Sector Amount: <input type="text"/>	No. of projects: <input type="text"/>	Completed Projects: <input type="text"/>
Sector: <input type="text"/>	Sector Amount: <input type="text"/>	Ongoing Projects: <input type="text"/>	Payments to date: <input type="text"/>
Sector: <input type="text"/>	Sector Amount: <input type="text"/>		
Sector: <input type="text"/>	Sector Amount: <input type="text"/>		

Figure 33: Home page in implementing agency portal

### 5.2.4.2 Implementing Agency / Project proposal

The first interaction between the I.A. and the system is adding the project proposal or concept paper, the proposal will be added as a soft copy file which will be attached to the system without any entering the data to any forms, the D.R. will be able to download these files to view and comment before approval. The I.A. has to start adding the projects or sub-projects names and

the estimated cost for each project also he has to define the sector for each sub-project to be with the sector allocation from the donor. The system will restrict the users from adding projects with a budget or a sector amount greater than the total allocated by displaying a pop up message with this error.

By adding and sending the proposal the project status recorded in the system as (waiting for proposal approval). Proposal notes send by D.R. also recorded in the system for tracking purposes after the revision and adding notes on proposal by D.R. The I.A. user can preview these notes, made amendments and then resend the modified proposal another time for final approval.

Implementing Agency Name

Program name / Grant:

Package No.:

Approved budget:

Allocated budget

Unallocated budget

### Sectors

Sector:  Amount:  Allocated  Unallocated

Sector:  Amount:  Allocated  Unallocated

### Add Project list

Project Name	Es. Cost	Project Code	Status	Sector	Package	Notes on proposal	Approval
--------------	----------	--------------	--------	--------	---------	-------------------	----------

Total

[+ Add project](#) [Save](#) [Send for approval](#) [Edit list](#) [Delete](#)

### Projects Proposals Upload

Project name:

Code:

Project proposal

By adding project list project status will be ( Waiting for proposal approval )

### D•R. notes on proposal

Project name:



Figure 34: Project proposal page in implementing agency portal

### 5.2.4.3 Implementing agency / Project status

Each I.A. can list all projects they working on at any time during the grant life cycle, all projects and sub-projects information and main tracking dates can be added to the list and then printed on a paper form.

Donor
Donor Representative
Implementing Agency
Contractor

Home
Project proposal
Projects Status
Tendering
Awarding
Implementation

Implementing Agency Name

Program name / Grant:

Project name:  Code:

Project Name	Es. Cost	Project Code	Sector	Package	Status
<b>Total</b>					

**Customize report**

Send proposal for approval date

Proposal notes date

Proposal notes dateapproval date

submitting bid doc. date

Bid Doc. notes date

**No objection to tender date**

Invetation to tender date

Opening date

Send award. Doc. for approval date

Award. doc. notes date

No. offers sent

No. offers recived

No objection to award

Contractor

Contract amount

Remaining budget

Project duration

Project planed ptart date

Project actual start date

Planned fvinshed date

Handing over date

Actual finsh date

No. of beneficiaries

Payment No.

Payment recived date

Payment amount

Total disbursement

Total remaining

»»
««

IA name

Project name

Project allocation

Estimated cost

Project code

Status

Sector

Package

Figure 35: Project status page in implementing agency portal



#### 5.2.4.4 Implementing agency / tendering

Each information and comments send from D.R. to I.A. can be recorded on a system and appear as a notification on the sub-menu, a small number will appear behind each item in the sub-menu to display the number of projects need interaction from the I.A. users. The tendering main menu will divided the tendering projects on three main categories on a different list to facilitate the projects tracking and interaction. First list Figure 37 will display the approved projects ready to start preparation of tendering documents, these projects are approved by the donor and ready to start adding bidding documents to get no-objection to tender, the user can choose any project from this list and start adding BoQ and upload the bidding documents and any other related documents Figure 38. The second list in Figure 37 preview the list of projects which ready to tender these projects have getting a no-objection to tender from the D.R. and their documents are approved and ready for invitation to tender, the next action of these projects are appear in Figure 39 which need interaction from the user only to add the issuing bidding document date and opening date to change the project status from (binding in bidding) to (tendering). The last list in Figure 37 is the tendering projects which is the projects in tendering process within the tendering duration which vary according the procurement manuals from each institution to another and varies from one week to one month (the tendering duration is a duration between issuing building documents for the bidder to prepare their bids and finished at the bid opening day). Through this duration the I.A. user can access to tendering projects page Figure 40 to add the contractors which participate in each project to be ready for bid opening data.

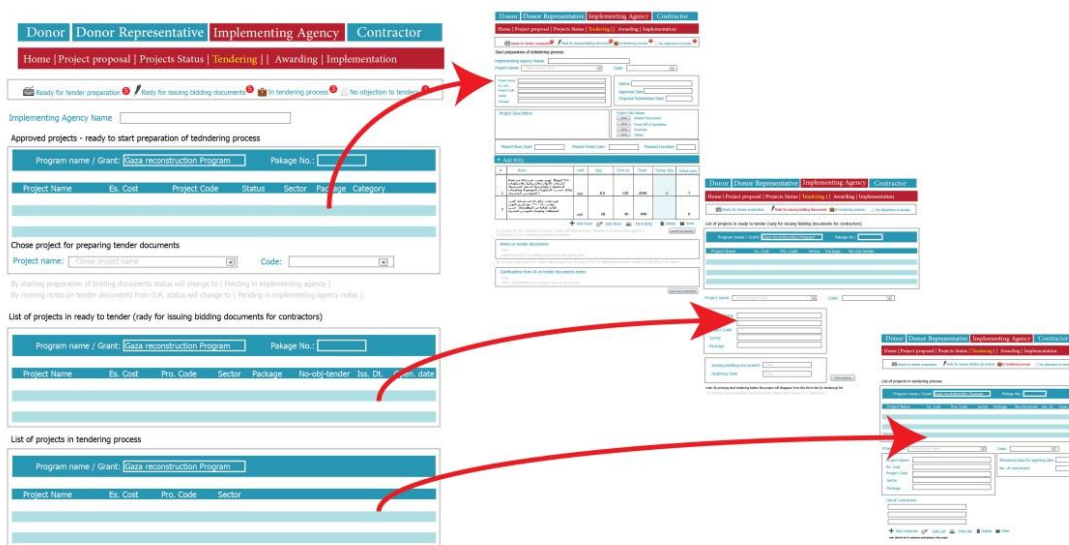


Figure 36: tracking tendering projects process in the system

Ready for tender preparation <sup>5</sup>
 Ready for issuing bidding documents <sup>5</sup>
 In tendering process <sup>3</sup>
 No objection to tenders <sup>1</sup>

