A Framework for the Identification and Communication of Client and User Requirements to Design Teams

BY

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عمادة الدراسات العليا
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DEDICATION

To my ***Parents, Wife*** and ***Daughters***

AKNOWLEDGEMENT

All praise is due to Almighty Allah (SWT), whom we praise, seek help and ask forgiveness. Peace and blessings of Allah (SWT) be upon His slave and His Messenger, Prophet Muhammad (PBUH), his family, and his companions. Many thanks to Allah (SWT), the most Merciful, the most Gracious, for all the uncountable bounties, who gave me the courage and patience to successfully accomplish this work.

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Finally, I have tried my best to avoid mistakes or inaccurate data and information in this study. I apologize for any mistake that was beyond my understanding and knowledge, and may ALLAH forgive me.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Thesis Abstract

Name: **Mohammed Nasser Juaim**

Title: **A Framework for the Identification and Communication of Client and User Requirements to Design Teams**

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Recent international research indicated that there is lack of a systematic and comprehensive framework for architectural programming. The study also revealed that current practices of architectural programming in Saudi Arabia are not really effective in providing a clear definition and understanding of the clients and projects requirements. The study confirms that there is a need to develop a standard methodology (framework model) that projects' programmers can adapt to professional architectural programming practice. The objectives of this thesis were to identify the factors which influence the process of developing and implementing the architectural program for buildings projects, and to develop architectural programming framework model that aim at capturing the process of properly identifying and communicating client and user requirements to design teams, and to assess the identified factors which influence the process of developing and implementing the architectural program for building projects in Saudi Arabia. Twenty-eight factors which influence the process of developing and implementing the architectural program were identified. Framework model for architectural programming was developed based on knowledge from international literature, observed professional practice and mainly the identified factors. The assessment of the identified 28 factors is critical to investigate the applicability of the developed framework in Saudi Arabia. The identified 28 factors were assessed through distributing the questionnaire survey to A/E offices from the Eastern Province, Riyadh and Jeddah as well as owners' representatives that located in Saudi Arabia. The assessment results confirm the importance of the identified factors where all factors were assessed either extremely important or very important or important. The developed framework can be applied locally in Saudi Arabia and can be adapted for any project type and by the two types of project programmers (external consultants and in-house staff).

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ملخص الدراسة

الاســـــــــم: **محمـــد ناصـــر حســـين جـــعيم**

عنوان الرسالة: **إطار عمل لتعريف وإيصال متطلبات المالك والمستخدم الى فريق التصميم**

التخصـــــص: **هندســـة معمـــاريـــة**

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تشير الأبحاث الحديثة إلى أن هناك حاجة لإسلوب قياسي أو لإطار عمل شامل لتنفيذ البرمجة المعمارية. أظهرت الدراسة في المملكة العربية السعودية كذلك بأن الممارسات الحالية للبرمجة المعمارية غير فعاله في إعطاء تعريف وفهم واضح لمتطلبات المالك والمشروع. أشارت الدراسة بأن هناك ضرورة لتطوير أسلوب قياسي (إطار عمل) يمكن أن يتبنى ويكيف بواسطة معدي البرنامج المعماري خلال الممارسة المهنية للبرمجة المعمارية. تتمثل أهداف هذه الأطروحة في تعريف العوامل المؤثرة في عملية أعداد وتنفيذ البرنامج المعماري لمشاريع البناء وتطوير إطار عمل يهدف للوصول إلى عملية تعريف وإيصال متطلبات المالك والمستخدم بشكل صحيح الى فريق التصميم بالإضافة إلى تقييم العوامل في المملكة العربية السعودية. وصلت هذه الدراسة لتعريف 28 عامل تؤثر في عملية إعداد وتنفيذ البرنامج المعماري. تم تطوير إطار عمل للبرمجة المعمارية وذلك بالاستناد على المراجع العالمية وملاحظة الممارسة العملية للبرمجة و كذلك على العوامل المعرفة. و لتحديد مدى أهمية العوامل المعرفة وتحديد قابلية تطبيق إطار العمل المقترح في المملكة العربية السعودية تم تقييم هذه العوامل من خلال استبيان تم توزيعه على المكاتب الهندسية والمعمارية في كلا من المنطقة الشرقية و الرياض و جدة بالإضافة لممثلي الملاك في المملكة العربية السعودية. تؤكد نتائج التقييم على أهمية العوامل المعرفة حيث أن جميع العوامل قيمت إما " مهم جدا بقوه" أو "مهم جدا" أو "مهم". إطار العمل المقترح يمكن أن يكيف وينفذ في المملكة العربية السعودية لأي نوع من أنواع مشاريع البناء وبواسطة أي من معدي البرنامج المعماري (الاستشاريين الخارجيين و الموظفين الداخليين).

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جامعة الملك فهد للبترول و المعادن

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محرم 1432 هـ

CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND

In the past, the pattern of buildings was to some extent known according to the function needed from the buildings. A bank was a bank, and a school was a school. Everyone knew what would take place in these buildings. This led to the simplicity of design in terms of time because each type of building (in terms of function) had their known pattern. This basic concept is not valid nowadays because of the change in society and technology. They become more complicated. According to this, architects and owners had to look for new ways to determine the basis for environmental design (Evans and Wheeler, 1969).

Over the last 20 years, new concepts in the organization of office work and the widespread use of electronic media and data processing have emerged. This has resulted in development of new functional solutions to suit these new requirements (Szarejko and Leszczynska, 2006).

Since the beginning of the nineteenth century, buildings have become more complex as they are expected to respond to several functions. This has prompted the need for developing much more elaborated programs/briefs to capture the requirements needed to carry out these functions, as earlier programs/briefs were characterized as being informal through containing simple verbal statement of requirements (Kumlin, 1995).

Zwemmer and Otter (2008) indicate that “in the past, programming was considered to be a static event of capturing the client’s requirements, prior to the design stage of a project”. This case is not anymore static in the today programming activates. The programming in recent times is characterized by an iterative and social learning process,

about the client organization and its spatial needs. Nevertheless, although there is a strong interaction among all parties of the project (client, stakeholders, consultants and designers), it is difficult for the client to fully capture the organizational needs (Zwemmer and Otter, 2008).

Yu et al, (2005) state that architectural programming/briefing can be described as the process of identifying the client organization requirements at the early design stage of a building project. The architectural program/brief is the output of this process, is "a formal document that sets out the client requirements for a construction project, and forms the basis for design" (Yu et al, 2005).

Kelly et al., 2005 define the construction programming/briefing as "process involves gathering, analyzing, and synthesizing information needed in the building process in order to, inform decision-making and decision implementation. Further, the program document should contain all the information used in the design process as a set of evaluation criteria to ensure an optimal solution to the building problem".

Architectural programming is a terminology commonly used at the USA, and also known as **design briefing** in UK (Yu et al., 2005; Shen and Chung 2006).

1.2 STATEMENT OF THE PROBLEM

The quality of a building can be defined as the level at which the final building design meets the clients' actual needs and requirements. A good building design can create a good building quality so the type and amount of the information contained in the building design affects the final building quality (Clift, 1996; Oliveira et al., 2008).

The building design aims basically at producing an entirely functional building that meets a set of actual needs and requirements of the clients. To achieve that goal, it is necessary for the design team and the client's stakeholders to collaboratively interact together throughout the design process. This is reflects the significant role of the Programming process (Hudson, 1999 and Harputlugil et al., 2006).

Recently, programming has become an important topic for research and guidance. It has acquired this interest because it is considered one of the most important stages in development projects as well as the better programming process can deliver a better product to the client. Researches on the efficiency of various stages of the project delivery process indicate that there are serious gaps between the client & user aspirations and expectations and the degree to which facilities meet and satisfy their requirements (Hudson, 1999; Smith, 2002; Erdener, 2003, Shen and Chung 2006 and Bogers et al., 2008).

Recently, international researches (e.g. Kelly et al., 2003; Yu et al, 2005, Shen and Chung, 2006 and Bogers et al., 2008) have indicated that due to the huge amount of information that needs to be considered and the difficulties present in identifying and communicating clients' actual needs and requirements properly to the design team during the programming process, architectural program is still considered to be inadequate and are not sufficiently clear, and thus may not truly reflect client requirements.

To overcome this problem, a number of studies have been conducted to develop programming guides for inexperienced clients. Despite these attempts, the current

programming practices are still considered to be inadequate by many researchers worldwide (e.g. Yu et al, 2005 and Bogers et al., 2008).

The lack of a systematic and comprehensive framework for identifying and clarifying client requirements, and communicating these requirements to the design team are the main obstacles to the success of the final building design (Kelly et al., 2003; Yu et al, 2005; Shen and Chung, 2006; Bogers et al., 2008).

In Saudi Arabia, interviewees stated that there exists no programming guides, and that programs are prepared formally or informally depending on the type of the client as well as the nature of the project.

Based on the above, this research will be conducted to investigate the factors influencing the development and implementation of the architectural program for buildings projects as well as to develop a framework that aims at capturing the process of properly identifying and communicating client and user requirements to the design team.

1.3 RESEARCH OBJECTIVES

The main objectives of this research are:

1. To identify the factors which influence the process of developing and implementing the architectural program for buildings projects.

2. To develop a framework that aims at capturing the process of properly identifying and communicating client and user requirements to design teams.

3. To assess the identified factors which influence the process of developing and implementing the architectural program for buildings projects in Saudi Arabia.

1.4 SCOPE AND LIMITATIONS

The following are the scope and limitations of this research:

1. The distribution of the questionnaire survey and interviews are limited to registered A/E design offices working in the Eastern Province, Riyadh and Jeddah as well as a sample of owners in the Eastern Province of Saudi Arabia.

2. The development of the framework for identifying and communicating the client and user requirements to the design team is limited by the knowledge from literature and observed professional practice as well as identified factors.

1.5 SIGNIFICANCE OF THE STUDY

The attributes of an ideal construction project ranges from a project that does not exceed the budget of the owner, a project that could be easily constructed and delivered on time, and a project that satisfies the requirements of the owner and users. Different stakeholders in construction projects are facing a multitude of problems according to their degree of involvement in the project. Building owners suffer from project delays as well as cost overruns. Contractors are challenged by constructability problems for their projects. Facility users are affected through occupying buildings that do not meet their requirements and expectations. Facility managers are challenged with operating buildings that are of a lesser quality so the significance of the study stems from the following:

1. The study has the potential to raise awareness within the building industry about the interaction as well as the communication throughout the programming process.

2. The programming process has recently become an important focus for international research and guidance.

3. The architectural programming phase is a crucial time in which critical decisions are made. Effective development of architectural program provides the potential for eliminating or reducing the mistakes that could occur during the design phase.

4. Current programming practice is still considered as being ‘‘inadequate’’ and having many limitations so there remains a need for studying the process of architectural programming for buildings to meet the increasing building requirements in Saudi Arabia.

5. The findings of the study would be directly relevant and applicable to buildings projects in Saudi Arabia.

1.6 RESEARCH METHODOLOGY

The research plan set to achieve the objectives of the thesis consists of five main phases. These phases are described as follows as shown in **Figure 1.1**:

1.6.1 Phase 1 – Investigation of Architectural Programming practices

This phase will be carried out for identifying international and local current practices of architectural programming through the following steps:

1.6.1.1 Identifying the international practice

This step will be carried out through the literature review for reviewing state-of-the-art in the fields of buildings design and quality, and architectural programming to achieve a thorough understanding of the domain area as well as identifying the international various processes (frameworks) through which client and user requirements are identified and communicated to design teams.

1.6.1.2 Identifying the local current practice

Interviews will be carried out with a selected sample of A/E offices and a selected sample of owners in the Eastern Province of Saudi Arabia (Total of 12 A/E offices and owners' representatives) for the purpose of data collection about the current practices of identifying and communicating client and user requirements to the design teams as well as the challenges and the limitations of these practices.

1.6.2 Phase 2- Identification of the factors

Investigation of the factors influencing the process of developing and implementing the architectural program is critical for the effective understanding of the nature of the programming process and the development of the proposed framework. This phase will

be carried through surveying and synthesizing various knowledge areas in architectural programming documented in international literature sources.

1.6.3 Phase- 3 Development of Framework

This phase will be carried out to develop the framework for the process of identifying and communicating user requirements to design teams (architectural programming). The proposed framework will be developed based on knowledge from the literature and observed professional practice as well as the identified factors.

1.6.4 Phase- 4 Assessment the identified factors

The proposed framework will be developed based on knowledge from the international literature and mainly the identified factors. The assessment of the identified factors in Saudi Arabia is critical to investigate the applicability of the developed framework in Saudi Arabia. This phase will be carried out through the following steps:

1.6.4.1 Development of questionnaire surveys

A questionnaire survey will be developed and administered to a representative sample of A/E design offices and firms in the Eastern Province, Riyadh and Jeddah and a selected sample of owners' representatives in Eastern Province of Saudi Arabia. The developed questionnaire survey will consist of two parts as follows:

- **Part-I:** Contains general questions about the respondent's area of professional practice as well as his experience.
- **Part-II:** This part of the questionnaire will focus on the assessment of the identified factors.

The respondents to the questionnaire survey will be asked to mark in their perceived relative degree of importance for each of the identified factors through

selecting one of five evaluation terms; "**Extremely Important**" with 4 points, "**Very Important**" with 3 points, "**Important**" with 2 points, "**Somewhat Important**" with one point and "**Not Important**" with zero points.

1.6.4.2 Identification of the Population and the sample Sizes

This step will be carried out to identify the type and size of the sample of respondents as follows:

I. A/E offices sample size:

- The sample of respondents that will locally assess the identified factors consisted of A/E offices from the Eastern Province, Riyadh and Jeddah. List of those A/E offices will be obtained from the Chambers of Commerce in these locations.

- The sample size will be determined using the following equations (kish,1995):

  - ✓ $n_o = (p*q)/v^2$…… (1.1)
  - ✓ $n = n_o/ [1+ (n_o/N)]$…… (1.2)

  Where:

  n_o: First estimate of sample size

  ***p*:** The proportion of the characteristic being measured in the target population.

  ***q* :** Completion of *p* or 1-*p*.

  V: The maximum percentage of standard error allowed (10% for this study)

  N: The population size.

  n: The sample size.

  Note: To maximize the sample, both ***p*** and ***q*** are each set at **0.5**.

II. Owners sample size:

At least 5 owners located at the Eastern Province of Saudi Arabia will be asked to assess the identified factors.

1.6.4.3 Pilot-testing of the questionnaire survey

Before the final distribution of the questionnaire survey, pilot-testing will be conducted with a selected sample of A/E design offices in the Eastern Province of Saudi Arabia for the purposes of:

- Testing the adequacy of the questions.
- Pointing out locations of ambiguities.
- Incorporating additional possible factors.
- Reviewing the adequacy of provided spaces for each question.
- Estimating the needed time for filling out the surveys.

1.6.4.4 Distribution the tested questionnaire survey

At this step, the pilot-tested questionnaire survey will be distributed to the A/E offices and firms in the Eastern province, Riyadh and Jeddah and a selected number of owners' representatives in the Eastern Province of Saudi Arabia to assess the importance of the identified factors.

1.6.5 Phase- 5 Data Analysis

This phase will be carried out to statistically analyze the data received from all categories of respondents (A/E offices, owners' representatives) to the questionnaire survey. The received responses from each type of respondents (A/E offices, owners' representatives) will be analyzed twice according to the respondents' classification. The respondents will be classified as follows:

- ✓ **Case one:** According to their discipline to four groups, project manager, architectural designers and architectural designers and programmers as well as the owners' representatives.

- ✓ **Case two:** According to their geographical location to three groups, Eastern Province, Riyadh and Jeddah.

Using **Excel** program and **SPSS** program, this phase will be carried out through the following steps:

1.6.5.1 Calculation of the importance index

Using Excel program, an important index will be calculated to reflect the level of importance of those factors. This index will be calculated using the following equation (Dominowski 1980):

$$\textbf{Importance index } I = \frac{\sum_{i=0}^{4} aixi}{4\sum xi} \times 100 \quad \% \quad \text{..... (1.3)}$$

Where:

i = Response category index where i= 0,1, 2, 3, 4
ai = Wight given to i response where *i= 0, 1, 2, 3, 4*
xi = variable expressing the frequency of i as illustrated in the following:

- ✓ $\boldsymbol{x_0}$ = frequency of **"Extremely Important"** response corresponding to a_0 = **4**.
- ✓ $\boldsymbol{x_1}$ = frequency of **"Very Important"** response corresponding to a_1 = **3**.
- ✓ $\boldsymbol{x_2}$ = frequency of **"Important"** response corresponding to a_2 = **2**.
- ✓ $\boldsymbol{x_3}$= frequency of **"Somewhat Important"** response corresponding to a_3 = **1**.
- ✓ $\boldsymbol{x_4}$ = frequency of **"Not Important"** response corresponding to a_4 = **0**.

The importance index of 0–<12.5% is categorized as ‘‘Not Important’’; 12.5–<37.5% is categorized as ‘‘Somewhat Important’’; 37.5–<62.5% is categorized as ‘‘Important’’; 62.5–<87.5% is categorized as ‘‘Very Important’’; and 87.5–100% is categorized as ‘‘Extremely Important.’’ The categorizations reflect the scale of the respondents’ answers to the questionnaire.

1.6.5.2 Identifying the variances among the respondents' assessment results:

Analysis of variance (ANOVA) is a general method for studying sampled-data relationships. The purpose is to test the significant differences between the results, and this is done by one way variance analysis and will be carried out using SPSS program.

Once the previous steps have been completed, discussions among the results will be carried out.

1.6.6 Phase 6 - Conclusions and Recommendations

Based on the final results obtained, a set of conclusions and recommendations will be developed. Areas of future research will be also highlighted.

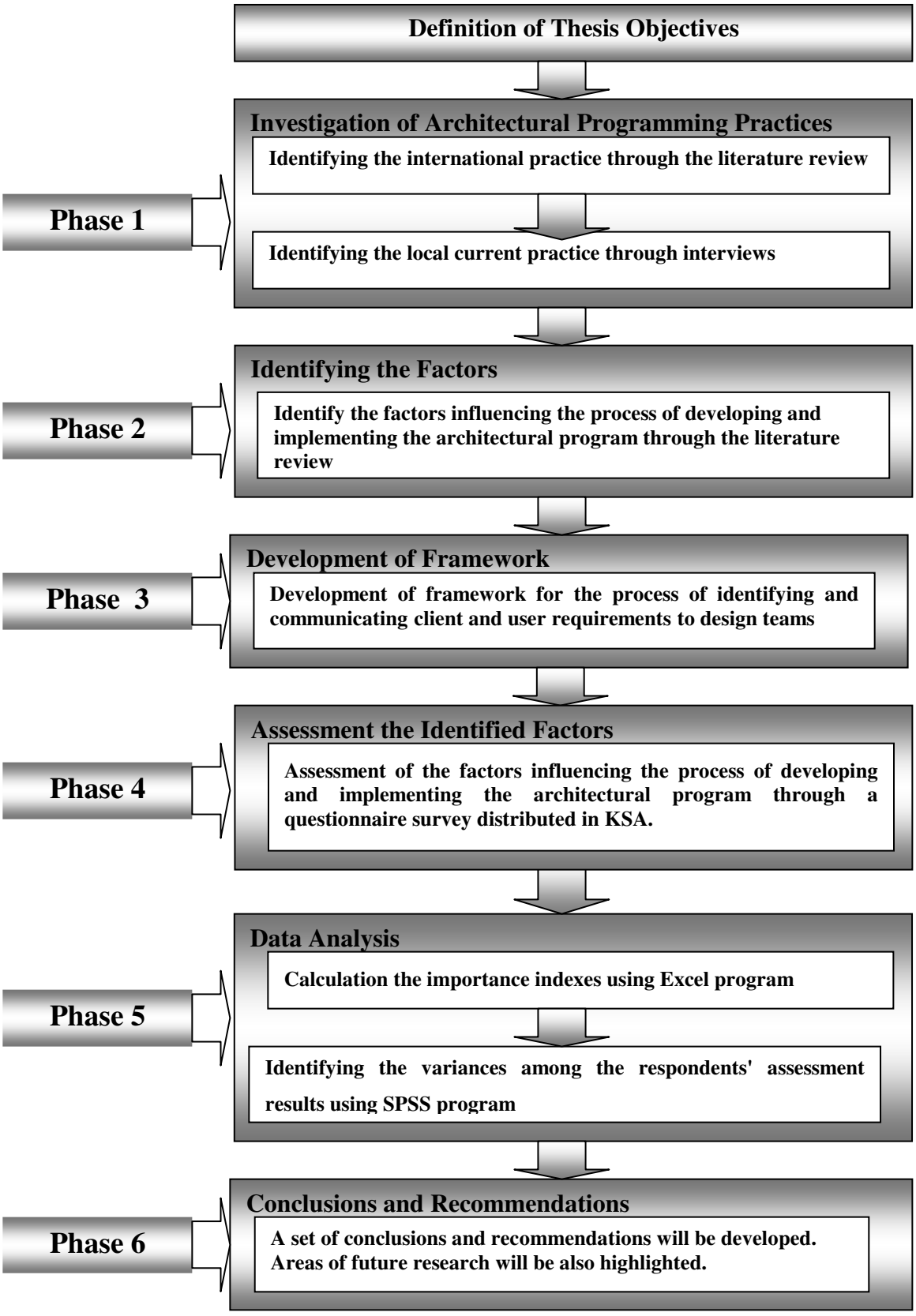

Figure 1.1 Research Methodology Flow Chart

1.7 THESIS ORGANIZATION

The thesis is organized into seven chapters to achieve the main objectives in accordance with the developed research methodology as follows:

CHAPTER ONE: Introduction

This chapter presents general background information on buildings and the architectural programming. It also presents a statement of the problem, the objectives of the study, its scope and limitations, significance of the study, research methodology and thesis organization.

CHAPTER TWO: Literature Review

This chapter summarizes the literature related to building design and quality, the definitions, characteristics, methods and problems of architectural programming, program writers and data as well as international practice of architectural programming (previous studies).

CHAPTER THREE: Local Current Practices of Architectural Programming

This chapter presents a comprehensive coverage of local current practices of architectural programming in Saudi Arabia

CHAPTER FOURE: Factors Affecting the Development and Implementation of Architectural Program

This chapter presents a comprehensive coverage of the factors that affect the development and implementation of the architectural program.

CHAPTER FIVE: Development of Framework

This chapter presents a development of the framework of identifying and communicating the client and user requirements to the design team through the architectural programming process for building projects.

CHAPTER SIX: Data Analysis

This chapter presents the analysis of the data received from all categories of respondents (A/E offices and owners' representatives) to the questionnaire survey.

CHAPTER SEVEN: Conclusions and Recommendations

This chapter presents the conclusions and summary of the study and recommendations for future studies.

CHAPTER TWO

LITRATURE REVIEW

2.1 INTRODUCTION

Essential objectives of the literature review were to acquire the comprehensive knowledge about the fields of building design, quality and architectural programming as well as the various processes through which client and user requirements are identified and communicated to design teams and the factors influencing the process of developing the architectural program. This literature review was carried out by retrieving various past research studies.

This chapter consists of three main topics, buildings, architectural programming and previous studies.

2.2 BUILDINGS

2.2.1 Building Design:

The building design aims basically to produce an entirely functional building that meets a set of actual needs and requirements of the clients. To achieve that goal, it is essential for the design contributors to collaboratively interact together throughout the design process (Hudson, 1999 and Harputlugil et al., 2006).

A large number of decisions should be taken during the design process. It is clear that decisions taken at earlier stages of the design process have a bigger effect on the building performance than decisions taken at later design stages or during building operation. Moreover, the appreciation of performance requirements during the preparing and development of the architectural program will possibly enhance the consciousness

towards performance objectives at the architectural programming phase (Harputlugil et al., 2006).

A design team consists of different professions such as architects, civil engineers, mechanical engineers, etc. The design program presents a framework for the design team to produce design concepts. The objective of this program is to communicate the client needs, requirements and expectations in a written document to design teams to familiarize them with the building project (Harputlugil et al., 2006).

Hudson, (1999) indicated that it is significant to abandon the idea of the program as the generator of shape. A building should not be considered as a set of functional statements translated by the designer into physical form. The program is a communication tool to facilitate interaction and dialogue between all project parties and facilitate the investigation of the possibilities of a project.

Programming and design become a parallel and complementary actions rather than sequential actions. Project goals should appear from the creative interaction between the programming and design (Salisbury, 1998 and Hudson, 1999).

The architectural program is expected to involve the most significant client's needs, requirements and desires. In practice, the program continues to develop even in the design phase through the impact of questions and ideas that arise during the design phase (Van der Voordt and Van Wegen, 2005).

2.2.2 Building Quality:

There are difficulties to absolutely define the quality for any design solution for a building because the building design depends on huge information which should be considered (Bowen et al, 1997).

Although, the quality of a building can be defined as the level at which the final building design meets the clients' actual needs and requirements. A good building design can create a good building quality so the type and amount of the information contained in the building design affect the building final quality (Clift, 1996; Oliveira et al., 2008).

Van der Voordt and Van Wegen (2005) defined quality as the level to which a product meets the requirements set for it. Thus, the functional quality of a building means its ability to meet the functions predicted.

2.3 ARCHITECTURAL PROGRAMMING

2.3.1 Definition of Architectural Programming

Architectural programming is a terminology commonly used at the USA, and also known as design briefing in UK (Yu et al., 2005 and Shen and Chung 2006).

Based on much research, (e.g. Othman et al., 2004; Yu et al. 2007, Zwemmer and Otter, 2008, Bogers et al., 2008) there are basically two different theories related to architectural programming. The first theory considers the program as an entity in itself, which should be static after a critical period. The second theory regards the program as an iterative and dynamic document that develops iteratively in a series of stages from an initial global program. The following are definitions that support these two theories:

Hershberger (1999), In the USA, defined architectural programming as "the first stage of the architectural design process in which the relevant values of the client, users, architects, and society are identified, important project goals articulated, facts about the project are uncovered, and facility needs made explicit. It follows that the architectural program is the document in which the identified values, goals, facts, and needs are presented".

Yu et al, (2005) stated that architectural programming is the process of identifying the client organization requirements at the early design stage of a building project. An

architectural program is the output of this process, is "a formal document that sets out the client requirements for a construction project, and forms the basis for design" (Yu et al, 2005).

Yu et al. (2007) defined construction briefing as “the process running throughout the construction project, by which means the client requirements are progressively captured and translated into effect”.

Blyth and Worthington (2001) defined briefing as an iterative, creative process which is developed and progresses to support the owner/client, design and construction teams in accomplishing the user’s aspirations and expectations.

Zwemmer and Otter (2008) defined briefing as “the process of capturing the purpose, intended use, requirements, objectives, and desired qualities of a construction project, resulting in an output document: the client’s program. Furthermore, the program provides the design team with data to commence their design, without the preservation of their artistic expression”.

Cherry and Petronis (2009) defined architectural programming today as “the research and decision-making process that identifies the scope of work to be designed”.

2.3.2 The Characteristics of the Architectural Programming

According to the previous definitions and the review of literature, the architectural programming addresses very important issues such as owner/client, client organization requirements, decision making process and the process itself as a dynamic and iterative process. These issues can be considered as characteristics which distinguish the programming process. These issues are discussed in the following:

1. Owner/Client and the Architectural Programming

Programming process includes the owner/client who informs the design team of his objectives, needs and requirements for the project in a formal document called the

program. The owner is one who has the responsibility for programming. The owner/client can be a single person, organisation or many of stakeholders, made up of individuals with differing wants and desires. The designer can find it difficult to satisfy the diverse goals of the group of stakeholders. Also there is two types of clients, the ‘user clients’ and ‘paying clients’. For that, it is extremely significant that the programming process should sufficiently capture the requirements of all stakeholders that make up the ‘Client’ (Hershberger 1999 and Yu et al., 2005).

To improve programming practice, it is significant to understand that when clients aren't be able to define what they want and what their needs, the designer or architects can't create a good design, so it is important to involve adequate number of stakeholders to identify client needs and they should know and coordinate their objectives to prevent distortion of the program (Kelly et al., 2003; Yu et al., 2007 and Bogers et al., 2008).

2. Client Organization Needs and Requirements

The client should identify his objectives, needs and requirements for the project and communicate this information to the design team in the program as a result of a programming process, so this process involves huge information, data and knowledge which can be started from preliminary to detailed information from different independent sources. The process also involves simultaneous and collaborative work by different project participants. For that, management and communication among all parties of the project are very significant in order to identify and clarify the client requirements (Yu et al., 2005 and Yu et al., 2007).

3. Critical Decision-Making Process

Decision-making process is an important characteristic that distinguishes the architectural programming process where it involves several crucial decisions. Several changes and adjustments and corrections could occur during the programming stage. At this stage, all possible alternatives should be clearly and comprehensively identified for comparison to ensure no potential alternative is missed. It is also a critical stage because of the huge potential to influence cost. Decisions, as well as justifications during the

programming process, should be formally documented (Yu et al., 2005). To make the best decisions, the programming team should acquire special decision- making methods (Kelly et al., 2003).

4. Dynamic and Iterative Process

Programming is considered to be an iterative, continuous and social learning process about the client organization and its spatial needs. Although all parties of project (e.g. the client, designers and consultants) strongly interact together, clients frequently find it difficult to completely capture their organizational needs. The building process is integrated process so programming interacts with most of project building phases such as the design process where the programming frequently interact with the design phase to reach to the best solution which meets the program so it is a complex, dynamic and iterative nature. It involves frequent interactions among the stakeholders to obtain information and to feedback design conclusions so it requires the collaborative work and commitment among a group of stakeholders and designers to ensure shared understanding and knowledge. Through this iterative process the client's value is gradually engaged into both the program and the design (Yu et al., 2005; Kelly et al., 2005, Zwemmer and Otter, 2008 and Bogers et al., 2008).

2.3.3 Who Does the Architectural Programming?

Cherry (1999) stated that a variety of professionals can perform the programming. Those professionals can be clients, consultant, and architects. The clients are not always able to perform the programming but the clients in this context are people who are experienced at programming who build frequently. These clients can only contribute to functional programming of user's needs.

Kumlin (1995) indicated that functional programs provide raw data, for example for office building, the functional program describe the number of personnel and their activities. It is always performed by the owner/client, user, or client, sometimes with the assistance of an expert consultant. The functional program is an essential source of the raw data needed to prepare the facility program.

Regarding the Clients who aren't able to perform the programming themselves, they hire programming professionals or consultants to prepare the program. These programming professionals or consultants are either architects or have architectural training or not. Some of them are expert in particular building types such as office buildings, hospitals or educational buildings …etc (Cherry, 1999).

For complex projects, the programmer or the professional consultant may prepare the program independently from the architect. In these projects, all parties of the project meet together intensively in workshops for one or two days for the purpose of discussion of the critical issues of the project program.

The owner/client is the one who has the responsibility to produce an useable program. In some cases, the owner/client doesn't have the expertise to develop the program, so he will ask an architect to prepare the program or .hire a programming professional or consultant. Several architects present this service of programming as an additional service separately from their standard contracts (Hershberger 1999; Van der Voordt and Van Wegen, 2005 and Cherry and Petronis, 2009).

2.3.4 Architectural Program Relevant Data

If a building is properly designed, it will provide the proper level of its use. This is achieved when the design is preceded by awareness and understanding of the client goals, aims and desires as well as the spatial consequences. What activities will occur in the building? How much space will be needed in the whole area and for each room? What are the considerations for facility accessibility, security and flexibility? What is the kind of interior climate in the facility? What are the laws and regulations that can limit these possibilities? Any limitations and requirements such as aesthetic, culture, economic or legal requirements and expectations must be clearly understood. All requirements, wishes and limiting conditions must be carefully recorded in the program to avoid later disappointment, and to make the designer compare the alternatives and to help him distinguish whether what is desired and wanted compare with what is possible. In other words, the program should completely set the requirements, wants and wishes of the

client and any other conditions which the building will need to satisfy as well as possibilities and priorities which affect the decision-making. The number of these requirements can be extensive, depending on the building size and the complexity of the building function. Although, it is extremely difficult to make everything that is wanted achievable with the available time and money, so the priority levels must be identified for decision- making (Van der Voordt and Van Wegen, 2005).

In 1966, Harold Horowitz discussed 11 areas of information that should be included in an architectural program as listed in the following (Hershberger, 1999):

1. Master plan goals and objectives.
2. Site information.
3. Building occupants characteristics.
4. Requirements of site improvement and development.
5. Restrictions and limitations.
6. Building functional requirements
7. Specific requirements.
8. Functional relationship of the spaces and relative location of the facility.
9. Budget of the project.
10. Ability to adapt in case of function change or future growth (Flexibility)
11. Priority levels among the requirements.

2.3.5 Programming Process Methods:

There are frequently attempts by clients, architects, building developer and experts and programmers to find appropriate definitions for particular architectural problems. Due to this, there different methods of programming have been developed and used over the years. These methods differ from simple discussions between owner/client and the architect to carefully articulated research studies covering all building aspects which lead to a comprehensive program. Most programming methods fall between the two (Hershberger, 1999).

2.3.6 Architectural Programming Problems:

As illustrated by recent studies, Problems related to the programming process still exist. These problems are mainly related the communication and information exchange among all parties of the project such as client, users, architects, managers …etc (Zwemmer and Otter, 2008).

A number of researchers have investigated the problems of architectural programming (e.g. Yu et al., 2005, Shen and Chung, 2006 and Yu et al., 2010). The identified problems include the following:

1. Lack of a comprehensive framework
2. Lack of identification of client requirements
3. Inadequate involvement of all the relevant parties of a project
4. Insufficient time allocated for programming
5. Inadequate communication between those involved in programming

The previous problems in the programming practices may reduce the client satisfaction of the project and affect the final performance of the building.

2.4 PREVIOUS STUDIES

A review of literature in architectural programming processes indicate that there are many international studies which have been completed on various process of programming based on different concepts such as programming process steps, the variables that affect the programming, the role of facility management and user engagement. The frameworks are illustrated in the following:

2.4.1 Framework Based on the Programming Process Steps

Cherry and Petronis, (2009) developed the process for programming. They stated that before the beginning of the process of programming a project; the programmer and the owner/client should develop a list of the stakeholders who will be involved as well as the lines of communication which must be identified and the authority of the committee must be made clear. They proposed six steps of a programming process as shown in figure 2.1. Those steps are *research the project type; establish goals and objectives; gather relevant information; identify strategies; determine quantitative requirements and summarize the program.*

1. Research the Project Type:

If the programmer doesn't have experience on a project type, this step is necessary. The programmer should understand and be familiar with some information such as the spaces types; the space criteria; space relationships; typical costs of material and construction per square meter for the building type; typical site requirements and technical, mechanical, electrical, security, and other issues unique to the type of the project.

2. Establish Goals and Objectives:

This step is achieved by all parties of the project where the programmer discusses and proposes the goals that will guide the remainder of programming process. Every one of the following kind of goals should be addressed: *Organizational Goals* such as the owner's goals; *Form and Image Goals* such as the aesthetic and psychological impact;

Function Goals such as people numbers to be accommodated*; Economic Goals* such as the project budget; *Time Goals* such as the time of project delivery and the expected changes and developments over the next 5, 10, 15, and 20 years; finally *Management Goals*.

