The Islamic University - Gaza
Deanery of Graduate Studies
Faculty of Engineering
Civil Engineering Department
Construction Management

الجامعة الإسلامية – غزة
عمادة الدراسات العليا
كلية الهندسة
قسم الهندسة المدنية
إدارة المشروعات الهندسية

Factors Affecting Accuracy of Pre-tender Cost Estimate in Gaza Strip

العوامل المؤثرة على دقة تقدير التكلفة في مرحلة ما قبل العطاء في قطاع غزه

Munther A. Abdal-Hadi

Prof. Dr. Adnan Enshassi
Professor of construction Engineering and Management

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بسم الله الرحمن الرحيم

"وانزل الله عليك الكتاب والحكمة وعلمك ما لم تكن تعلم

وكان فضل الله عليك عظيما"

صدق الله العظيم

النساء – آية 113

Dedication

To My father and mother for their endless support

To my wife for her unlimited encouragement

To my children (Heba, Ahmed, Omer and Ali) who were missing my direct care during my study.

To all my sisters, colleagues and friends for their sustainable support

Munther Abdal-Hadi

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Abstract

Construction industry is considered an important sector for the development in Gaza Strip. Estimating process is an important element of the construction industry. Pre-tender cost estimating of construction projects requires extensive knowledge and expertise. The aim of this research is to identify and evaluate the main factors affecting accuracy of pre-tender cost estimate in Gaza Strip from both clients' and consultants' point of views.

This research was prepared during Gaza Strip faced since 2007 a bad political and economical situations due to the closure and blockade. These circumstances were badly affect in construction industry in Gaza Strip due to the shortage of basic materials such as cement and aggregate.

This research has been conducted through literature reviews of the topic related to the cost estimating process, followed by a field survey. The questionnaire included sixty four factors, categorized into five groups. Seventy eight questionnaires were distributed as follows: fifty to clients, and twenty eight to consultants. Seventy questionnaires were received as follows: forty six from clients, and twenty four from consultants as respondents.

The results of analyzing 64 factors considered in the questionnaire conclude that the main factors affecting accuracy of pre-tender cost estimate are: material (prices /availability /supply /quality /imports), closure and blockade, project team's experience in the construction type, the experience and skill level of the consultant, clear and detail drawings and specifications, quality of information and flow requirements, completeness of cost information, accuracy and reliability of cost information, currency exchange fluctuation, and finally clear contract conditions.

The study recommended both clients and consultants to give more attention to cost estimating process to manage their projects in good way. They should monitor the performance of their estimates in terms of accuracy and hire a qualified technical staff in order to obtained the accurate estimate. Both clients and consultants are requested to keep computerized historical data of finished projects and to pay more attention to training needs of their employees in order to improve their performance in cost estimate. The study also recommended the government to adopt material prices list to enable estimators, if there is a change in the costs of certain items, to come up with the best estimates.

ملخص البحث

يعتبر قطاع صناعة الإنشاءات من القطاعات الهامة في قطاع غزه، وتعتبر عملية تقدير التكلفة من أهم عناصر صناعة الإنشاءات. حيث أن عملية تقدير التكلفة لمشاريع التشييد تتطلب خبره ومعرفه واسعة. إن الهدف الرئيسي لهذا البحث هو تحديد وتحليل العوامل التي تؤثر على دقة تقدير التكلفة في مرحلة ما قبل العطاء من وجهة نظر كلا من المالك والاستشاري.

تم إعداد هذا البحث في مرحلة كانت تتعرض لها قطاع غزه إلى أسوه وضع سياسي واقتصادي بسبب سياسة الإغلاق والحصار المفروض عليها منذ 2007. هذه الأوضاع كان لها التأثير السيئ على صناعة التشييد في قطاع غزه بسبب نقص مواد البناء الأساسية كالاسمنت والحصمة.

اعتمد البحث على مراجعة الدراسات السابقة في المواضيع ذات العلاقة بعملية تقدير التكلفة ، تبع ذلك بحث ميداني . شمل الاستبيان على أربعة وستون عاملاً تم تصنيفهم على خمس مجموعات. تم توزيع الاستبيان على ثمان وسبعون عينه كالتالي : 50 من فئة المالك و 28 من فئة الاستشاري. تم استقبال سبعون استبيان كالتالي : 46 من فئة المالك و24 من فئة الاستشاري.