Implementing Agency Name

Approved projects - ready to start preparation of tendering process

Program name / Grant:  Package No.:

Project Name	Es. Cost	Project Code	Status	Sector	Package	Category

Choose project for preparing tender documents

Project name:  Code:

By starting preparation of bidding documents status will change to ( Pending in implementing agency )

By receiving notes on tender documents from D.R. status will change to ( Pending in implementing agency notes )

List of projects in ready to tender (ready for issuing bidding documents for contractors)

Program name / Grant:  Package No.:

Project Name	Es. Cost	Pro. Code	Sector	Package	No-obj-tender	Iss. Dt.	Open. date

List of projects in tendering process

Program name / Grant:

Project Name	Es. Cost	Pro. Code	Sector

Figure 37: Tendering project page

Ready for tender preparation <sup>5</sup>
 Ready for issuing bidding documents <sup>5</sup>
 In tendering process <sup>3</sup>
 No objections to tender <sup>1</sup>

Start preparation of tendering process

Implementing Agency Name

Project name:  Code:

Project Name <input type="text"/>	Status <input type="text"/>
Es. Cost <input type="text"/>	Approval Date <input type="text"/>
Project Code <input type="text"/>	Proposal Submission Date <input type="text"/>
Sector <input type="text"/>	
Package <input type="text"/>	

Project Description

Project Files Upload

Biddind Documents  
 Priced Bill of Quantities  
 Drawings  
 Others

Planned Start Date:  Planned Finish Date:  Planned Duration:

+ Add BOQ

#	Item	Unit	Qty	Unit pr.	Total	Today Qty	Total com.
1	٢٥٠ لزوم B توريد وصب خرسانة مسلحة كشقات الابواب والشبابيك والديكورات الداخلية ( والخارجية أسفل الشبابيك وذلك حسب الديكورات الموجودة وتعليمات المهندس المشرف )	m3	8.5	120	2040	2	7
2	توريد وصب ديكور خارجي مسلح قوس مقاس ١٤٠-١٦٠ مع تكسير القوس القائم وازالته من الموقع وذلك حسب المخططات وتعليمات المهندس المشرف	m3	28	30	840		0

[+ Add Item](#)
[Edit Item](#)
[Print BOQ](#)
[Delete](#)
[Save](#)

By sending for No. objection to tender status will change from ( Pending in implementing agency ) to (Pending in D.R. in bidding documents revision).

[Send for No objection](#)

Notes on tender documents

Date  
Notes from D.R. on bidding documents will appear here

By reciving notes from D.R status will change from (Pending in D.R. in bidding documents revision) to (Pending in IA notes)

Clarifications from IA on tender documents notes

Date  
write clarifications and changes made on documents

[Send notes modifications](#)

Figure 38: the projects ready for tender preparation (which get no objection to tender)

Ready for tender preparation Ready for issuing bidding documents In tendering process No objections to tender

List of projects in ready to tender (ready for issuing bidding documents for contractors)

Program name / Grant: <input type="text" value="Gaza reconstruction Program"/>		Package No.: <input type="text"/>			
Project Name	Es. Cost	Pro. Code	Sector	Package	No-obj-tender

Project name:  Code:

Project Name	<input type="text"/>
Es. Cost	<input type="text"/>
Project Code	<input type="text"/>
Sector	<input type="text"/>
Package	<input type="text"/>

Issuing bidding documents	<input type="text" value="Date"/>
Oppining Date	<input type="text" value="Date"/>

note: By pressing start tendering button the project will disappear from this list to the (In tendering) list  
By adding issuing bidding documents date status will change to ( Tendering )

Figure 39: The projects ready to issuing building documents



Ready for tender preparation



Rady for issuing bidding documents



In tendering process



No objections to tender

## List of projects in tendering process

Program name / Grant: <input type="text" value="Gaza reconstruction Program"/>		Package No.: <input type="text"/>					
Project Name	Es. Cost	Pro. Code	Sector	Package	No-obj-tender	Iss. Dt.	Open. date

Project name: Code: 

Project Name	<input type="text"/>
Es. Cost	<input type="text"/>
Project Code	<input type="text"/>
Sector	<input type="text"/>
Package	<input type="text"/>

Remaining days for opping date	<input type="text"/>
No. of contractors	<input type="text"/>

## List of contractors

<input type="text"/>
<input type="text"/>
<input type="text"/>

Add cotractor
 Edit List
 Print list
 Delete
 Save

note: Add the list of contractors participating in this project

Figure 40: List of projects in tendering

**5.2.4.5 Implementing agency / Awarding**

The awarding process is the process start from the bid opening day and ending with the D.R. approval of evaluation report and issuing the no-objection to award to start the next phase which is the implementation. The awarding page Figure 41 has a three list of projects all of them considered to be in awarding process. The first list preview the projects which ready to awarding

process which is the projects that reach the opening date, each of these projects can be reached by click on the project name to start adding the opening information like, number of contractors, bid opening committee, each contractor amount, notes and other information in Figure 42. The next list is the projects in the bid evaluation process which also considered in awarding process within I.A., at this stage the system user can add the price comparison sheet on the pre-entered bill of quantity for all the bidders and made the arithmetic corrections to get the lowest bidder. The system user also have to upload the bid evaluation report on a standard awarding form (which not part of our system) and send the project for D.R. for revision to get no-objection to award Figure 43.

Donor
Donor Representative
Implementing Agency
Contractor

Home
Project proposal
Projects Status
Tendering
Awarding
Implementation

Ready for awarding process
 In awarding within I.A.
 In awarding within D.R.
 No objections to award

Implementing Agency Name

List of projects ready to awarding process

Program name / Grant:

Project Name	Es. Cost	Project Code	Sector	Package	Opening date	No of tenders

List of projects in awarding within IA

Program name / Grant:

Project Name	Es. Cost	Project Code	Opping date

List of projects in awarding within DR

Program name / Grant:

Project Name	Es. Cost	Project Code	Sector	Package	Opping date	Sent to D.R. date

Figure 41: Awarding page in implementing agency portal

Donor Donor Representative Implementing Agency Contractor

Home | Project proposal | Projects Status | Tendering | **Awarding** | Implementation

Ready for awarding process In awarding within I.A. In awarding within D.R. No objections to award

Project name: Choose project name Code:

No objection to tender Issuing bidding documents Bid opening Modified Bid opening

Bids opening By I.A.