3. Gather Relevant Information

Based on the identified goals, the relevant information can be determined and researched. This information includes: building users, their activities and schedules; equipment information, design criteria, standards and codes; energy requirements; future development; and site analysis, available post occupancy studies of similar building types.

4. Identify Strategies

Strategies for programming suggest a procedure for achieving the project goals. The use of bubble diagrams as a tool in programming can be useful for indicating spaces' function relationships and needs.

5. Determine Quantitative Requirements

This step is very important, where the available budget has to be balanced with the amount of desired improvements within the project timeframe.

6. Summarize the Program

Finally, when all of the previous steps are executed, a program can be written as summary statements in the document for the owner, committee members, and the design team. The scope of work which is described in the program should be approved by the decision-makers. After that, the information must be translated at the design process phase. Sometimes the programmer stays involved throughout the remainder of project

phases to ensure that the requirements defined in the program are carried out and realized in the facility design stage.

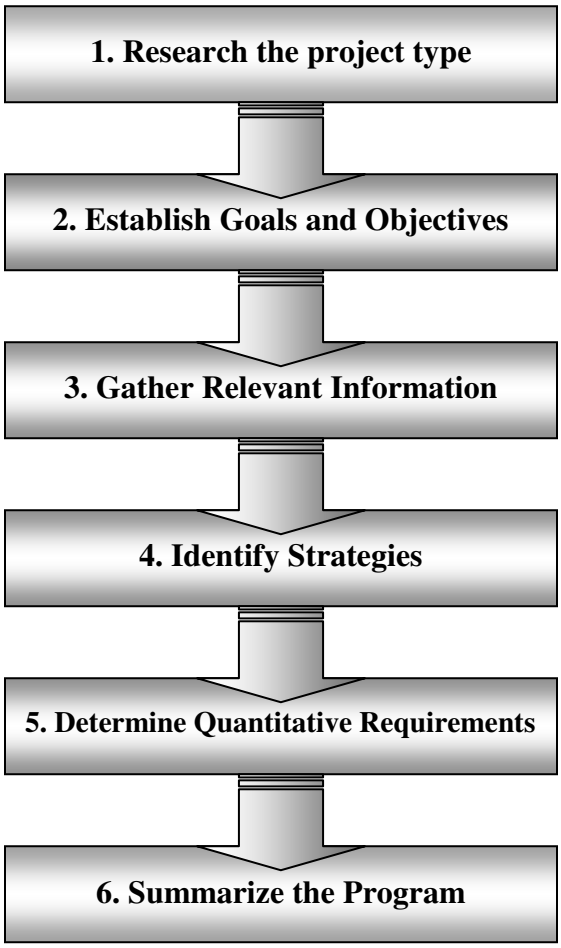

Figure 2.1 Programming Process Steps (Cherry and Petronis, 2009)

2.4.2 Framework Based on the Variables that Affect the Programming

Kelly et al., (2003) developed a theoretical framework to execute the programming process. For more explanation, the following discussion will be carried out. Kelly et al., (2003) identified two different types of program; "the *strategic program* which is a statement of the broad scope and purpose of the project and its key parameters

including overall budget and program, agreed at an early stage of the project, and the *project program* which is the full statement of the client's functional and operational requirements for the completed project".

They identified a number of factors that influence the programming process and they stated how each of these factors relates to one another. These variables are input to the framework and they are: "Projects", "Stakeholder Management", "Change Management", "Knowledge Management", "Risk and Conflict Management", "Post Occupancy Evaluation (POE)" and "Post Project Evaluation (PPE)", "Teams and Team Dynamics", "Client Types", "Types of Business and Organizational Theory", "Decision Making", "Communication", "Critical Success Factors and Key Performance Indicators", and "Culture and Ethics" (Kelly et al., 2003).

The researchers identified three predominant areas in the programming process that require consideration. These three areas are people factors, management inputs, and a series of controls and measures which occur throughout the different stages of the programming process from strategic to project programming, as shown in figure 2.2.

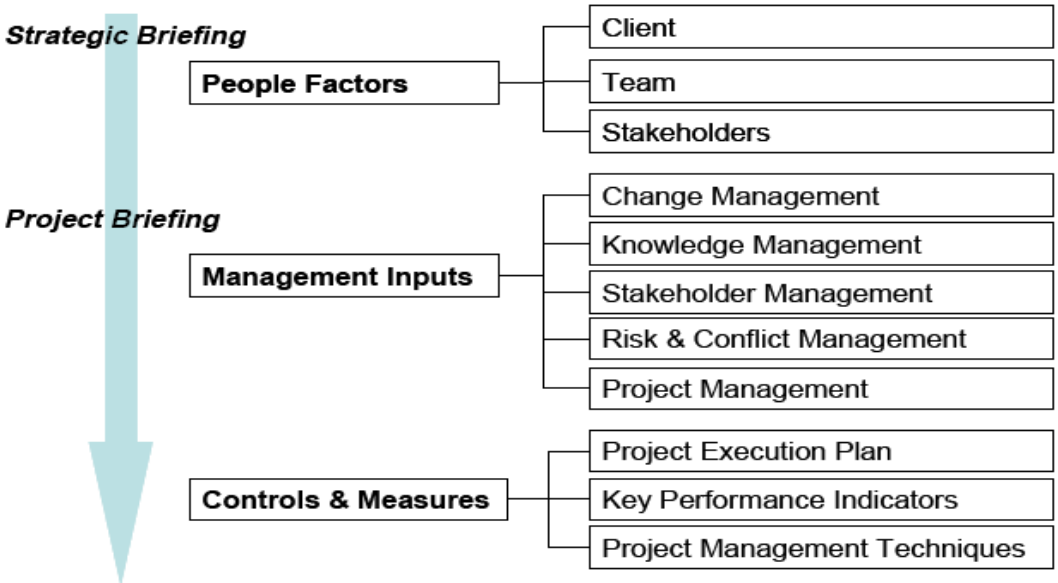

Figure 2.2 Programming Considerations (Kelly et al., 2003)

The developed framework for the programming process involves a number of discrete activities, as follows (Kelly et al., 2003):

1. Identify a trigger for the change (project) in the client organization. This step is vital to identify the initial identification of the requirement for change (project).
2. Identify the project's critical success factors which range from clear objectives and requirements of the project to trust and involvement of the main stakeholders. This step can be executed by the analysis of the requirement for change (project) and can be carried out by the client organization.
3. To continue to be successful, any organization can't stay static without any developments or changes, therefore to improve the organization business, the organization has to undergo change by initiating projects. For that, initiating the project should involve an explicit statement of change (project) to benefit the organization.
4. Forming the project team comprising primary and secondary stakeholders within the client organization, as well as external stakeholders which may be impacted by the initiation of the project.
5. The client organization and stakeholders form the team to develop the strategic program. This program, also known as the concept program, is described as being "aspirational".
6. The formation of the strategic program is followed by the client's decision to build as is, or to modify the developed program.
7. When the decision is made to build, a project team is formed solution and focused on the project program.

At the project program stage, a number of 'inputs', 'controls' and 'measures' are established to ensure the successful progression from the programming stage through the remaining building's steps.

The *inputs* involve all kinds of management, as well as their related techniques to enhance project success, as shown in figure 2.2. For example, (knowledge management), each one of the team has his special knowledge that may be a valuable input to the

project program. This information should be shared and transferred to all members of the team to guide and support the project.

The *controls* and *measures* involve the utilization of different kinds of project management techniques, the implementation of a project execution plan and the use of key performance indicators, which may be the industry's standard indicators or those identified by the project team, or both of them.

Previous Post Occupancy evaluations (POE) and post project evaluations (PPE) will also affect the project program and decisions made at this stage and should outline the successes and failures of previous projects to ensure organizational learning resulting in more successful projects.

Factors like communication, decision making and, the impact of culture and ethics, influence the programming from beginning of the process throughout the facility's life cycle.

2.4.3 Framework Based on the Role of Facility Management

Erdener, (2003) developed a framework for the building process involved the programming process based on the role of facility management as a strategic partner in identifying facility requirements in a dynamic and flexible method.

Firstly, he identified the programming as a necessary function for preparing the program which consists of a number of steps as shown in figure 2.3.

In the first step, the program author identifies the goals (desired ends) that explain the client's aspirations and aims as an individual or a group of stakeholders, originating from the business plan.

Second step is collecting the relevant program information, such as site availability, to economic conditions to legal requirements. At this step, it is easy for the facility manager to add his knowledge and comments for realistic quantified space requirements, timeframe, and the budget required for completing the project.

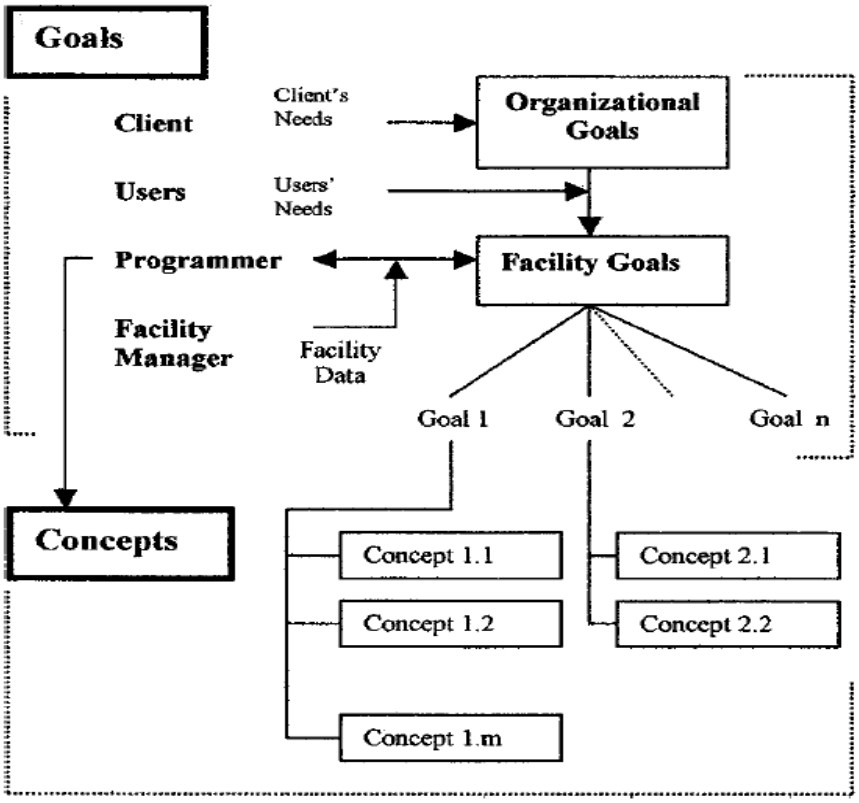

Figure 2.3 Relationship between Organizational and Facility-Related Goals and Concepts Programming (Erdener, 2003)

After that, by considering that goals are desired ends which can be considered as hints of a certain level of quality, the program author should identify ways, means, methods, and techniques to meet them.

All the programming information collected, organized, and analyzed in previous steps is recorded and written in a statement, which summarizes the project problem that needs to be solved in the design phase.

Erdener proposed the framework based on the previous programming steps as shown in figure 2.4.

As illustrated in figure 2.4, the building process is an integrated process. It is clear that the programming process depends on all parties that participate in identifying the client-user facility needs and requirements. Those parties are architects, programming specialists, facility managers, client-users and consultants.

The program information consists of two parts, the first part is information used to develop the schematic design which is the first phase in the design of project where the designer or architect prepares schematic diagrams giving a general view of the components and the scale of the project after detailed discussions with the client (owner) or stakeholders.

The second part is the strategic information used with the information results from the schematic program to develop the program which will be used by the design team to develop the facility design.

The role of facility management as a strategic partner in identifying the facility requirements is to appear as a feedback from post-occupancy evaluation of similar project types. Note, the occupied facility is the source for the POE data, whereas both projects of similar type and the subject building equally contribute to the accumulated experience.

Only the facility manager can provide practical comments and information on space, comfort, and service quality that should properly be used to the process for increasing the facility performance. This requires providing a feedback from the facility management phase of ready facility to programming phase.

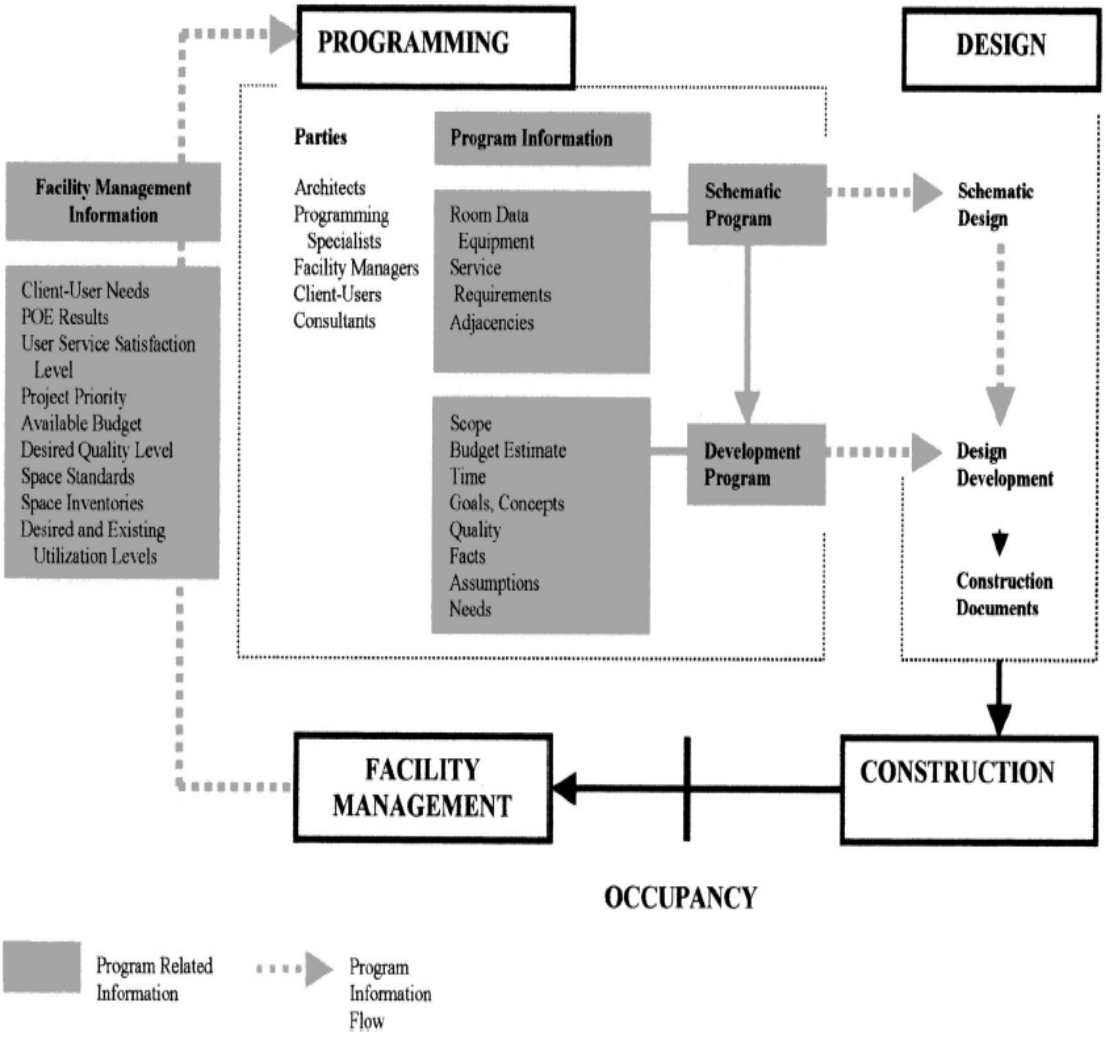

Figure. 2.4 Erdener Framework (Erdener, 2003)

2.4.4 Framework Based on the Concept of User Engagement

Zwemmer and Otter (2008) identified an iterative strategic framework which is based on the concept of user engagement (UE). This concept describes the active and dynamic participation of users during the different phases of the programming and design process. The framework is proposed to be used by client organizations of large construction projects.

The framework consists of three phases which are strategic, preliminary and detailed phase. The construction stage is presented as well because that the building process is an integrated process.

For farther explanation, to understand the concept of user engagement, the different groups of engaged users and the different steps within the framework of user engagement will be described as follows:

Within the general concept, three different groups of engaged users as follows:

The first group is *"the external stakeholder* which are people who could affect the strategic phase, but are not members of the client organization" (e.g. neighbors).

The second group is *"the user study groups* which are people who have a distinctive amount of specific knowledge of the building requirements. This group should be considered as consultants".

The third group is "the *facility study groups* which are all employees and managers who are motivated to collaborate in the programming and design process".

Due to the involved number of project parties, the number of engaged users will depend on process phases, this model represents two lines (dashed and solid) to characterize this flexibility as shown in figure 2.5.

Furthermore, when the number of engaged users increases, a special manager might be hired to manage this engagement process.

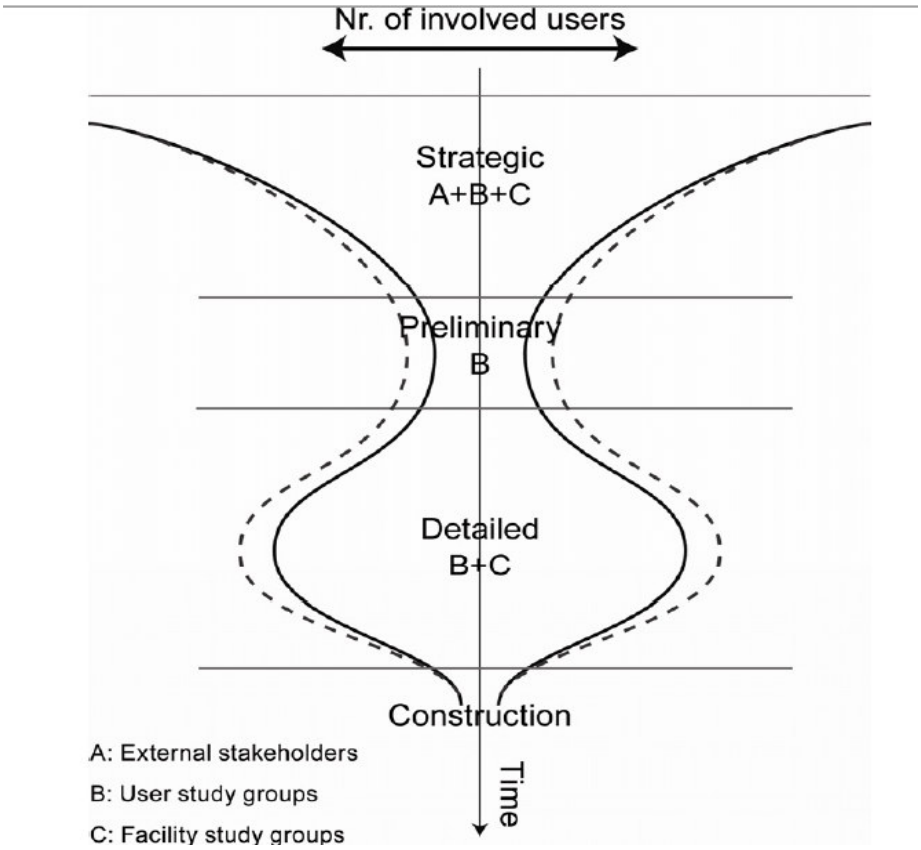

Figure 2.5 Concept of User Engagement UE (Zwemmer and Otter, (2008)

The researcher presented that the application of this framework is independent, so the previous groups should be interpreted as a suggestion to the number of people involved.

The framework developer identified four conditions which the presented concept is based on. These four conditions are:

1. The client needs to be conscious that user engagement could add value to the project. The client should be committed as well. Time and money must be taken in account.
2. The process is a collaborative, learning organization, in which the owner/client representative is the actual decider, so it is necessary to be organized.
3. This collaborative work should be committed by the designers who are responsible for any design activities.

4. It is important to provide feedback to users on how the input is used, and how it has influence the result. This is to retain users' commitment.

The Framework Description:

The framework contains 17 stages within the three phases, strategic, preliminary and detailed phases discussed in the following, as shown in Figure 2.6:

1. Strategic phase.

This phase consists of 11stages; "Sense of Urgency, Project Scope, Define client organization, Select project manager (PM), Create Awareness UE, Commitment UE, (Planning, Analysis and Evaluation), Start-up-meeting, Strategic Needs Analysis (SNA), Strategic Evaluation and Writing the Strategic Needs" (Zwemmer and Otter, 2008).

1. Sense of Urgency, 2. Project Scope

In order to, continue to be successful, companies should focus on increasing innovation and strategy. This leads to development and changes, which consequently affect business, organizational and spatial strategy which could lead to initiate the project. This stage should start the strategic phase of the process by analysis of the scope of the project and the client's strategic requirements.

3. Define client organization, 4. Select project manager (PM)

For an efficient decision making method, small client project organization should be formed. Depending on the amount of professional experience the client should think about employing a manager for the project.

5. Create Awareness UE, 6. Commitment UE

These stages are critical to the success the concept of UE, which requires stakeholders' commitment, so it is very important that the client should be conscious of the significance of the strategic phase of the programming process.

7a. Planning, 7b Analysis, 7c Evaluation

The planning should carried out and communicated to the stakeholders and to further facilitate a transparent process, all parties of the project (e.g. architect, project manager, and consultants) should understand and be aware of each other's roles and responsibilities. There are other sources of knowledge which can influence the strategic phase, such as POE and studies on building characteristics.

8. Start-up-meeting

Since the programming process encourages the collaborative work, this stage is important to introduce every participator and user groups within the project as well as help to ensure commitment and cooperation. The overall objective of this stage is to initiate and prepare the statement of needs.

9. Strategic Needs Analysis (SNA)

The actual programming process starts after the previous stage, where the initial step of the programming process is the list of needs and values, which should be used to the strategic program. The SNA provide a good insight into the values of different stakeholders. In order to administer and coordinate the various needs and values of stakeholders, many statistical tools have been developed. These tools are useful to statistically process data and manage the obtained data. Ultimately, the client organization should make a decision about an efficient strategy.

10. Strategic Evaluation, 11. Writing the Strategic Needs

The strategic needs analysis with the data from the POE provides information which can be used as inputs for the strategic program. Both the project manager (PM) and the client organization should write this strategic document. If possible this document should be written in business language and should also shape the architectural values. To ensure an open process, this output document should not only be communicated to all parties of the project (client and engaged users) during the SNA.

2. Preliminary Phase.

This phase consists of 3 stages; "(Design competition); (Evaluate competition design and select architect) and (Redefine project organization, select consultants and define iterative design and programming process)" (Zwemmer and Otter, 2008).

12. Design competition, 13. Evaluate competition design, select architect

After accomplishment the strategic program document, the process of selection of architects, evaluate the proposed design will be started by the architect. The written strategic program should be translated into the design of a building which corresponds to values and needs. Finally, the architect will be selected by the owner/client and informed of this selection to all related parties of the project.

14a Redefine project organization, 14b select consultants

At this stage, after the detailed design was carried out, in order to ensure an effective process, consultants, professionals and project managers as well as *the user study* groups need to be involved to provide their feedback on the developed design through an intensive and iterative interaction with the designers. The engaged groups should contribute their knowledge to the process. Furthermore, the consultants should provide additional and professional knowledge to the project team. This will be achieved by a new start-up meeting.

14c Define iterative design and programming process

In order to effectively and efficiently perform the programming process, the iterative steps should be identified and planned and the project manager should define the required information throughout the various stages of the process.

3. Detailed Phase

This phase consists of 3 stages; "Iterative design and programming process; Final design, Construction phase and Evaluate process" (Zwemmer and Otter, 2008).

15. Iterative design and briefing/programming process

This stage is very important and can be described as follows: the developed program is used by the designer to create corresponding designs. After that, the developed design well be tested against the program to make the project organization decide if the program should be altered after the process is restarted, and will increase in detail and complexity. Throughout this stage, the *facility study groups* and *user study groups* are engaged.

16a. Final design, 16b Construction phase

Throughout the detailed stages, as the iterative process, the program will progress to be a detailed document where the preliminary and final design is frequently compared to the program. Since the building process is an integrated process and this framework has related to the strategic programming theory, the detailed design phases are correlated to the facility construction phase.

17. Evaluate process

This stage is a critical source to provide feedback and knowledge to the programming framework of the future projects. It is important to evaluate the process, and to propose changes and developments to the process tool.

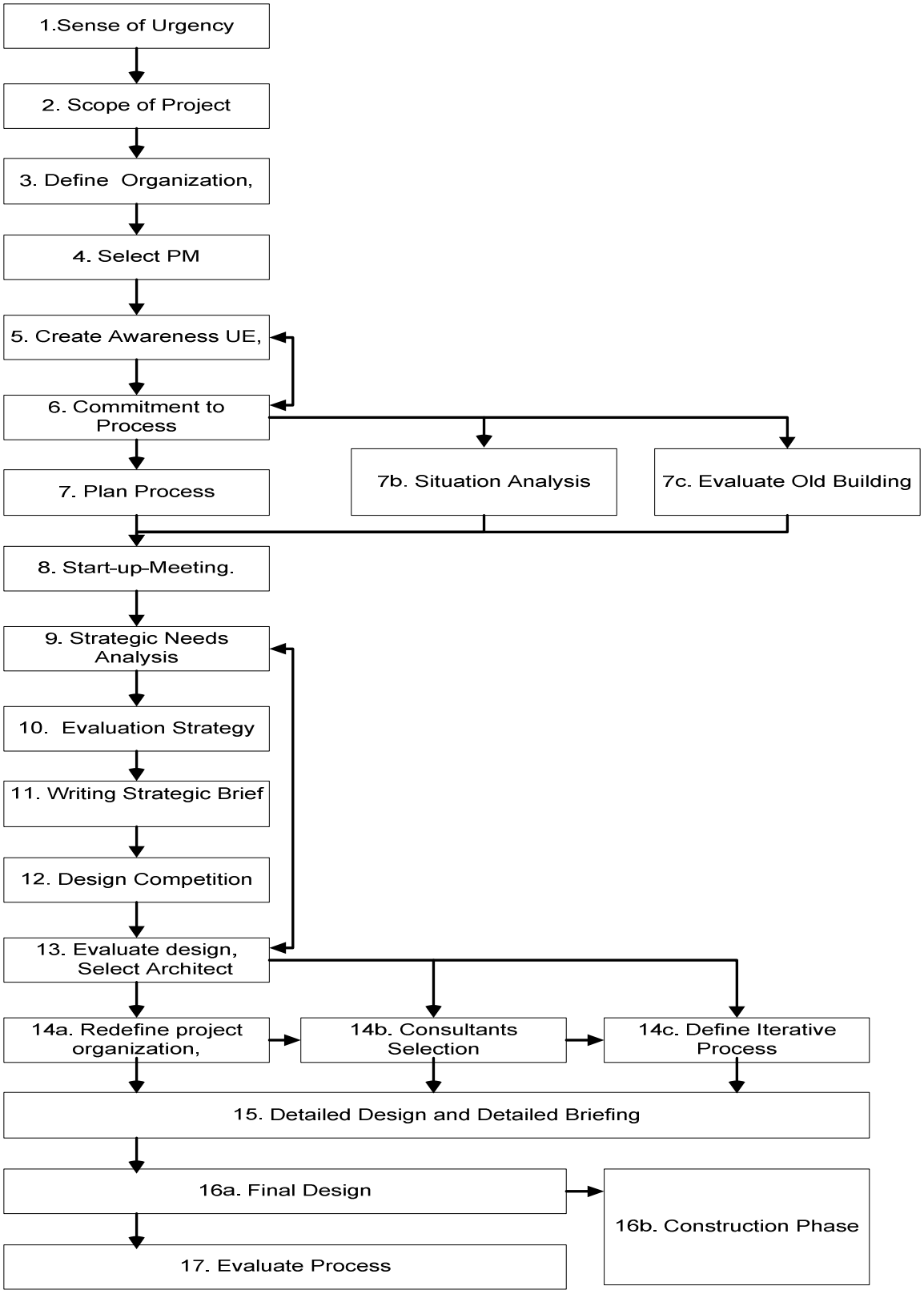

Figure. 2.6. Zwemmer and Otter Framework (Zwemmer and Otter, 2008)

2.5 DISSCUSION

This Chapter presents the literature related to building design and quality, the definitions, characteristics, methods and problems of architectural programming, program writers and data, as well as international practice of architectural programming (previous studies). The purpose of this is to acquire a comprehensive knowledge about the fields the architectural programming process. It was revealed that it is very difficult to absolutely define the quality for any design solution for a building because it depends on huge information that should be considered. The architectural programming process is the process of identifying the project requirements at early project stages of a building project. There are different methods of programming which have been developed and used over the years. These methods vary from simple discussions between owner and the architect to carefully articulated research studies covering all building aspects which lead to a comprehensive program. Most programming methods fall between these two methods. It was indicated that the lack of a systematic and comprehensive framework to identifying and clarifying client's actual needs and requirements, and communicating these requirements to the project design team, are the main obstacles to the success of the final building design and quality. This phase of study revealed that there are many problems of international architectural programming, such as, lack of a comprehensive framework, lack of identification of client requirements, inadequate involvement of all the relevant parties of a project, insufficient time allocated for programming and inadequate communication between those involved in programming.

The next chapter describes the investigation of local current practices of architectural programming in Saudi Arabia through conducting interviews with a selected sample of A/E offices and a selected sample of owners' representatives in Saudi Arabia for the purpose of understanding the current practices of identifying and communicating client and user requirements to the design teams as well as the challenges and the limitations of these practices.

CHAPTER THREE

LOCAL CURRENT PRACTICES OF ARCHITECTURAL PROGRAMMING

3.1 INTRODUCTION

This chapter presents an investigation of local current practices of architectural programming in Saudi Arabia. It focuses on describing the approaches followed in identifying the requirements of building projects and the methods adopted to communicate these requirements to design teams. Interviews were carried out with a selected sample of architects/architectural engineers in addition to a selected sample of owners' representatives in Saudi Arabia. The interviews were carried out for the purpose of understanding the current practices of identifying and communicating client and user requirements to the design teams as well as the factors affecting this process.

3.2 METHODOLOGY OF INTERVIEWS

Interviews were carried out with 10 architects/architectural engineers at A/E design firms and offices and 2 representatives of building projects owners. Details of these interviewees are included in Table 3.1 and 3.2. The interviews focused on:

- Identifying the current practices on how to identify the building project requirements and how to communicate these requirements to design teams.
- Identifying the challenges and the limitations of these practices.

The conducted interviews were structurally based on a developed standard set of questions (shown in Appendix I).

Table 3.1 Interviewed Architects/Architectural Engineers

No	Name of the Interviewed Person	A/E Firm or Office	Region	Date of the Interview	Method of the Interview
1.	Mr. Khalil Ahmed Project Manager	Saudi Consult	Eastern	04/5/ 2010	Face-to-Face
2.	Mr. Ali Al-Shree Project Manager	Saudi Eamar Consult Engineering	Eastern	04/5/ 2010	Face-to-Face
3.	Mr. Moataz Wasfi Projrct Manager	Al-Ajmi for Consult Engineering	Eastern	08/5/ 2010	Face-to-Face
4.	Mr. Peter Costa Projrct Manager	Radicon-Gulf Consult (Eastern)	Eastern	08/5/ 2010	Face-to-Face
5.	Mr. Mohammad Mosa Mr. Mohammad Sayed Arch. Designers	Architecture Dimensions Engineering Office	Eastern	10/5/ 2010	Face-to-Face
6.	Mr. Abdullah Hamdi Projrct Manager	Alroiah for Engineering Consulting	Eastern	10/5/ 2010	Face-to-Face
7.	Mr. Hassan Waked Design Manager	Zuhair Fayez Partnership Consultants	Jeddah	15/5/ 2010	Phone
8.	Mr. Abdul-Aziz Shab Arch. Designer	Abdul-Aziz Shab for Architectural Engineering	Eastern	18/5/ 2010	Phone
9.	Mr. Ahmed bu-Khamsin Executive Director	Architectural Center for Engineering Consultants	Riyadh	19/5/ 2010	Phone
10	Mr. jaafar Abu Hlaikah Projrct Manager	Dar Gassan for Engineering Consultants	Eastern	19/5/ 2010	Phone

Table 3.2 Interviewed Owners' representatives

No	Name of the Interviewed Person	Organization	Region	Date of the Interview	Method of the Interview
1.	Mr. Saleh Al-Gannam Projrct Manager Mr. Abdullah Abu Zaid	KFUPM, Projects Management	Eastern	4 /5/ 2010	Face-to-Face
2.	Mr.Mohammad Tarazan Projrct Manager	ARAMCO	Eastern	11/5/ 2010	Face-to-Face

The respondents were requested to explain their architectural programming practices, opinions and suggestions in response to the questions. The results of the interviews will be discussed in the following sections:

3.3 FINDINGS OF THE LOCAL PRACTICE

To gain insight into the practice of programming in Saudi industry, a series of focused interviews were undertaken and the collected data is presented as follows:

3.3.1 Types of Architectural Programmers

The interviews indicated that the service of architectural programming could be provided by one of two parties follows:

- **First type (external consultants):** External consults are hired by clients from the private sector. Mostly, the external consultant, being the architect/architectural engineer, would be responsible for identifying the project's requirements as well as developing the design solutions for the project.

- **Second type (in-house staff):** In-house staff, commonly referred to as the project management team, is usually part of the client's organization. The client organization in this case could be a public sector client or a corporate client. The project management teams in such organizations would be responsible for the preparation of the organization's project requirements.

3.3.2 Programming Procedures for the Identification of Client and Project Requirements

The interviews revealed that architectural programming is practiced differently, depending on the type of the programmer, namely, external consultants or in-house staff. Accordingly, the architectural programming procedures in Saudi industry are described as follows:

- **First type (external consultants):** The client verbally communicates his goals, needs and requirements to the external consultant. The consultant would then directly prepare a functional program, followed by a series of conceptual and schematic designs for the project as illustrated in Figure 3.1.