لقد أوضحت النتائج لأربع وستون عاملاً أن أهم العوامل المؤثرة على دقة تقدير التكلفة في مرحلة ما قبل العطاء في قطاع غزه هي المواد (السعر، التوفر، التوريد، الجودة، الاستيراد من الخارج)، الإغلاق والحصار ، خبرة فريق المشروع لدى الاستشاري في نوعية التشييد المراد تقدير تكلفته، مستوى خبرة ومهارة الاستشاري، وضوح وتفاصيل المخططات والمواصفات، جودة وتدفق المعلومات المطلوبة، اكتمال معلومات التكلفة، دقة وثقة المعلومات المتعلقة بالتكاليف ، تقلب صرف العملات ، وأخيراً وضوح شروط العقد.

وقد أوصت الدراسة كل من ا لمالكين والاستشاريين لإبداء اهتمام أكبر بعملية تقدير التكلفة لتمكينهم من إدارة مشاريعهم بشكل جيد وذلك من خلال توظيف طواقم مؤهلة من أجل الحصول على تقدير دقيق. كما أوصت الدراسة بضرورة ا لحفاظ على البيانات التاريخية للمشاريع المنتهية محوسبة وتوجيه المزيد من الاهتمام لاحتياجات موظفيهم من خلال عقد دورات تدريبيه من أجل تحسين أدائهم في تقدير التكلفة. كما أوصت الدراسة الحكومة على إنشاء مركز للمعلومات لتمكين المهندسين المعنيين، إذا كان هناك تغيير في تكاليف بعض المواد ، من التوصل إلى أفضل التقديرات.

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List of Abbreviations

GDP	Gross Domestic Product
NGOs	Non Government Organizations
PCBS	Palestinian Central Bureau of Statistics
PECDAR	Palestinian Economic Council for Development & Reconstruction
PMI	Project Management Institutional
RII	Relative Importance Index
SPSS	Statistical Package for Social Sciences
UNDP	United Nations Development Program
UNRWA	United Nations Relief and Works Agency
UK	United Kingdom
USA	United State of America

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CHAPTER 1: INTRODUCTION

1.1. Background and Rationale

Construction industry is a major element in the Palestinian economy. Any improvement in the construction industry will probably lead a clear improvement in the Palestinian economy. An improvement in the construction industry can be achieved by improving the construction project management functions. One of the most important construction management functions is estimating process. The success or failure of a project is dependent on the accuracy of estimates. Accurate estimates optimize good contracting (Ahuja, et al, 1994). It is the process of calculating and analyzing all the costs which will enter into a particular job and arriving at a total. In nearly all contract types, the preparation of a realistic cost estimate is a necessary part of any construction operation (Holm et al, 2005).

Cost estimating procedure is a process undertaken by consulting firms or estimating department in clients agencies to develop cost estimate of a project from available information. The procedure varies in its extensively an complexity depending on what stage the project is on and, hence, what information available about the project structural constituents and the project characteristics (Shash and Ibrahim, 2005). The project information and characteristics get clear as the project development advances along its traditional stages which include feasibility study, preliminary and detailed engineering, contract development and bid cycle, and construction (Adrian, 1992).

For consulting firms, cost estimation is considered the task that guarantees success, if done properly, or failure if done casually. The failure may not only affect the present project but could drive the firm involved out of business (Shash and Ibrahim, 2005).

The consulting firms and estimating departments in clients agencies may prepare cost estimates at several of a project development. Every stage shares the importance to the success of the project in hand and the business in general. First, the consulting firm or estimating departments related to client organizations may prepare cost estimates for a client at the feasibility study stage to determine the success and the financial return of his investment. Secondly, the consulting firm or estimating departments related to client

organizations may prepare cost estimate during the preliminary and final engineering so they will be able to quantify the resources required to execute the work involved and, accordingly, determine the methods that the project will be financed. Also clients and the consulting firm will use the estimate, performed during the preliminary and final engineering, as a measure to evaluate the bids submitted by interested construction contractors (Adrian, 1992).