No. of contractors bid opening committee Name Position

Bid opening Sheet

Bid opening Sheet Contractor Amount Notes

Figure 42: bid opening sheet page (from the projects ready for awarding process page)

Donor Donor Representative Implementing Agency Contractor

Home | Project proposal | Projects Status | Tendering | **Awarding** | Implementation

Ready for awarding process In awarding within I.A. In awarding within D.R. No objections to award

Project name: Choose project name Code:

+ Price comparison sheet

#	Item	Unit	Qty	Es. Cost		Contractor ١		Contractor ٢		Contractor ٣	
				U.pr.	Total	U.pr.	Total	U.pr.	Total		
1	٢٥٠ لرومب٣ توريد وصب خرسانه مسلحة كمنصات الابواب والشبابيك والديكورات الداخلية ( والخارجية أسفل الشبابيك وذلك حسب الديكورات الموجودة وتعليمات المهندس المشرف )	m3	8.5	120	2040						
2	توريد وصب ديكور خارجي مسلح قوس مفاص ١٤٠ - ١٦٠ مع تكسير القوس القائم وارائه من الموقع وذلك حسب المخططات وتعليمات المهندس المشرف										

+ Add Contractor Edit Print sheet Delete Save

Awarded contractor Contractor name Contract amount amount

Upload evaluation report Sending evaluation report date Send to DR for approval

note: By pressing Send to DR for approval button the project will disappear from this list to the (In awarding within D.R.) list

notes on evaluation report from D.R. Notes date

Figure 43: bid evaluation report (from in awarding within I.A. page)

Donor

Donor Representative

Implementing Agency

Contractor

Home | Project proposal | Projects Status | Tendering | **Awarding** | Implementation



Ready for awarding process

In awarding within I.A.

In awarding within D.R.



No objections to award

List of projects getting no-objection to award

Program name / Grant:



Project Name	Es. Cost	Project Code	Sector	Package	No obj. aw.	Contractor	Amount
--------------	----------	--------------	--------	---------	-------------	------------	--------


Chose project for start implementation

Project name:

Code:

Planned Start Date:

Planned Finish Date:

Planned Duration:

Actual Start Date:

Actual Finish Date:

Actual Duration:



Save



Edit



Print acceptance letter



Print contract form

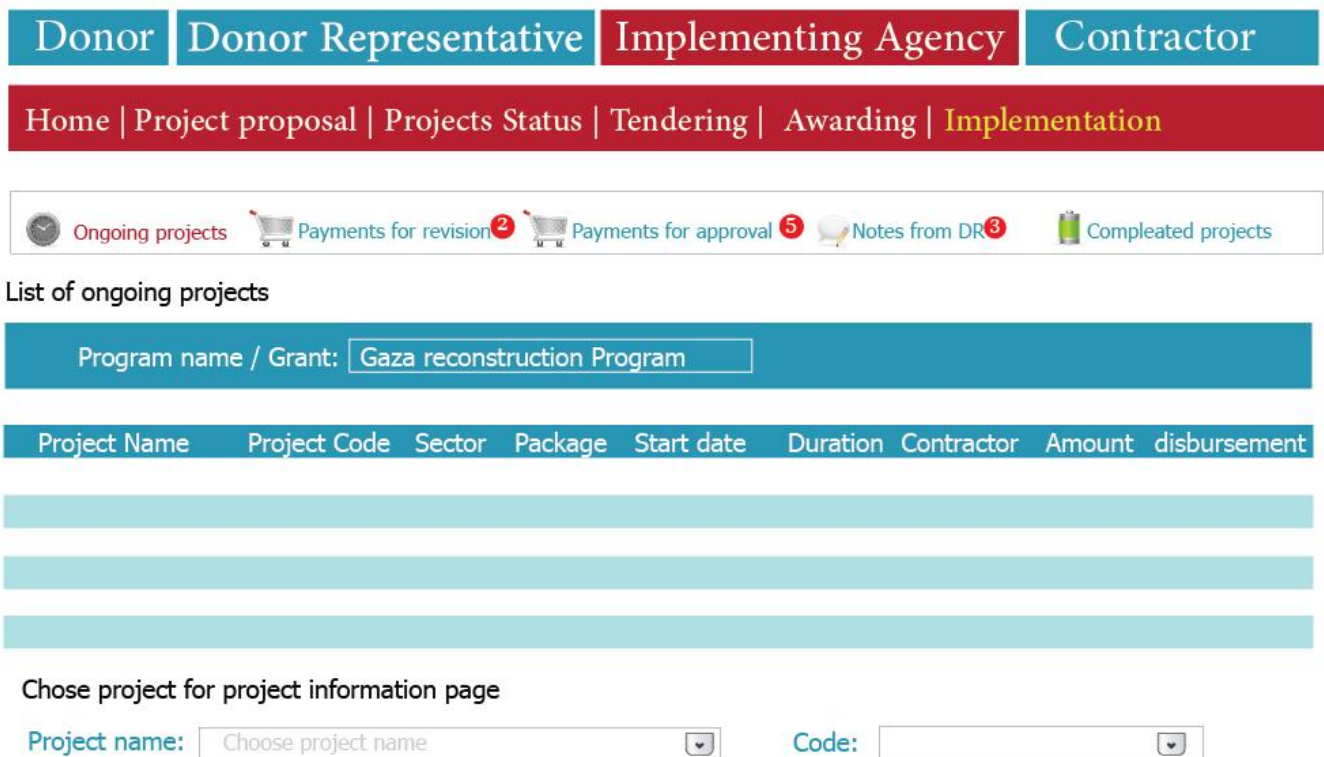
Figure 44: no objection to awards page

After the approval of D.R. the I.A. users can get no-objection to award automatically by the system and this approval can be found on the last tab in the sub-menu as shown in Figure 44.