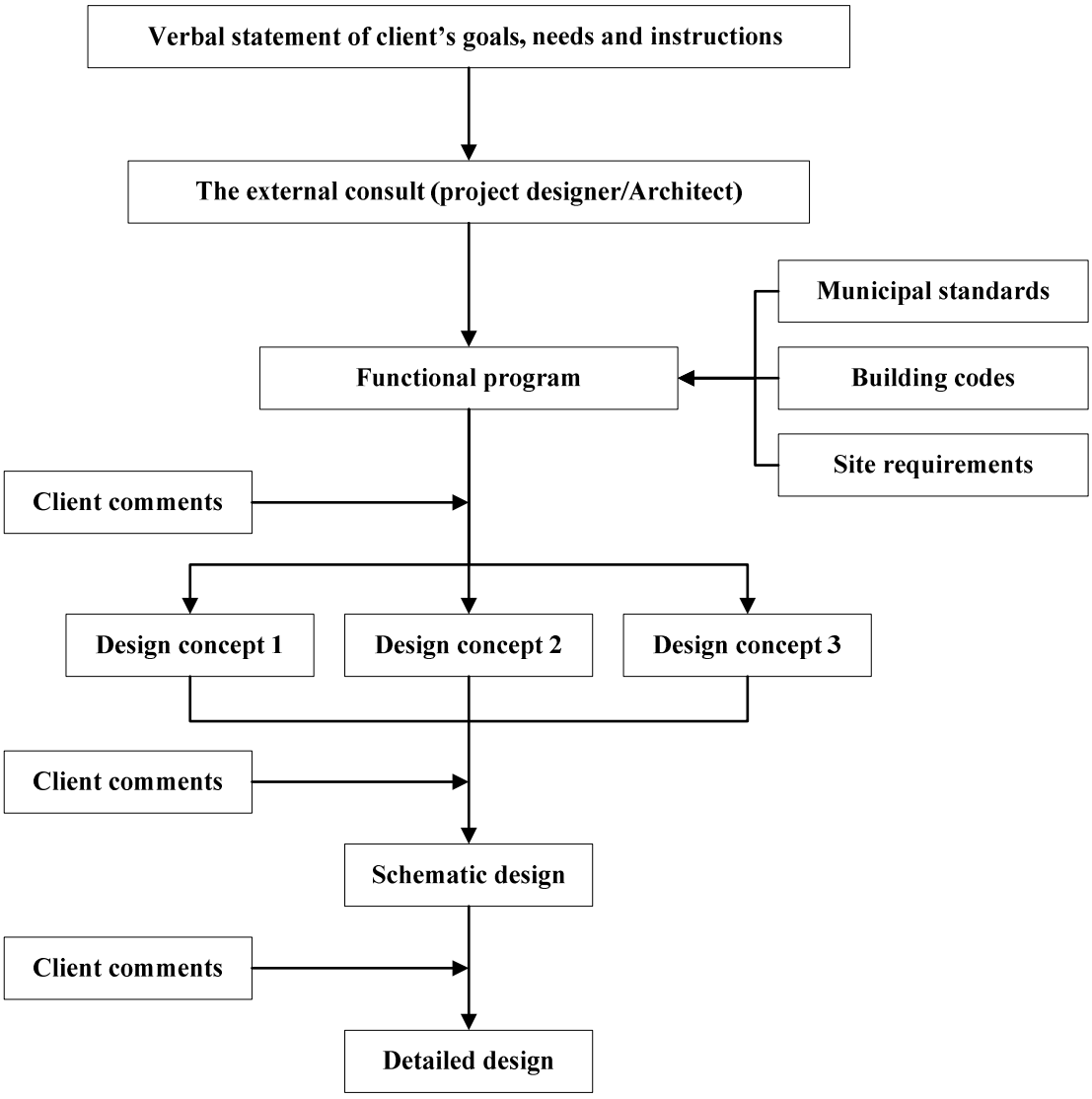

Figure 3.1 External Consultants' Procedures of Architectural Programming

- **Second type (In-house staff):** The project manager or the programmer collects the functional requirements and needs of the end users for the purpose of developing a functional project program. The prepared program would then be discussed with the end users. However, if the end users are unknown, the project manager or the programmer would simply develop the project requirements by modifying the existing requirements of previous similar projects and submit it for approval.

  The prepared program, in a written form, would only contain the functional requirements for the project (spaces, areas, number of end users) as well as the scope of work. The design team would then be expected to develop the remaining components of the project program such as space relationships, priority levels and site requirements. Figure 3.2 illustrates the programming procedures followed by in-house staff for the identification of project requirements.

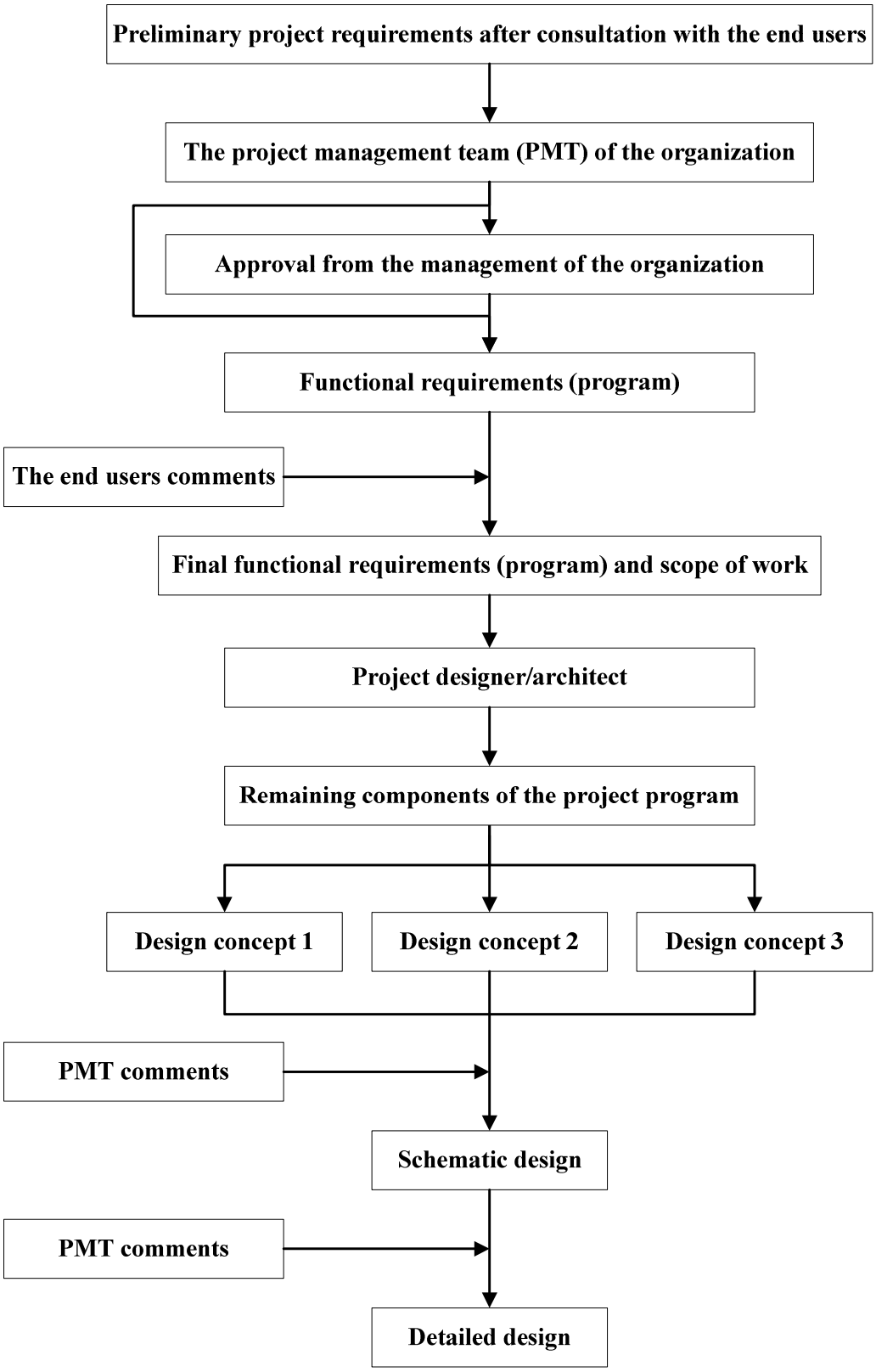

Figure 3.2 In-house Staff's Procedures of Architectural Programming

3.3.3 Attention to Client and Project Requirements

As indicated previously, there are two types of clients. The first type is the private-sector client. The second is the public-sector and corporate client. Accordingly, there exist variations in the level of attention exerted to identify client and project requirements according to the type of the client, as follows:

- **Private-sector clients:** Most of the interviewed architects/architectural engineers indicated that most private-sector clients are developers who will sell or offer-for-rent their buildings to the public after the completion of their projects. They tend to be more focused on the economical side and completion date of their investments. Therefore, they do not focus much on the identification of project requirements. Consequently, project requirements are not be well defined in private-sector projects. Interviewed architects/architectural engineers have indicated several challenges that impact the development of the project requirements, including:

    1. Client's lack of experience.
    2. Absences of commitment from some clients towards the development of project requirements.
    3. Lack of awareness among most of the clients about the significance of architectural programming.
    4. Unknown end users.
    5. Unclear goals and requirements set by the clients.
    6. Changing requirements at later stages during the design process.
    7. Setting a vague budget for the projects.
    8. Lack of fees for the whole process (requirements identification and project design).

- **Public-sector and corporate clients:** The interviewed architects/architectural engineers indicated that statements of needs for this category of clients are

prepared through research on the end user's requirements. Additionally, in-house staff would be conduct studies pertaining to the collection of project requirements. Thus, client requirements in this category are generally well defined. . Interviewed owner's representatives have indicated several challenges that impact the development of the project requirements, including:

1. The end users sometimes do not know their requirements.
2. The end users sometimes are unknown.
3. Constraints through the organization's policies.
4. Constraints through the organization's budget.
5. Rapid changes in the organizational requirements due to changes of work methods, technology developments and organizational structure.

3.3.4 Problems Related to the Current Practice

The findings revealed that the current practices of architectural programming in Saudi Arabia are not effective in providing a clear understanding of the client's and project's requirements. A number of problems identified below are as follows:

3.3.4.1 Lack of a clear methodology or guide on architectural programming

Interview findings indicated that there exist no programming guides, and that programs are prepared formally, or informally, depending on the type of the client, as well as the nature of the project. Architects/architectural engineers and owners usually consider architectural programming as an event, not as a process. Most designers and owners only focus on the development of conceptual and schematic designs, rather than the development of the project requirements which are developed concurrently during these design stages. Consequently, several problems may arise such as changing requirements at later stages during the design phase and even during the construction phase.

3.3.4.2 Lack of client's experience with the building process

Interviews confirm that one of the major problems in the building industry is lack of experience among private-sector clients with the building process. Clients may neither know what exactly their wants are, or their project requirements. In addition, such clients may frequently change their requirements. In such cases, the architects/architectural engineers should be responsible for informing the client about the value and the expected benefits of the architectural programming phase during the project life cycle. Contrasting with the private-sector clients, specialized project management teams working for public and corporate clients are comprised of design professionals who are familiar with the building process. Therefore, this problem of lack of client's experience with the building process is not a serious concern for public and corporate clients.

3.3.4.3 Lack of participants' involvement in the architectural programming process

Interviews indicated that the involvement of the participants who are able to identify the strengths and constraints of the projects from their different viewpoints is essential for identifying the client and project requirements. However, it was pointed out that the architectural programs are usually prepared by a group of few participants from the client organization, or by an architect/designer in the industry. From the results of interviews, it was found that some clients do not know exactly who the end users are, so they had difficulty for identifying the end users and getting them involved in the process.

3.3.4.4 Changing requirements at a later stage of the design process

Interviews indicated that in most cases, private-sector clients do not know what their wants are. Consequently, they change their requirements several times. On the other hand, most of the changes in the projects owned by the public-sector and corporate clients are attributed to the organizational policies and available budgets.

3.3.4.5 Lack of time allocated for the programming phase

Interviews revealed that many clients request reductions in the amount of time allocated for the identification of the project requirements, for the purpose of initiating earlier starts for the design and construction phases. This results in poor identification of project requirements at the early stages of the building process.

3.4 DISCUSSION

This chapter presents the identification of the local current practices of architectural programming in Saudi Arabian industry. It describes the approaches followed for identifying the requirements of building projects and the methods adopted to communicate these requirements to the design teams. Structured interviews, based on a developed standard set of questions, were performed with 10 architects/architectural engineers at A/E design offices and 2 representatives of building projects owners.

The results of the interviews indicated that the service of architectural programming could be carried out by one of two parties. The first is the external consultant for private-sector clients, while the second is the in-house staff of public-sector and corporate clients. Both parties practice quiet different procedures for developing the architectural program. The main difference is that:

- In the first type, the client hires an external consultant to design the project, where the goals, needs and requirements are verbally communicated.

- In the second type, the project functional requirements (program) are prepared by the in-house staff. The prepared program is then communicated to the project designer in a written form.

In private-sector clients, interviewed architects/architectural engineers have indicated several challenges that impact the development of the project requirements. These

challenges are the client's lack of experience, absences of commitment from some clients towards the development of project requirements, lack of awareness among most of the clients about the significance of architectural programming, unknown end users, unclear goals and requirements set by the clients, changing requirements at later stages during the design process, setting a vague budget for the projects and lack of fees for the whole process (requirements identification and project design).

In public-sector and corporate clients, according to the interviews with owners' representatives, the major challenges emerge throughout the programming process are that the end users sometimes do not know their requirements, the end users sometimes are unknown, constraints through the organization's policies, constraints through the organization's budget and rapid changes in the organizational requirements due to changes of work methods, technology developments and organizational structure.

Most of the interviewees believed that their current practices in programming are practical for the industry. However, the research findings revealed that these practices are not really effective in providing a clear definition and understanding of the clients and projects requirements. A number of major problems have been identified which are lack of a clear methodology or guidance on the architectural programming, lack of experience of the client with the building process, lack of participants' involvement in the architectural programming process, changing requirements at a later stage of the design process, lack of time allocated for the programming phase.

The next chapter presents the factors influencing the process of developing and implementing the architectural program for building projects. Identification of factors was carried out through surveying and synthesizing various knowledge areas in architectural programming documented in international literature sources and observed professional practice.

CHAPTER FOUR

FACTORS AFFECTING THE DEVELOPMENT AND IMPLEMENTATION OF THE ARCHITECTURAL PROGRAM

4.1 INTRODUCTION

Investigation of the factors influencing the process of developing and implementing the architectural program is critical for the effective understanding of the nature of the programming process and the development of the proposed framework that aims at capturing the process of properly identifying and communicating client and user requirements to design teams. Identification of the factors was carried out through surveying and synthesizing various knowledge areas in architectural programming documented in international literature sources and observed professional practice. This chapter identifies a series of twenty eight factors that could potentially affect the processes of developing and implementing the architectural program.

4.2 ARCHITECTURAL PROGRAMMING RELATED FACTORS

The factors that influence the process of developing and implementing the architectural program are classified under six categories related to the owner and his representatives, the architectural programmer, the program data, the role of communication throughout the programming process, the allocated time, budget and the management and control of the programming process.

4.2.1 FACTORS RELATED TO THE OWNER AND HIS REPRESENTATIVES

4.2.1.1 Involvement of the Owner in the Architectural Programming Process

An architectural programming process requires the involvement of the owner who informs the design team of his objectives, needs and requirements for the project (Hershberger, 1999). Owners may not entirely understand their roles within the building process, as well as the legal and financial implications of constructing a building (Bowen et al, 1997). The owner of the project may be a single person, organization or many stakeholders, made up of individuals, each having different goal and project requirements. As the programming process should sufficiently capture all the requirements of the stakeholders, the designer may experience difficulties in trying to satisfy their diverse goals (Yu et al., 2005). Shen and Chung (2006) advocate the involvement of stakeholders in the architectural programming process, as their active involvement serves to identify strengths, constraints and eventually consensus which ensure the reliability of the project. Cherry and Petronis (2009) indicate that prior to working through the programming process for a project, the programmer and the owner should identify project participants that will be involved in contributing to the architectural program. Further, channels of communication as well as levels of authority are also identified. Commenting on the involvement of the owner and his representatives in the architectural programming process, Bogers et al. (2008) states that “it is important to realize that architects cannot produce a good design, when clients fail to be clear about what they want”.

4.2.1.2 Involvement of the End User in the Architectural Programming Process

End users are considered to be a significant source of knowledge on the specific requirements for building projects (Zwemmer and Otter, 2008). Users may constitute more than one entity. They may constitute a diverse collection of individuals or groups with different interests and views. Moreover, these users might be part of the client

organization, external tenants, combination of both types, or they may be individuals or groups upon whom the organization relies, such as its customers and visitors (Blyth and Worthington, 2001). Brauer (1992) indicates that due to the diversity of facility users' types, confusion about whom to seek requirements from or who has the authority to approve requirements may occur. When direct contact between the users and the designer may not be feasible, the architectural program should contain as much information as possible about the requirements of the different types of users of the buildings (Bogers et al., 2008). Yu et al. (2007) stressed the significance of involving adequate representation of all parties representing the client organization to address their needs and requirements.

4.2.1.3 Involvement of the Project Manager (Representing the Owner) in the Architectural Process

Owing to the complexity of the building process and the diverse parties involved in the process, the owner may choose to appoint a project manager to coordinate and manage the whole process. This project manager may be staff from the client's organization or an external consultant. There exits two classifications of project managers. The first classification is that the process project managers, who convey the owner's interests and expectations to the building team, ensure that the owner's objectives are met. The second classification is that the construction managers work towards delivering the end product (i.e. the building) to the owner (Blyth and Worthington, 2001). Interaction with the project management team of the client organization is effective and much more productive, than the direct interaction with the owner. This is mainly due to the fact that the project management team is comprised of design professionals who are familiar with the building process (Ibrahim, 2010; Costa, 2010).

4.2.1.4 The Owner's Level of Experience with the Building Process

Kelly et al., (2003) identified some programming problems such as inexperience of the owner with the building process, inadequate representation of the owner in the architectural programming process, and partial identification of the owner's project

requirements. These problems may lead to the development of a vague architectural program for the project (Bowen et al, 1997). Comprehension of the architectural program largely depends on the experience of projects' owners. Experienced owners tend to develop a detailed, sometimes meticulous program; while inexperienced owners have a propensity to overlook the project program completely (Yu. et. al., 2010). A series of interviews confirmed that one of the major problems in the building industry is lack of experience among owners with the building process. Owners may neither know what their wants, or their requirements. In addition, such owners may frequently change their requirements. In such cases, the architect has the responsibility of informing the owner about the importance and the expected benefits of architectural programming (Wasfi, 2010; Sayed and Mosa, 2010 and Hamdi, 2010).

4.2.2 FACTORS RELATED TO THE ARCHITECTURAL PROGRAMMER

4.2.2.1 Familiarity of the Architectural Programmer with the Project Type

Architects responsible for developing the architectural program may not have enough experience in the requirements of the specific project type they are involved in. Consequently, the outcome of the programming process may be of an inferior quality (Shen and Chung (2006). Lack of experience on the project type may result in developing inaccurate assumptions pertaining to space types, space allocation criteria, space relationships and proximities from one to another, costs of materials and construction of this building type, typical site requirements and technical, mechanical, electrical, security, or other requirements, unique to the type of the project (Cherry and Petronis, 2009). In addition to unfamiliarity with the project types, absence of information pertaining to the type of the end users may result in the development of an improper architectural program for the project (Al-Ghannam and Abu-Zaid, 2010).

4.2.2.2 Familiarity of the Architectural Programmer with Various Building Systems (Structure, Electrical, etc)

The architect usually assumes the responsibilities of developing the architectural program as well as developing design solutions for the project. However, Shen and Chung (2006) indicate that not all architects are good programmers. A specialist in one filed may overlook essential information that pertains to other professionals. For example, architects may be unfamiliar with the construction process and may miss out some issues in the construction phase. Architects tend to focus on the design of the facility, rather than on clearly establishing the needs and requirements of clients in the architectural programming process. As a result of this bias, from program-writer towards focusing only facility design, the outcome generated from the architectural programming process may suffer from details needed to reflect the requirements of the client organization (Shen and Chung, 2006). Costa (2010) emphasizes that architects, being responsible for developing the architectural program, should possess adequate experience in other professional disciplines.

4.2.2.3 The Architectural programmer's Ability to Comprehend the Project Requirements during the Architectural Programming Phase

Recognizing that one person cannot know all the requirements. The representative/participant may overlook important things or may have entered items incorrectly (Brauer, 1992). The programmer should be able to comprehend the project requirements (Wasfi, 2010; Abdullah, 2010). Efficient programming depends mainly on the involvement and the skill of two parties. These parties are the programmer and the owner (Salisbury, 1998). Owners and their consultants normally focus on documenting their requirements in large reports. As a result, architects may not sufficiently comprehend the full extent of the documented requirements to commence work in the design phase (Bogers et al., 2008).

4.2.2.4 The Architect's Ability to Comprehend the Developed Program during the Design Phase

The building design basically aims to produce a functional building that meets a set of actual needs and requirements of the clients (Harputlugil et al., 2006). If the building is properly designed, it will provide the proper level of its use. This will be achieved when the design is preceded by awareness and understanding of the client/end users' goals, aims and desires as well as the spatial consequences (Van der Voordt and Van Wegen, 2005). The architect should properly understand the prepared program and carefully interpret it during the design process. Equally, it is important to be aware that when owners fail to determine and clarify their project requirements, architects are not expected to comprehend these requirements (Bogers et al., 2008).

4.2.3 FACTORS RELATED TO THE PROGRAM DATA

4.2.3.1 Clarity of Project Goals Set by the Owner

A successful programming process depends on identifying and understanding the goals of the project (Yu et al. 2007). The earliest activity in architectural programming focuses on identifying the goals and objectives for the project by the owner or his representatives. There exist several types of goals for consideration during the development of the program. These types include (1) organizational goals, such as the owner's goals; (2) form and image goals, such as aesthetic and psychological impact; (3) functional goals, such as, the number of people to be accommodated; (4) economical goals, such as, the project budget; (4) time goals, such as, the project delivery date and the expected changes and developments over the next 5, 10, 15, and 20 years; and finally, (6) management goals, such as, deadline for achieving steps of the architectural programming process (Cherry, 1999).

4.2.3.2 Clarity of Project Requirements *(Functional, Technical and Behavioral)*

Owners should identify their project requirements clearly, systematically and comprehensively (Shen and Chung, 2006). Owners and their consultants usually identify and document their needs and requirements in large reports. Therefore, when owners fail to clarify the extent of their requirement, architects will find it challenging to develop effective design solutions (Bogers et al., 2008). Yu et al. (2005) indicates that while developing the architectural program, it is necessary to consider and maintain the proper balance of the interests of all parties in the client organization. Further, the architectural programmer is expected to be keen on responding to the requirements of all parties of the client organization.

4.2.3.3 Identifying Functional Relationships among the Various Facility Spaces

Spatial relationships are best illustrated through the development of simple diagrams. There exists a wide variety of styles that could be used to develop space relationship diagrams. These styles range from freehand sketches to hard line drawings (Kumlin, 1995). Spatial relationship diagrams can be used to illustrate circulation patterns between different spaces, spaces that may require security measures, and other properties for the space. The "Bubble" diagram is one type of space relationship diagrams. Bubble diagrams indicate space adjacencies relative to one another within the building to facilitate smooth operation (Cherry and Petronis, 2009). Another type of space relationship diagrams is known as the “Adjacency Matrix”. This type permits the accommodation of wide range of relationships between spaces, housing different functions, based on established levels of adjacent priorities (Kumlin, 1995). Relationship diagrams are extremely useful for depicting correlations pertaining to spatial requirements for the project. Spatial relationships differ from one project type to another depending on the characteristics of the activities conducted in the organization.

4.2.3.4 Establishing Priority Levels for the Various Requirements of the Project

The Priority level set for each requirement in the project is an integral part of the data needed to develop and implement the architectural program (Kumlin, 1995). Established levels of priority identify opportunities for developing design solutions and set constraints on the implementation of the solutions (Cherry, 1999). Kumlin (1995) indicates that these established levels of priorities provide an useful measure of control and assessment of the final design solution. In situations where the requirements cannot be implemented, due to time, budgetary or other constraints, the programmer and the owner, should work towards establishing modified priority levels. An example for a modified level of priority is having to allocate one conference room to three departments, rather than one for each department (Cherry, 1999). Kumlin (1995) revealed that in cases where the significance of some of the program requirements is not indicated, the program may be subjected to a wide range of interpretations during the design phase.

4.2.3.5 Adherence to the Applicable Codes and Municipal Standards for the Project Type

Architects, while developing the architectural program, have to be aware of the relevant codes and standards that apply to the project. Some of these codes and standards are legislative requirements for licensing, accreditation, or equity purposes. Examples include codes and standards pertaining to zoning and licensing requirements as well as other legal obligations. Architects must adhere to these codes and standards throughout the programming process, as these codes and standards could have a strong bearing on the cost of the project, they must be considered at the initial stages of the design phase (Cherry and Petronis, 2009).

4.2.3.6 Effect of Project Scale on Developing the Architectural Program

In most projects, the architectural program is developed based on discussions with the owner, end users, facility managers, as well as external consultants (Bogers et al., 2008). A program can vary considerably in length, content and format, depending on three main

issues. The first relates to the professional experience of the owner. The second is associated with the type, scale and complexity of the project. The third pertains to the organization of the construction process (Shen and Chung, 2006). In large and complex projects, programming is more significant than in standardized and small projects (Bogers et al., 2008).

4.2.3.7 Feedback from Previous Projects (Post-Project Evaluation and Post-Occupancy Evaluation)

Feedback from previous post-project evaluation (PPE) is very useful to the architectural programmer. PPE focuses on the process of evaluating projects right after the completion of their construction. This evaluation usually occurs before the building has been occupied by the users. PPE provides the programmer and the designer with useful feedback on problems and solutions pertaining to the design and construction of similar types of projects.

Previous post occupancy evaluations (POE) provide valuable feedback to planners, design professionals, facility managers involved in the planning, design and operation of projects. POE concentrates on building users and their requirements. It provides insights into the outcomes of past design decisions and the resulting building performance. This knowledge forms a sound basis for improving existing buildings and designing, constructing and operating better buildings in the future (Preiser et al., 1988).

Feedback generated from PPE and POE provides for an improved understanding of the successes and failures of previous projects. This feedback leads to better decision making in the programming process of subsequent projects (Blyth and Worthington, 2001; Yu et al. 2007).

4.2.3.8 Anticipation of Changes in the Future Use of the Building

A well documented set of user requirements provides for a building that is expected to meet the expectations of its users. However, as time goes on, the range of activities and the users occupying the building may change. Due to such changes, the building may not be able to cope with the new requirements of its users (Brauer, 1992). Consequently, the building may suffer from functional obsolescence at an earlier stage of its service life (Langston and Lauge-Kristensen, 2002). Tarzan (2010) indicates that due to rapid changes in technology and organizational structures, anticipated future developments and changes should be addressed during the programming phase to ensure the development of long lasting design solutions.

4.2.4 FACTORS RELATED TO THE ROLE OF COMMUNICATION THROUGHOUT THE PROGRAMMING PROCESS

4.2.4.1 Utilization of Face-to-Face Contact as a Communication Method

The success of the architectural programming process depends on effective communication between all participants in the project. Active listening throughout the programming process facilitates a free and complete exchange of information. It also enables effective communication. Prepared or facilitated workshops could improve the communication among all project participants (Yu et al. 2007). Bogers et al. (2008) asserts that programming documents cannot replace face-to-face communication with the project owner as written requirements do not always reflect the actual expectations of the owner and his representatives. Commenting on the significance of face-to-face communication, Bogers et al. (2008) states that “many of the architects say that they always try to establish a direct dialogue with users and clients, even though they are not supposed to do so in some projects. Direct contact with users is seen as necessary to get a “feel” for the organization and the ambitions and priorities of the clients”.

4.2.4.2 Frequent Communication between the Owner and his project Representatives with the Programmer

Frequent communication between the owner and his project representatives (i.e. end users and project manager) with the programmer during and throughout the architectural programming process is essential for identifying, clarifying and representing the project requirements (Yu et al. 2007). Bowen et al. (1997) indicate that communication among the owner, the end users and the programmer to identify their requirements significantly affects satisfaction with the finished building project. Costa (2010) indicates that architects frequently need to interact with the project owner or his representatives to address their needs and requirements, especially when the owners don't have any experience with building process.

4.2.4.3 Frequent Communication between the Owner or his Project Representatives and the Design Team

Architects see face-to-face communication as a means to check their level of understanding and the correctness of their interpretation of the program requirements (Bogers et al., 2008). Bowen et al. (1997) advocates that communication among members of the design team, during the design phase, could result in discovering the discrepancies made in the developed architectural program and developing means to resolve such inconsistencies. Lack of adequate communication may result in the development unsatisfactory design solutions. Abu-Hlaikah (2010) indicates that the owners sometime may not be aware of the important role of the programming phase, and as such, they may not know their exact needs. Therefore, face-to-face contact with the owners is essential to identify their needs and requirements.

4.2.4.4 Utilization of Different Methods *(Figures, Pictures and Text)* to Document and Effectively Communicate the Architectural Program

The adequacy of documentation methods used to compile the architectural program is a significant factor towards the development of a satisfactorily design solution. Kumlin (1995) states that "most people are verbal thinkers, but architects, and engineers are visual thinkers. Programming is the bridge between these thinking languages, and therefore the program should incorporate as many graphics as the budget and time allows. The very best messages are those that contain both pictures and words". Shen and Chung (2006) indicate that the architectural program is typically expressed either in written format or verbal format, or through a combination of written and verbal formats. Zwemmer and Otter (2008) prefers that the architectural program, which states the architectural values, is documented in business language as a common form of communication. Yu et al. (2007) comments that a lack of common language usually provides for vague statements that could be misinterpreted as a result of the assumptions made.

4.2.5 FACTORS RELATED TO THE ALLOCATED TIME AND BUDGET

4.2.5.1 Allocating Enough Time for Developing the Architectural Program

An early start of the construction phase is a common objective for almost all project owners. Several clients allocate a short amount of time for the architectural programming process, which may result in poor definition of the client's actual needs and requirements (Shen and Chung, 2006). The time allocated for developing the architectural program may also be affected by commercial pressures from clients. These commercial pressures in most cases require detailed designs to be prepared as soon as possible, as there is urgency to obtain an immediate design solution. These reduce the time allocated to comprehend the actual needs and requirements of the clients and may affect the performance and the success of the project (Yu et al., 2005).

4.2.5.2 Setting Up of a Deadline to Freeze the Development Architectural Program

The architectural program should be compiled, completed and agreed upon before commencing the design phase for the project. In essence, the architectural program should act as a reference document which should be available to all project parties (Yu et al. 2007). Othman et al. (2004) indicates that later changes to the architectural program constitute a major source of dispute and litigation globally throughout the construction industry. Once established, changes made to the architectural program at later stages could affect the cost, time and quality of the project.

4.2.5.3 Allocating a Separate Service Fee for Developing the Architectural Program

Usually in small buildings projects, the architectural program is developed by the architect without an additional fee. On the other hand, in large building projects, the client usually pays separately for the commissioning the architect to develop the architectural program (Cherry, 1999). Interviewed architects agreed that there is no fee allocated for preparing the architectural program separately in comparison to preparing the design documents for the project.

4.2.5.4 Setting a Clear Budget for the Whole Project

Information about the set budget for completing the project is an essential concern for the developer of the architectural program. The common absence of this type of information in many types of project could result in the misinterpretation of some of the requirements. Lack of information on the set budget for the project makes it very challenging for architects to comprehend the contents of the architectural program. Expressions such as “high-quality” or “high-standards” may not in fact be understood when budget information is missing (Bogers et al., 2008)

4.2.6 FACTORS RELATED TO THE MANAGEMENT AND CONTROL OF THE ARCHITECTURAL PROGRAMMING PROCESS

4.2.6.1 Commitment of all Participants in the Programming Process

The development of an effective architectural program requires the collaborative interaction between all participants in the architectural programming process. This collaboration is in the form of exchanging information on requirements and providing feedback on the developed architectural program. Commitments among all participants in the project to facilitate a collaborative interaction ensure the development of an efficient architectural program. Project participants have to be aware of the strategic benefits of the architectural program in order to cultivate commitment for this significant phase of the building process (Zwemmer and Otter, 2008). Tarazan (2010) and Waked (21010) emphasize that the commitment among all project participants during the architectural programming phase is extremely important. It builds up trust between all project participants, which reflects positively on the whole building process.

4.2.6.2 Inclusion of Influential Project Parties that May Enrich the Architectural Programming Process

The number of persons in a group has a strong bearing on the quality of the interaction among them. As groups increase in sizes, participation of members in discussions may becomes less dynamic and unproductive. Selection of the minimum number of resourceful, yet cooperative members in the group, facilitates exchange of ideas more freely. Those members are focused with completing the task. They usually experience less difficulty in communication, and they coordinate their activities. In addition, they demonstrate clearer insight and better judgment in matter pertaining to the project (Kumlin, 1995).

4.2.6.3 Timely and Proper Decision-Making at the Various Stages of the Development and Implementation of the Architectural Program

Management and control of the different groups involved throughout the development and implementation of the architectural program are essential factors that affect its success. The architectural programming process involves making decisions, on several program requirements, during the development and implementation of the program. Yu et al. (2005) indicate that decisions on changes, adjustments and corrections normally occur during the programming phase. Blyth and Worthington (2001) advocate that it is crucial for the success of the project that right decisions are made at their right times by the right project participants. Decisions are guided throughout the project by the owner during the programming phase, by the design team during the design phase and by the contractor during the construction phase. Decisions are then exercised by the owner during the occupancy phase. Moreover, the owner usually assumes the dominate role throughout the project life cycle.

4.2.6.4 Frequent Review and Refinement of the Program during the Early Design Stages

During the design phase, architects develop a number of conceptual designs based on their interpretation of the complied project program (Shen and Chung, 2006). Since the architectural programming process is an iterative one, the developed program will take the form of a detailed document as it is subjected to multiple rounds of review and refinements during the design phase (Zwemmer and Otter, 2008). In practice, the program continues to develop even further during the design phase as many questions and ideas arise (Van der Voordt and Van Wegen, 2005). Interviews with architects revealed that project owners, especially within residential sector, may not be able to identify their requirements without reviewing preliminary design documents.

4.3 DISCUSSION

Investigation of the factors influencing the process of developing and implementing the architectural program is critical for the effective understanding of the nature of the programming process and the development of the proposed framework.

This chapter presents a set of twenty eight factors that could potentially affect the processes of developing and implementing the architectural program for building projects. These identified factors were classified under six categories related to the owner and his representatives, the architectural programmer, the program data, the role of communication throughout the programming process, the allocated time and budget and the management and control of the programming process.

The next chapter presents a development of the framework that aims at capturing the process of properly identifying and communicating client and user requirements to design teams. The proposed framework will be developed based on knowledge from the literature and observed professional practice as well as the identified factors presented in this chapter.

CHAPTER FIVE

DEVELOPMENT OF GENERIC FRAMEWORK FOR ARCHITECTURAL PROGRAMMING

5.1 INTRODUCTION

This chapter presents a development of the framework aimed at identifying and communicating the client and user requirements to design teams through the architectural programming process for building projects.

The lack of a systematic and comprehensive framework for identifying and clarifying client requirements, and communicating these requirements to the design team are the main obstacles to the success of the final building design (Kelly et al., 2003; Yu et al, 2005; Shen and Chung, 2006). As discussed in chapter one, a number of studies have been conducted to develop programming guides for inexperienced clients. Despite these attempts, the current programming practices are still considered to be inadequate by many researchers (e.g. Yu et al, 2005 and Bogers et al., 2008).

In Saudi Arabia, interviewees stated that there exists no programming guides, and that programs are prepared formally or informally depending on the type of the client as well as the nature of the project. This research asserts that there is a need to develop a standard methodology (framework model) that a projects' architectural programmer can adopt in the professional practice of architectural programming.

The proposed framework is developed based on knowledge from the international literature, observed professional practice and the identified factors. The framework, presented as a process model, is generic, meaning that the activities involved can be

adapted and applied to any project type and by the two types of project programmers (external consultants and in-house staff).

The framework models developed herein, are presented as $IDEF_0$ (*Integration Definition for Functional Modeling*) process models (Federal, 1993). A process model displays the interactions between activities in terms of inputs and outputs while showing the controls placed on each activity and the types of resources assigned to each activity.