Construction is a vital activity in the Palestinian economy, not only for its substantial contribution in the Palestinian Gross Domestic Product (GDP) and in employment, but also for its strong interrelations with other economic activities (PCBS, 2009). There are many factors that affect the accuracy of cost estimating of construction projects in Gaza Strip such as availability of materials on the local market, borders closure, political and economic situation, which should be taken into account in the early stage of an estimate. Some factors can increase costs and the possibility of contractual disputes between the various parties involved. Other factors can lead the estimator to decrease the cost of an item and hence lead to successful tendering in a very competitive market.

Therefore, accurate estimating, which is done before the physical realization of the work, requires detailed study of the bid document and the environmental situation. It also involves a careful analysis of the results of the study in order to arrive at the most accurate estimate of the probable cost consistent with the time available and the accuracy and completeness of the information submitted.

This research presents to the estimators proper knowledge for estimating projects. Since the estimating process is an art, this research introduces the different factors that are essential and should be considered in estimating cost by consulting firms in order to have a realistic estimate and maintain good reputation

1.2. Problem Statement

Estimating is defined as technical process. It is described as both an art and also a science. Pre-tender estimating is usually carried out by consultant on behalf of his client and is an attempt to forecast contractor tender sum before the design is finalized or before tenders are received. It is therefore important that the estimate should be as accurate as possible (Odusami and Onukwube, 2008).

Inaccuracies in cost estimation can cause both the client and the consulting firm unlimited number difficulties. Overestimating of cost estimation may cause the client to spend extra amount of it for no reasons where it can be better spent on other beneficial matters. In addition, an inflated cost estimate may cause the client to reconsider the scope of the project especially if he is not convinced that the cost estimate justifies the benefits that will be expected to be received (Fisk, 1988). Finally, an overestimated cost estimate may discourage financing institutions from lending the required amount of money due to doubts regarding the cost versus benefits of the project. Underestimating of cost estimates may lead the client and the consulting firm to even more problems. They tend to deceive both parties and cause them, especially the client, to be liberal in developing the project scope and at the end being unable proceed with completing the project or having to down scope it in order to complete it (Al-Thunaian, 1996).

The estimator does have available some reliable references for estimating labors, materials, equipment and other major components. These major items have a high visibility factor and consequently receive adequate attention in the preparation of the pre-tender estimate. However, there are little known, low visibility factors affecting the estimate accuracy such as procurement form and contract arrangement which should be taken in to consideration in the preparation of pre-tender estimates. Unfortunately, these factors are either entirely overlooked or sadly neglected by the cestimators in Gaza Strip.

Identification of these low visibility factors which affect the pre-tender estimate accuracy is very important in order to improve the construction industry. This study is an attempt to identify these factors, their importance and their impact on the accuracy of construction cost estimating.

1.3. Research Aim

The aim of this research is to assist clients and consultants in Gaza Strip in improving the predictive ability of the cost estimate by exploring the affecting factors of estimate accuracy and to provide the clients and consultants with practical recommendation for better estimation.

1.4. Research Objectives

The specific objectives of this research are:

1. To identify the factors affecting accuracy of pre-tender cost estimate in Gaza Strip.
2. To study the perspective of clients of the essential factors affecting accuracy of pre-tender cost estimate in Gaza Strip.
3. To study the perspective of consulting firms of the essential factors affecting accuracy of pre-tender cost estimate in Gaza Strip.
4. To study the relationship between the perspective of clients and consulting firms of the essential factors affecting accuracy of pre-tender cost estimate in Gaza Strip.

1.5. Significance of the Study

Cost estimate improvement is one of the main elements of improving the construction industry. There are many groups inside and outside the construction industry who will be benefited from this research. Among these groups are: owners, consultants, designers, and academicians. Some of the benefits that this research offers include:

- Orient the different groups in the construction industry of the existence and the scope of accuracy cost estimation practice in the consulting firms in Gaza Strip.
- Indicate the accuracy level of pre-tender cost estimates prepared by consulting firms, which will in turn, highlight the extent of improvement needed to improve the current techniques used.
- Provide areas for research for academicians who may elect to study areas where improvements can be made.
- Provide possible improvement of consulting cost estimating system and its benefits to clients, consulting firms and the constructor of the project.