#### 5.2.4.6 Implementing agency / Implementation

The implementation process is the last phase in the grant management life cycle which is the most important phase, this cycle span from sending the contractor a letter of acceptance and signing a contract until the delivery and handing over of the works or the goods under the contract agreement. The implementation page Figure 45 will display all the ongoing projects in this phase with all related data like contractor name, contract amount, start date and disbursement amount. This menu can be customized to add or remove any additional information about the projects in the table. By choosing any ongoing project the user will reach the project information page which displays all the project data, the user can also add progress information to be saved in the progress log and add and display the project photos. The user can click on the upper link (daily report) Figure 47 to look at the daily report, the I.A. site engineer will revise the report, add his comment and save the report to the system database. The first upper link in the sub-menu is BoQ which preview the bill of quantity of the project with the complicated quantities column Figure 48. The I.A. staff site visits can be documented with a site visit report and photos on the site visit report page Figure 49.



Donor Donor Representative Implementing Agency Contractor

Home | Project proposal | Projects Status | Tendering | Awarding | Implementation

Ongoing projects Payments for revision 2 Payments for approval 5 Notes from DR 3 Completed projects

List of ongoing projects

Program name / Grant: Gaza reconstruction Program

Project Name	Project Code	Sector	Package	Start date	Duration	Contractor	Amount	disbursement

Chose project for project information page

Project name: Choose project name Code:

Figure 45: ongoing projects page

Implementing Agency Name

Ongoing projects Payments for revision <sup>2</sup> Payments for approval <sup>5</sup> Notes from DR <sup>3</sup> Completed projects

BOQ  Daily reports  Site visit reports  Payments report Previous Project Next Project

Project Name <input type="text"/>	Approval Date <input type="text"/>
Es. Cost <input type="text"/>	Proposal Submission Date <input type="text"/>
Project Code <input type="text"/>	No-objection to tender date <input type="text"/>
Sector <input type="text"/>	No-objection to Award date <input type="text"/>
Package <input type="text"/>	Letter of acceptance date <input type="text"/>
Contract Amount: <input type="text"/>	Contract sign date <input type="text"/>

Planned Start Date: <input type="text"/>	Planned Finish Date: <input type="text"/>	Planned Duration: <input type="text"/>
Actual Start Date: <input type="text"/>	Actual Finish Date: <input type="text"/>	Actual Duration: <input type="text"/>

Progress  Payments to date:

Progres report   
Date

Project photos

photo

photo

photo

photo

photo

Add photo Delete photo

Figure 46: project information page

**Daily reports** ← Previous report    next report →

📄 New report
💾 Save report
⚙️ Edit report
🗑️ Delete report
🖨️ Print

🔍

Date: 
 Waether: 
 Report No.: 
Approval

working Day
  Non-working Day
 Reason:

**MAN POWER**

Project Manager	Engineer	Surveyor	Skilled Labors	Unskilled Labors	Others

**MACHINERY**

Loader	Grader	Water Tank	Truck	Roller 25 ton Compactor	Plate Compact	Thiodolite	Others

**Work Report**

**Obstacles and Comments**

**Imlementing agency notes on daily report**

**Payments:**

Payment No	Payment Amount	Contractor date	Approval by IA date	Approval by D.R. Date
Total Disbursed				

Figure 47: daily report page in I.A. portal

Implementing Agency Name

Ongoing projects 
 Payments for revision <sup>2</sup>
 Payments for approval <sup>5</sup>
 Notes from DR <sup>3</sup>
 Completed projects

■ BOQ 
 ■ Daily reports 
 ■ Site visit reports 
 ■ Payments report

Previous Project Next Project

Bill of quantities

Customize table

#	Item	Unit	Qty	Unit price	Total	Act Q.
	Total					

Figure 48: Bill of quantities page in I.A. portal

Donor | Donor Representative | **Implementing Agency** | Contractor

Implementing Agency Name

Ongoing projects 
 Payments for revision <sup>2</sup>
 Payments for approval <sup>5</sup>
 Notes from DR <sup>3</sup>
 Completed projects

■ BOQ 
 ■ Daily reports 
 ■ Site visit reports 
 ■ Payments report

Previous Project Next Project

Site visits

Report

Upload photos

Date

Upload files

Save 
 Edit 
 Print

Figure 49: Site visits report in the I.A. portal

### 5.2.4.7 Implementing agency / Implementation / Payments for revision

The second tab in the upper menu will go to payments for revision page Figure 50, in this page the I.A. staff can preview the payment request sent by the contractor, revise it, make comments to the contractor and resent the final approved payment to the D.R. for final approval and disbursement. Within the current payment request the user can preview the previous payments by clicking on (view previous payments link on this page to go to all payments under the current project Figure 51.

Donor Donor Representative Implementing Agency Contractor

[Home](#) | [Project proposal](#) | [Projects Status](#) | [Tendering](#) | [Awarding](#) | [Implementation](#)

Ongoing projects Payments for revision<sup>2</sup> Payments for approval<sup>5</sup> Notes from DR<sup>3</sup> Completed projects

Choose project to preview payment information

Project name:  Code:

Program name / Grant:  [View previous payments](#)

Payment no.  Payment amount  [Send to DR for approval](#)

Previous Payment

Project Name	Project Code	Duration	Start date	Contractor	Contract Amount	Pay No.	Pay Am.	disbursement

Item	Unit	Qty	U.pr.	Total	Prev. Qty	Total	This Qty	Total	Total Qty	Total
#										

Notes on payment documents to contractor

Date

Memo

[Send notes to contractor](#) [Approve payment](#)

D.R. Notes on payment documents

Date

Memo

Figure 50: payment request page in I.A. portal

Donor | Donor Representative | **Implementing Agency** | Contractor

Home | Project proposal | Projects Status | Tendering | Awarding | **Implementation**

Ongoing projects | Payments for revision <sup>2</sup> | Payments for approval <sup>5</sup> | Notes from DR <sup>3</sup> | Completed projects

Choose project to preview payment information

Project name:  Code:

Program name / Grant:

Payment no.  Payment amount

Previous Payment

Payment No.	Payment Submit. date	Payment approval date	Payment amount	Retintion 10%
Payment No. ١	05/03/2012 م	15/03/2012 م	210,000 \$	21,000 \$
Payment No. ٢	15/05/2012 م	20/05/2012 م	300,000 \$	30,000 \$
Payment No. ٣	15/07/2012 م	20/07/2012 م	250,000 \$	25,000 \$
Total Payments to date			760,000 \$	76,000 \$
Total Disbursement to date				693,000 \$