Appendix II provides a description of $IDEF_0$ process modeling methodology. This model can act as policy guidelines for conducting architectural programming activities, and provides a way for of bridging the gaps in architectural programming practice.

5.2. ARCHITECTURAL PROGRAMMING FRAMEWORK

The framework model consists of six sequential processes. For each of the processes, a number of supporting activities have been defined. As shown in Figure 5.1, the six processes forming the framework model can be described as follows:

1. Identify Project Information
2. Research the Project Type
3. Identify Requirements of End Users
4. Analyze and Balance the Identified Project Requirements
5. Document the Project Program
6. Review and Update the Developed Project Program

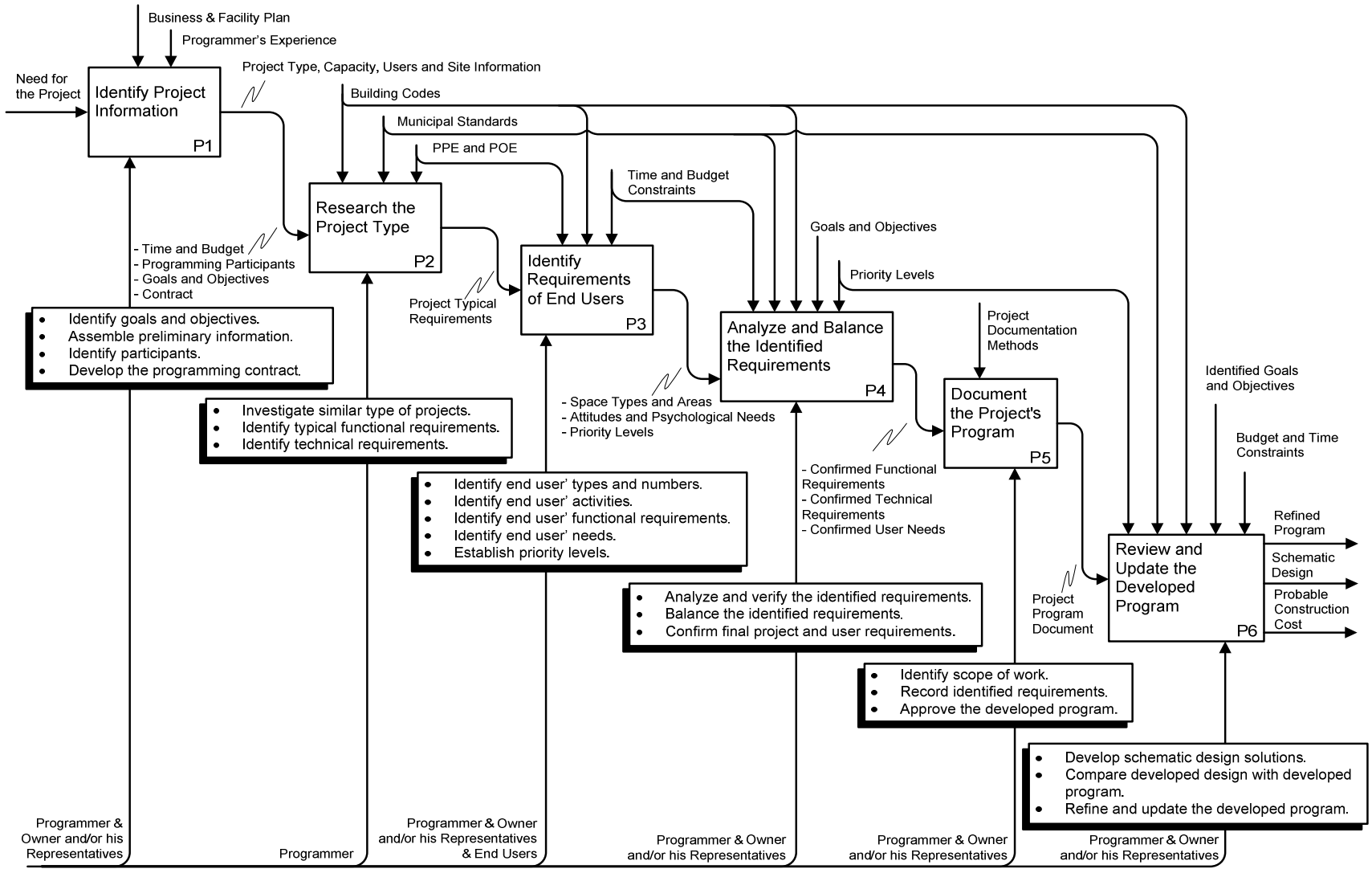

Figure 5.1 General Processes Involved in the Architectural Programming Framework Model

5.2.1 Identify Project Information

5.2.1.1 Process Definition

The “Identify Project Information” process (node “P1” as shown in Figure 5.1), involves investigating general information about the project, the project's owner, the project's end users and the project goals and objectives. This process depends on the involvement of the project owner and/or his representatives and the owner’s level of experience with the building process, as well as the architectural programmer’s ability to comprehend the project requirements.

This process can be facilitated through a series of face-to-face meetings between the architectural programmer and the owner and/or his representative/s. A site visit can also be useful to acquaint the architectural programmer with the available site that will be utilized for developing the project.

The input necessary to carry out this process is the need for a facility as a project. This need has emerged as an objective in order to implement the facility plan. An output of this process is a statement of the goals and objectives of the project. The outputs also include statements on the project type, capacity, site area, geometry, orientation and architectural style. In addition, the outputs also include statements on the period of time allocated for developing the architectural program, the allocated budget for developing the project, the participants in the programming process and the programming contract.

This process is divided into four functions as shown in Figure 5.2. The following paragraphs provide a description of the functions involved.

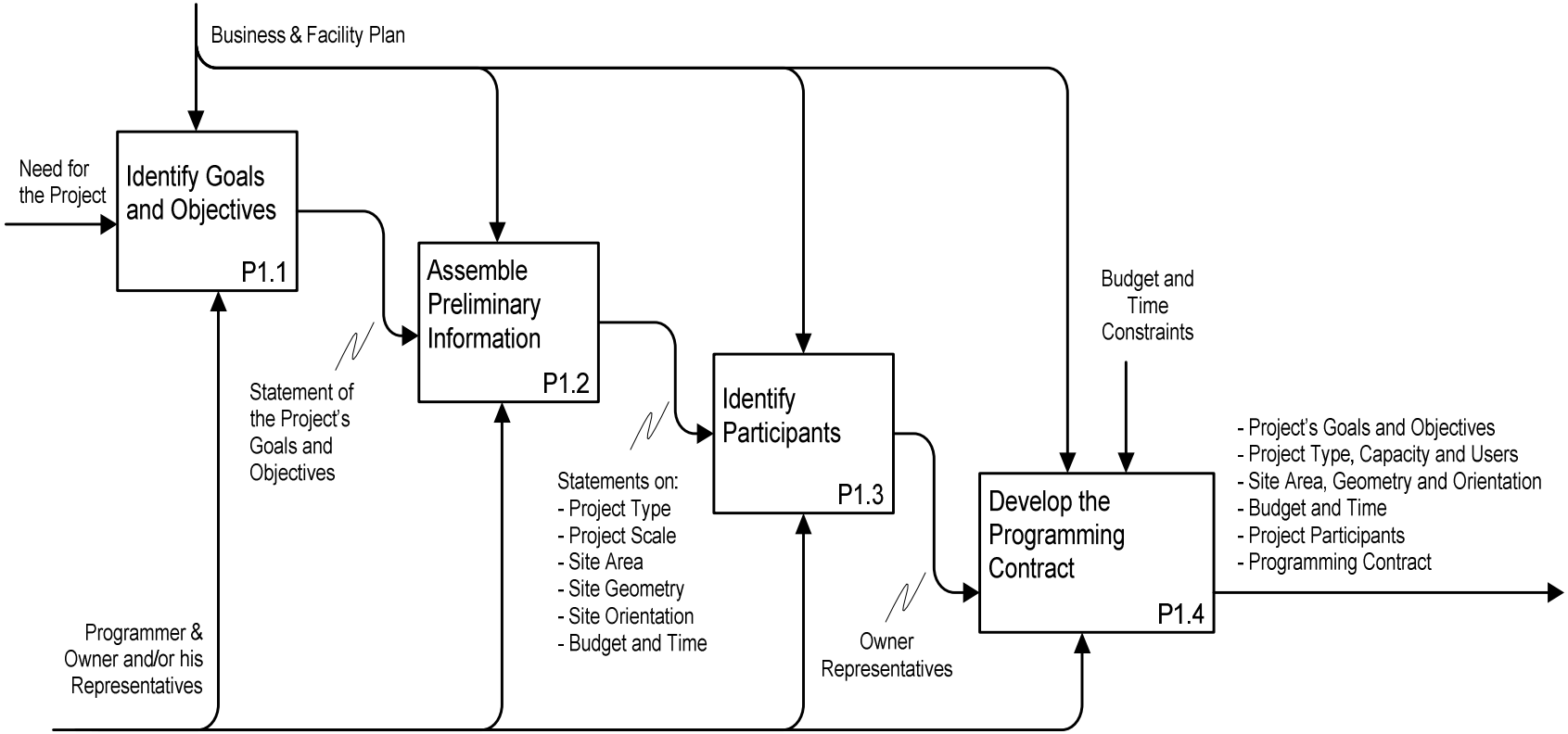

Figure 5.2: Identified Project Requirements

5.2.1.2 Process Activities

Identify goals and objectives (P1.1): The earliest step in all projects involves identifying and declaring the project's goals and objectives. This step defines the outcomes of the project and the steps required to achieve that outcome (Goetz, 2010). Project goals and objectives range from economical, aesthetic, functional, technical, time to anticipated future expansion (Cherry and Petronis, 2009). These goals and objectives serve as a consistent reference for decision making on many of the project matters. The owner of the project and/or his representatives should identify the project goals and objectives clearly and accurately. The project programmer should encourage the owner and his representatives to determine as much information as possible to all the related goals and objectives for the project.

Assemble preliminary information (P1.2): This step serves to identify the project type, capacity, site information, end users, and information related to time and budjet constrains. Shen and Chung (2006) state that the architectural program could vary considerably in length, content and format depending on the project type, scale and complexity. Further, information for the allocated budget for developing the project is an essential concern for the architectural programmer (Bogers et al., 2008).

Identify participants (P1.3): This step serves to identify the individuals who will participate in the architectural programming process and their roles. The owner of the project should identify the personnel who represent him to participate in the programming process. Brauer (1992) points out that because of the diversity of the types of building users, confusion about who to seek requirements from or who has the authority to approve requirements may occur. Yu et al. (2007) state that it is very significant to involve an adequate representation of all the parties that represent the client organization to address their needs and requirements. Ormerod and Newton (2005) stress the importance of involving a range of people in developing the architectural program, either as members of the project participants (owner representatives), or for providing specialist input. Being aware of the strategic benefits of the architectural program, project

participants are expected to devote commitments for this significant phase of the building process (Zwemmer and Otter, 2008).

Develop the programming contract (P1.4): This function is very important for the efficient management of the programming process, as it ensures the commitment of all participants in the programming process.

5.2.2 Research the Project Type

5.2.2.1 Process Definition

The "Research the Project Type" process (node "P2" as shown in Figure 5.1) involves gaining familiarity with the specific project type under consideration as well as its sets of functional and technical requirements.

It entails exploring and identifying the applicable codes and municipal standards for the specific project type for which an architectural program will be developed. Cherry and Petronis (2009) state that this step is necessary if the programmer is working on a project type for the first time.

The inputs of this process are statements on the project type, capacity and site information. The outputs from this process are the typical technical and functional project requirements and the previous similar projects' successes, failures and requirements. This process is divided into three functions as shown in Figure 5.3. The following paragraphs provide a description of the functions involved.

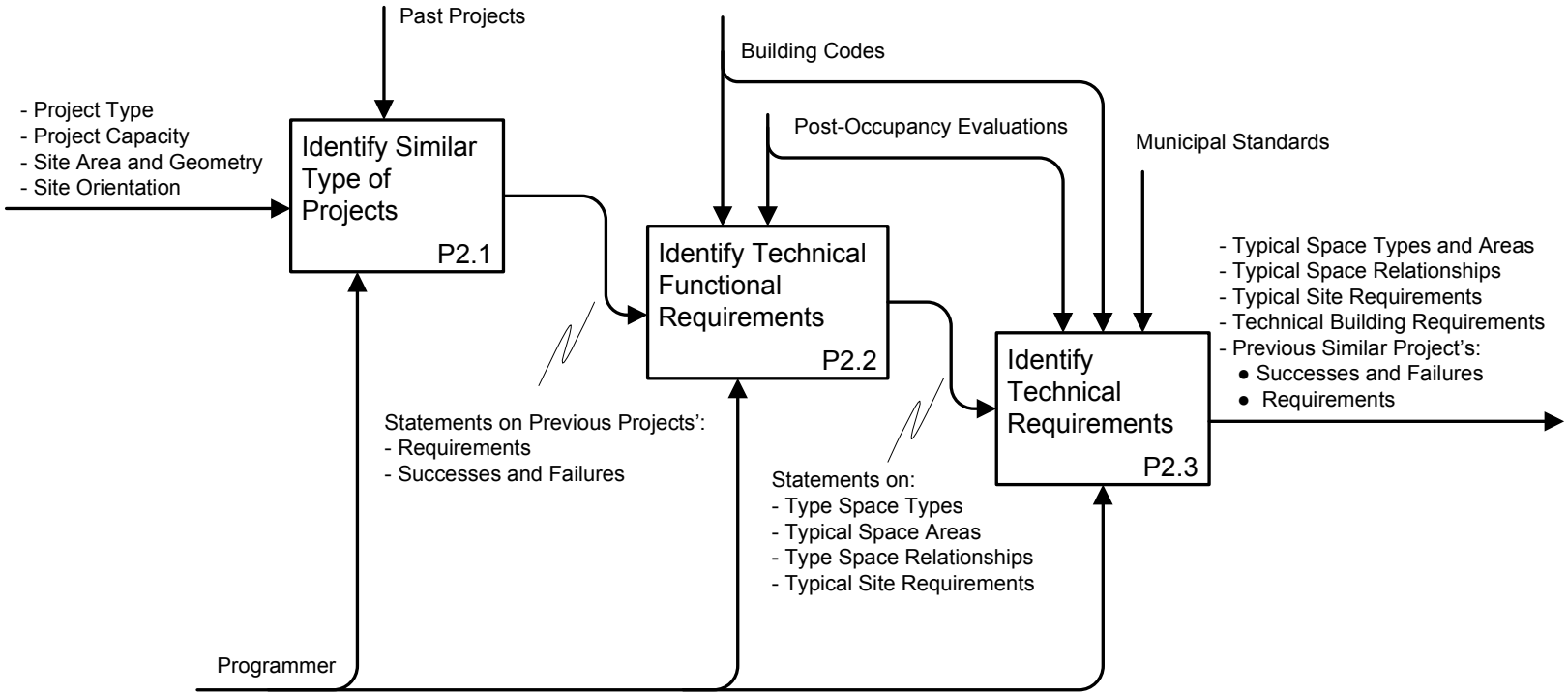

Figure 5.3: Research the Project Type

5.2.2.2 Process Activities

Investigate similar project types (P2.1): This function serves to identify the advantages and disadvantages and so the problems and solutions of similar project type as well as identifying the users' requirements and needs. Preiser et al. (1988) state that the results obtained from post-occupancy evaluation provides insights into the outcomes of past design decisions and the resulting building performance. Post-occupancy evaluation is defined as "the process of systematically evaluating the extent to which a facility, once occupied for a period of time, meets the intended organizational goals and user-occupant needs". The information generated from the evaluation of previous projects provides valuable feedback to facility planners, design professionals, facility managers involved in the planning, design and operation of projects (Preiser et. al., 1988). Hadjri and Crozier (2009) indicate that post-occupancy evaluation could be utilized to either improve spaces in existing buildings or for a programming the future buildings.

Identify typical functional requirements (P2.2): This function serves to identify typical space types, areas and relationships as well as the typical site requirements for the specific project under consideration. A vital source of information for this programming step is relevant codes and standards that apply to the specific project type.

Identify technical requirements (P2.3): This function serves to identify the structural, mechanical, electrical and security requirement relevant to the type of the project under consideration. Brauer (1992) states technical and functional requirements provide the information necessary to develop an appropriate design solution. Technical requirements deal with structural, mechanical, environmental, safety and fire protection and other matters that require specialists knowledge and training. These requirements can be acquired from technical literature, state laws, codes and standards.

5.2.3 Identify Requirements of End Users

5.2.3.1 Process Definition

The “Identify Requirements of End Users” process (node “P3” as shown in Figure 5.1) involves exploring detailed information about the requirements and needs of the project's end users. This can be best achieved through two data collection methods. The first is face-to-face meetings between the architectural programmer and the owner and/or his representative(s). The second is through conducting a survey aimed at the end users for the purpose of collecting data related to their requirements and needs.

Cherry (1999) indicates that the development of an user profile for each type of user is a practical approach to organize the information related to the end users of the building project. To a large extent, the effectiveness of this process depends on the involvement of the end users, the owner’s level of experience with the building process, the ability of the architectural programmer to comprehend the requirements of the project, the commitment of all participants to contribute to the programming process as well as the inclusion of all influential project parties.

The inputs necessary to carry out this process are statements of the project type, capacity, site information, and typical technical and functional requirements of the project.

The outputs from this process are statements on the end users' requirements, needs and priority levels for the facility. This process is divided into five functions as shown in Figure 5.4. The following paragraphs provide a description of the functions involved.

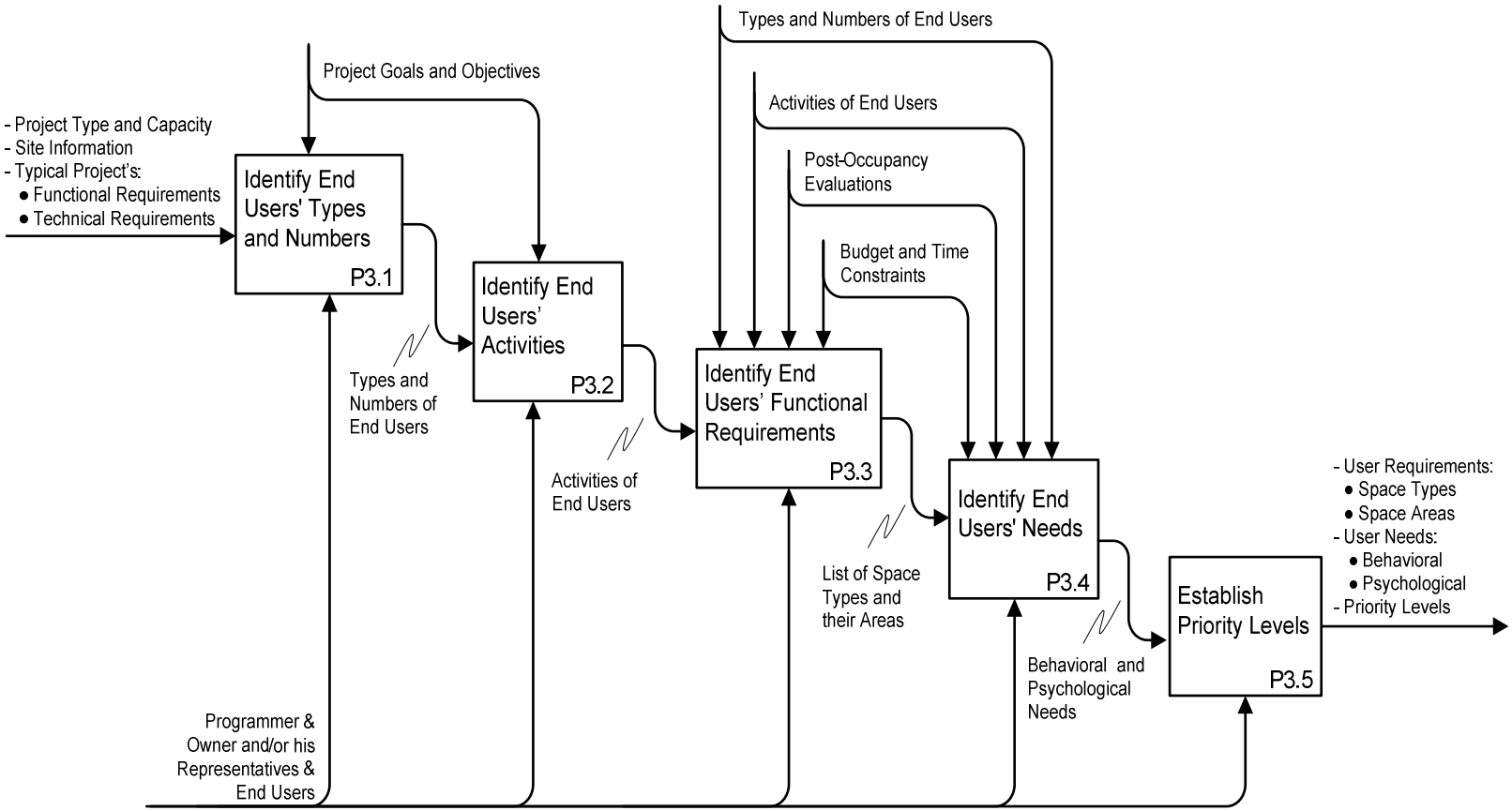

Figure 5.4: Identify Requirements of End Users

5.2.3.2 Process Activities

Identify end users' types and numbers (P3.1): This function serves to identify the number and types of building user groups. Blyth and Worthington (2001) clarify that the end users may constitute a diverse collection of individuals or groups with different interests and attitudes. Moreover, these end users might be part of the client organization, external tenants, combination of both types, or they might be individuals or groups upon whom the organization relies, such as its customers and visitors. Cherry (1999) states that when the building users' numbers aren't recorded systemically, it may be more difficult to identify and quantify.

Identify end users' activities of (P3.2): This function serves to identify the activities that are conducted in the building project. As occupants comfort with a building is directly related to the suitability of that building to accommodate the activities conducted within (Turpin-Brooks and Viccars, 2006), the architectural programmer should be aware of the type of activities that will take place in the building. Brauer (1992) indicates that the end users' facility requirements are derived from an analysis of the operations and activities that take place in the facility.

Identify end users' functional requirements (P3.3): This function serves to identify the types and amounts of space that will enable the end users of the building to carry out their activities. Brauer (1992) indicates that functional requirements entail the types and amount of space and various characteristics of space that must be prepared to support people, activities and equipment. Bogers et al (2008) assert that architectural program should contain as much information as possible about the requirements of the different types of users.

Identify end users' needs (P3.4): This function serves to identify the needs and expectations of the end users from the building. Cherry (1999) explains that identifying attitudes and psychological needs is usually much more difficult than identifying functional requirements. This is mainly due to the fact that these needs are

personal. Depending on the nature of the project, this type of information can be gathered formally or informally by conducting interviews or administering a questionnaire survey to the end users.

Establish priorities levels (P3.5): Establishing priority levels is very important to balance the identified requirements during a decision-making process. This function serves to identify preferences and priorities among the identified requirements. Determining a priority level for each requirement in the project is an integral part of the data needed to develop and implement the projects architectural program (Kumlin, 1995). Cherry (1999) indicates that depending on the nature of the project, this type of information can be gathered formally or informally, through conducting interviews with the end users, or administering a questionnaire survey aimed at the end users for the purpose of collecting data related to their requirements and needs.

5.2.4 Analyze and Balance the Identified Project Requirements

5.2.4.1 Process Definition

This process (node “P4” as shown in Figure 5.1) involves verifying, analyzing and balancing the identified project and users’ requirements and needs. While developing the architectural program, it is necessary to consider and maintain a proper balance of the interests of all parties (Yu et al, 2005). The architectural programmer has to be aware of the fact that it is challenging for one individual to identify all the requirements needed in the building project Therefore, the programmer needs to verify all the incoming requirements from the several participants in the programming process to eliminate incorrect requirements as well as add any requirement that was overlooked (Brauer, 1992).

Data, which constrain this process, include the project's goals and objectives, set budget, ability of the architectural programmer to comprehend the requirements of the project as well as building codes and municipal standards. Activities throughout this process are performed by the programmer and the owner and/or his representatives, and facilitated by a series of face-to-face meetings between the two parties.

The inputs necessary to carry out this process are statements on the typical technical and functional requirements for the project, as well as statements on the end users' requirements and needs. The outputs generated from this process are statements on the confirmed spaces types, areas, relationships, and confirmed technical systems, including the structural, mechanical, electrical and security systems as well as confirmed end user needs.

This process is divided into three functions as shown in Figure 5.5. The following paragraphs provide a description of the functions involved.

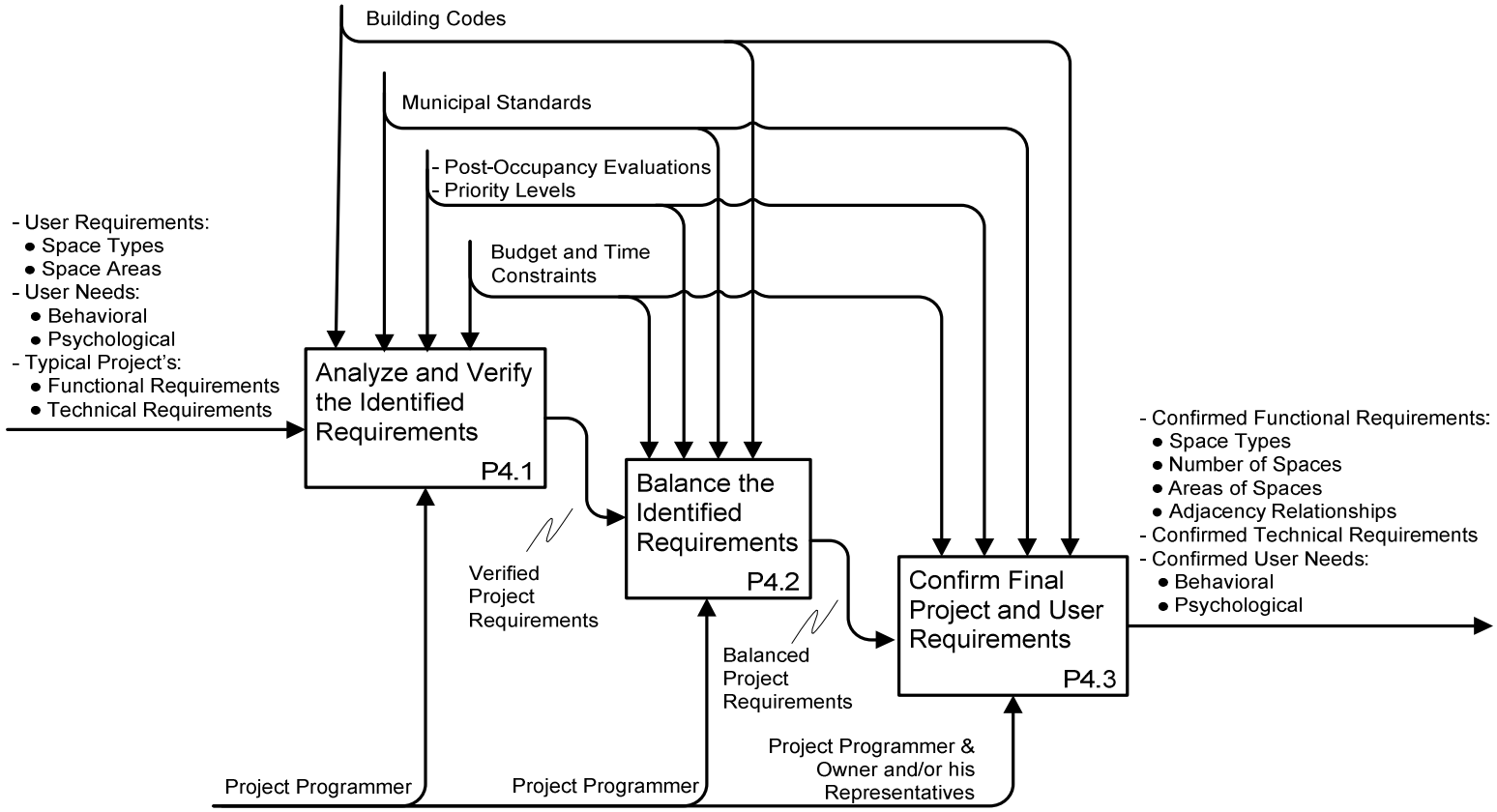

Figure 5.5: Analyze and Balance the Identified Project Requirements

5.2.4.2 Process Activities

Analyze and verify the identified requirements (P4.1): This function serves to perform an analysis of the identified different requirements and needs of the project owner as well as the end users. Additionally, the architectural programmer will need to verify these requirements. Several statistical tools have been developed for the purpose of verifying the identified requirements. Two of these tools include the Strategic Needs Analysis (SNA), as described by Smith et al (2005), as well as Value Management, as explained by Yu et al (2005). Zwemmer and Otter (2008) state that to ensure an efficient programming process, the data can be analyzed via statistical software packages.

Balance the identified requirements (P4.2): This function serves to balance the identified requirements of all parties. The number of requirements of any project depends on the building size and the complexity of the building function (Van der Voordt and Van Wegen, 2005). For example, large scale projects that have a complex function, such as hospitals and airport terminals, would require the identification of an extensive set of project requirements. Van der Voordt and Van Wegen (2005) also add that the incorporation of all the identified requirements and needs would be extremely challenging, due to time and budgetary constraints. As such, these requirements have to be balanced during a decision-making process, based on an identified set of priorities.

Confirm final project requirements (P4.3): Based on the previous two activities, this function serves to develop a confirmed statement with the project owner and/or his representatives, on the final set of functional, as well as technical requirements of the project.

5.2.5 Document the Project Program

5.2.5.1 Process Definition

The "Document the Project Program" process (node "P5" as shown in Figure 5.1), involves identifying the intended scope of work for the project. The process also involves documenting the final architectural program to be handed over to the design team, once approved by the owner.

Kumlin (1995) indicates that the final documentation of the program can be organized in a variety of methods, depending on the end users requirements and needs.

The adequacy of the documentation methods used to compile the architectural program is an influential factor towards the development of a satisfactorily design solution. The final documentation can be accomplished through the use of different methods (figures, pictures and text).

The input necessary to carry out this process is the confirmed project and user requirements. The output generated from this process is the approved architectural program document. This process is divided into three functions as shown in Figure 5.6. The following paragraphs provide a description of the functions involved.

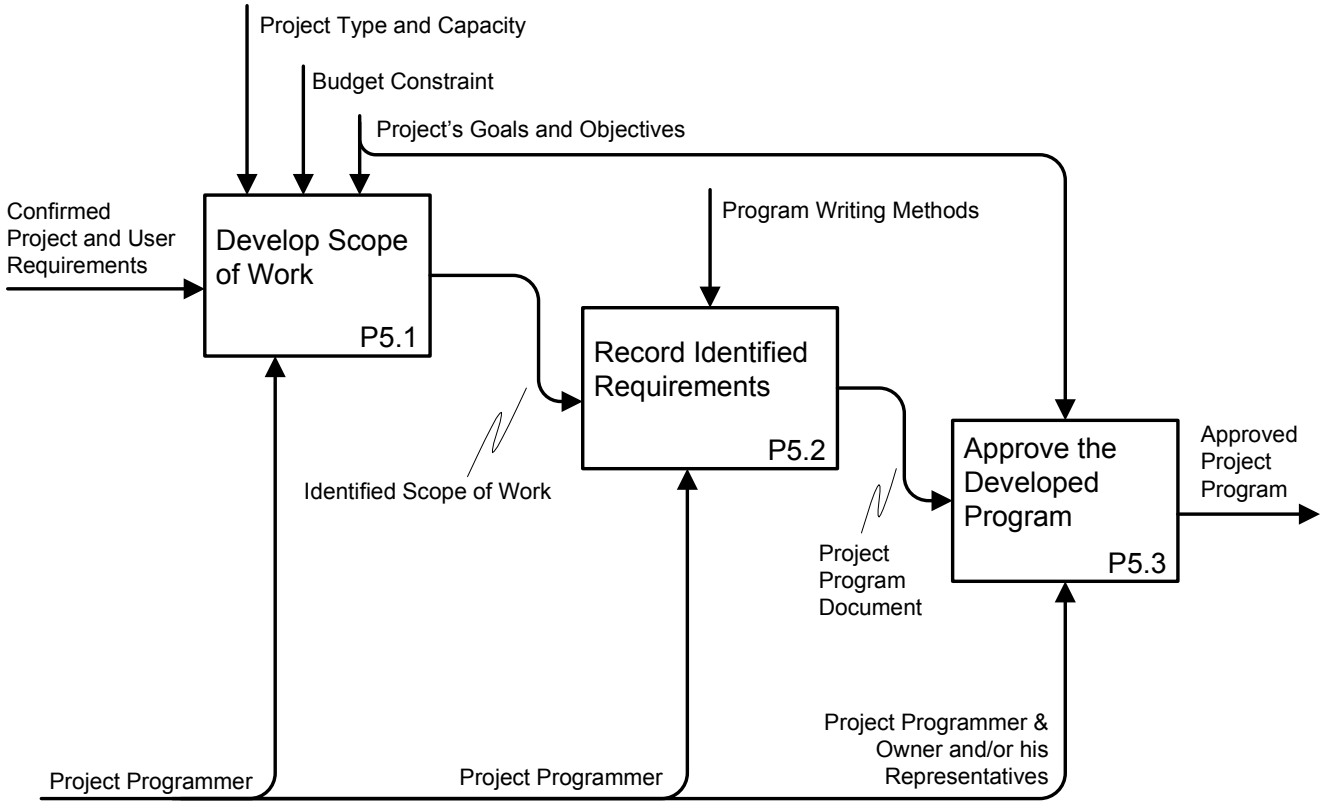

Figure 5.6: Document the Project Program

5.2.5.2 Process Activities

Develop scope of work (P5.1): This function serves to determine the intended scope of work for the project by the design team. The scope of work describes the work that needs to be performed by the design team. It should be documented in the project program.

Document confirmed requirements (P5.2): This function serves to document the confirmed project and users' requirements as well as the developed scope of work. Hershberger (1999) outlines eleven fields of information that should be documented in an architectural program, as a minimum. These fields include goals and objectives, site information, building occupants' characteristics, requirements of site restrictions and limitations, building functional requirements, technical requirements, functional relationship, budget of the project, project future growth anticipation (flexibility), and priorities among the requirements.

Approve the developed program (P5.3): This function serves to approve the developed program document. Yu et al. (2007) indicate that the architectural program should be compiled, completed and agreed upon before commencing the design phase for the project. In essence, the architectural program should act as a reference document, which is made available to all project parties. Cherry and Petronis (2009) state that sometimes the programmer stays involved throughout the remainder of project phases.

5.2.6 Review and Update the Developed Program

5.2.6.1 Process Definition

The "Review and Update the developed Program" process (node "P6" as shown in Figure 5.1) involves reviewing and refining the project program during the early design phase. The design phase aims primarily at producing a functional building that meets a set of actual needs and requirements of the client. At this process, the architect prepares schematic designs, including sets of drawings and other documents illustrating the scale and relationship of the project components for approval by the owner. The architect also submits to the owner a statement of the probable construction cost (Harputlugil et al., 2006).