1.6. Research Scope and Limitations

This research included the following limitations:

1. The study included the factors affecting accuracy of pre-tender cost estimate in Gaza Strip only.
2. Only clients and the consulting firms which have a engineering syndicate registration in January 2009 are included in this research.
3. There is a lack of similar previous studies implemented in Gaza Strip.

4. The duration of research from March 2009 to March 2010 lied in a very complex political situation in Gaza Strip where most of construction projects in Gaza Strip have been suspended since July 2007, due to borders closures.

1.7. Methodology Outline

The research was conducted in three main stages. The first stage included identifying the research problem, setting out the research's aim and objectives and developing the research plan. The second phase included reviewing the literature related to cost estimate. The third phase was developing a questionnaire to investigate the factors that affecting accuracy of pre-tender cost estimate in Gaza Strip. Statistical analysis for questionnaires was done by using Statistical Package for the Social Sciences (SPSS). Discussion for the obtained results was also made. Finally, conclusions of research and recommendations were then drafted.

1.8. Research Contents

Apart from this chapter, there are other four chapters and three annexes. Chapter 2 presents the literature review of accuracy pre-tender cost estimate for construction projects. Chapter 3 presents the Methodology. Chapter 4 presents research results. It includes the questionnaire design, the method of analysis, and analysis of the surveyed results and discussion of these results. Chapter 5 presents conclusions, recommendations, and recommendations for further studies.

There are three Annexes, which supplement these chapters. They are:

Annex 1: The questionnaire (Arabic Version).

Annex 2: The questionnaire (English Version).

Annex 3: The questionnaire validity

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

Construction is a unique industry, which is essentially risky because most projects must be priced before they are constructed, whereas in other industries the selling price is based on known manufacturing costs. The success or failure of a project is dependent on the accuracy of several estimates done throughout the course of the project. A serious industry problem is inaccurate estimating (Ahuja et al, 1994). The preparation of cost estimate of the project is one of the most difficult tasks in project management because it must be done before the work is accomplished (Oberlender 1993).

Estimating has been recognized as an important element of construction project (Kim et al, 2008). It prepared in a systematic manner appropriate to the size and complexity of the project, and to a level of accuracy commensurate with the available information and intended use of the information developed (Hendrickson, 2000).

Cost estimating is the technical function undertaken to assess and predict to total cost of executing an item of work in a given time using all available project information and resources (Kwakye, 1994). Like other planning activities, cost estimating is a challenging task. This is due to the competitive of construction industry; in order to secure a job the cost estimate must be as accurate and competitive as possible (Marjuki, 2006). It is a heavily experience-based process, which involves evaluations of unknown circumstances and complex relationships of cost-influencing factors (Elhag et al, 2005). It is the process of analyzing a specific scope of work and predicting the cost of performing the work. It involves collecting, analyzing and summarizing all available data related to a building construction project (Holm et al., 2005).

Inadequate estimating invariably leads to misallocation of scarce resources. If estimates are consistently high, compared to bid costs and ultimately final costs, fewer projects will be authorized than could have been performed with the resources available, resulting in loss of benefits. If estimates are consistently low, more projects can be authorized than can be fully funded, resulting in project slowdowns, scope changes, performance shortfalls, and generally higher costs and lower benefits. If estimates are consistently neither high nor low, but still inaccurate, the estimated benefit/cost ratios will not be

correct and the most beneficial projects may not be authorized, while less beneficial projects are authorized. All of these conditions result in misallocation of funds and a loss in benefits to the public (Flyvbjerg et al. 2002).

The purpose of pre-tender cost estimating is to provide an indication of the probable costs of construction at a very early stage in the life of a construction project. It is one of the most important factors influencing the client's decision to build. An approximate cost estimate that is too high may discourage the prospective client from preceding further with the scheme (lost opportunities) or at the least cause him to re-consider the scope of the project. Conversely, if the estimate is too low, it may result in abortive (wasted) development efforts, dissatisfaction on the part of the client (such as obtaining lower than expected returns) or even litigation (Shash and Ibrahim, 2005).