Figure 51: previous payments page

Donor | Donor Representative | **Implementing Agency** | Contractor

Home | Project proposal | Projects Status | Tendering | Awarding | **Implementation**

Ongoing projects | Payments for revision <sup>2</sup> | Payments for approval <sup>5</sup> | Notes from DR <sup>3</sup> | Completed projects

Chose project to preview payment information

Project name:  Code:

List of payments for approval within donor reprisintative

Program name / Grant:

Project Name	Project Code	Duration	Start date	Contractor	Contract Amount	Pay No.	Pay Am.	disbursement
--------------	--------------	----------	------------	------------	-----------------	---------	---------	--------------

Figure 52: the payments sent to D.R. pending for approval page

## 5.2.5 Contractor portal

The contractor is the entity which is awarded a contract to start the implementation process, the contractor will get a username and password to access the system to communicate with I.A.,

Donor
Donor Representative
Implementing Agency
Contractor

Daily report | BOQ | Payments | Memo | Variation orders |

<p><b>Program name / Grant:</b> Gaza reconstruction Program</p> <p><b>Donor:</b> برنامج دول التعاون لإعادة إعمار غزة</p> <p><b>Project name :</b> مشروع إعادة إعمار ٦٠ وحدة سكنية مدمرة كلياً</p> <p><b>Project Code:</b> GCC-04- 07</p> <p><b>Budget:</b> 3,210,000 \$      <b>Payments to date:</b> 2,210,000 \$</p> <p><b>Start date:</b> 05/01/2012 م</p> <p><b>End date:</b> 05/01/2013 م</p>	<p><b>Project duration:</b> 365 day</p> <p><b>Remainning Duration :</b> 120 day</p> <p><b>Unjustified delay :</b> 20 day</p> <p><b>Justified delay :</b> 15 day</p>
--	---

▶▶ Next report    ◀◀ Previous report

**Contractor Name:**

New report
 Save report
 Edit report
 Delete report
 Print

**Date:**     **Weather:**     **Report No.:**     Approval

working Day   
  Non-working Day   
 Reason

**MAN POWER**

Project Manager	Engineer	Surveyor	Skilled Labors	Unskilled Labors	Others

**MACHINERY**

Loader	Grader	Water Tank	Truck	Roller 25 ton Compactor	Plate Compact	Thiodolite

**Work Report**

**Obstacles and Comments**

+ Add completed BoQ items

Figure 53: contractor daily reports form

The contractor role in the system is limited to previewing his project information, bill of quantities, adding daily reports and submitting a payment requests to I.A., all the contractor interaction with the system are displayed in Figure 53, Figure 54, Figure 55, Figure 56, Figure 57.

Donor | Donor Representative | Implementing Agency | Contractor

Daily report | BOQ | Payments | Memo | Variation orders |

<p>Program name / Grant: Gaza reconstruction Program  Donor: برنامج دول مجلس التعاون لإعادة إعمار غزة  Project name : مشروع إعادة إعمار ٦٠ وحدة سكنية مدمرة كلياً  Project Code: GCC-04- 07  Budget: 3,210,000 \$      Payments to date: 2,210,000 \$  Start date: 05/01/2012 م  End date: 05/01/2013 م</p>	<p>Project duration: 365 day  Remainnig Duration : 120 day  Unjustified delay : 20 day  Justified delay : 15 day</p>
---	--

### Bill of Quantities

Save Quantities Edit Quantities Export to Excel Print

Contractor Name:							
#							
	Item	Unit	Qty	Unit pr.	Total	Today Qty	Total com.
1	توريد وصب خرسانة مسلحة ٢٥٠ لزوم كتشفات الأبواب B والشبابيك والديكورات الداخلية ) والخارجية أسفل الشبابيك وذلك حسب الديكورات الموجودة ( وتعليمات المهندس المشرف	m3	8.5	120	2040	2	7
2	توريد وصب ديكور خارجي مسلح فوس مقاس ١٤٠-١٦٠ مع تكسير القوس القائم وازالته من الموقع وذلك حسب المخططات وتعليمات المهندس المشرف	m3	28	30	840		0

Figure 54: Bill of quantity page in contractor portal



Program name / Grant: Gaza reconstruction Program  
 Donor: برنامج دول مجلس التعاون لإعادة إعمار غزة  
 Project name : مشروع إعادة إعمار ٦٠ وحدة سكنية مدمرة كلياً  
 Project Code: GCC-04- 07  
 Budget: 3,210,000 \$ Payments to date: 2,210,000 \$  
 Start date: 05/01/2012 م  
 End date: 05/01/2013 م

Project duration: 365 day  
 Remainnig Duration : 120 day  
 Unjustified delay : 20 day  
 Justified delay : 15 day

### Payments Report

 Add new payment requist

Payment No.	Payment Submitted date	Payment approval date	Payment amount	Retintion 10%
Payment No. ١	05/03/2012 م	15/03/2012 م	210,000 \$	21,000 \$
Payment No. ٢	15/05/2012 م	20/05/2012 م	300,000 \$	30,000 \$
Payment No. ٢	15/07/2012 م	20/07/2012 م	250,000 \$	25,000 \$
Total Payments to date			760,000 \$	76,000 \$
Total Disbursement to date				693,000 \$

Figure 55: Payments page in contractor portal

<p>Program name / Grant: Gaza reconstruction Program                  Donor: برنامج دول مجلس التعاون لإعادة إعمار غزة                  Project name : مشروع إعادة إعمار ٦٠ وحدة سكنية مدمرة كلياً                  Project Code: GCC-04- 07                  Budget: 3,210,000 \$      Payments to date: 2,210,000 \$                  Start date: 05/01/2012 م                  End date: 05/01/2013 م</p>	<p>Project duration: 365 day                  Remainnig Duration : 120 day                  Unjustified delay : 20 day                  Justified delay : 15 day</p>
---	--

Payment Requist

Save Payment   
 Edit Quantities   
 Export to Excel   
 Add prev. Quantities   
 Print

Payment No. 4		Date: 15/08/2013 م					
#	Item	Unit	Qty	Unit pr.	Total	This Qty	Total
<b>Total</b>					3,210,000 \$		200,000 \$

Project total amount: 3,210,000 \$  
 Previs payments total amount: 760,000 \$  
 Payment No. 4 total amount: 200,000 \$  
 Total completion works amount to date: 960,000 \$  
 This retintion: 20,000 \$  
 This payment: 180,000 \$