Practically, the developed program continues to develop even further during the design phase as many questions and ideas arise (Van der Voordt and Van Wegen, 2005). If the requirements are well-documented, the designer can reduce time needed to interact with users, and as such, will need to make fewer assumptions (Brauer, 1992).

This process depends on the methods that are used to document the requirements and the ability of the architect to comprehend the developed program as well as the set deadline to freeze the project program. This process can be facilitated through a series of face-to-face meetings between the owner or his representative/s and the programmer with the design team.

The input necessary to carry out this process is the approved project program. The outputs generated from this process are the project schematic design solutions, refined project program and as well as preliminary construction estimate. This process is divided into three functions as shown in Figure 5.7. The following paragraphs provide a description of the functions involved.

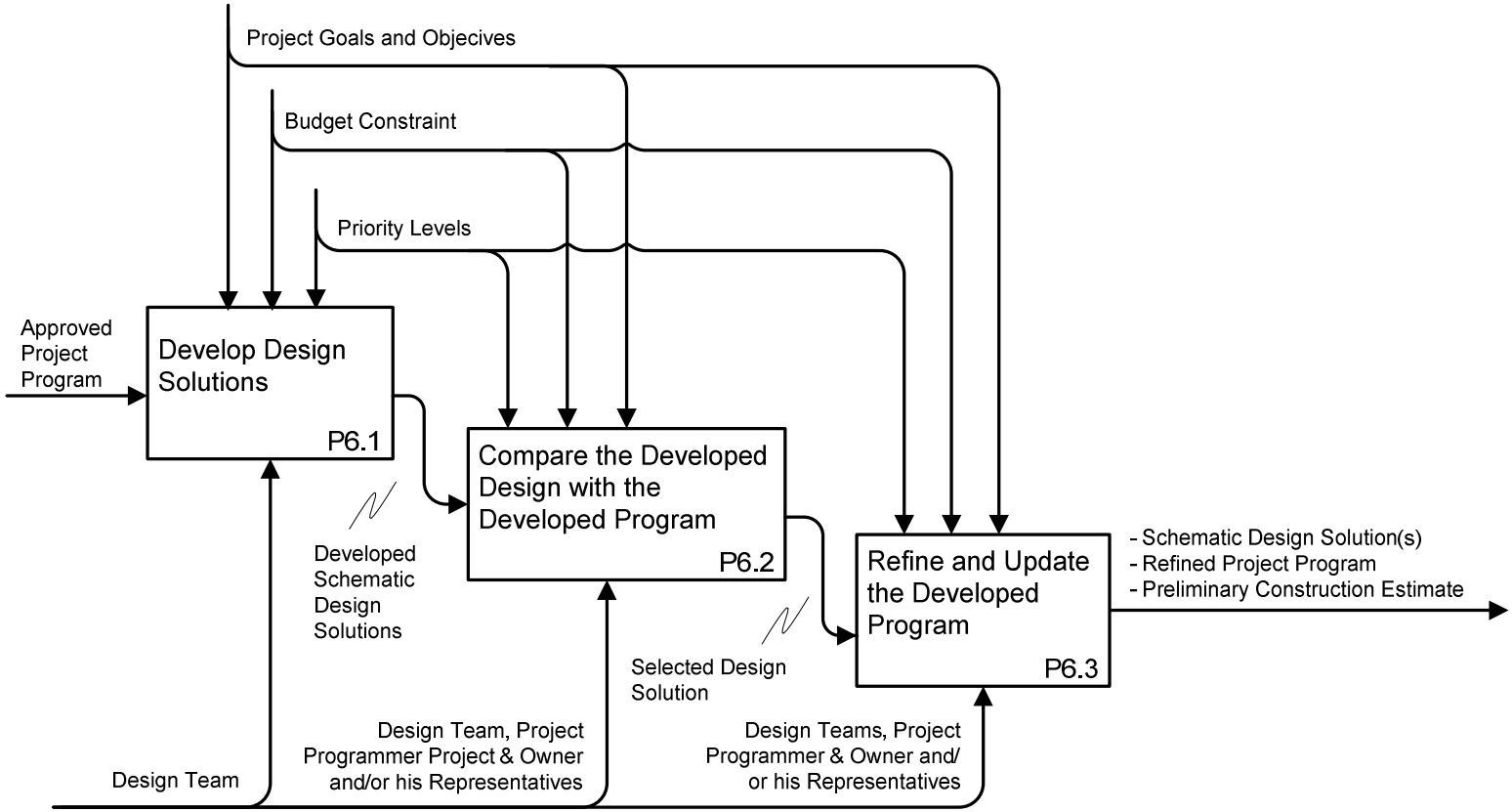

Figure 5.7: Review and Update the Developed Program

5.2.6.2 Process Activities

Develop schematic design solutions (P6.1): This function serves to interpret and translate the documented information in the project program into facility project plans. At this step, the designer should develop all possible design solutions. The type and the amount of information depicted in the building design affects the building final quality (Clift, 1996; Oliveira et al., 2008). Shen and Chung (2006) indicate that during the design phase, architects develop a number of conceptual designs based on their interpretation of the complied project program.

Compare developed design with developed program (P6.2): At this step, the developed design solutions should be comprehensively examined to ensure that no potential alternatives have been missed or overlooked. Brauer (1992) reveals that if requirements are identified accurately, comprehensively, and are well documented, the amount of time necessary to complete the development of the design solution can be reduced. The designer will also spend less amount of time to gather missing information or to verify data, and can move quickly and confidently towards developing the best design solutions.

Refine and update the developed program (P6.3): At this step the program should be frozen to commence the detailed design phase. Interviews with architects in Saudi Arabia revealed that project owners, especially those in the residential sector, may not be able to identify their requirements without reviewing preliminary design documents. Brauer (1992) points out that any unnecessary change is money wasted. Most changes can be avoided by carefully compiling the project and end users requirements. However, carefully defined user requirements will result in minimizing the chances of wasting money on unneeded space. Othman et al. (2004) indicate that changes made to the architectural program at later stages of the project could affect the cost, time and quality of the project.

5.3 DISCUSSION

The current programming practices are still considered to be inadequate as indicated by many researchers worldwide. In Saudi Arabia, interviewees stated that there exists no programming guides, and that programs are prepared formally or informally depending on the type of client as well as the nature of the project. Some of the problems in current practice were identified as lack of a comprehensive framework, lack of identification of client requirements, inadequate involvement of all the relevant parties of a project, insufficient time allocated for programming and inadequate communication between those involved in programming process.

This chapter presented a framework model that aims at capturing the process of identifying and communicating client and user requirements to design teams. The proposed framework was developed based on knowledge from literature and observed professional practice as well as the identified factors which were illustrated in chapter four. The developed framework is generic, meaning that the activities involved can be adapted and applied for any project type and by two types of project programmers (external consultants and in-house staff).

The proposed framework model is described schematically as an $IDEF_0$ process model for illustrating architectural programming process. A process model reveals the interactions between activities in term of inputs and outputs while showing the controls placed on each activity and the type of resources assigned to each activity. It is a graphic representation of a programming process that displays the activities to any desired level of detail. This model can act as policy guidelines for conducting architectural programming activities, and provides a way of bridging the gaps in architectural programming practice.

Illustrating the framework in the form of $IDEF_0$ helps project programmers to identify what functions should be performed, what is required to perform those functions, what

are the constrains and opportunities that control these functions and how to achieve these functions.

Usefulness of the developed framework stems from:

- Standardizing process descriptions.
- The activities that need to be undertaken within each process.
- The methodology of how and what information needs to be communicated between activities.
- Each activity is seen in its proper context relative to the other activities, and the project programmer can identify the impact of any change upon the whole process.
- The problems in current local practice of programming were avoided in the proposed framework.
- The developed framework is flexible for any types of projects and can be used by any type of program developer.

The next chapter presents the analysis of the data received from the respondents to the questionnaire survey (A/E offices and owners' representatives). It discusses the two types of data obtained from the responses to the questionnaire, as follows: respondents' general information and assessment of factors influencing the development and implementation of the architectural program for architectural projects. Analysis of the data received is carried out using simple descriptive statistical techniques, including simple graphics, percentages and simple summaries of the findings.

CHAPTER SIX

DATA ANALYSIS AND RESULTS

6.1 INTRODUCTION

The proposed framework was developed based on knowledge from international literature, observed professional practice and mainly, identified factors. The assessment of the identified factors which influence the process of developing and implementing the architectural program is critical to investigate the applicability of the developed framework in Saudi Arabia.

Twenty-eight factors influence the process of developing and implementing the architectural program for building projects, they were identified as illustrated in chapter four. These 28 factors were assessed through developing, testing and administering of the questionnaire survey as described in the following:

6.2 DEVELOPMENT OF QUESTIONNAIRE SURVEY

A questionnaire survey (Appendix III), was developed and administered to a representative sample of A/E design offices and firms in the Eastern Province, Riyadh and Jeddah and a selected sample of owners' representatives in the Eastern Province of Saudi Arabia. It consisted of two parts as follows:

- **Part-I:** Contains general questions about the respondent's area of professional practice as well as his experience.

- **Part-II:** This part of the questionnaire focused on the assessment of the identified 28 factors.

6.3 IDENTIFICATION OF THE POPULATION AND SAMPL SIZES

The study population consisted of two types who have direct relation with the development or implementation of architectural programs for building projects. The study population was limited to registered A/E design offices working in the Eastern Province, Riyadh and Jeddah and a selected sample of owners' representatives in Eastern Province of Saudi Arabia. A list of **112**, **279** and **80** registered A/E design offices in the Eastern Province Riyadh and Jeddah respectively were obtained from the Chambers of Commerce in these locations. The size of the samples of respondents was identified as follows:

I. A/E offices sample size:

- The sample of respondents who locally assessed the identified factors consisted of A/E offices from the Eastern Province, Riyadh and Jeddah. A list of those A/E offices was obtained from the Chambers of Commerce in these locations.

- The sample size was determined using equations 1.1 and 1.2 highlighted in chapter one.

- **Calculation the Sample Size (n) :**

The population sizes (N) are **112, 279** and **80** in the Eastern Province, Riyadh and Jeddah respectively as obtained from the Chambers of Commerce in Eastern province, Riyadh and Jeddah. The sample sizes are calculated as follows:

- ✓ **In Eastern province, sample size (n)** = 25/ [1+ (25/112)] = **20**
- ✓ **In Riyadh**, **the sample size (n)** = 25/ [1+ (25/279)] = **23**
- ✓ **In Jeddah**, **the sample size (n)** = 25/ [1+ (25/80)] = **19**

II. Owners sample size:

At least 5 owners located at the Eastern Province of Saudi Arabia were identified to assess the identified factors.

6.4 PILOT-TESTING OF THE QUESTIONNAIRE SURVEY

Before the final distribution of the questionnaire survey, a pilot-testing was conducted with a selected sample of A/E design offices in the Eastern Province of Saudi Arabia for the purposes of:

- Testing the adequacy of the questions.
- Identification locations of ambiguities.
- Incorporating additional possible factors.
- Reviewing the adequacy of provided spaces for each question.
- Estimating the time needed to fill out the surveys.

6.5 DISTRIBUTION THE TESTED QUESTIONNAIRE SURVEY

At this step, the tested questionnaire survey was distributed to the **130** A/E offices and firms in the Eastern province, Riyadh, Jeddah and a selected **6** main owners' representatives in the Eastern Province of Saudi Arabia to assess the importance of the identified 28 factors.

The respondents to the questionnaire survey were asked to mark their perceived relative degree of importance for each of the identified factors through selection one of five evaluation terms; "**Extremely Important**", "**Very Important**", "**Important**", "**Somewhat Important**" and "**Not Important**" .

Due to that there were many respondents who were not helpful, the responses to the questionnaire survey were collected **from 19, 23** and **8** in the Eastern Province, Riyadh and Jeddah respectively. The responses were also collected from **3** owners' representatives in the Eastern Province.

6.6 DATA ANALYSIS

This chapter presents the analysis of the data received from the respondents (50 A/E offices and 3 owners' representatives) to the questionnaire survey. Based on the design of the questionnaire survey (Appendix III), the following sections present a discussion of the two types of data obtained from the respondents to the questionnaire as follows:

- **Part One:** Respondents' General Information
- **Part Two:** Assessment of the Identified Factors

6.6.1 PART ONE: RESPONDENTS' GENERAL INFORMATION

This part contained general questions about the respondent's area of professional practice as well the number of years of experience. Analysis of the data received was carried out using simple descriptive statistical techniques including simple graphics, percentages and simple summaries of the findings.

6.6.1.1 Respondent's Experience

Due to the nature of the study, almost all respondents were architects who have the responsibility of preparing the projects' architectural program. All respondents were asked to specify their work experience by selecting one out of four ranges of years of experience as follows: "Less than 5 years", "5 – 10 years", "10 – 20 years" and "Over 20 years". Brief description of the Respondents' experiences is as follows:

6.6.1.1.1 A/Es' Respondents' Experience

The results showed that 72 % of the respondents (36 A/E out of a total of 50) had been practicing for more than 10 years. As illustrated in Figure 6.1, the overall experience of the fifty respondents shows that about 36% of the respondents (18 A/E) had more than twenty years of experiences, about 36% (18 A/E) had ten to twenty years of experience,

20% (10 A/E) had five to ten years of experience and about 8 % (4 A/E) had an experience of less than 5 years.

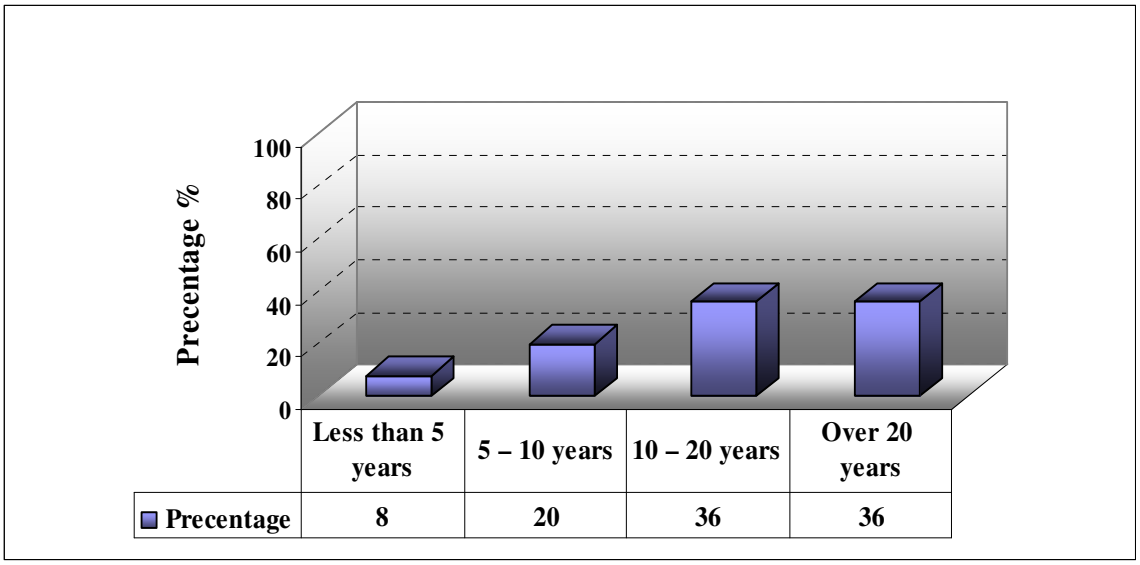

Figure 6.1 A/Es' Respondents Years of Experience

6.6.1.1.2 Owners Representatives' Respondents' Experience

The results showed that 100 % of the respondents (3 owners) had been practicing for more than 10 years. The overall experience of the three respondents shows that two of the respondents had more than 20 years of experiences and one of them had 10 to 20 years of experience.

6.6.1.2 Respondents' Roles in their Offices or Firms

The respondents were asked to specify their roles in the A/E design office and organizations by selecting one out of four categories of practice as follows: “Project Manager”, “Architectural Designer”, “Architectural Programmer” and “Architectural Programmer and Designer”.

As illustrated in Figure 6.2, the results indicated that 56% (28 A/Es out of 50) of the A/Es respondents are either practicing as the project managers or architectural departments' heads of the A/E design office which adds more value to the obtained assessment. This category of respondents has indicated that throughout their career, they had practiced as architectural design, architectural programming or both.

The results also indicated that 18% (9 A/Es) are practicing as architectural designers, 0% (none) are practicing as architectural programmers, and 26% (13 A/Es) are practicing as both Architectural programmers and designers. In addition, some of the respondents specified that they are practicing as the A/Es office manager, architectural department head, technical manager and director of design.

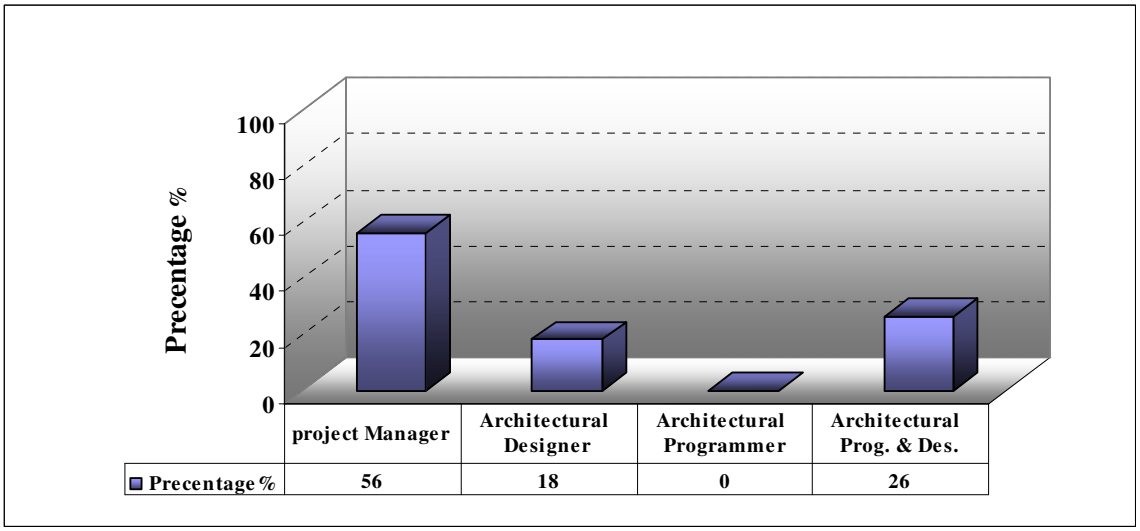

Figure 6.2 A/E Respondents' Roles

Further, the results indicated that **100%** (3) of owners' representatives' respondents are project managers. This type of respondents is classified as owners' representatives.

6.6.1.3 Systemic Practice of Architectural Programming

All respondents were asked to specify their practicing procedures of architectural programming through the following question: *During your practice in architectural programming, do you follow a systematic or standard method to prepare the architectural program?*

The answer to this question indicated that 84% (42 A/Es out of 50) of the A/Es respondents and 100% of owners' representatives follow a systematic method for preparing the architectural program. In addition, most of those respondents pointed out that there are no readily developed forms or adopted framework for preparing projects programs.

6.6.1.4 Types of Projects Carried out by the Respondents

Six categories of project types were determined. These categories of projects are residential, educational, offices; recreational, sports and commercial buildings. All respondents were asked to specify the projects that they worked on.

The results indicated that 32% (16 A/Es out of 50) of the A/Es respondents worked on all these types of projects. As shown in Figure 6.3, 100% of the respondents worked on the residential buildings projects, about 64% (32 A/Es) of the A/Es respondents worked on the educational buildings projects, 70% (35 A/Es) of the respondents worked on the offices buildings projects, 46% (23 A/Es) of the A/Es respondents worked on the recreational buildings projects, 38% (19 A/Es) of the A/Es respondents worked on the sports buildings projects and 84% (42 A/Es) of the A/Es respondents worked on the commercial buildings projects.

Other types of the projects were specified by some of the A/Es respondents which were sanitary, museums, petrochemical and fuel stations building projects.

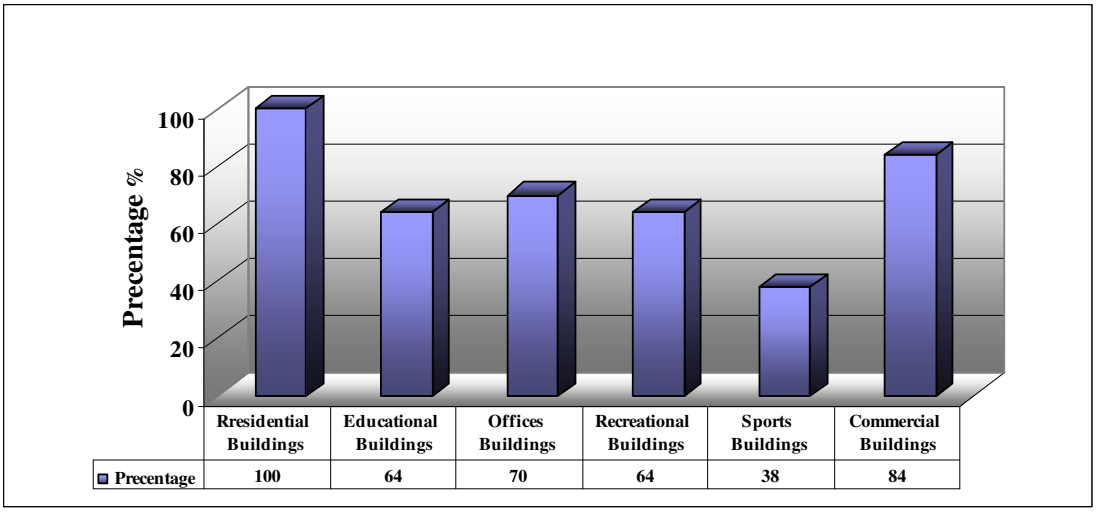

Figure 6.3 Types of Project Carried out by the A/E Respondents

Further, the results indicated that owners' representatives have worked on most of these projects.

6.6.2 PART TWO: FACTORS ASSESSMENT

The second part of the questionnaire focused on the assessment of the identified twenty eight factors that could potentially affect the processes of developing and implementing the architectural program. These factors were classified under six categories. The respondents to the questionnaire survey were asked to mark in their perceived relative degree of importance for each of the identified factors using one of five evaluation terms; “Extremely Important”, “Very Important”, “Important”, “Somewhat Important” and “Not Important”.

The received responses from each type of respondents (A/E offices, owners' representatives) were analyzed twice according to the respondents' classification. The respondents were classified as follows:

- ✓ **Case one:** According to their discipline to four groups, project manager, architectural designers and architectural designers and programmers as well as the owners' representatives.

- ✓ **Case two:** According to their geographical region to three groups, Eastern Province, Riyadh and Jeddah.

A summary of the responses to the questionnaire survey are illustrated in **Appendix VI.**

The two cases of data analysis were carried out using the Excel program and SPSS program as follows:

1. Step One. Calculation of the importance indexes and determination of the rates of importance:

As indicated in Chapter one and for the two cases of analysis, the importance index for each factor has been calculated using the Exile program using equation 1.3 highlighted in chapter one.

To reflect the scale of the respondents' answers to the questionnaire, the importance index is classified as the following:

The importance index of 0–<12.5% is categorized as ''Not Important''; 12.5–<37.5% is categorized as ''Somewhat Important''; 37.5–<62.5% is categorized as ''Important''; 62.5–<87.5% is categorized as ''Very Important''; and 87.5–100% is categorized as ''Extremely Important.''.

A summary of the assessed factors' importance indexes and rate of importance **(According to respondents' discipline)** is illustrated in **Table 5.1.**

A summary of the assessed factors' importance indexes and rate of importance **(According to respondents' geographical region)** is illustrated in **Table 5.2.**

2. Step Two. Identifying the variances among the respondents' assessment results:

Analysis of variance (ANOVA) is a general method for studying sampled-data relationships. The purpose is to test the significant differences between the results, and this is done by one way variance analysis and was carried out using **SPSS** program. In this situation, Tukey's test was used to identify the significance differences between the respondents' assessment results.

Tukey's test also known as the Tukey's HSD (Honestly Significant Difference) test is a single-step multiple comparison procedure and statistical test generally used in conjunction with an ANOVA to find which assessment result are significantly different from one another (Gravetter and Wallnau, 2007).

NOTE: If the calculated p-value (sig) is higher than the determine significance level (0.05), there is no significant different between two simples assessment.

6.6.2.1 Calculation of the importance indexes and determination of the rates of importance:

For the two cases of analysis, the importance index for each factor has been calculated using the following formula (Dominowski 1980):

$$\textbf{Importance index } I = \frac{\sum_{i=0}^{4} aixi}{4 \sum xi} \times 100 \quad \%$$

To reflect the scale of the respondents' answers to the questionnaire, the importance index is classified as the following:

The importance index of 0–<12.5% is categorized as ''Not Important''; 12.5–<37.5% is categorized as ''Somewhat Important''; 37.5–<62.5% is categorized as ''Important''; 62.5–<87.5% is categorized as ''Very Important''; and 87.5–100% is categorized as ''Extremely Important.''.

A summary of the assessed factors' importance index values and rate of importance (According to respondents' discipline) is illustrated in Table 6.1.

A summary of the assessed factors' importance index values and rate of importance (According to respondents' geographical region) is illustrated in Table 6.2.

Table 6.1 Assessed Factors' Importance Indexes and Rate of Importance (According to respondents' disciplines)

	Factors Affecting Development and Implementation of the Architectural Program for building Projects	Project Managers		Architectural Designers		Architectural Des. & Prog.		Owners' Representatives		Total	
		Importance Index	Rate of Importance	Importance Index	Rate of Importance	Importance Index	Rate of Importance	Importance Index	Rate of Importance	Importance Index	Rate of Importance
A. Factors Related to the Owner and his Representative(s)											
1	Involvement of the owner in the architectural programming process.	81.3	Very Imp.	83.3	Very Imp.	61.5	Important	66.7	Very Imp.	75.9	Very Imp.
2	Involvement of the end user in the architectural programming process.	67.6	Very Imp.	58.3	Important	59.6	Important	75.0	Very Imp.	64.4	Very Imp.
3	Involvement of the project manager *(representing the owner)* in the programming process.	75.0	Very Imp.	50.0	Important	59.6	Important	58.3	Important	66.0	Very Imp.
4	The owner's level of experience with the building process.	50.9	Important	52.8	Important	46.2	Important	58.3	Important	50.5	Important
B. Factors Related to the Architectural Programmer											
5	Familiarity of the architectural programmer with the project type.	92.0	Ext. Imp.	97.2	Ext. Imp.	88.5	Ext. Imp.	100	Ext. Imp.	92.5	Ext. Imp.
6	Familiarity of the architectural programmer with various building systems *(structure, electrical, etc).*	79.5	Very Imp.	88.9	Ext. Imp.	76.9	Very Imp.	75	Very Imp.	80.2	Very Imp.
7	The architectural programmer's ability to comprehend the project requirements during the architectural programming phase.	87.5	Ext. Imp.	83.3	Very Imp.	96.2	Ext. Imp.	100	Ext. Imp.	89.6	Ext. Imp.
8	The architect's ability to comprehend the developed program during the design phase.	87.5	Ext. Imp.	83.3	Very Imp.	88.5	Ext. Imp.	100	Ext. Imp.	87.7	Ext. Imp.
C. Factors Related to the Program Data											
9	Clarity of project goals set by the owner.	87.5	Ext. Imp.	86.1	Very Imp.	86.5	Very Imp.	91.7	Ext. Imp.	87.3	Very Imp.
10	Clarity of project requirements *(functional, technical and behavioral).*	80.4	Very Imp.	86.1	Very Imp.	67.3	Very Imp.	83.3	Very Imp.	78.3	Very Imp.
11	Identifying functional relationships among the various facility spaces.	83.0	Very Imp.	75.0	Very Imp.	69.2	Very Imp.	75	Very Imp.	77.8	Very Imp.

12	Establishing priority levels for the various requirements of the project.	**76.8**	**Very Imp.**	**80.6**	**Very Imp.**	**69.2**	**Very Imp.**	**58.3**	**Important**	**74.5**	**Very Imp.**
13	Adherence to the applicable codes and municipal standards for the project type.	**89.3**	**Ext. Imp.**	**90.6**	**Ext. Imp.**	**84.6**	**Very Imp.**	**75**	**Very Imp.**	**87.5**	**Ext. Imp.**
14	Effect of project scale on developing the architectural program.	**75.9**	**Very Imp.**	**72.2**	**Very Imp.**	**76.9**	**Very Imp.**	**50**	**Important**	**74.5**	**Very Imp.**
15	Feedback from previous projects *(post-project evaluation and post-occupancy evaluation).* *	**68.5**	**Very Imp.**	**52.8**	**Important**	**53.8**	**Important**	**66.7**	**Very Imp.**	**62.0**	**Important**
16	Anticipation of changes in the future use of the building.	**63.4**	**Very Imp.**	**58.3**	**Important**	**51.9**	**Important**	**50**	**Important**	**59.0**	**Important**
D. Factors related to the Role of Communication throughout the Programming Process											
17	Utilization of face-to-face contact as a communication method.	**82.1**	**Very Imp.**	**77.8**	**Very Imp.**	**76.9**	**Very Imp.**	**91.7**	**Ext. Imp.**	**80.7**	**Very Imp.**
18	Frequent communication between the owner and his project representatives with the programmer. *	**86.1**	**Very Imp.**	**72.2**	**Very Imp.**	**76.9**	**Very Imp.**	**75**	**Very Imp.**	**80.8**	**Very Imp.**
19	Frequent communication between the owner or his project representatives with the design team.	**83.9**	**Very Imp.**	**63.9**	**Very Imp.**	**71.2**	**Very Imp.**	**66.7**	**Very Imp.**	**76.4**	**Very Imp.**
20	Utilization of different methods (*figures, pictures and text*) to document and effectively communicate the architectural program.	**78.6**	**Very Imp.**	**69.4**	**Very Imp.**	**77.1**	**Very Imp.**	**50**	**Important**	**75.0**	**Very Imp.**
E. Factors Related to the Allocated Time and Budget											
21	Allocating enough time for developing the architectural program.	**77.7**	**Very Imp.**	**80.6**	**Very Imp.**	**75.0**	**Very Imp.**	**75**	**Very Imp.**	**77.4**	**Very Imp.**
22	Setting up a deadline to freeze the development of architectural program.	**74.1**	**Very Imp.**	**63.9**	**Very Imp.**	**63.5**	**Very Imp.**	**75**	**Very Imp.**	**69.8**	**Very Imp.**
23	Allocating a separate service fee for developing the architectural program.	**64.3**	**Very Imp.**	**55.6**	**Important**	**42.3**	**Important**	**50**	**Important**	**56.6**	**Important**
24	Setting a clear budget for the whole project.	**82.1**	**Very Imp.**	**72.2**	**Very Imp.**	**71.2**	**Very Imp.**	**83.3**	**Very Imp.**	**77.8**	**Very Imp.**
F. Factors Related to Management and Control of the Architectural Programming process											
25	Commitment of all participants in the programming process.	**79.5**	**Very Imp.**	**69.4**	**Very Imp.**	**69.2**	**Very Imp.**	**66.7**	**Very Imp.**	**74.5**	**Very Imp.**
26	Inclusion of influential project parties that may enrich the architectural programming process.	**68.8**	**Very Imp.**	**63.9**	**Very Imp.**	**57.7**	**Important**	**58.3**	**Important**	**64.6**	**Very Imp.**
27	Timely and proper decision-making at the various stages of the development and implementation of the architectural program.	**85.7**	**Very Imp.**	**75.0**	**Very Imp.**	**82.7**	**Very Imp.**	**66.7**	**Very Imp.**	**82.1**	**Very Imp.**
28	Frequent review and refinement of the program during the early design stages.	**77.7**	**Very Imp.**	**80.6**	**Very Imp.**	**82.7**	**Very Imp.**	**50**	**Important**	**77.8**	**Very Imp.**

Table 6.2 Assessed Factors' Importance Indexes and Rate of Importance (According to respondents' region)

	Factors Affecting Development and Implementation of the Architectural Program for building Projects	Eastern Province		Riyadh		Jeddah	
		Importance Index	Rate of Importance	Importance Index	Rate of Importance	Importance Index	Rate of Importance
A. Factors Related to the Owner and his Representative(s)							
1	Involvement of the owner in the architectural programming process.	73.7	Very Imp.	79.3	Very Imp.	75.0	Very Imp.
2	Involvement of the end user in the architectural programming process.	64.5	Very Imp.	63.6	Very Imp.	62.5	Very Imp.
3	Involvement of the project manager *(representing the owner)* in the programming process.	59.2	Important	72.8	Very Imp.	65.6	Very Imp.
4	The owner's level of experience with the building process.	51.3	Important	47.8	Important	53.6	Important
B. Factors Related to the Architectural Programmer							
5	Familiarity of the architectural programmer with the project type.	92.1	Ext. Imp.	93.5	Ext. Imp.	87.5	Ext. Imp.
6	Familiarity of the architectural programmer with various building systems *(structure, electrical, etc).*	90.8	Ext. Imp.	72.8	Very Imp.	78.1	Very Imp.
7	The architectural programmer's ability to comprehend the project requirements during the architectural programming phase.	93.4	Ext. Imp.	87.0	Very Imp.	84.4	Very Imp.
8	The architect's ability to comprehend the developed program during the design phase.	90.8	Ext. Imp.	84.8	Very Imp.	84.4	Very Imp.
C. Factors Related to the Program Data							
9	Clarity of project goals set by the owner.	86.8	Very Imp.	85.9	Very Imp.	90.6	Ext. Imp.
10	Clarity of project requirements *(functional, technical and behavioral).*	76.3	Very Imp.	78.3	Very Imp.	81.3	Very Imp.
11	Identifying functional relationships among the various facility spaces.	77.6	Very Imp.	79.3	Very Imp.	75.0	Very Imp.
12	Establishing priority levels for the various requirements of the project.	71.1	Very Imp.	79.3	Very Imp.	75.0	Very Imp.
13	Adherence to the applicable codes and municipal standards for the project type.	89.5	Ext. Imp.	88.0	Ext. Imp.	85.7	Very Imp.
14	Effect of project scale on developing the architectural program.	85.5	Very Imp.	72.8	Very Imp.	59.4	Important
15	Feedback from previous projects *(post-project evaluation and post-occupancy evaluation).*	72.2	Very Imp.	54.3	Important	59.4	Important
16	Anticipation of changes in the future use of the building.	65.8	Very Imp.	56.5	Important	53.1	Important

D. Factors related to the Role of Communication throughout the Programming Process							
17	Utilization of face-to-face contact as a communication method.	**81.6**	**Very Imp.**	**79.3**	**Very Imp.**	**78.1**	**Very Imp.**
18	Frequent communication between the owner and his project representatives with the programmer.	**81.9**	**Very Imp.**	**81.5**	**Very Imp.**	**78.1**	**Very Imp.**
19	Frequent communication between the owner or his project representatives with the design team.	**76.3**	**Very Imp.**	**79.3**	**Very Imp.**	**71.9**	**Very Imp.**
20	Utilization of different methods (*figures, pictures and text*) to document and effectively communicate the architectural program.	**76.4**	**Very Imp.**	**77.2**	**Very Imp.**	**75.0**	**Very Imp.**
E. Factors Related to the Allocated Time and Budget							
21	Allocating enough time for developing the architectural program.	**72.4**	**Very Imp.**	**78.3**	**Very Imp.**	**87.5**	**Ext. Imp.**
22	Setting up a deadline to freeze the development of architectural program.	**75.0**	**Very Imp.**	**68.5**	**Very Imp.**	**59.4**	**Important**
23	Allocating a separate service fee for developing the architectural program.	**59.2**	**Important**	**54.3**	**Important**	**59.4**	**Important**
24	Setting a clear budget for the whole project.	**77.5**	**Very Imp.**	**75.0**	**Very Imp.**	**84.4**	**Very Imp.**
F. Factors Related to Management and Control of the Architectural Programming process							
25	Commitment of all participants in the programming process.	**72.4**	**Very Imp.**	**78.3**	**Very Imp.**	**71.9**	**Very Imp.**
26	Inclusion of influential project parties that may enrich the architectural programming process.	**61.8**	**Important**	**68.5**	**Very Imp.**	**62.5**	**Very Imp.**
27	Timely and proper decision-making at the various stages of the development and implementation of the architectural program.	**81.6**	**Very Imp.**	**81.5**	**Very Imp.**	**90.6**	**Ext. Imp.**
28	Frequent review and refinement of the program during the early design stages.	**78.9**	**Very Imp.**	**78.3**	**Very Imp.**	**84.4**	**Very Imp.**

6.6.2.2 Identifying the variances among the respondents' assessment results

This step was carried out using SPSS program by using Tukey's test which is a single-step multiple comparison procedure and statistical test generally used in conjunction with an ANOVA to find which means are significantly different from one another (Gravetter and Wallnau, 2007).