The complexity of the construction projects and the lack of time allocated for cost estimating often lead to a poor performance of the estimate (Marjuki, 2006). The outcome of an estimate can be accurate, underestimate or overestimate. An accurate estimate generally results in the most economical project cost, while an underestimate and overestimate often lead to greater actual expenditures. Underestimate means the design and specifications cost more than they are estimated. It is also often a result of poor planning and inexperience estimating, whereby substantial cost items may be omitted. This unrealistic estimate leads to project delays, reorganization, and re-planning, which usually results in significant cost growth. On the other hand, an overestimate can be as bad as an underestimate. Overestimation of a project at the pre-tender stage can lead to a viable project being dropped or re-tendered when there is no bid close enough to permit project award (Oberlender and Trost, 2001). Inaccuracy in the estimate of a project may arise from two sources, namely, bias associated with the project itself and bias associated with the estimating technique used and the environment (Aibinu and Pasco, 2008). In this manner, only and accurate, realistic estimate can lead to achievable cost or a truly successful project cost performance.

2.2 Definition of Estimating

Researcher and experts give cost estimating different definition, thus the following paragraphs state some of them. The Project Management Institutional (PMI) defines the cost estimating to involve developing an approximation (estimate) of costs of the

resources needed to complete project activities (Duncan 1996). Hendrickson specifies that are design, bid and control. Furthermore, he defines that at the very early stage of design, the screening estimate or order of magnitude estimate is made before the facility is designed, therefore it relies on the cost data of similar facilities built in the past. While preliminary or conceptual estimate is based on the conceptual design of the facility at the state when the basic technologies for the design are known. Moreover, the detailed or definitive estimate is made when the scope of work is clearly defined and the completed plans and specification when they are ready for the owner to solicit bids from construction contractors (Hendrickson 2000).

Association for the Advancement of Cost Engineering (AACE) International (2007) define the cost estimation to provide the basis for project management, business planning, budget preparation and cost and schedule control. Included in these costs are assessments and an evaluation of risks and uncertainties. On the other hand, Clough (1986) defines the construction estimating as the compilation and analysis of the many items that influence and contribute to the cost of a project. Stewart (1991) quotes a definition of cost estimation from the Society of Cost Estimating and Analysis (SCEA),as "the art of approximating the probable worth or cost of an activity based on information available at the time". Ritz (1994) gives another definition which is, "the project cost estimate is the predicted cost of executing the work".

Cost estimate is defined as the technique that is followed in order to determine the amount in monetary terms necessary to undertake an activity. The determination accounts for materials, labor, equipment, and many other variables that affect conducting that activity (Al-Thunaian, 1996). On the other hand, Dysert (2006) defined a cost estimate as, "is the predictive process used to quantify, cost, and price the resources required by the scope of an investment option, activity, or project." While, Akintoye (2000) defined cost estimate as, "is crucial to construction contact tendering, providing a basis for establishing the likely cost of resources elements of the tender price for construction work".

Estimating is the process of looking into the future and trying to forecast project costs and resource requirements (Halpin 1985). An estimate is a judgment, opinion, forecast or prediction. It is a judgment or opinion of the cost of a process, product, project or service.

It is a prediction or forecast of what a work output or work activity will cost (Stewart 1991). Estimating is a collection and analysis of the bill items which influences and contribute to the cost of the project (Clough, 1986).

Consequently, all those definition are similar describing cost estimating as being the process of guessing and foreseeing the future costs of a project or product before it actually exist.

2.3 The Purpose of Cost Estimating

The estimate becomes one of the most important pieces of information for decision making at the early stage of construction (Serpell, 2005). Cost estimators develop cost information for owner or managers to use in determining resource and material quantities, making bids for contracts, determining if a new product will be profitable, or determining which product are making a profit for a firm (Dysert, 2006, and Schottlander, 2006). As for the client, cost estimate will act as an indicator against the probable cost at the early stage of construction. With the indicator, client can be well aware regarding the project cost and monitoring the project budget. Besides, the cost estimate will ensure the cost estimated within the clients' budget. Other than serve as cost guidance, cost estimate actually will help client in tender evaluation process. The cost estimate that built up earlier with the assist from the quantity surveyor will then guide the client to evaluation the most competitive bid (Trost and Oberlender, 2003). The primary function of cost estimation is to produce an accurate and reliable cost forecast of a construction project. However, what cost should be forecasted depends on the requirements of a client and also upon the information and data available (Elhag et al, 2005).