Figure 56: payment request form on contractor portal

<p>Program name / Grant: Gaza reconstruction Program                  Donor: برنامج دول مجلس التعاون لإعادة إعمار غزة                  Project name : مشروع إعادة إعمار ٦٠ وحدة سكنية مدمرة كلياً                  Project Code: GCC-04- 07                  Budget: 3,210,000 \$      Payments to date: 2,210,000 \$                  Start date: 05/01/2012 م                  End date: 05/01/2013 م</p>	<p>Project duration: 365 day                  Remainnig Duration : 120 day                  Unjustified delay : 20 day                  Justified delay : 15 day</p>
---	--

### Variation Order Request

Variation Order type     within approved budget     over approved budget

Variation order amount   

Items type     From BOQ     New Items

#	Item	Unit	Qty	Unit pr.	Total

Description

[Send for approval](#)

Figure 57: variation order form on contractor portal

### 5.3 Project tracking

The implementation agency and donor representative need some information to keep tracking all the projects at the same time; the most powerful tool for any sub-project tracking is the status module. This module has been developed upon the users request and the change of sub-projects status in each phase and depending on each action on the system.

This progress monitoring module allows project participants to track key events. Additionally, project participants can share the current progress or delivery condition of these events. The progress monitoring module has an easy access option allowing participants to track and record

all information related to the event status. Additionally, project participants can share changed information and compare differences between planned events and related predecessor activities and successor activities (Lin, 2010).

### **5.3.1 Current situation of tracking projects**

By revising the paper documents and interviewing the grant stakeholders we found that a tracking process is very weak which result an unexpected delay in revision and approval of document and delay of process work flow. The current system adapts 4 statuses which are:

- Pending in I.A.: which describe the status of the project within implementing agency during the preparation of proposal
- Tendering: the status during advertising of the projects in the newspapers or distributed the quotations to the bidders.
- Awarding: the status during awarding process but not mention in which side (I.A. or D.R.)
- Completed: the totally disbursement projects and delivered.

These four status has a weakness due to unable to describe the actual flow of wok for example, pending in I.A. status did not refer in which phase this pending is, is it in the revision of proposal or in the revision of biding documents or in the awarding process, the current status only describe the status of proposal preparation process and so on.

So as appear that a lot of phases during the grant life cycle did not appear clearly in the current system and need more discretion for efferent tracking.

### **5.3.2 New tracking system**

A new tracking system was developed to show all the processes, delays, bottle nicks during the project life cycle to accurately describe in which side is the project exactly. By studying the process deeply a new system was developed to have six main statuses and many sub-status as illustrated in Figure 58 and Figure 59.