Important note: If the calculated p-value (sig) is higher than the determine significance level (0.05), there is no significant different between two simples assessment.

The result of the variances analysis for each factor among the respondents' assessments will be discussed in the following section.

6.7 DISCUSSION OF RESULTS

As detailed in chapter four, the factors that could potentially affect the processes of developing and implementing the architectural program are identified and classified under six categories based on its nature. Each category has several factors, and no other significant or relevant factors suggested by any of the respondents to the questionnaire survey. As shown in Table 6.1 & 6.2, the importance index for each factor was calculated.

The importance index was categorized to reflect the scale of the respondents' answers to the questionnaire where the importance index of **0–<12.5%** is categorized as ''Not Important''; **12.5–<37.5%** is categorized as ''Somewhat Important''; **37.5–<62.5%** is categorized as ''Important''; **62.5–<87.5%** is categorized as ''Very Important''; and **87.5–100%** is categorized as ''Extremely Important.''.

A summary of the assessed factors' importance indexes and rate of importance (According to respondents' discipline) is illustrated in Table 6.1.

A summary of the assessed factors' importance indexes and rate of importance (According to respondents' geographical region) is illustrated in Table 6.2.

As shown in Table 6.1 & 6.2, the assessment of the identified factors differs from one type of respondents to other so the variances between the assessment results for each factor were calculated using SPSS program.

The assessments were analyzed twice, once according to the respondents' disciplines and the other according to the respondents' geographical region.

Discussion of assessments results and variances with brief descriptions for each factor is illustrated in the following sections.

6.7.1 Analysis of Factors Related to the Owner and his Representative(s)

This category includes four factors, namely involvement of the owner in the architectural programming process, involvement of the end user in the architectural programming process, involvement of the project manager *(representing the owner)* in the programming process, the owner's level of experience with the building process. The results of assessment of factors included in this category will be discussed as follows:

FACTOR 1. Involvement of the owner in the architectural programming process

Architectural programming process requires the involvement of the owner who identifies his goals, needs and requirements for the project and informs theses requirements to the design team (Hershberger, 1999).

The results of the assessment point out that "*involvement of the owner in the architectural programming process"* was perceived to be "very important" by the total of respondents as shown in Table 6.1.

The variance analysis indicated that there was no significant difference in the assessment of this factor among the respondents neither according to their discipline nor their location. The results indicate that all respondents agree on the assessment of this factor as shown in Tables 6.3 and 6.4 respectively.

The results of the assessment according to the respondents' discipline indicate that this factor was perceived to be "very important" by the groups of project managers, architectural designers and owners' representatives. On the other hand, the assessment' results by the group of the architectural designers and programmers indicate that this factor was perceived to be "important". Table 6.1 illustrates the importance index values as determined by the assessment made by all groups. It is believed that these results are reasonable due to the fact that the project owner is the main decision maker throughout

all the phases of the project. Additionally, the results of the assessment according to the respondents' geographical region indicate that this factor was perceived to be "very important" by all the respondents in the Eastern Province, Riyadh and Jeddah. Table 6.2 illustrates the importance index values as determined by the assessment made by all groups.

Table 6.3 Factor 1. Variance analysis according to respondents' disciplines

(I) Discipline	(J) Discipline	(P-value) Sig.
Project Manager	Architectural Designer	**.995**
	Architectural Des. & Prog.	**.063**
	Owner Repr.	**.722**
Architectural Designer	Architectural Des. & Prog.	**.139**
	Owner Repres.	**.696**
Architectural Des. & Prog.	Owner Repres.	**.985**

Table 6.4 Factor 1. Variance analysis according to respondents' regions

(I) Region	(J) Region	(P-value) Sig.
Eastern Province	Riyadh	**.743**
	Jeddah	**.991**
Riyadh	Jeddah	**.905**

FACTOR 2. Involvement of the end user in the architectural programming process

Adequate representation of all parties representing the client organization is very important to address their requirements and needs (Yu et al., 2006a).

The results of the assessment indicated that "*Involvement of the end user in the architectural programming process"* was perceived to be "very important" by the total number of respondents as shown in Table 6.1. The variance analysis emphasized that

there was no significant difference in the assessment of this factor among the respondents neither according to their discipline nor their location. The results confirm that all respondents agreed on the assessment of this factor as shown in Tables 6.5 and 6.6 respectively.

The results of the assessment according to the respondents' discipline indicate that this factor was perceived to be "very important" by the groups of project managers and owners' representatives. On the other hand, the assessment' results by the groups of architectural designers and architectural designers and programmers indicate that this factor was perceived to be "important". Table 6.1 illustrates the importance index values as determined by the assessment made by all groups. It is believed that these results are reasonable, due to the fact that there is a problem related to the identification of the end users, the effect of the owner in the identification of end users requirements. If possible, the end users should be involved in the programming process wherever they have the ability to identify their needs.

In addition, the results of the assessment according to the respondents' geographical region, indicate that this factor was perceived to be "very important" by all the respondents in the Eastern Province, Riyadh and Jeddah. Table 6.2 illustrates the importance index values as determined by the assessment made by all groups.

Table 6.5 Factor 2. Variance analysis according to respondents' disciplines

(I) Discipline	**(J) Discipline**	**(P-value) Sig.**
Project Manager	Architectural Designer	**.834**
	Architectural Des. & Prog.	**.841**
	Owner Repr.	**.974**
Architectural Designer	Architectural Des. & Prog.	**1.000**
	Owner Repres.	**.818**
Architectural Des. & Prog.	Owner Repres.	**.835**

Table 6.6 Factor 2. Variance analysis according to respondents' regions

(I) Region	(J) Region	(P-value) Sig.
Eastern Province	Riyadh	**.995**
	Jeddah	**.986**
Riyadh	Jeddah	**.995**

FACTOR 3. Involvement of the project manager (representing the owner)

Due to the complexity of the building process and the various parties involved in the process, the owner may assign a project manager for the purpose of coordinating and managing the whole process (Blyth and Worthington, 2001).

The results of the assessment indicate that "*involvement of the project manager (representing the owner) in the programming process"* was perceived to be "very important" by the total of respondents as shown in Table 6.1.

The variance analysis indicates that there is a difference in the assessment of this factor between the project managers and architectural designers where p-value is $0.045 < 0.05$ as shown in Tables 6.7. The reason may refer to the fact that architectural designers prefer to work without constrains from the project managers as an owner representative. It is believed that the role of the project managers as an owner representative is very important especially in big scale projects where the project managers (as professionals) will be helpful in the programming and design phases.

The results of the assessment according to the respondents' discipline indicate that this factor was perceived to be "very important" by the group of project managers. On the other hand, the assessment' results by the groups of architectural designers, architectural

designers and programmers and owners' representatives, indicate that this factor was perceived to be “important”. Table 6.1 illustrates the importance index values as determined by the assessment made by all groups.

In addition, the results of the assessment according to the respondents’ geographical region, indicate that this factor was perceived to be “very important” by the groups of the respondents in Riyadh and Jeddah, but it was perceived to be “important” by the group of the respondents in the Eastern Province. Table 6.2 illustrates the importance index values as determined by the assessment made by all groups.

Table 6.7 Factor 3. Variance analysis according to respondents' disciplines

(I) Discipline	(J) Discipline	(P-value) Sig.
Project Managers	Architectural Designers	**.045**
	Architectural Des. & Prog.	**.242**
	Owner Repr.	**.669**
Architectural Designer	Architectural Des. & Prog.	**.795**
	Owner Repres.	**.955**
Architectural Des. & Prog.	Owner Repres.	**1.000**

Table 6.8 Factor 3. Variance analysis according to respondents' regions

(I) Region	(J) Region	(P-value) Sig.
Eastern Province	Riyadh	**.215**
	Jeddah	**.826**
Riyadh	Jeddah	**.776**

FACTOR 4. The owner's level of experience with the building process

A series of conducted interviews confirm that one of the major problems in the building industry is lack of experience among owners with the building process.

The results of the assessment indicated that "*the owner's level of experience with the building process"* was perceived to be "important" by the total of respondents as shown in Table 6.1.

The variance analysis emphasize that there was no significant difference in the assessment of this factor among the respondents neither according to their discipline nor their location. The results confirm that all respondents agreed on the assessment of this factor, as shown in Tables 6.9 and 6.10 respectively.

The results of the assessment according to the respondents' discipline indicate that this factor was perceived to be "important" by all the groups of respondents. Table 6.1 illustrates the importance index values as determined by the assessment made by all groups.
Additionally, the results of the assessment according to the respondents' geographical region indicate that this factor was perceived to be "important" by all the respondents in the Eastern Province, Riyadh and Jeddah. Table 6.2 illustrates the importance index values as determined by the assessment made by all groups.

This agreement of the assessment may be due to the fact that if the owner is not familiar with the building process, it is not an obstacle to programming process. It is believed that the experienced owner will actually cooperate with the project team where familiarity of the owner with building process will assist in communication between the programmer and the owner, as the owner in this case will be able to identify the project goals and objectives properly.

Table 6.9 Factor 4. Variance analysis according to respondents' disciplines

(I) Discipline	(J) Discipline	(P-value) Sig.
Project Manager	Architectural Designer	**.998**
	Architectural Des. & Prog.	**.953**
	Owner Representatives.	**.969**
Architectural Designer	Architectural Des. & Prog.	**.942**
	Owner Repre.	**.990**
Architectural Des. & Prog.	Owner Repre.	**.895**

Table 6.10 Factor 4. Variance analysis according to respondents' regions

(I) Region	(J) Region	(P-value) Sig.
Eastern Province	Riyadh	**.912**
	Jeddah	**.981**
Riyadh	Jeddah	**.879**

6.7.2 Analysis of Factors Related to the Architectural Programmer

As shown in Table 6.1, this category contains four factors, namely familiarity of the architectural programmer with the project type, familiarity of the architectural programmer with various building systems (structure, electrical, etc), the architectural programmer's ability to comprehend the project requirements during the architectural programming phase, the architect's ability to comprehend the developed program during the design phase. The results of assessment of factors included in this category will be discussed as follows:

FACTOR 5. Familiarity of the architectural programmer with the project type

Having experience on the project type may result in developing accurate assumptions pertaining to space types, space allocation criteria or other requirements unique to the type of the project and vice versa (Cherry and Petronis, 2009).

The results of the assessment indicate that "*familiarity of the architectural programmer with the project type"* was perceived to be "extremely important" by the total of respondents as shown in Table 6.1.

The variance analysis indicates that there was no significant difference in the assessment of this factor among the respondents neither according to their discipline nor their location. The results confirm that all respondents agree on the assessment of this factor as shown in Tables 6.11 and 6.12 respectively.

The results of the assessment according to the respondents' discipline indicate that this factor was perceived to be "Extremely important" by all the groups of respondents. Table 6.1 illustrates the importance index values as determined by the assessment made by all groups.

Additionally, the results of the assessment, according to the respondents' geographical region, indicate that this factor was perceived to be "Extremely important" by all the respondents in the Eastern Province, Riyadh and Jeddah. Table 6.2 illustrates the importance index values as determined by the assessment made by all groups.

As shown in Table 6.1, this factor received the highest importance index value within all assessed factors. This confirms that the programmer should be familiar with project type. If the programmer is not familiar with the project type, he/she has to investigate the project type through the standard books, municipal standards as well as reviewing PPE & POE of similar project type.

Table 6.11 Factor 5. Variance analysis according to respondents' disciplines

(I) Discipline	(J) Discipline	(P-value) Sig.
Project Manager	Architectural Designer	**.739**
	Architectural Des. & Prog.	**.865**
	Owner Representatives.	**.760**
Architectural Designer	Architectural Des. & Prog.	**.445**
	Owner Repre.	**.990**
Architectural Des. & Prog.	Owner Repre.	**.544**

Table 6.12 Factor 5. Variance analysis according to respondents' regions

(I) Region	(J) Region	(P-value) Sig.
Eastern Province	Riyadh	**.946**
	Jeddah	**.714**
Riyadh	Jeddah	**.551**

FACTOR6. Familiarity of the architectural programmer with various building systems

A specialist in one field may ignore critical information that pertains to other professionals (Shen and Chung (2006). As architects have responsibility for developing the projects' architectural programs, they should possess adequate experience in other professional disciplines (Costa, 2010).

The results of the assessment point out that "*familiarity of the architectural programmer with various building systems (structure, electrical, etc)"* was perceived to be "very important" by the total of respondents, as shown in Table 6.1.

The variance analysis indicates that there was no significant difference in the assessment of this factor among the respondents according to their discipline. The results confirmed that all respondents agreed on the assessment of this factor, as shown in Tables 6.13. On the other hand, the Variance analysis indicates that there was a difference in the assessment of this factor among the respondents according to their location. The results indicate that there was a difference in the assessment of this factor between the respondents in the Eastern Province and the respondents in the Riyadh, where p-value was $0.044 < 0.05$, as shown in Tables 6.14.

The results of the assessment according to the respondents' discipline indicated that this factor was perceived to be "extremely important" by the group of architectural designers. On the other hand, the assessment' results by the groups of project managers, architectural designers and programmers and owners' representatives indicated that this factor was perceived to be "very important". Table 6.1 illustrates the importance index values as determined by the assessment made by all groups. This assessment result by the architectural designers may be due to the fact that they face problems which related to selected building systems. These problems appear during the design phase so they emphasize the significance of this factor.

The results of the assessment according to the respondents' geographical region indicated that this factor was perceived to be "extremely important" by the respondents in the Eastern Province. This factor was perceived to be "very important" by the respondents in the Riyadh and Jeddah regions. Table 6.2 illustrates the importance index values as determined by the assessment made by all groups.

Table 6.13 Factor 6. Variance analysis according to respondents' disciplines

(I) Discipline	(J) Discipline	(P-value) Sig.
Project Manager	Architectural Designer	**.749**
	Architectural Des. & Prog.	**.990**
	Owner Repr.	**.991**
Architectural Designer	Architectural Des. & Prog.	**.677**
	Owner Repres.	**.831**
Architectural Des. & Prog.	Owner Repres.	**.999**

Table 6.14 Factor 6. Variance analysis according to respondents' regions

(I) Region	(J) Region	(P-value) Sig.
Eastern Province	Riyadh	**.044**
	Jeddah	**.411**
Riyadh	Jeddah	**.846**

FACTOR 7. The architectural programmer's ability to comprehend the project requirements during the architectural programming phase

The programmer should be able to comprehend the project requirements (Wasfi, 2010; Abdullah, 2010). Efficient programming depends mainly on the involvement and the skill of the programmer and the owner (Salisbury, 1998).

The results of the assessment point out that "*the architectural programmer's ability to comprehend the project requirements during the architectural programming phase"* was perceived to be "extremely important" by the total number of respondents, as shown in Table 6.1.

The variance analysis indicated that there was no significant difference in the assessment of this factor among the respondents neither according to their discipline nor their location. The results confirmed that all respondents agreed on the assessment of this factor, as shown in Tables 6.15 and 6.16 respectively.

The results of the assessment according to the respondents' discipline indicated that this factor was perceived to be "extremely important" by the groups of project managers, architectural designers and programmers and owners' representatives. On the other hand, the assessment' results by the group of architectural designers pointed out that this factor was perceived to be "very important". Table 6.1 illustrates the importance index values as determined by the assessment made by all groups.

The results of the assessment according to the respondents' geographical region indicated that this factor was perceived to be "extremely important" by the respondents in the Eastern Province. This factor was perceived to be "very important" by the respondents in Riyadh and Jeddah. Table 6.2 illustrates the importance index values as determined by the assessment made by all groups.

Table 6.15 Factor 7. Variance analysis according to respondents' disciplines

(I) Discipline	(J) Discipline	(P-value) Sig.
Project Manager	Architectural Designer	**.607**
	Architectural Des. & Prog.	**.610**
	Owner Repr.	**.680**
Architectural Designer	Architectural Des. & Prog.	**.186**
	Owner Repres.	**.319**
Architectural Des. & Prog.	Owner Repres.	**.976**

Table 6.16 Factor 7. Variance analysis according to respondents' regions

(I) Region	(J) Region	(P-value) Sig.
Eastern Province	Riyadh	**.354**
	Jeddah	**.999**
Riyadh	Jeddah	**.517**

FACTOR 8. The architect's ability to comprehend the developed program during the design phase

When owners fail to identify and clarify their project requirements, architects are not expected to comprehend these requirements. On the other hand, the architect should properly understand the developed program and carefully interpret it during the design process (Bogers et al., 2008).

The results of the assessment indicate that "*the architect's ability to comprehend the developed program during the design phase"* was perceived to be "extremely important" by the total number of respondents as shown in Table 6.1.

The variance analysis indicated that there was no significant difference in the assessment of this factor among the respondents neither according to their discipline nor their location. The results confirm that all respondents agreed on the assessment of this factor, as shown in Tables 6.17 and 6.18 respectively.

The results of the assessment according to the respondents' discipline indicated that this factor was perceived to be "extremely important" by the groups of project managers, architectural designers and programmers and owners' representatives. On the other hand, the assessment' results by the groups of architectural designers indicated that this factor was perceived to be "very important". Table 6.1 illustrates the importance index values as determined by the assessment made by all groups.

The results of the assessment, according to the respondents' geographical region, indicated that this factor was perceived to be "extremely important" by the respondents in the Eastern Province. This factor was perceived to be "very important" by the respondents in Riyadh and Jeddah. Table 6.2 illustrates the importance index values as determined by the assessment made by all groups.

Table 6.17 Factor 8. Variance analysis according to respondents' disciplines

(I) Discipline	**(J) Discipline**	**(P-value) Sig.**
Project Manager	Architectural Designer	**.737**
	Architectural Des. & Prog.	**.991**
	Owner Repr.	**.791**
Architectural Designer	Architectural Des. & Prog.	**.905**
	Owner Repres.	**.486**
Architectural Des. & Prog.	Owner Repres.	**.732**

Table 6.18 Factor 8. Variance analysis according to respondents' regions

(I) Region	(J) Region	(P-value) Sig.
Eastern Province	Riyadh	**.520**
	Jeddah	**.916**
Riyadh	Jeddah	**.437**

6.7.3 Analysis of Factors Related to the Program Data

This category included eight factors, namely clarity of project goals set by the owner, clarity of project requirements (functional, technical and behavioral), identifying functional relationships among the various facility spaces, establishing priority levels for the various requirements of the project, adherence to the applicable codes and municipal standards for the project type, effect of project scale on developing the architectural program, feedback from previous projects (post-project evaluation and post-occupancy evaluation), anticipation of changes in the future use of the building. The results of assessment of the factors included in this category are discussed in the following:

FACTOR 9. Clarity of project goals set by the owner

To develop the architectural program successfully, it should be identify and understand the objectives and goals of project (Yu et al. 2006a).

The results of the assessment indicated that "*clarity of project goals set by the owner"* was perceived to be "very important" by the total of respondents as shown in Table 6.1.

The variance analysis indicated that there was no significant difference in the assessment of this factor among the respondents neither according to their discipline nor their location. The results confirmed that all respondents agreed on the assessment of this factor, as shown in Tables 6.19 and 6.20 respectively.

The results of the assessment, according to the respondents' discipline indicated that this factor was perceived to be "extremely important" by the groups of project managers and owners' representatives. On the other hand, the assessment' results by the groups of architectural designers and architectural designers and programmers pointed out that this factor was perceived to be "very important". Table 6.1 illustrates the importance index values as determined by the assessment made by all groups.

The results of the assessment, according to the respondents' geographical region indicated that this factor was perceived to be "extremely important" by the respondents in Jeddah. This factor was perceived to be "very important" by the respondents in the Eastern Province and Riyadh. Table 6.2 illustrates the importance index values as determined by the assessment made by all groups.

Table 6.19 Factor 9. Variance analysis according to respondents' disciplines

(I) Discipline	(J) Discipline	(P-value) Sig.
Project Manager	Architectural Designer	**.995**
	Architectural Des. & Prog.	**.997**
	Owner Repr.	**.967**
Architectural Designer	Architectural Des. & Prog.	**1.000**
	Owner Repres.	**.942**
Architectural Des. & Prog.	Owner Repres.	**.948**

Table 6.20 Factor 9. Variance analysis according to respondents' regions

(I) Region	(J) Region	(P-value) Sig.
Eastern Province	Riyadh	**.975**
	Jeddah	**.815**
Riyadh	Jeddah	**.712**

FACTOR 10. Clarity of project requirements (functional, technical and behavioral)

Projects' Owners should identify their project requirements and needs clearly, systematically and comprehensively (Shen and Chung, 2006).

The results of the assessment indicated that "*clarity of project requirements (functional, technical and behavioral)"* was perceived to be "very important" by the total number of respondents as shown in Table 6.1.

The variance analysis indicated that there was no significant difference in the assessment of this factor among the respondents neither according to their discipline nor their location. The results confirmed that all respondents agreed on the assessment of this factor, as shown in Tables 6.21 and 6.22 respectively.
The results of the assessment, according to the respondents' discipline indicated that this factor was perceived to be "very important" by all the groups of respondents. Table 6.1 illustrates the importance index values as determined by the assessment made by all groups.

Additionally, the results of the assessment, according to the respondents' geographical region indicated that this factor was perceived to be "very important" by all the respondents in the Eastern Province, Riyadh and Jeddah. Table 6.2 illustrates the importance index values as determined by the assessment made by all groups.

Table 6.21 Factor 10. Variance analysis according to respondents' disciplines

(I) Discipline	(J) Discipline	(P-value) Sig.
Project Manager	Architectural Designer	**.845**
	Architectural Des. & Prog.	**.161**
	Owner Repr.	**.993**
Architectural Designer	Architectural Des. & Prog.	**.098**
	Owner Repres.	**.996**
Architectural Des. & Prog.	Owner Repres.	**.527**

Table 6.22 Factor 10. Variance analysis according to respondents' regions

(I) Region	(J) Region	(P-value) Sig.
Eastern Province	Riyadh	**.945**
	Jeddah	**.823**
Riyadh	Jeddah	**.927**

FACTOR 11. Identifying functional relationships among the various facility spaces

There exists a wide variety of styles that can be used to develop space relationship diagrams. These styles range from freehand sketches to hard line drawings (Kumlin, 1995). Relationship diagrams are extremely helpful and useful for depicting correlations relating to spatial requirements for the project.

The results of the assessment indicated that "*identifying functional relationships among the various facility spaces"* was perceived to be "very important" by the total number of respondents as shown in Table 6.1.

The variance analysis indicated that there was no significant difference in the assessment of this factor among the respondents neither according to their discipline nor their location. The results confirmed that all respondents agreed on the assessment of this factor, as shown in Tables 6.23 and 6.24 respectively.

The results of the assessment according to the respondents' discipline indicated that this factor was perceived to be "very important" by all the groups of respondents. Table 6.1 illustrates the importance index values as determined by the assessment made by all groups.

In addition, the results of the assessment according to the respondents' geographical region indicated that this factor was perceived to be "very important" by all the respondents in the Eastern Province, Riyadh and Jeddah. Table 6.2 illustrates the importance index values as determined by the assessment made by all groups.

Table 6.23 Factor 11. Variance analysis according to respondents' disciplines

(I) Discipline	(J) Discipline	(P-value) Sig.
Project Manager	Architectural Designer	**.765**
	Architectural Des. & Prog.	**.238**
	Owner Repr.	**.927**
Architectural Designer	Architectural Des. & Prog.	**.926**
	Owner Repres.	**1.000**
Architectural Des. & Prog.	Owner Repres.	**.975**

Table 6.24 Factor 11. Variance analysis according to respondents' regions

(I) Region	(J) Region	(P-value) Sig.
Eastern Province	Riyadh	**.966**
	Jeddah	**.957**
Riyadh	Jeddah	**.882**

FACTOR 12. Establishing priority levels for the various requirements of the project

Setting priority levels for each requirement in the project is an integral part of the data needed to develop and implement the project architectural program (Kumlin, 1995). Established levels of priorities identify opportunities for developing design solutions and set constraints on the implementation of the solutions (Cherry, 1999).

The results of the assessment indicated that "*establishing priority levels for the various requirements of the project"* was perceived to be "very important" by the total number of respondents, as shown in Table 6.1.

The variance analysis indicated that there was no significant difference in the assessment of this factor among the respondents neither according to their discipline nor their location. The results confirm that all respondents agreed on the assessment of this factor, as shown in Tables 6.25 and 6.26 respectively.

The results of the assessment according to the respondents' discipline indicated that this factor was perceived to be "very important" by the groups of project managers, architectural designers and architectural designers and programmers. On the other hand, the assessment' results by the group of owners' representatives indicated that this factor was perceived to be "important". Table 6.1 illustrates the importance index values as determined by the assessment made by all groups. It is believed that these results are reasonable, because of that the owners want to get their requirements as identified.

In addition, the results of the assessment according to the respondents' geographical region indicated that this factor was perceived to be "very important" by all the respondents in the Eastern Province, Riyadh and Jeddah. Table 6.2 illustrates the importance index values as determined by the assessment made by all groups.

Table 6.25 Factor 12. Variance analysis according to respondents' disciplines

(I) Discipline	**(J) Discipline**	**(P-value) Sig.**
Project Manager	Architectural Designer	**.965**
	Architectural Des. & Prog.	**.706**
	Owner Repr.	**.475**
Architectural Designer	Architectural Des. & Prog.	**.600**
	Owner Repres.	**.393**
Architectural Des. & Prog.	Owner Repres.	**.848**

Table 6.26 Factor 12. Variance analysis according to respondents' regions

(I) Region	(J) Region	(P-value) Sig.
Eastern Province	Riyadh	**.424**
	Jeddah	**.898**
Riyadh	Jeddah	**.872**

FACTOR 13. Adherence to the applicable codes and municipal standards for the project type

When architects develop the architectural program, they have to be aware of the applicable standards and codes that are relevant to the project. As these standards and codes could have a strong effect on the project cost, they must be considered at the initial stages of the design phase (Cherry and Petronis, 2009).

The results of the assessment indicated that "*Adherence to the applicable codes and municipal standards for the project type"* was perceived to be "extremely important" by the total number of respondents as shown in Table 6.1.

The variance analysis indicated that there was no significant difference in the assessment of this factor among the respondents neither according to their discipline nor their location. The results confirmed that all respondents agreed on the assessment of this factor, as shown in Tables 6.27 and 6.28 respectively.

The results of the assessment according to the respondents' discipline indicated that this factor was perceived to be "extremely important" by the groups of project managers, architectural designers. On the other hand, the assessment' results by the groups of architectural designers and programmers and owners' representatives indicated that this

factor was perceived to be “important”. Table 6.1 illustrates the importance index values as determined by the assessment made by all groups. It is believed that these results are logical because the project managers and designers are aware of the problems which are related to municipal standards.

Additionally, the results of the assessment according to the respondents’ geographical region indicated that this factor was perceived to be “extremely important” by the respondents in the Eastern Province and Riyadh. This factor was perceived to be “very important” by the respondents in Jeddah. Table 6.2 illustrates the importance index values as determined by the assessment made by all groups.

Table 6.27 Factor 13. Variance analysis according to respondents' disciplines

(I) Discipline	(J) Discipline	(P-value) Sig.
Project Manager	Architectural Designer	**.997**
	Architectural Des. & Prog.	**.842**
	Owner Repr.	**.508**
Architectural Designer	Architectural Des. & Prog.	**.857**
	Owner Repres.	**.524**
Architectural Des. & Prog.	Owner Repres.	**.810**

Table 6.28 Factor 13. Variance analysis according to respondents' regions

(I) Region	(J) Region	(P-value) Sig.
Eastern Province	Riyadh	**.958**
	Jeddah	**.865**
Riyadh	Jeddah	**.943**

FACTOR 14. Effect of project scale on developing the architectural program

A program can differ considerably in length, content and format depending on three main issues, the owner's professional experience, the project type, scale and complexity and the organization of the construction process (Shen and Chung, 2006).

The results of the assessment indicated that "*effect of project scale on developing the architectural program"* was perceived to be "very important" by the total number of respondents as shown in Table 6.1.
The variance analysis indicated that there was no significant difference in the assessment of this factor among the respondents according to their discipline. The results confirmed that all respondents agree on the assessment of this factor as shown in Tables 6.29.

On the other hand, the Variance analysis indicated that there was a difference in the assessment of this factor among the respondents according to their location. The results indicated that there was a difference in the assessment of this factor between the respondents in the Eastern Province and the respondents in Jeddah where p-value is 0.007 < 0.05, as shown in Tables 6.30. This result may be because the number of respondents in Jeddah was less than Eastern Province.

The results of the assessment according to the respondents' discipline indicated that this factor was perceived to be "very important" by the groups of project managers, architectural designers and architectural designers and programmers. On the other hand, the assessment' results by the group of owners' representatives indicated that this factor was perceived to be "important". Table 6.1 illustrates the importance index values as determined by the assessment made by all groups.

Additionally, the results of the assessment according to the respondents' geographical region, indicated that this factor was perceived to be "very important" by the respondents in the Eastern Province and Riyadh. This factor was perceived to be "important" by the

respondents in Jeddah. Table 6.2 illustrates the importance index values as determined by the assessment made by all groups.

Table 6.29 Factor 14. Variance analysis according to respondents' disciplines

(I) Discipline	(J) Discipline	(P-value) Sig.
Project Manager	Architectural Designer	**.972**
	Architectural Des. & Prog.	**.999**
	Owner Repr.	**.379**
Architectural Designer	Architectural Des. & Prog.	**.960**
	Owner Repres.	**.568**
Architectural Des. & Prog.	Owner Repres.	**.377**

Table 6.30 Factor 14. Variance analysis according to respondents' regions

(I) Region	(J) Region	(P-value) Sig.
Eastern Province	Riyadh	**.099**
	Jeddah	**.007**
Riyadh	Jeddah	**.220**

FACTOR 15. Feedback from previous projects (post-project evaluation and post-occupancy evaluation

POE and PPE provide the programmer and the designer with useful and helpful feedback on problems and solutions relevant to the design and construction of similar projects types. This knowledge forms a sound basis for improving existing buildings and designing, constructing and operating better buildings in the future (Preiser et al., 1988).

The results of the assessment indicated that "*feedback from previous projects (post-project evaluation and post-occupancy evaluation)"* was perceived to be "important" by the total number of respondents as shown in Table 6.1.

The variance analysis indicated that there was no significant difference in the assessment of this factor among the respondents neither according to their discipline nor their location. The results confirmed that all respondents agreed on the assessment of this factor, as shown in Tables 6.31 and 6.32 respectively.

The results of the assessment according to the respondents' discipline indicated that this factor was perceived to be "very important" by the groups of project managers and owners' representatives. On the other hand, the assessment' results by the groups of architectural designers and architectural designers and programmers indicated that this factor was perceived to be "important". Table 6.1 illustrates the importance index values as determined by the assessment made by all groups.

Additionally, the results of the assessment according to the respondents' geographical region indicated that this factor was perceived to be "very important" by the respondents in the Eastern Province. This factor was perceived to be "important" by the respondents in Riyadh and Jeddah. Table 6.2 illustrates the importance index values as determined by the assessment made by all groups.

Table 6.31 Factor 15. Variance analysis according to respondents' disciplines

(I) Discipline	**(J) Discipline**	**(P-value) Sig.**
Project Manager	Architectural Designer	**.485**
	Architectural Des. & Prog.	**.431**
	Owner Repr.	**1.000**
Architectural Designer	Architectural Des. & Prog.	**1.000**
	Owner Repres.	**.884**
Architectural Des. & Prog.	Owner Repres.	**.896**

Table 6.32 Factor 15. Variance analysis according to respondents' regions

(I) Region	(J) Region	(P-value) Sig.
Eastern Province	Riyadh	**.114**
	Jeddah	**.527**
Riyadh	Jeddah	**.899**

FACTOR 16. Anticipation of changes in the future use of the building

In time, the range of activities and the users who occupy and use the building may change. Because of such changes, the building may not be able to cope with the new requirements of its users (Brauer, 1992).

The results of the assessment indicated that "*anticipation of changes in the future use of the building"* was perceived to be "important" by the total number of respondents, as shown in Table 6.1.

The variance analysis indicated that there was no significant difference in the assessment of this factor among the respondents neither according to their discipline nor their location. The results confirmed that all respondents agreed on the assessment of this factor, as shown in Tables 6.33 and 6.34 respectively.

The results of the assessment according to the respondents' discipline indicated that this factor was perceived to be "very important" by the group of project managers. On the other hand, the assessment' results by the groups of architectural designers, architectural designers and programmers and owners' representatives indicated that this factor was perceived to be "important". Table 6.1 illustrates the importance index values as determined by the assessment made by all groups.

Additionally, the results of the assessment according to the respondents' geographical region indicated that this factor was perceived to be "very important" by the respondents in the Eastern Province. This factor was perceived to be "important" by the respondents in Riyadh and Jeddah. Table 6.2 illustrates the importance index values as determined by the assessment made by all groups.

Table 6.33 Factor 16. Variance analysis according to respondents' disciplines

(I) Discipline	(J) Discipline	(P-value) Sig.
Project Manager	Architectural Designer	**.953**
	Architectural Des. & Prog.	**.533**
	Owner Repr.	**.818**
Architectural Designer	Architectural Des. & Prog.	**.936**
	Owner Repres.	**.960**
Architectural Des. & Prog.	Owner Repres.	**.999**

Table 6.34 Factor 16. Variance analysis according to respondents' regions

(I) Region	(J) Region	(P-value) Sig.
Eastern Province	Riyadh	**.467**
	Jeddah	**.463**
Riyadh	Jeddah	**.942**

6.7.4 Analysis of Factors related to the Role of Communication throughout the Programming Process

This category includes four factors, namely utilization of face-to-face contact as a communication method, frequent communication between the owner and his project representatives with the programmer, frequent communication between the owner or his project representatives and the design team, utilization of different methods (figures, pictures and text) to document and effectively communicate the architectural program. The results of assessment of factors included in this category are discussed as follows:

FACTOR 17. Utilization of face-to-face contact as a communication method

Bogers et al. (2008) states that "many of the architects say that they always try to establish a direct dialogue with users and clients, even though they are not supposed to do so in some projects. Direct contact with users is seen as necessary to get a "feel" for the organization and the ambitions and priorities of the clients".