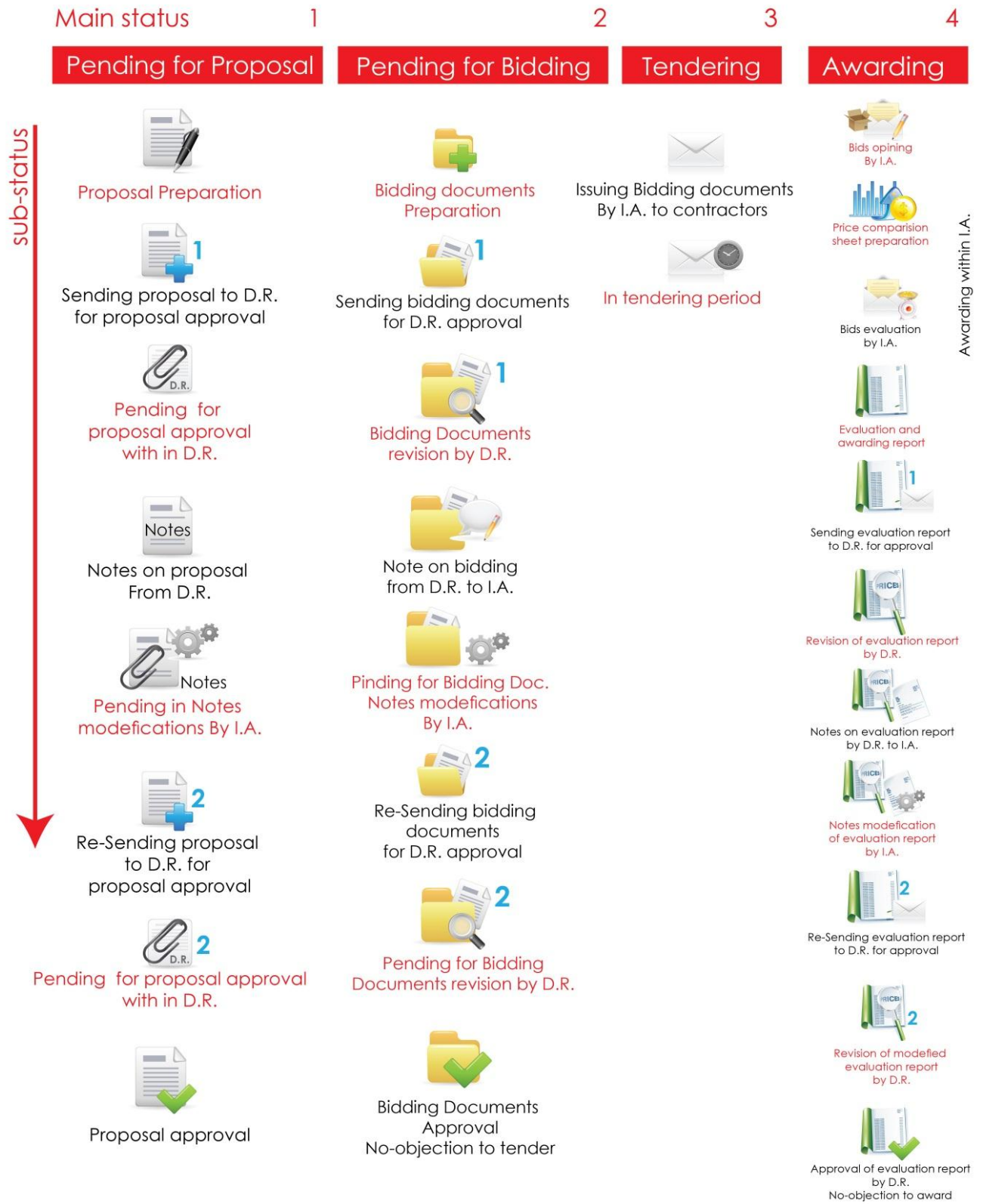


Figure 58: New status tracking system

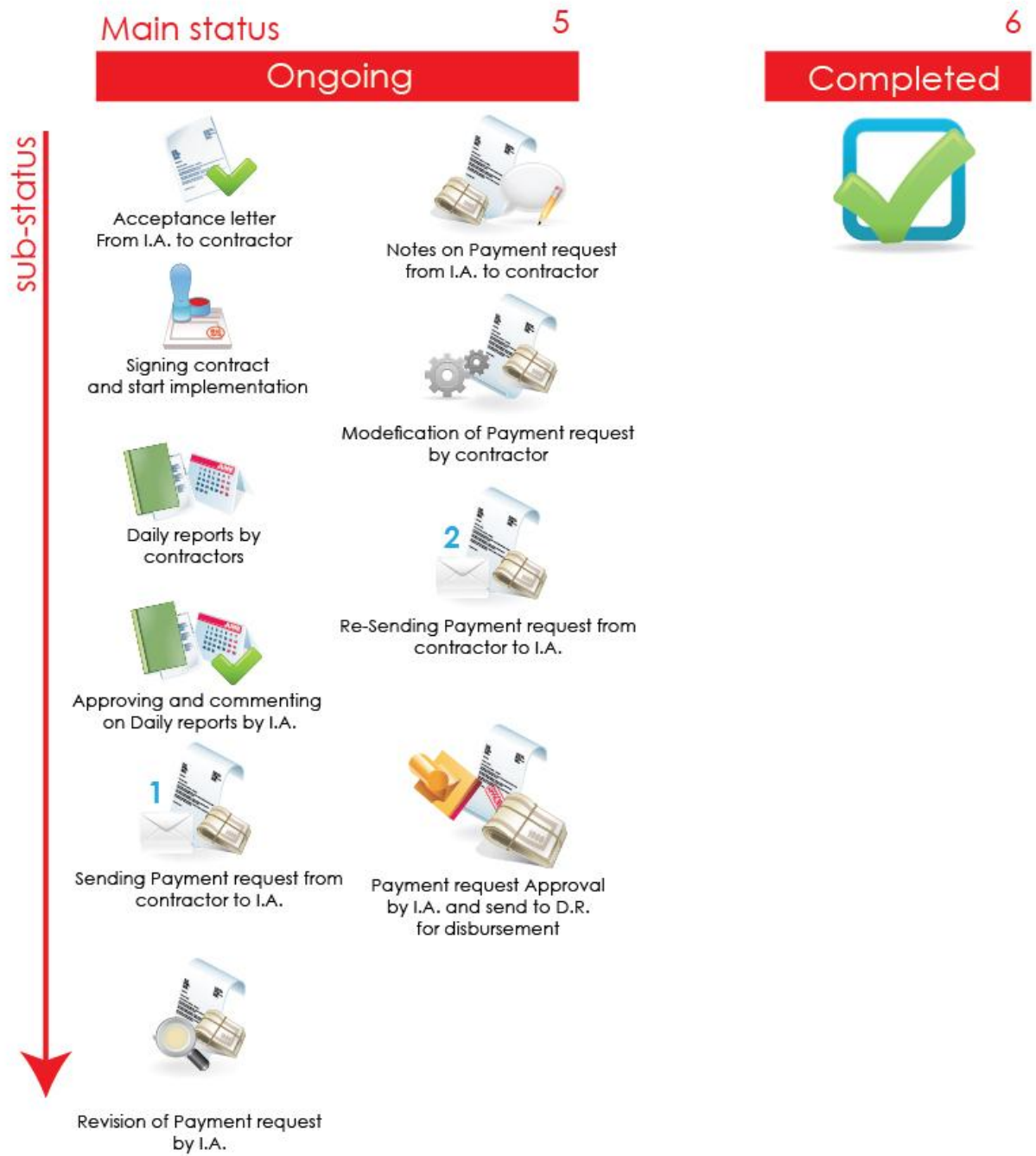


Figure 59: Modified status tracking system (2)

# Chapter 6: Model Evaluation

Software and databases evaluation is a practice established for so long as that of developing software itself (Martyn & Unwin, 1986). Not only evaluating in the sense of exercising the code using examples, but also evaluating in the sense of making some development step and then reflecting on the results of the step to check whether they were really what were intended. The idea of evaluating as an integral part of the software and database development process which takes place at all stages in order to meet the needs of the users is adopted in this thesis. This chapter presents the qualitative techniques used for the evaluation of the system, and the obtained results.

## 6.1 Methodology for System evaluation

### 6.1.1 Verification of contents

After writing the *System Requirements*, the information and relations between stakeholders were checked and verified for any discrepancies and errors. This was achieved by the submission of the system data content for criticism and evaluation by several project stakeholders like project managers and engineers. The stakeholders were asked to take a look and comment on the principles of organizing the flow of information into Phases/Stages, Activities/Sub-activities, Document reports, etc. Group of experts in grants management, procurement management and system analysis were met and revised the system design to put notes and advices for enhancements, the experts were listed in appendix 2.

The following questions were used to verify the requirements to see that the right problem was being solved.

### 6.1.2 Questions for grants experts

#	Question	Experts perception
1	Is the system's scope well-defined?	Most of the experts agreed that the system scope is well defined.
2	Is the system useful and easy to use? Is the user interface well designed and friendly for users?	Most of the experts agreed that the system interface appear to be friendly for users but they can't take a final decision before trying the

		actual system to show if there is any pages have to be modified to make the dealing with the system more quickly. One of the experts say that this system will be hard to use with some contractors which have lake of IT knowledge and infrastructure.
3	Have all the stakeholders of the system been identified?	Most of the experts agreed that the stakeholders were identified but some of them say that some users are missing like data entry user in some cases is needed; secretary also is needed sometimes for upload files to the system which need long time in large size files.
4	Are there any general areas omitted?	Some experts say that to make the system complete we need a general portal without access for all contractors to login for download the bidding documents before participating in the bid submission. Some experts say that the system needs more interfaces for implementation process for site inequities and material acceptance. The consultancy services contracts and procurement was not appearing in the system.
5	Are Phases/Stages well defined?	Experts say that the phases of the work are well defined in detail
6	Are Activities/Sub activities well defined?	Experts say that all the activities of grant management are well defined, some of them say that the proposal have to be submitted and evaluated electronically instead of uploading file.
7	Are types of contract well defined?	All types of contracts are will defined except the consultancy contracts not included in the



		<p>system.</p> <p>The category of the contract (works or goods) not defined in the system.</p>
8	Are types of process of work well defined?	The process of work are will defined but appear to be complicated due to large amount of interfaces, and the amount of details included in the system.
9	Are the relations between stakeholders well defined?	The experts said that the relation was well defined but the interaction of donor is limited, the ways of money replenishments were not appear on the system.
10	Is the web system reducing the time of work flow?	Some of the experts were agreed that the system will decrease the work flow time and make the process quickly, but some of them say that the system will be a more load on the users for making data entry for all detailed information.
11	Is the system adding a value to the project documentation?	The most of experts say that the system will be an added value for grants management if it well is applicable, but some of them say it need effort for training and validation before acceptance.
12	What is your general perception about the system?	Most of the experts say that the system is a good idea for grants management if it will be valid and applicable to use.

### 6.1.3 Questions for IT experts

#	Question	IT experts perception
1	Are the system friendly user interface?	The IT experts reviewed the system design and analysis and reviewed all the interfaces and they agreed that all pages were friendly user interfaces without any complication
2	Are the relations between pages will defined?	Also the agreed that the relations between pages of all users are defined well and can be programed easily
3	Are there any problems will face the programmers?	The IT experts Saied that there are no significant problems will face programmers except some flowcharts for detailed relations in the database building which need more detailed charts
4	Are there missing or additional information needed to start programing?	Only the detailed charts of data base and ER diagram for inputs and outputs need to be more clear

### 6.2 Evaluation results

After trying the proposed system the users, the users said they had not faced real difficulties with the user interface; the web based model is useful and can be help to reduce the time of work flow. The system may add a high value to the work by trying it for a long period and in the beginning of a new program or fund. Also filling the system with the old data may create a very important database for the old projects. The information is well organized in the system model and the notification system helps the users to remind the deadline dates successfully and keep projects tracking on time without any delay. The reports generated by the system need to be more customized to fit the donor and the upper management requirements.

# Chapter 7: Conclusion & recommendation

## 7.1 Conclusion

- This research is meaningful for Web-based grants management, in that it explores a new direction for information integration. In the near future, Web-based collaboration systems will be developed toward the platforms for automatic information exchange and integrated representation. The proposed system is better than the current Web applications which are used in some institutions because it is able to share information between all stakeholders at the same time.
- This research found through the interviews with grant managements experts that there is an acceptance for using a web-based management system which can significantly improve the performance and quality of the project.
- The web-based application system is still a new concept in the construction industry in Gaza strip, many institutions are working on developing new systems for facilitating their work and the others have no objection to use such systems in case of availability and easy to use.
- The existing web-based applications in some institutions are actually used but there are limitation on the number of users and the interactivity of all project stakeholders, so there is no interaction of contractors for example and no electronic approvals were generated by the systems.
- The proposed system effectively improves the efficiency and effectiveness of information sharing between projects management stakeholders which enhances the ability of managers to control and monitor project progress on time. The system improves the acquiring of daily reports and progress from contractors and provides easy monitoring service for controlling construction process.
- On-time reports can be generated by the system to monitor the overall grant progress and status without any interactions from any other users in case of right use of the system and filling all information on daily basis.
- In case of entering all the projects information the system will be used as powerful tool for decision making in the future also can be used as a rich data base which contains BoQs, specifications, and drawings and many related documents for new projects.

- This internet-based system will give the stakeholders a freedom of access to various resources on design, engineering, and construction specifications. This also provides real-time up-to-date specifications through the internet. The proposed model is particularly effective if multiple organizations are involved in sharing their data through the internet.

## 7.2 Recommendations

- In order to take full advantage of the potential provided by rapidly developing IT, it is essential to intensify co-ordination between research and industry in this domain. Basic web page management system skill education and training in the construction industry is an urgent demand in order to improve construction project management, due to the incompetence and immaturity of IT knowledge in the industry. It is hoped that further research in the above field will contribute to the improvement of construction project management as well as grant management in the future.
- In terms of future work, this model has to be implemented and programmed to be evaluated actually within the grant management institutions
- Future research should be conducted to define the applicability of web based grants management systems in construction projects. However, once it has been determined that web page grant management system is advantageous; the guidelines presented here can be generalized to any project participant who seeks to utilize web page grant management system.
- Such system as to be adopted and used on a large scale by governmental bodies like Ministry of Planning to be a useful tool for managing all grants to minimize the duplication of funding.
- The system may be updated to be used for all contractors for managing their daily activities on a construction project to facilitate their work and increasing the productivity.
- The system has to be validated in a large scale, by a donor representative institution to make any missing data and update any needed reports.
- More efforts for updating the system are needed to provide the system with some rules that can show reports in the form of graphs.
- The web-based application of grants management could be securely developed by modifying object-oriented technology and parameterized queries.

- For the IT private sector, they have to invest in such system which can be rented to small scale construction companies for managing their daily work flow in their projects.

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## Appendices

## Appendix 1

### **Simi-structured interview questions for grants management stakeholders**

- Are there a web-based management system used for projects management?
- What is the degree of interactivity with the system?
- Who are the system users?
- What is the work flow process of the work in the institution?
- In case of lake of web based system? Do you prefer to deal with such systems?
- What are your requirements and potentials for such system?

## Appendix 2

### Experts who met for system model evaluation

#	Name	Position	Institution
1	Deya Al baba	Office engineer	UNDP
2	Mutazz Muhaisen	Gaza office manager	Municipal development fund
3	Ahmed Dardona	Procurement specialist	Municipal development fund
4	Nour Al Madhoun	Solid waste Gaza project manager	Municipal development fund
5	Mohammed Wael Abu Shaaban	Monitoring and evaluation officer	IDB representative office EMCC
6	Mohammed Abu Haloub	Gaza office manager	Qatar Charity
7	Alaa Al ghalayiny	Gaza office manager	NDC
8	Munzther Abdulhadi	Projects manager	NDC
9	Rashid Al rozzi	Gaza office manager	International labor organization
10	Diya Al Rayyes	IT specialist and system analyst	Bank of Palestine
11	Mohammed Jindya	IT specialist and system analyst	Ministry of education
12	Nour eldin Ouda	IT specialist and system analyst	Ministry of health