The results of the assessment indicate that "*utilization of face-to-face contact as a communication method"* was perceived to be "very important" by the total number of respondents, as shown in Table 6.1.

The variance analysis indicated that there was no significant difference in the assessment of this factor among the respondents neither according to their discipline nor their location. The results confirmed that all respondents agreed on the assessment of this factor, as shown in Tables 6.35 and 6.36 respectively.

The results of the assessment according to the respondents' discipline indicated that this factor was perceived to be "extremely important" by the group of owners' representatives. On the other hand, the assessment' results by the groups of project managers, architectural designers, architectural designers and programmers indicated that this factor

was perceived to be “very important”. Table 6.1 illustrates the importance index values as determined by the assessment made by all groups.

Additionally, the results of the assessment according to the respondents’ geographical region indicated that this factor was perceived to be “very important” by all respondents in the Eastern Province, Riyadh and Jeddah. Table 6.2 illustrates the importance index values as determined by the assessment made by all groups.

Table 6.35 Factor 17. Variance analysis according to respondents' disciplines

(I) Discipline	(J) Discipline	(P-value) Sig.
Project Manager	Architectural Designer	**.947**
	Architectural Des. & Prog.	**.878**
	Owner Repr.	**.876**
Architectural Designer	Architectural Des. & Prog.	**1.000**
	Owner Repres.	**.751**
Architectural Des. & Prog.	Owner Repres.	**.690**

Table 6.36 Factor 17. Variance analysis according to respondents' regions

(I) Region	(J) Region	(P-value) Sig.
Eastern Province	Riyadh	**.939**
	Jeddah	**.921**
Riyadh	Jeddah	**.989**

FACTOR 18. Frequent communication between the owner and his project representatives with the programmer

The successful architectural programming process depends on effective communication among all project participants (Yu et al. 2006a). Bowen et al. (1997) pointed out that communication between the owner, the end users and the programmer to identify their requirements significantly affects satisfaction with the completed building project.

The results of the assessment indicated that *"Frequent communication between the owner and his project representatives with the programmer"* was perceived to be "very important" by the total of respondents as shown in Table 6.1.

The variance analysis indicated that there was no significant difference in the assessment of this factor among the respondents neither according to their discipline nor their location. The results confirmed that all respondents agreed on the assessment of this factor, as shown in Tables 6.37 and 6.38 respectively.

The results of the assessment according to the respondents' discipline indicated that this factor was perceived to be "very important" by the group of respondents. Table 6.1 illustrates the importance index values as determined by the assessment made by all groups.

Additionally, the results of the assessment according to the respondents' geographical region indicated that this factor was perceived to be "very important" by all respondents in the Eastern Province, Riyadh and Jeddah. Table 6.2 illustrates the importance index values as determined by the assessment made by all groups.

Table 6.37 Factor 18. Variance analysis according to respondents' disciplines

(I) Discipline	(J) Discipline	(P-value) Sig.
Project Manager	Architectural Designer	**.106**
	Architectural Des. & Prog.	**.308**
	Owner Repr.	**.644**
Architectural Designer	Architectural Des. & Prog.	**.897**
	Owner Repres.	**.993**
Architectural Des. & Prog.	Owner Repres.	**.997**

Table 6.38 Factor 18. Variance analysis according to respondents' regions

(I) Region	(J) Region	(P-value) Sig.
Eastern Province	Riyadh	**.997**
	Jeddah	**.855**
Riyadh	Jeddah	**.876**

FACTOR 19. Frequent communication between the owner or his project representatives and the design team

Architects point out that face-to-face communication is a means to test their level of understanding and the accuracy of their interpretation of the project program (Bogers et al., 2008).

The results of the assessment indicated that *"frequent communication between the owner or his project representatives and the design team"* was perceived to be "very important" by the total of respondents as shown in Table 6.1.

The variance analysis indicated that there was no significant difference in the assessment of this factor among the respondents neither according to their discipline nor their

location. The results confirmed that all respondents agreed on the assessment of this factor, as shown in Tables 6.39 and 6.40 respectively.

The results of the assessment according to the respondents' discipline indicated that this factor was perceived to be "very important" by the group of respondents. Table 6.1 illustrates the importance index values as determined by the assessment made by all groups.

Additionally, the results of the assessment according to the respondents' geographical region indicated that this factor was perceived to be "very important" by all respondents in the Eastern Province, Riyadh and Jeddah. Table 6.2 illustrates the importance index values as determined by the assessment made by all groups.

Table 6.39 Factor 19. Variance analysis according to respondents' disciplines

(I) Discipline	(J) Discipline	(P-value) Sig.
Project Manager	Architectural Designer	**.066**
	Architectural Des. & Prog.	**.374**
	Owner Repr.	**.622**
Architectural Designer	Architectural Des. & Prog.	**.756**
	Owner Repres.	**.984**
Architectural Des. & Prog.	Owner Repres.	**.991**

Table 6.40 Factor 19. Variance analysis according to respondents" regions

(I) Region	(J) Region	(P-value) Sig.
Eastern Province	Riyadh	**.967**
	Jeddah	**.910**
Riyadh	Jeddah	**.814**

FACTOR 20. Utilization of different methods (figures, pictures and text) to document and effectively communicate the architectural program

Typically, the projects programs are expressed either in written format or verbally, or through a combination of verbal and written format (Shen and Chung, 2006).

The results of the assessment indicated that *"utilization of different methods (figures, pictures and text) to document and effectively communicate the architectural program"* was perceived to be "very important" by the total of respondents as shown in Table 6.1. The variance analysis indicated that there was no significant difference in the assessment of this factor among the respondents neither according to their discipline nor their location. The results confirmed that all respondents agreed on the assessment of this factor as shown in Tables 6.41 and 6.42 respectively.

The results of the assessment according to the respondents' discipline indicated that this factor was perceived to be "very important" by the groups of project managers, architectural designers, architectural designers and programmers. On the other hand, the assessment results by the group of owners' representatives indicated that this factor was perceived to be "important". Table 6.1 illustrates the importance index values as determined by the assessment made by all groups.

Additionally, the results of the assessment according to the respondents' geographical region indicated that this factor was perceived to be "very important" by all respondents in the Eastern Province, Riyadh and Jeddah. Table 6.2 illustrates the importance index values as determined by the assessment made by all groups.

The adequacy of the documentation methods used to compile the project program is a significant factor towards the development of a satisfactorily design solution.

Table 6.41 Factor 20. Variance analysis according to respondents' disciplines

(I) Discipline	(J) Discipline	(P-value) Sig.
Project Manager	Architectural Designer	**.671**
	Architectural Des. & Prog.	**.997**
	Owner Repr.	**.127**
Architectural Designer	Architectural Des. & Prog.	**.843**
	Owner Repres.	**.513**
Architectural Des. & Prog.	Owner Repres.	**.203**

Table 6.42 Factor 20. Variance analysis according to respondents' regions

(I) Region	(J) Region	(P-value) Sig.
Eastern Province	Riyadh	**.992**
	Jeddah	**.987**
Riyadh	Jeddah	**.966**

6.7.5 Analysis of Factors Related to the Allocated Time and Budget

As shown in Table 6.1, this category contains four factors, namely allocating enough time for developing the architectural program, setting up of a deadline to freeze the development architectural program, allocating a separate service fee for developing the architectural program, setting a clear budget for the whole project. The results of assessment of factors included in this category are discussed as follows:

FACTOR 21. Allocating enough time for developing the architectural program

An early initiation of the construction phase is a common purpose for almost all project owners. Several clients (projects owners) allocate a short time for the architectural programming process, which may result in poor identification of the client's actual needs and requirements (Shen and Chung, 2006).

The results of the assessment indicated that *"allocating enough time for developing the architectural program"* was perceived to be "very important" by the total number of respondents as shown in Table 6.1.

The variance analysis indicated that there was no significant difference in the assessment of this factor among the respondents neither according to their discipline nor their location. The results confirmed that all respondents agreed on the assessment of this factor, as shown in Tables 6.43 and 6.44 respectively.

The results of the assessment according to the respondents' discipline indicated that this factor was perceived to be "very important" by all groups of respondents. Table 6.1 illustrates the importance index values as determined by the assessment made by all groups.

Additionally, the results of the assessment according to the respondents' geographical region indicated that this factor was perceived to be "very important" by the respondents in the Eastern Province and Riyadh. This factor was perceived to be "extremely important" by the respondents in Jeddah. Table 6.2 illustrates the importance index values as determined by the assessment made by all groups.

Table 6.43 Factor 21. Variance analysis according to respondents' disciplines

(I) Discipline	(J) Discipline	(P-value) Sig.
Project Manager	Architectural Designer	**.981**
	Architectural Des. & Prog.	**.977**
	Owner Repr.	**.996**
Architectural Designer	Architectural Des. & Prog.	**.914**
	Owner Repres.	**.974**
Architectural Des. & Prog.	Owner Repres.	**1.000**

Table 6.44 Factor 21. Variance analysis according to respondents' regions

(I) Region	(J) Region	(P-value) Sig.
Eastern Province	Riyadh	**.572**
	Jeddah	**.145**
Riyadh	Jeddah	**.458**

FACTOR 22. Setting up a deadline to freeze the development architectural program

The architectural program of any project should be compiled, completed and agreed upon before initiating the design phase for the project (Yu et al., 2006a). Changes that may be made to the architectural program at later stages could affect the project cost, time and quality (Othman et al., 2004).

The results of the assessment indicated that *"setting up a deadline to freeze the development architectural program"* was perceived to be "very important" by the total of respondents as shown in Table 6.1.
The variance analysis indicated that there was no significant difference in the assessment of this factor among the respondents neither according to their discipline nor their location. The results confirmed that all respondents agreed on the assessment of this factor, as shown in Tables 6.45 and 6.46 respectively.

The results of the assessment according to the respondents' discipline indicated that this factor was perceived to be "very important" by all groups of respondents. Table 6.1 illustrates the importance index values as determined by the assessment made by all groups.

Additionally, the results of the assessment according to the respondents' geographical region indicated that this factor was perceived to be "very important" by the respondents in the Eastern Province and Riyadh. This factor was perceived to be "important" by the respondents in Jeddah. Table 6.2 illustrates the importance index values as determined by the assessment made by all groups.

Table 6.45 Factor 22. Variance analysis according to respondents' disciplines

(I) Discipline	**(J) Discipline**	**(P-value) Sig.**
Project Manager	Architectural Designer	**.732**
	Architectural Des. & Prog.	**.613**
	Owner Repr.	**1.000**
Architectural Designer	Architectural Des. & Prog.	**1.000**
	Owner Repres.	**.917**
Architectural Des. & Prog.	Owner Repres.	**.898**

Table 6.46 Factor 22. Variance analysis according to respondents' regions

(I) Region	(J) Region	(P-value) Sig.
Eastern Province	Riyadh	**.697**
	Jeddah	**.332**
Riyadh	Jeddah	**.669**

FACTOR 23. Allocating a separate service fee for developing the architectural program

Generally, in small projects, the project architectural program is developed by the architect without an additional fee, but in large projects, the client usually pays the commission separately to the architect to develop the project architectural program (Cherry, 1999).

The results of the assessment indicated that *"allocating a separate service fee for developing the architectural program"* was perceived to be "important" by the total number of respondents, as shown in Table 6.1.

The variance analysis indicates that there was no significant difference in the assessment of this factor among the respondents neither according to their discipline nor their location. The results confirmed that all respondents agreed on the assessment of this factor, as shown in Tables 6.47 and 6.48 respectively.

The results of the assessment according to the respondents' discipline indicated that this factor was perceived to be "very important" by the group of project managers. On the other hand, the assessment results by the groups of architectural designers, architectural designers and programmers and owners' representatives indicated that this factor was

perceived to be “important”. Table 6.1 illustrates the importance index values as determined by the assessment made by all groups.

Additionally, the results of the assessment according to the respondents’ geographical region indicated that this factor was perceived to be “important” by all respondents in the Eastern Province, Riyadh and Jeddah. Table 6.2 illustrates the importance index values as determined by the assessment made by all groups.

Table 6.47 Factor 23. Variance analysis according to respondents' disciplines

(I) Discipline	(J) Discipline	(P-value) Sig.
Project Manager	Architectural Designer	**.882**
	Architectural Des. & Prog.	**.163**
	Owner Repr.	**.872**
Architectural Designer	Architectural Des. & Prog.	**.758**
	Owner Repres.	**.993**
Architectural Des. & Prog.	Owner Repres.	**.980**

Table 6.48 Factor 23. Variance analysis according to respondents' regions

(I) Region	(J) Region	(P-value) Sig.
Eastern Province	Riyadh	**.880**
	Jeddah	**1.000**
Riyadh	Jeddah	**.925**

FACTOR 24. Setting a clear budget for the whole project

Information about the pre-determined budget for completing the project is a critical concern for the developer of the architectural program. Lack of information about the set budget for the project makes it very challenging for architects to comprehend the contents of the architectural program of the project (Bogers et al., 2008).

The results of the assessment indicated that *"Setting a clear budget for the whole project"* was perceived to be "very important" by the total number of respondents, as shown in Table 6.1.

The variance analysis indicated that there was no significant difference in the assessment of this factor among the respondents neither according to their discipline nor their location. The results confirmed that all respondents agreed on the assessment of this factor, as shown in Tables 6.49 and 6.50 respectively.

The results of the assessment according to the respondents' discipline indicated that this factor was perceived to be "very important" by all groups of respondents. Table 6.1 illustrates the importance index values as determined by the assessment made by all groups.

Additionally, the results of the assessment according to the respondents' geographical region indicated that this factor was perceived to be "very important" by all respondents in the Eastern Province, Riyadh and Jeddah. Table 6.2 illustrates the importance index values as determined by the assessment made by all groups.

Table 6.49 Factor 24. Variance analysis according to respondents' disciplines

(I) Discipline	(J) Discipline	(P-value) Sig.
Project Manager	Architectural Designer	**.601**
	Architectural Des. & Prog.	**.413**
	Owner Repr.	**1.000**
Architectural Designer	Architectural Des. & Prog.	**1.000**
	Owner Repres.	**.889**
Architectural Des. & Prog.	Owner Repres.	**.844**

Table 6.50 Factor 24. Variance analysis according to respondents' regions

(I) Region	(J) Region	(P-value) Sig.
Eastern Province	Riyadh	**.880**
	Jeddah	**1.000**
Riyadh	Jeddah	**.925**

6.7.6 Analysis of Factors Related to Management and Control of the Architectural Programming process

This category contains four factors, namely commitment of all participants in the programming process, inclusion of influential project parties that may enrich the architectural programming process, timely and proper decision-making at the various stages of the development and implementation of the architectural program, frequent review and refinement of the program during the early design stages. The results of assessment of factors included in this category are discussed in the following:

FACTOR 25. Commitment of all participants in the programming process

Preparation of an effective architectural program requires collaborative interaction among all parties of the project in the architectural programming process. Commitments among all project parties to facilitate a collaborative interaction ensure the development of an efficient architectural program. (Zwemmer and Otter, 2008).

The results of the assessment indicated that *"commitment of all participants in the programming process"* was perceived to be "very important" by the total number of respondents as shown in Table 6.1.
The variance analysis indicated that there was no significant difference in the assessment of this factor among the respondents neither according to their discipline nor their location. The results confirmed that all respondents agreed on the assessment of this factor, as shown in Tables 6.51 and 6.52 respectively.

The results of the assessment according to the respondents' discipline indicated that this factor was perceived to be "very important" by all groups of respondents. Table 6.1 illustrates the importance index values as determined by the assessment made by all groups.

Additionally, the results of the assessment according to the respondents' geographical region indicated that this factor was perceived to be "very important" by all respondents in the Eastern Province, Riyadh and Jeddah. Table 6.2 illustrates the importance index values as determined by the assessment made by all groups.

Table 6.51 Factor 25. Variance analysis according to respondents' disciplines

(I) Discipline	(J) Discipline	(P-value) Sig.
Project Manager	Architectural Designer	**.739**
	Architectural Des. & Prog.	**.259**
	Owner Repr.	**.844**
Architectural Designer	Architectural Des. & Prog.	**.949**
	Owner Repres.	**.998**
Architectural Des. & Prog.	Owner Repres.	**.997**

Table 6.52 Factor 25. Variance analysis according to respondents' regions

(I) Region	(J) Region	(P-value) Sig.
Eastern Province	Riyadh	**.947**
	Jeddah	**.999**
Riyadh	Jeddah	**.957**

FACTOR26. Inclusion of influential project parties that may enrich the architectural programming process

The number of persons in a group has a strong effect on the interaction quality among them. As groups increase in members, the participation in discussions may become less dynamic and unproductive (Kumlin, 1995).

The results of the assessment indicated that *"inclusion of influential project parties that may enrich the architectural programming process"* was perceived to be "very important" by the total of respondents as shown in Table 6.1.

The variance analysis indicated that there was no significant difference in the assessment of this factor among the respondents neither according to their discipline nor their location. The results confirmed that all respondents agreed on the assessment of this factor, as shown in Tables 6.53 and 6.54 respectively.

The results of the assessment according to the respondents' discipline indicated that this factor was perceived to be "very important" by the groups of project managers and architectural designers. On the other hand, the assessment results by the groups of architectural designers and programmers and owners' representatives indicated that this factor was perceived to be "important". Table 6.1 illustrates the importance index values as determined by the assessment made by all groups.

Additionally, the results of the assessment according to the respondents' geographical region, indicate that this factor was perceived to be "very important" by the respondents in Riyadh and Jeddah. This factor was perceived to be "important" by the respondents in the Eastern Province. Table 6.2 illustrates the importance index values as determined by the assessment made by all groups.

Table 6.53 Factor 26. Variance analysis according to respondents' disciplines

(I) Discipline	**(J) Discipline**	**(P-value) Sig.**
Project Manager	Architectural Designer	**.951**
	Architectural Des. & Prog.	**.520**
	Owner Repr.	**.890**
Architectural Designer	Architectural Des. & Prog.	**.932**
	Owner Repres.	**.985**
Architectural Des. & Prog.	Owner Repres.	**1.000**

Table 6.54 Factor 26. Variance analysis according to respondents' regions

(I) Region	(J) Region	(P-value) Sig.
Eastern Province	Riyadh	**.660**
	Jeddah	**.998**
Riyadh	Jeddah	**.824**

FACTOR27. Timely and proper decision-making at the various stages of the development and implementation of the architectural program

It is essential for the success of the project that right decisions are made at the right times by the right persons (project participants) (Blyth and Worthington, 2001).

The results of the assessment indicate that *"timely and proper decision-making at the various stages of the development and implementation of the architectural program"* was perceived to be "very important" by the total number of respondents as shown in Table 6.1.

The variance analysis indicated that there was no significant difference in the assessment of this factor among the respondents neither according to their discipline nor their location. The results confirm that all respondents agree on the assessment of this factor, as shown in Tables 6.55 and 6.56 respectively.

The results of the assessment according to the respondents' discipline indicated that this factor was perceived to be "very important". Table 5.1 illustrates the importance index values as determined by the assessment made by all groups.

Additionally, the results of the assessment, according to the respondents' geographical region, indicate that this factor was perceived to be "very important" by the respondents in the Eastern Province and Riyadh. This factor was perceived to be "extremely

important" by the respondents in Jeddah. Table 6.2 illustrates the importance index values as determined by the assessment made by all groups.

Table 6.55 Factor 27. Variance analysis according to respondents' disciplines

(I) Discipline	(J) Discipline	(P-value) Sig.
Project Manager	Architectural Designer	**.519**
	Architectural Des. & Prog.	**.971**
	Owner Repr.	**.419**
Architectural Designer	Architectural Des. & Prog.	**.818**
	Owner Repres.	**.927**
Architectural Des. & Prog.	Owner Repres.	**.609**

Table 6.56 Factor 27. Variance analysis according to respondents' regions

(I) Region	(J) Region	(P-value) Sig.
Eastern Province	Riyadh	**1.000**
	Jeddah	**.555**
Riyadh	Jeddah	**.534**

FACTOR 28. Frequent review and refinement of the program during the early design stages

In practice, the architectural program continues to develop even during the project design phase as many questions and ideas arise (Van der Voordt and Van Wegen, 2005).

The results of the assessment indicate that *"frequent review and refinement of the program during the early design stages"* was perceived to be "very important" by the total number of respondents, as shown in Table 6.1.

The variance analysis indicated that there was no significant difference in the assessment of this factor among the respondents neither according to their discipline nor their location. The results confirmed that all respondents agreed on the assessment of this factor, as shown in Tables 6.57 and 6.58 respectively.

The results of the assessment according to the respondents' discipline indicated that this factor was perceived to be "very important" by the groups of project managers, architectural designers and architectural designers and programmers. On the other hand, the assessment results by the group of owners' representatives indicated that this factor was perceived to be "important". Table 6.1 illustrates the importance index values as determined by the assessment made by all groups.

Additionally, the results of the assessment, according to the respondents' geographical region, indicated that this factor was perceived to be "very important" by all respondents in the Eastern Province, Riyadh and Jeddah. Table 6.2 illustrates the importance index values as determined by the assessment made by all groups.

Table 6.57 Factor 28. Variances analysis according to respondents' disciplines

(I) Discipline	**(J) Discipline**	**(P-value) Sig.**
Project Manager	Architectural Designer	**.988**
	Architectural Des. & Prog.	**.979**
	Owner Repr.	**.219**
Architectural Designer	Architectural Des. & Prog.	**1.000**
	Owner Repres.	**.214**
Architectural Des. & Prog.	Owner Repres.	**.180**

Table 6.58 Factor 28. Variances analysis according to respondents' regions

(I) Region	(J) Region	(P-value) Sig.
Eastern Province	Riyadh	**.995**
	Jeddah	**.970**
Riyadh	Jeddah	**.947**

6.7.7 Main Categories of Factors

The main six categories of factors were ranking according to the total of respondents as shown in Table 6.59.

Table 6.59 Main Categories of Factors' Importance indexes and Ranking

MAIN CATEGORIES		Total of Respondents	
		Importance Index	Ranking
A.	Factors Related to the Owner and his Representative(s).	**64.2**	**6**
B.	Factors Related to the Architectural Programmer.	**87.5**	**1**
C.	Factors Related to the Program Data.	**75.1**	**3**
D.	Factors Related to the Role of Communication throughout the Programming Process.	**78.2**	**2**
E.	Factors Related to the Allocated Time and Budget.	**70.4**	**5**
F.	Factors Related to Management and Control of the Architectural Programming process.	**74.8**	**4**

6.7.7.1 Category A. Related to the Owner and his Representative(s)

This category was ranked to be the lowest within all categories, as shown in Table 6.59. The factor "*Involvement of the owner in the architectural programming process*" was ranked to be the highest of all factors within this category, as shown in Table 6.1. This

assessment result may due to the fact that the owner is the main decision- maker and should be included throughout the process.

6.7.7.2 Category B. Related to the Architectural Programmer

This category was ranked to be the highest within all categories, as shown in Table 6.59. The factor "*familiarity of the architectural programmer with the project type*" was ranked to be the highest of all factors within this category, as well the highest within the whole factors with in all categories as shown in Table 6.1. This result of assessment is reasonable as the programmer should become familiar with many issues related to the project type. Each project type has its own history of development and vocabulary. There are theories and philosophies related to each building type that there is a need to understand.

6.7.7.3 Category C. Related to the Program Data

This category was ranked to be relatively high within all categories, as shown in Table 6.59. The factor "*adherence to the applicable codes and municipal standards for the project type*" was ranked to be the highest of all factors within this category. This result of assessment is reasonable as the municipal standards must be followed.

6.7.7.4 Category D. Related to the Role of Communication throughout the Programming Process

This category was ranked to be very high within all categories, as shown in Table 6.59. The factor "*frequent communication between the owner and his project representatives with the programmer.*" was ranked to be the highest of all factors within this category, as shown in Table 6.1. This result of assessment is reasonable as the programming process mainly depends on the communication among all project parties in most steps of development the program. The need of interaction with the project owner or his

representatives for addressing their needs and requirements is very significant especially when the owners don't have any experience with building processes.

6.7.7.5 Category E. Related to the Allocated Time and Budget

This category was ranked to be very low within all categories, as shown in Table 6.59. The factor "*setting a clear budget for the whole project*." was ranked to be the highest of all factors within this category, as shown in Table 6.1. This result reasonable as the absence of information about the budget could result in the misinterpretation of some of the requirements as well as make it difficult to identify the project requirements.

6.7.7.6 Category F. Related to Management and Control of the Architectural Programming process

This category was ranked to be relatively low within all categories, as shown in Table 6.59. The factor "*timely and proper decision-making at the various stages of the development and implementation of the architectural program*." was ranked to be the highest of all factors within this category, as shown in Table 6.1. This result is reasonable as this factor affects the whole programming process at its various stages where it is critical for the success of project programming that right decisions are made at their right times by the right project participants.

6.8 DISCUSSION

This chapter presented the method used for collecting data. It also presented the analysis of the data received from the respondents (A/E offices and owners' representatives) to the questionnaire survey. The sample of respondents who assessed the identified factors consisted of A/E offices and firms from the Eastern Province, Riyadh and Jeddah as well as project owners' representatives that are located in the Eastern Province in Saudi Arabia.

Twenty-eight factors influence the process of developing and implementing the architectural program for building projects were identified as illustrated in chapter four. These 28 factors were assessed by 53 individuals representing the A/Es and owners' representatives. The received responses from each type of respondents (A/E offices, owners' representatives) were analyzed twice according to the respondents' classification. The first is according to their discipline to four groups, project manager, architectural designers and architectural designers, while the second is according to their geographical region to three groups, Eastern Province, Riyadh and Jeddah.

This chapter presented a discussion of the two types of data obtained from the respondents to the questionnaire, respondents' general information and assessment of the identified factors.

Calculation of the importance indexes and determination of the rates of importance for each factor were carried out using Excel program. Identifying the variances among the respondents' assessment results was also carried out by SPSS program for the purpose of identifying the significant differences between the respondents' assessment results.

The results of the assessment according to the respondents' disciplines indicate that there is a slight difference in the assessment of factor "*involvement of the project manager (representing the owner) in the programming process"*. The reason may refer to the fact that the architectural designers prefer to work without constrains from the project managers as an owner representative. It is believed that the role of the project managers as an owner representative is very important, especially in big scale projects, where the project managers as professionals will be helpful in the programming and design phases.

The results of the assessment according to the respondents' geographical region indicate that there is a slight difference in the assessment of factors "*familiarity of the*

architectural programmer with various building systems (structure, electrical, etc)" between the respondents in the Eastern Province and the respondents in the Riyadh.

The results of the assessment according to the respondents' geographical region indicate that there is a slight difference in the assessment of factors "*effect of project scale on developing the architectural program"* between the respondents in the Eastern Province and the respondents in Jeddah. This result may refer to the number of respondents in Jeddah is less than Eastern Province.

The results of study pointed out that the responses generally agree on the assessment where there is no significant different among the samples assessment. Also the analysis result confirmed that the confidence level of the samples assessment was 95% (significance level of 0.05) and the probability of that the assessments and the relationship happened by chance is very small.

In Saudi Arabia, there exist no programming guides, and programs are prepared formally or informally depending on the type of client as well as the nature of the project. However, little attention has been given to the programming process from the architects/ architectural engineers and especially from the client.

This study presented a generic framework which can act as policy guidelines for conducting architectural programming activities, and provides a way of bridging the gaps in architectural programming practice. It covers all programming process sides and it should decrease the distance between the programmer, client, end users, and designer. Furthermore, it should contribute to a better insight into the programming process and knowledge of the different participants. It will be reflected in a better design solution, and therefore a better useable building.

Commitments among all participants in the project to facilitate a collaborative interaction ensure the development of an efficient architectural program. The main obstacle to

carrying out the proposed framework is the committeemen from the client and the project participant, especially in the private sector. To overcome this problem, the programmer would be responsible for informing the client and the participants about the value and the expected benefits of the architectural programming phase during the project life cycle. Developing the programming contract is also extremely important as it ensures the commitment of all participants in the programming process.

Assessment of identified factors is critical to investigate the applicability of the developed framework in Saudi Arabia. The assessment results confirm the importance of the identified factors where all factors were assessed as either extremely important or very important or important by the respondents in Saudi Arabia. The developed framework can be applied locally in Saudi Arabia. It is flexible to accommodate any type and size of building projects. Further, it can be applied by both types of architectural programmers (external consultants and in-house staff). However, while there is no empirical data to support this framework, it should be investigated in practice where the implementation of this proposed framework by the practitioners (A/Es) in the construction industry should be used to further improve this tool.

CHAPTER SEVEN

CONCLUSION AND RECOMMENDATIONS

7.1 INTRODUCTION

In this research, the factors influencing the process of developing and implementing the architectural program for buildings projects were identified and these factors were used to assist in developing the generic framework for architectural programming. These identified 28 factors were assessed to investigate the applicability of the developed framework in Saudi Arabia. The developed framework can be adopted by the architectural programmer in their professional practice of architectural programming. In this chapter, a summary of research is discussed, followed by conclusions derived from the research and recommendations for future studies.

7.2 SUMMARY OF STUDY

The main objectives of this research were to identify the factors which influence the process of developing and implementing the architectural program for buildings projects, and to develop architectural programming framework models that aims at capturing the process of properly identifying and communicating client and user requirements to design teams, and to assess the identified factors which influence the process of developing and implementing the architectural program for buildings projects in Saudi Arabia.

The methodology consists of five phases. **First,** the research focused on identifying international and local current practices of architectural programming. The research focused on acquiring the knowledge through extensive literature review for identifying the international practices of architectural programming. Then, interviews were conducted with ten architects at A/E design firms and offices and two representatives of building projects owners. The interviews resulted in identifying the local current practices on how to identify the building project requirements and how to communicate these requirements to the design team as well as identifying the challenges and the limitations of these practices.

Second, the factors influencing the process of developing and implementing the architectural program for buildings projects were identified, resulting in the list of twenty-eight factors which classified and grouped under six main categories. This phase was carried out through surveying and synthesizing various knowledge areas on architectural programming documented in international literature sources.

Third, the framework that aims at capturing the process of properly identifying and communicating client and user requirements to design teams was developed. The proposed framework is developed based on knowledge from the literature and observed professional practice and the identified factors.

Fourth, the identified 28 factors were assessed to investigate the applicability of the developed framework in Saudi Arabia. This phase was carried out through the development of the questionnaire survey. The questionnaire was developed, tested and distributed and then collected from 50 A/E offices from the Eastern Province, Riyadh and Jeddah as well as 3 owners' representatives that are located in the Eastern Province of Saudi Arabia.

The received responses from each type of respondents (A/E offices, owners' representatives) were analyzed twice according to the respondents' classification. The

first is according to their disciplines to four groups, project manager, architectural designers and architectural designers, while the second is according to their geographical region to three groups, Eastern Province, Riyadh and Jeddah. The analysis resulted in determining the level of importance for each factor.

Finally, a set of conclusions and recommendations was developed. Areas of future research are also highlighted.

7.3 CONCLUSION

The following conclusions were reached from this research:

1. The results of the study indicated that due to the large amount of information that requires to be considered and the difficulties appear during identifying and communicating clients' actual needs and requirements to the design team during the programming process, architectural program is still considered to be inadequate and are not sufficiently clear, and thus may not truly reflect client requirements.

2. In Saudi Arabia, interviewees stated that there exists no programming guides, and that programs are prepared formally or informally depending on the type of the client as well as the nature of the project. The findings revealed that current practices of architectural programming are not really effective in providing a clear definition and understanding of the clients and project requirements.

3. The findings revealed that there is a need to develop a standard methodology (framework model) that project architectural programmers can adopt in their professional practice of architectural programming.

4. Investigation of the factors influencing the process of developing and implementing the architectural program is critical for the effective understanding of the nature of the programming process and the development of the proposed framework.

5. Surveying and synthesizing various knowledge areas on architectural programming documented in international literature sources resulted in identifying twenty-eight factors classified and grouped under six main categories. The identified factors assisted in development of the architectural programming framework.

6. The proposed framework was developed based on knowledge from literature and observed professional practice and the identified factors. The developed framework can be adapted and applied for any project type and by two types of project programmers (external consultants and in-house staff).

7. The questionnaire survey was developed , administered and collected from 53 A/E design offices in the Eastern Province, Riyadh, Jeddah and a owners' representatives in Eastern Province of Saudi Arabia for the purpose of assessment the identified factors.

8. Based on the results of study, it can be concluded that all respondents agree on the assessment of identified factors. Also, the analyzed result confirm that the confidence level of the sample assessment is 95% (significance level of 0.05) and the probability of that the assessments and the relationship happened by chance is very small.

9. The assessment of identified factors is critical to investigate the applicability of the developed framework in Saudi Arabia.

10. The assessment results illustrate that all factors were assessed as either extremely important or very important or important. It confirmed that the developed framework can be applied locally in Saudi Arabia. It is flexible to accommodate any type and size of building project. Further, it can be applied by both types of architectural programmers (external consultants and in-house staff).

11. **The following paragraphs provide brief description of specific aspects in the framework:**

- Identify Project Information: investigating general information about the project, project's owner and the project's end users and the project goals and objectives.

- Research the Project Type: reviewing the literature about the project type and similar previous projects as well as investigating the applicable codes and municipal standards for the project type.

- Identify Requirements of End Users: explore detailed information about the project's end users requirements and needs.

- Analyze and Balance the Identified Project Requirements: verifying, analyzing and balancing the identified project and users requirements and needs.

- Document the Project Program: identifying scope of works and documenting the project program as summary statements in the document for the owner and the design team as well.

- Review and Update the Developed Project Program: developing design solutions to meet the developed project program and refine the program accordingly.

7.4 RECOMMENDATIONS

The following recommendations were developed from the research stated in this thesis:

1. The identified factors are beneficial both to academic researchers and practitioners.

2. It is recommended that any organization should take into consideration the importance of having a guide or framework for identifying their projects requirements.

3. The development of an architectural programming framework model provides useful information to project programmers for self-evaluation and for identifying useful directions for improvement the programming practice.

4. Using the proposed framework is necessary and can be adapted to facilitate and improve programming practice, in Saudi Arabia for any project types.

5. While there is no empirical data to support this theory, this framework should be investigated in practice, where the implementation of this proposed framework by the practitioners (A/Es) in the construction industry should be used to further improve this tool.

7.5 DIRECTIONS FOR FURTHER RESEARCH

The programming process has recently become an important focus for international research and guidance. It is observed that there is no research related to architectural programming in Saudi Arabia. There is a need to conduct more research for improving the practice of architectural programming in Saudi Arabia.

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APPENDIX I

Investigation of the Local Current Practice of Architectural Programming through Interviews

The Objectives of This Phase of the Study Are:

- ✓ **Identifying the current practices on how to identify the building projects requirements and how to communicate these requirements to the design team (programming).**
- ✓ **Identifying the limitations of these practices.**

THE INTERVIEWS QUISTIONS:

Questions for A/E: Designer/Programmer

1. What is your scope of practice at the A/E office?

   - ❑ architectural designer
   - ❑ architectural programmer
   - ❑ All of the above

2. Please give me a brief description of your current programming practice?

3. How do you initiate the process?

4. From your daily practice, identify all parties that participate in the programming process? And what is the role of each one?

   - ❑ Programmer
   - ❑ Owner or his representative
   - ❑ Project manager
   - ❑ Users
   - ❑ Architect/designer
   - ❑ Others (please specify)

5. From your daily practice, Please provide a brief description about the used methods of communications during the programming process?

   - ❑ Workshops at different stages of the process
   - ❑ Informal meetings with owner/client and all participants
   - ❑ Formal meetings with owner/client and all participants

6. From your daily practice, how do you collect different stakeholders' requirements?

- ❑ Through the owner or his representative
- ❑ Through the project manager
- ❑ Through a workshop with all of them

7. In your current practice, when would the architectural program be frozen or finalized?

- ❑ Before starting the design process
- ❑ After the schematic design
- ❑ During a later stage in the design process

8. What are your responsibilities?

- ❑ Preparing the program
- ❑ Control the programming process
- ❑ Control all participants
- ❑ Control the program with design process
- ❑ Ensuring that the identified requirements (program) will be included in the design of the project
- ❑ Others (please specify)

9. Does the owner appreciate the significance of the programming process?

10. Does the owner allocate sufficient time for the programming process?

11. Who has the authority for decisions-making during the programming process?

- ❑ The programmer
- ❑ The owner
- ❑ The architect
- ❑ The project manager
- ❑ All of the above

12. From your daily practice, what are the main challenges faced during the development of the program?

13. From your daily practice, what are the main challenges faced during the implementation of the program during the design process?

14. From your daily practice, what are the main challenges to you during the programming process?

- ❑ Time allocated to complete the process
- ❑ Budget allocated to complete the process
- ❑ Client's lack of experience
- ❑ Unclear goals set by the client
- ❑ Vague requirements from the client
- ❑ Communication methods between all stockholders
- ❑ Changing the project requirements at later stages
- ❑ Control and management of the process
- ❑ Others (please specify)

15. In current programming practice, when would your role be completed?

- ❑ Before starting the design process
- ❑ After schematic design
- ❑ After the completion of design process
- ❑ After the completion of construction process

16. From your daily practice, what are the main factors that affect the development of the project program?

- ❑ Roles of participants
- ❑ Management of the process
- ❑ Communication among the client stakeholders
- ❑ Methods followed to communicate the requirements between different participants
- ❑ Communication with the architect
- ❑ Time allocated for the development of the program
- ❑ Budget allocated to the development of the program
- ❑ Remaining phases of the building project (design, construction)
- ❑ Available data from post-project evaluation and post-occupancy evaluations of similar projects.
- ❑ Others (please specify)

17. From your daily practice, what are the main factors that affect the implementation of the project program?

- ❑ Role of participants
- ❑ Management of the process
- ❑ Communication among all project parties

- ❑ Methods followed to communicate the requirements between different participants.
- ❑ Communication with the architect
- ❑ Time allocated for the design process
- ❑ Budget allocated for the entire project
- ❑ Unclear client goals and requirements
- ❑ Vague requirements from the client
- ❑ Priorities among the requirements
- ❑ Remaining phases of the building project (construction)
- ❑ Available data from post-project evaluation and post-occupancy evaluations of similar projects.
- ❑ Others (please specify)

18. Please suggest ways for the improvement of the programming practice?

Questions for owner's representatives:

1. In your current practice, how do you identify your requirements (project requirements)?

2. On what basis, would you prepare your project requirements?

3. How do you select your project programmer?

- ❑ Through hiring a professional program consultant
- ❑ The project designer as (programmer and designer)

4. From your daily practice, how do you communicate your requirements to the architect or to design team?

- ❑ Verbally
- ❑ Formal document
- ❑ Workshops include all participants
- ❑ All of the above

5. What are your responsibilities?

- ❑ Selection of the programmer
- ❑ Selection of the designer
- ❑ Identifying the long term goals to the programmer and/or designer
- ❑ Identifying communication lines
- ❑ Control the stakeholders

- ❑ Decisions- making
- ❑ Others (please specify)

6. From your daily practice, identify the parties that represent you in the programming process? And what is the role of each one?

- ❑ Programmer
- ❑ Project manager
- ❑ Architect/designer
- ❑ Others (please specify)

7. Identify all parties that participate in the programming process? And what is the role of each one?

- ❑ Programmer
- ❑ Owner/his representative
- ❑ Project manager
- ❑ Users
- ❑ Architect/designer
- ❑ Others (please specify)

8. As a representative of owner, do you prefer to perform the program yourself?

- ❑ Yes, (Why)
- ❑ No (Why not)

9. Do you allocate special budget for preparing the project program?

- ❑ Yes, (Why)
- ❑ No (Why not)

10. What are the main challenges faced during the development of the program?

11. What are the main challenges faced during the implementation of the program during the design process?

12. From your daily practice, what are the main challenges that you face during the programming process?

- ❑ Time of the whole project
- ❑ Budget of the whole project
- ❑ Lack of experience

- ❑ Communication Methods among all parties.
- ❑ Control of the process
- ❑ Understanding process

13. From your point of view, what are the main factors that affect the development of the project program?

- ❑ Roles of participants
- ❑ Management of the process
- ❑ Communication among the client stakeholders
- ❑ Methods followed to communicate the requirements between different participants
- ❑ Communication with the architect
- ❑ Time allocated for the development of the program
- ❑ Budget allocated to the development of the program
- ❑ Remaining phases of the building project (design, construction)
- ❑ Available data from post-project evaluation and post-occupancy evaluations of similar projects.
- ❑ Others (please specify)

14. From your daily practice, what are the main factors that affect the implementation of the project program during the life of the project?

- ❑ Roles of participants
- ❑ Management of the process
- ❑ Communication among all project parties
- ❑ Methods followed to communicate the requirements between different participants.
- ❑ Communication with the architect
- ❑ Time allocated for the design process
- ❑ Budget allocated for the entire project
- ❑ Unclear client goals and requirements
- ❑ Vague requirements from the client
- ❑ Priorities among the requirements
- ❑ Remaining phases of the building project (construction)
- ❑ Available data from post-project evaluation and post-occupancy evaluations of similar projects.
- ❑ Others (please specify)

15. Please suggest ways for the improvement of the programming practice?

APPENDIX II

IDEF0 Process Modeling Notation Guide

This section describes the notation for $IDEF_0$ process modeling language used to present graphically the proposed architectural programming framework. IDEF refers to *Integration Definitions for Function Modeling*. $IDEF_0$ is one such method of modeling that permits the construction of models comprising system functions (activities, actions, processes, operations), functional relationships , and data (information or objects) that support systems integration **(Federal, 1993).**

IV.1 Background

In 1981, IDEF was developed by the U.S. Air Force's Integrated Computer-Aided Manufacturing (ICAM) to improve manufacturing productivity through systematic application of computer technology. Series techniques of IDEF methods were developed which included the following:

1. **$IDEF_0$**, used to produce a 'function model' which is a structured representation of functions, activities or processes within the modeled system or subject area. It is a graphical modeling tool that can be used to analyze and design complex systems.

2. **$IDEF_1$**, used to produce an 'information model' which represents the structure and semantics of information within the modeled system or subject area.

3. **$IDEF_2$**, used to produce a 'dynamic model' which represents the time varying behavioral characteristics of the modeled system or subject area.

IV.2 The IDEF0 Approach

IDEF0 may be used first to define the requirements and specify the functions, and then to design an implementation that meets the requirements and performs the functions. For existing systems, IDEF0 can be used to analyze the functions that the system performs

and to record the mechanisms (means) by which these are done. The result of applying IDEF0 to a system is a model that consists of a hierarchical series of diagrams.

IV.3 Components of IDEF0

The components of IDEF0 model are show in the Figure IV.1. The function (activity) is represented by boxes corresponding to activities, processes, operations, or transformations. Inputs are represented by the arrows entering the left side of an activity box which undergoes a process or operation, and is typically transformed. Outputs are represented by arrows flowing to the right side of an activity box, which results from a process or objects which are created by a function. Mechanisms are represented by arrows flowing to the bottom of the activity box that carry out the activity. The node is in the bottom right corner of the box which is a unique identifier to every function. The data entities are illustrated schematically in Figure IV.1 and Table IV.1 (**Federal, 1993**).

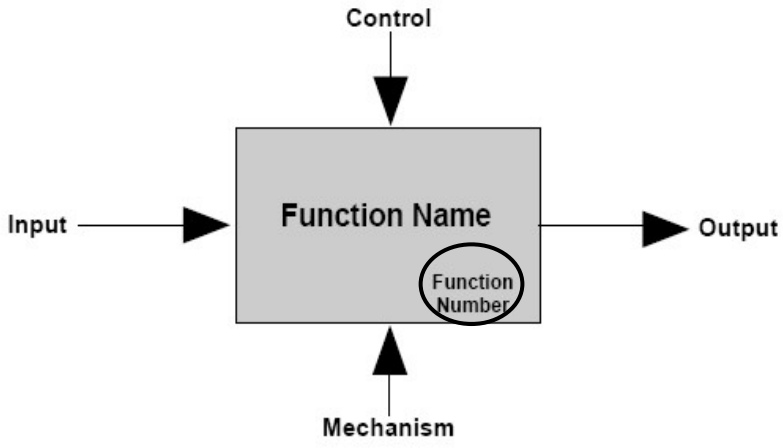

Figure IV.1 IDEF0 arrangement (Federal, 1993)

Table IV.1: Data Entity Descriptions

Entity	**Description**
Function	An activity, action, process, operation, or transformation, which is described by an active verb. A function is shown as a box.
Input	An entity, which undergoes a process or operation, and it typically transformed. Data or material used to produce the output of an activity. It enters the left of the box, and may be information or material resource.
Output	An entity which results form a process or objects which are created by a function. Data or materials produced by or resulting from the activity. An output is shown exiting the right hand side of the box.
Control	An entity which influences or determines the process of converting inputs into outputs. Data that constrain an activity, regulating the transformation of inputs into outputs. A control is shown entering the top side of the box.
Mechanism	An entity such as people, machines, or existing systems that perform or provide energy to the activity. A mechanism is shown entering the bottom side of the box.
Node	A unique identifier to every function, which is shown in the bottom right-hand corner of the box.

APPENDIX III

King Fahd University of petroleum and minerals
College of Environmental Design
Architectural Engineering Department

Date: June 1, 2010

Dear Sir,

Subject: **Study of the Factors Influencing the Development and Implementation of the Architectural Program for building Projects**

The architectural programming can be described as the process of identifying the client project requirements at the early design stage of a building project. The **architectural program** is the output of this process, is "a formal document that sets out the client needs and requirements for a building project. Furthermore, the program provides the design team with data to commence the project design process.

In this study, the researcher aims to identify and assess the factors that influence the process of developing and implementing the **architectural program** for building projects. The Questionnaire consists of two parts. Part one includes general information about the respondents. Part Two includes the assessment of the factors.

Your input to this questionnaire will lead to a better understanding of these factors. Any information obtained through this questionnaire will stringently be used for educational purposes.

Please return this questionnaire once filled to the following address:

Mr. Mohammed Nasser Juaim
Architectural Engineering Department
King Fahd University of Petroleum and Minerals
Dhahran 31261
Saudi Arabia

E-mail: M_JUAIM@yahoo.com

Fax: 03-860-3785

Mobile: 0566554665

Thank you for your cooperation

QUESTIONNAIRE

Part One: General Information

1) Respondent Information

Name (Optional)	
Office or Company Name	
Telephone no	
Facsimile	
E-Mail Address	
Office or Company Address	

2) The Experience Years

a) Less than **5** years		b) **5-10** years	
c) **10-20** years		d) Over **20** years.	

3) Respondent position: *(according to your experience, you can select more than one position)*

Position	
Project Manager	
Architectural Designer	
Architectural Programmer	
Architectural Programmer and Designer	
Others………………………………………………….…………………	

4) During your practice in architectural programming, do you follow systematic and standard methods to prepare the architectural program?

a) Yes	
b) No	

Remarks...……
…………………………………………………………………………………………….………..………..…………
……..

5) Types of Project that you mainly worked on:

a) Residential Buildings	
b) Educational Buildings	
c) Office Buildings	
d) Recreational Buildings	
e) Sports Buildings	
f) Commercial Buildings	
Others (Please specify)……………………………..…………	

Part Two: Assessment of Factors Influencing the Development and Implementation of the Architectural Program for building Projects

Please rate the degree of importance of each of the following factors by selecting one of the following evaluation scales:

Extremely Important, Very Important, Important, Somewhat Important and Not Important

	Factors Affecting Development and Implementation of the Architectural Program for building Projects	Extremely Important	Very Important	Important	Somewhat Important	Not Important
A. Factors Related to the Owner and his Representative(s)						
1.	Involvement of the owner in the architectural programming process.					
2.	Involvement of the end user in the architectural programming process.					
3.	Involvement of the project manager *(representing the owner)* in the programming process.					
4.	The owner's level of experience with the building process.					
B. Factors Related to the Architectural Programmer						
5.	Familiarity of the architectural programmer with the project type.					
6.	Familiarity of the architectural programmer with various building systems *(structure, electrical, etc).*					
7.	The architectural programmer's ability to comprehend the project requirements during the architectural programming phase.					
8.	The architect's ability to comprehend the developed program during the design phase.					
C. Factors Related to the Program Data						
9.	Clarity of project goals set by the owner.					
10.	Clarity of project requirements *(functional, technical and behavioral).*					
11.	Identifying functional relationships among the various facility spaces.					
12.	Establishing priority levels for the various requirements of the project.					
13.	Adherence to the applicable codes and municipal standards for the project type.					
14.	Effect of project scale on developing the architectural program.					
15.	Feedback from previous projects *(post-project evaluation and post-occupancy evaluation).*					
16.	Anticipation of changes in the future use of the building.					

D. Factors related to the Role of Communication throughout the Programming Process						
17.	Utilization of face-to-face contact as a communication method.					
18.	Frequent communication between the owner and his project representatives with the programmer.					
19.	Frequent communication between the owner or his project representatives with the design team.					
20.	Utilization of different methods (*figures, pictures and text*) to document and effectively communicate the architectural program.					
E. Factors Related to the Allocated Time and Budget						
21.	Allocating enough time for developing the architectural program.					
22.	Setting up a deadline to freeze the development of architectural program.					
23.	Allocating a separate service fee for developing the architectural program.					
24.	Setting a clear budget for the whole project.					
F. Factors Related to Management and Control of the Architectural Programming Process						
25.	Commitment of all participants in the programming process.					
26.	Inclusion of influential project parties that may enrich the architectural programming process.					
27.	Timely and proper decision-making at the various stages of the development and implementation of the architectural program.					
28.	Frequent review and refinement of the program during the early design stages.					
Others (Please Specify)						
1.						
2.						
3.						
4.						
5.						

King Fahd University of petroleum and minerals
College of Environmental Design
Architectural Engineering Department

بسم الله الرحمن الرحيم

التاريخ: 1 يونيو2010م

عزيزي المعماري

الموضوع: **دراسة العوامل المؤثرة على عملية إعداد وتنفيذ البرنامج المعماري لمشاريع المباني**

البرمجة المعمارية يُمْكِنُ أَنْ تُوْصَفَ كعملية تعريف وتحديد متطلباتِ مشروعِ الزبونَ في مرحلةِ مبكره من تصميم البناية (المشروع). **البرنامجَ المعماريَ** هوناتجُ هذه العمليةِ ويمكن تعريفه بوثيقة رسمية تحتوي على احتياجات ومتطلباتَ الزبونَ لمشروع بناية ما، علاوة على ذلك، يُزوّدُ البرنامجَ فريق التصميم بالبياناتِ اللازمة للبدء بعمليةِ تصميمِ المشروعَ.

الباحث يهدف في هذه الدراسه إلى تعريف و تقييم العواملَ المؤثرة على عملية إعداد وتنفيذ **البرنامج المعماري** لمشاريع المباني بشكل عام. يتكون الإستبيان من جزئين. الجزء الأول يتضمن معلومات عامة عن المستجيب و الجزء الثاني يتضمن تقييم العوامل.

مساهمتكَ في هذا الاستبيان سَتُؤدّي إلى فَهْم أفضل لهذه العواملِ. ونؤكد لكم أن المعلومات لن تستخدم إلا لغرض البحث فقط.

بعد الإنتهاء من تعبئة الإستبيان الرجاء إرساله الى العنوان التالي:

محمد ناصر حسين جعيم
قسم الهندسه المعماريه
جامعة الملك فهد للبترول والمعادن
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شكـــــراً لتعاونكم

الإستبيـــــــــان

الجـــــزء الأول: معلـــــومات عامة

1) معلومات عن المستجيب

الإسم(اختياري)	
اسم المكتب أو الشركه	
التلفون	
الفاكس	
البريد الألكتروني	
عنوان المكتب أو الشركه	

2. سنوات الخبره

اقل من 5 سنوات		من 5 إلى 10 سنوات	
من 10 إلى 20 سنة		أكثر من 20 سنة	

3. الموقع الوظيفي *(يمكنك أختيار أكثر من مسمى طبقا لخبراتك)*

المسمى	
مدير مشروع	
مصمم معماري	
معد للبرنامج المعماري	
مصمم معماري ومعد للبرنامج المعماري	
مسمى آخر.....	

3.خلال ممارستك لاعداد البرنامج المعماري, هل تتبع طرق نظامية وقياسية لإعداد البرنامج المعماري؟

أ. نعـــــم	
ب. لا	
ملاحظات.....	

4.أنواع المشاريع التي عملت عليها بشكل رئيسي

أ. مباني سكنية	
ب. مباني تعليمية	
ت. مباني ادارية	
ث. مباني ترفيهية	
ج. مباني رياضية	
د. مباني تجارية	
أخرى (الرجاء التحديد).....	

الجـــــزء الثاني: تقييم العوامل المؤثرة على عملية إعداد وتنفيذ <u>البرنامج المعماري</u> للمشاريع المباني

الرجاء تحديد درجة أهمية كُلّ عامل من العوامل المعرفه أدناه باستخدام أحد المقاييس التاليه:

مهم جداً بقوه , مهم جداً , مهم , مهم الى حد ما و غير مهم

العوامل المؤثرة على عملية إعداد وتنفيذ <u>البرنامج المعماري</u> لمشاريع المباني		مهم جداً بقوه	مهم جداً	مهم	مهم الى حد ما	غير مهم
أ. عوامل مرتبطة بمالك المشروع وممثليه						
.1	مشاركة المالك بجدية في عملية البرمجة المعمارية.					
.2	مشاركة المستخدم النهائي بجدية في عملية البرمجة المعمارية.					
.3	مشاركة مدير المشروع (ممثلا للمالك) في عملية البرمجة المعمارية.					
.4	مستوى خبرة المالك بعملية البناء.					
ب. عوامل مرتبطة بمعد البرنامج المعماري						
.5	إلمام معد البرنامج المعماري بنوع المشروع.					
.6	إلمام معد البرنامج المعماري بأنظمة البناء المختلفة *(إنشائية , كهربائية,.... إلخ).*					
.7	قدرة معد البرنامج المعماري على فهم و إدراك وترجمة المتطلبات خلال مرحلة البرمجة المعمارية.					
.8	قدرة المهندس المعماري على فهم وترجمة البرنامج المعماري خلال مرحلة التصميم.					
ت. عوامل مرتبطة ببيانات البرنامج						
.9	وضوح أهداف المشروع الموضوعه بواسطة المالك.					
.10	وضوح متطلبات المشروع *(الوظيفية , التقنية و النفسية).*					
.11	تحديد العلاقات الوظيفيه بين الفضاءات المختلفه للمنشأه.					
.12	تحديد مستويات الأولويه ضمن متطلبات المشروع.					
.13	التقيد بالقوانين والمعاييروقوانين البناء للمنطقة التي تناسب نوع المشروع.					
.14	تأثير حجم المشروع على إعداد البرنامج المعماري.					
.15	الإستفاده من تقييم المشاريع السابقه *(تقييم ما بعد الانشاء وتقييم ما بعد الاشغال لنفس نوع المشروع).*					
.16	توقع التغيرات في الإستخدام المستقبلي للمنشأه.					
ث. عوامل مرتبطة بدور الإتصال خلال عملية البرمجة						
.17	إستخدام الإتصال المباشر (وجها لوجه) كطريقه للتواصل.					
.18	التواصل المتكرر بين المالك وممثليه مع معد البرنامج المعماري.					
.19	التواصل المتكرر بين المالك أوممثليه مع فريق التصميم المعماري.					
.20	إستخدام طرق مختلفه *(الرسوم التوضيحية, الصور والكتابة)* لتوثيق و ايصال البرنامج المعماري بطريقه فعالة .					
ج. عوامل مرتبطة بالوقت والميزانية						
.21	تخصيص وقت كافي لعملية إعداد البرنامج المعماري.					
.22	وضع تاريخ نهائي لتثبيت التطويرفي البرنامج المعماري.					
.23	تخصيص ميزانية منفصلة لعملية إعداد البرنامج المعماري.					

24.	وضع ميزانية واضحة لكامل المشروع.					
د. عوامل مرتبطه بالإدارة و السيطرة على عملية البرمجة المعمارية						
25.	إلتزام جميع الأطراف المشاركه في عملية البرمجه المعمارية.					
26.	تضـمين أطـراف المشـروع ذات التـأثير التـي قـد تثـري عمليـه إعـداد البرنـامج المعماري.					
27.	إتخاذ القرارات الصحيحه في الوقت المناسب خلال عمليه إعداد وتنفيذ البرنـامج المعماري.					
28.	مراجعـه البرنـامج بشـكل متكـرر وتطـويره خـلال المراحـل المبكـره للتصـميم المعماري.					
أخرى (الرجاء التحديد)						
.1						
.2						
.3						
.4						
.5						

APPENDIX IV

A summary of the responses to the questionnaire survey (According to disciplines)

	Factors Affecting Development and Implementation of the Architectural Program for building Projects	Project Managers					Architectural Designers					Architectural Des. & Prog.					Owners' Representatives					Total				
		Extremely Important	Very Important	Important	Somewhat Important	Not Important	Extremely Important	Very Important	Important	Somewhat Important	Not Important	Extremely Important	Very Important	Important	Somewhat Important	Not Important	Extremely Important	Very Important	Important	Somewhat Important	Not Important	Extremely Important	Very Important	Important	Somewhat Important	Not Important
A. Factors Related to the Owner and his Representative(s)																										
1	Involvement of the owner in the architectural programming process.	13	10	4	1	0	5	3	0	1	0	1	8	0	4	0	0	2	1	0	0	19	23	5	6	0
2	Involvement of the end user in the architectural programming process.	9	8	4	5	1	2	2	2	3	0	2	3	6	2	0	0	3	0	0	0	13	16	12	10	1
3	Involvement of the project manager *(representing the owner)* in the programming process.	9	11	7	1	0	0	2	5	2	0	3	4	2	3	1	0	1	2	0	0	12	18	16	6	1
4	The owner's level of experience with the building process.	3	6	10	5	3	1	1	5	2	0	1	2	5	4	1	0	1	2	0	0	5	10	22	11	4
B. Factors Related to the Architectural Programmer																										
5	Familiarity of the architectural programmer with the project type.	20	7	1	0	0	8	1	0	0	0	8	4	1	0	0	3	0	0	0	0	39	12	2	0	0
6	Familiarity of the architectural programmer with various building systems *(structure, electrical, etc).*	16	4	5	3	0	6	2	1	0	0	4	7	1	1	0	1	1	1	0	0	27	14	8	4	0
7	The architectural programmer's ability to comprehend the project requirements during the architectural programming phase.	17	8	3	0	0	4	4	1	0	0	11	2	0	0	0	3	0	0	0	0	35	14	4	0	0
8	The architect's ability to comprehend the developed program during the design phase.	18	6	4	0	0	4	4	1	0	0	9	2	2	0	0	3	0	0	0	0	34	12	7	0	0
C. Factors Related to the Program Data																										
9	Clarity of project goals set by the owner.	15	12	1	0	0	4	5	0	0	0	7	5	1	0	0	2	1	0	0	0	28	23	2	0	0
10	Clarity of project requirements *(functional, technical and behavioral).*	10	14	4	0	0	4	5	0	0	0	2	7	2	2	0	1	2	0	0	0	17	28	6	2	0
11	Identifying functional relationships among the various facility spaces.	15	7	6	0	0	3	3	3	0	0	1	10	1	0	1	1	1	1	0	0	20	21	11	0	1

12	Establishing priority levels for the various requirements of the project.	**10**	**12**	**5**	**0**	**1**	**3**	**5**	**1**	**0**	**0**	**1**	**9**	**2**	**1**	**0**	**0**	**1**	**2**	**0**	**0**	**14**	**27**	**10**	**1**	**1**
13	Adherence to the applicable codes and municipal standards for the project type.	**18**	**8**	**2**	**0**	**0**	**5**	**3**	**0**	**0**	**0**	**7**	**4**	**2**	**0**	**0**	**1**	**1**	**1**	**0**	**0**	**31**	**16**	**5**	**0**	**0**
14	Effect of project scale on developing the architectural program.	**9**	**13**	**4**	**2**	**0**	**2**	**5**	**1**	**1**	**0**	**4**	**6**	**3**	**0**	**0**	**0**	**1**	**0**	**1**	**0**	**15**	**25**	**8**	**4**	**0**
15	Feedback from previous projects *(post-project evaluation and post-occupancy evaluation).* *	**7**	**9**	**8**	**3**	**0**	**1**	**3**	**2**	**2**	**1**	**3**	**1**	**5**	**3**	**1**	**1**	**1**	**0**	**1**	**0**	**12**	**14**	**15**	**9**	**2**
16	Anticipation of changes in the future use of the building.	**5**	**10**	**8**	**5**	**0**	**0**	**5**	**2**	**2**	**0**	**1**	**4**	**4**	**3**	**1**	**0**	**1**	**1**	**1**	**0**	**6**	**20**	**15**	**11**	**1**
D. Factors related to the Role of Communication throughout the Programming Process																										
17	Utilization of face-to-face contact as a communication method.	**14**	**10**	**3**	**0**	**1**	**1**	**8**	**0**	**0**	**0**	**4**	**7**	**1**	**1**	**0**	**2**	**1**	**0**	**0**	**0**	**21**	**26**	**4**	**1**	**1**
18	Frequent communication between the owner and his project representatives with the programmer. *	**14**	**11**	**2**	**0**	**0**	**1**	**6**	**2**	**0**	**0**	**3**	**8**	**2**	**0**	**0**	**0**	**3**	**0**	**0**	**0**	**18**	**28**	**6**	**0**	**0**
19	Frequent communication between the owner or his project representatives with the design team.	**15**	**8**	**5**	**0**	**0**	**2**	**3**	**2**	**2**	**0**	**4**	**5**	**2**	**2**	**0**	**0**	**2**	**1**	**0**	**0**	**21**	**18**	**10**	**4**	**0**
20	Utilization of different methods (*figures, pictures and text*) to document and effectively communicate the architectural program.	**11**	**11**	**5**	**1**	**0**	**2**	**4**	**2**	**1**	**0**	**3**	**7**	**2**	**0**	**0**	**0**	**1**	**1**	**1**	**0**	**16**	**23**	**10**	**3**	**0**
E. Factors Related to the Allocated Time and Budget																										
21	Allocating enough time for developing the architectural program.	**8**	**15**	**5**	**0**	**0**	**4**	**4**	**0**	**1**	**0**	**4**	**5**	**4**	**0**	**0**	**1**	**1**	**1**	**0**	**0**	**17**	**25**	**10**	**1**	**0**
22	Setting up a deadline to freeze the development of architectural program.	**10**	**10**	**6**	**1**	**1**	**1**	**5**	**1**	**2**	**0**	**2**	**6**	**2**	**3**	**0**	**1**	**1**	**1**	**0**	**0**	**14**	**22**	**10**	**6**	**1**
23	Allocating a separate service fee for developing the architectural program.	**9**	**5**	**9**	**3**	**2**	**1**	**4**	**1**	**2**	**1**	**1**	**2**	**4**	**4**	**2**	**0**	**1**	**1**	**1**	**0**	**11**	**12**	**15**	**10**	**5**
24	Setting a clear budget for the whole project.	**14**	**8**	**6**	**0**	**0**	**3**	**4**	**0**	**2**	**0**	**5**	**2**	**5**	**1**	**0**	**1**	**2**	**0**	**0**	**0**	**23**	**16**	**11**	**3**	**0**
F. Factors Related to Management and Control of the Architectural Programming process																										
25	Commitment of all participants in the programming process.	**14**	**8**	**4**	**1**	**1**	**1**	**6**	**1**	**1**	**0**	**4**	**3**	**5**	**1**	**0**	**0**	**2**	**1**	**0**	**0**	**19**	**19**	**11**	**3**	**1**
26	Inclusion of influential project parties that may enrich the architectural programming process.	**7**	**10**	**8**	**3**	**0**	**2**	**3**	**2**	**2**	**0**	**1**	**4**	**6**	**2**	**0**	**0**	**1**	**2**	**0**	**0**	**10**	**18**	**18**	**7**	**0**
27	Timely and proper decision-making at the various stages of the development and implementation of the architectural program.	**17**	**7**	**3**	**1**	**0**	**4**	**2**	**2**	**1**	**0**	**4**	**9**	**0**	**0**	**0**	**0**	**2**	**1**	**0**	**0**	**25**	**20**	**6**	**2**	**0**
28	Frequent review and refinement of the program during the early design stages.	**14**	**6**	**6**	**1**	**1**	**2**	**7**	**0**	**0**	**0**	**6**	**5**	**2**	**0**	**0**	**0**	**1**	**1**	**1**	**0**	**22**	**19**	**9**	**2**	**1**

A summary of the responses to the questionnaire survey (According to regions)

	Factors Affecting Development and Implementation of the Architectural Program for building Projects	EASTERN PROVIANCE					RIYADH					JEDDAH				
		Extremely Important	Very Important	Important	Somewhat Important	Not Important	Extremely Important	Very Important	Important	Somewhat Important	Not Important	Extremely Important	Very Important	Important	Somewhat Important	Not Important
A. Factors Related to the Owner and his Representative(s)																
1	Involvement of the owner in the architectural programming process.	6	9	1	3	0	10	9	2	2	0	3	3	1	1	0
2	Involvement of the end user in the architectural programming process.	5	4	8	1	1	7	5	3	7	0	1	4	1	2	0
3	Involvement of the project manager *(representing the owner)* in the programming process.	3	5	7	4	0	7	10	4	1	1	2	2	3	1	0
4	The owner's level of experience with the building process.	3	4	6	3	3	2	3	10	7	1	0	2	4	1	0
B. Factors Related to the Architectural Programmer																
5	Familiarity of the architectural programmer with the project type.	14	4	1	0	0	18	4	1	0	0	4	4	0	0	0
6	Familiarity of the architectural programmer with various building systems *(structure, electrical, etc).*	13	5	1	0	0	10	4	6	3	0	3	4	0	1	0
7	The architectural programmer's ability to comprehend the project requirements during the architectural programming phase.	14	5	0	0	0	14	6	3	0	0	4	3	1	0	0
8	The architect's ability to comprehend the developed program during the design phase.	13	5	1	0	0	14	4	5	0	0	4	3	1	0	0
C. Factors Related to the Program Data																
9	Clarity of project goals set by the owner.	10	8	1	0	0	11	11	1	0	0	5	3	0	0	0
10	Clarity of project requirements *(functional, technical and behavioral).*	5	10	4	0	0	9	10	2	2	0	2	6	0	0	0
11	Identifying functional relationships among the various facility spaces.	7	7	5	0	0	10	9	3	0	1	2	4	2	0	0
12	Establishing priority levels for the various requirements of the project.	4	10	4	0	1	9	10	3	1	0	1	6	1	0	0
13	Adherence to the applicable codes and municipal standards for the project type.	13	4	2	0	0	14	7	2	0	0	3	4	0	0	0
14	Effect of project scale on developing the architectural program.	10	7	2	0	0	5	14	1	3	0	0	3	5	0	0

15	Feedback from previous projects *(post-project evaluation and post-occupancy evaluation).*	**6**	**7**	**2**	**3**	**0**	**4**	**5**	**7**	**5**	**2**	**1**	**1**	**6**	**0**	**0**
16	Anticipation of changes in the future use of the building.	**3**	**9**	**4**	**3**	**0**	**3**	**6**	**9**	**4**	**1**	**0**	**4**	**1**	**3**	**0**
D. Factors related to the Role of Communication throughout the Programming Process																
17	Utilization of face-to-face contact as a communication method.	**9**	**8**	**1**	**0**	**1**	**8**	**12**	**2**	**1**	**0**	**2**	**5**	**1**	**0**	**0**
18	Frequent communication between the owner and his project representatives with the programmer. *	**7**	**9**	**2**	**0**	**0**	**8**	**13**	**2**	**0**	**0**	**3**	**3**	**2**	**0**	**0**
19	Frequent communication between the owner or his project representatives with the design team.	**9**	**4**	**4**	**2**	**0**	**11**	**7**	**3**	**2**	**0**	**1**	**5**	**2**	**0**	**0**
20	Utilization of different methods (*figures, pictures and text*) to document and effectively communicate the architectural program.	**6**	**8**	**3**	**1**	**0**	**8**	**10**	**4**	**1**	**0**	**2**	**4**	**2**	**0**	**0**
E. Factors Related to the Allocated Time and Budget																
21	Allocating enough time for developing the architectural program.	**5**	**7**	**7**	**0**	**0**	**7**	**13**	**2**	**1**	**0**	**4**	**4**	**0**	**0**	**0**
22	Setting up a deadline to freeze the development of architectural program.	**9**	**5**	**2**	**2**	**1**	**4**	**12**	**4**	**3**	**0**	**0**	**4**	**3**	**1**	**0**
23	Allocating a separate service fee for developing the architectural program.	**6**	**4**	**2**	**5**	**2**	**4**	**5**	**8**	**3**	**3**	**1**	**2**	**4**	**1**	**0**
24	Setting a clear budget for the whole project.	**10**	**3**	**6**	**1**	**0**	**9**	**6**	**5**	**2**	**0**	**3**	**5**	**0**	**0**	**0**
F. Factors Related to Management and Control of the Architectural Programming process																
25	Commitment of all participants in the programming process.	**8**	**5**	**3**	**2**	**1**	**9**	**9**	**4**	**1**	**0**	**2**	**3**	**3**	**0**	**0**
26	Inclusion of influential project parties that may enrich the architectural programming process.	**3**	**7**	**5**	**4**	**0**	**7**	**6**	**7**	**3**	**0**	**0**	**4**	**4**	**0**	**0**
27	Timely and proper decision-making at the various stages of the development and implementation of the architectural program.	**9**	**7**	**2**	**1**	**0**	**11**	**8**	**3**	**1**	**0**	**5**	**3**	**0**	**0**	**0**
28	Frequent review and refinement of the program during the early design stages.	**9**	**5**	**4**	**1**	**0**	**9**	**10**	**3**	**0**	**1**	**4**	**3**	**1**	**0**	**0**

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