The purpose of an estimate is to postulate the costs required to complete a project in accordance with the contract plans and specification (Antohie, 2009). Furthermore, it is important that management has as much information as possible when deciding on funding projects. Sutherland (1999) explains the purposed as to provide the client and design team with as precise an estimate of final cost as possible so that the project can be accomplished within the client's budget. Likewise, Weatney (cited in Marjuki, 2006) outlines the purpose of a cost estimate through the following:

- Provides an assessment of capital cost for a specified piece of work.

- Forms the basis for planning and control by defining the scope of work and its associated estimated cost.
- Provide much of the basic information (hours, resources, tasks, and durations) which is needed for preparing a schedule. It also states general resource requirements such as labor, material, and construction equipment.
- Provides the financial input required to prepare a cash flow curve.
- Is a catalyst for discussion, idea generation, team participation, clarity and buy-in, it ties together much of the relevant project information within a simple document.

The main purpose of cost estimation is to produce an accurate and reliable cost estimate of a construction project. To reach this purpose the estimator have to look in deep to all factors that affect the project cost and make sure from the information source.

2.4 Estimating and Project Management Roles

Both project management and estimator differently share responsibilities in performing an estimate at the decision level.

2.4.1 Project Management Estimating Responsibility

A pre-tender cost estimate is an important piece of information when making decisions at the project planning and design stage (Aibinu and Pasco, 2008, Skitmore and Cheung, 2007). Therefore, management must know what cost information is needed and how to use it in making decisions. Estimate development must be directed and approved by management prior to issue. The project manager is actively involved in the development of the estimate and is reasonable for the final product. The project team is responsible for providing the necessary project deliverables and scope information to the estimator (Dysert 1999).

2.4.2 Estimator Responsibility

Estimating is a vital part of the construction industry. The success or failure of a project is dependent on the accuracy of several estimates throughout the course of the project, that is, from conceptual and feasibility estimates through to the detailed or bid estimates (Enshassi et al, 2007). An accurate, liable and realistic bid preparation demand good judgment and estimating skills (Skitmore et al, 1990, Dysert 2005). It is the estimator responsibility to ensure that a project team understands the information needs for the estimate, then ensure that a project team understands the information needs for the

estimate, then ensure that the information provided is suitable to produce the quality of estimate desire (Dysert 2005). Cost estimating, particularly in the construction industry, is not an exact science. A qualified cost estimator, well versed in appropriate estimating techniques, can reasonably be expected to determine what the work, as defined in the contract documents, should cost. In addition to having a thorough understanding of the contract documents and any unique project characteristics, there are several other factors that the estimator should consider when preparing a construction cost estimate. These cost factors include: fluctuation of costs, traffic conditions, restrictive work hours or method of work, small quantities of work, separated operations, handwork and inefficient operations, accessibility, geographic location, construction season, and material shortages (Hatem and Ponte, 2009).

2.4.3 Estimator Skill

The challenge that faces a cost estimation is to have it close the actual cost, this inquires good skill and experience. Dysert and Elliot (2000) and Leung (2003) avowed that an effective estimating organization requires highly knowledgeable personnel, possessing technical skills. Furthermore they define a set of skills as estimating core competencies as follows :

- Understanding of the capital project process and estimate requirements for each class of estimate.
- Understanding of the contractual relationships
- Ability to identify important aspects of the contract
- Understanding of building design
- Ability to read and interpret drawings, documents and specifications
- Detailed understanding of the estimate requirements for each class of estimate.
- Code of accounts/works breakdown structure/project breakdown structure.
- Basic project controls on budget, schedule, cost control, change management, progress measurements, earned value, forecasting.
- Data analysis on labor productivity, database standards and development, historical data analysis, and benchmarking.

- Strategic estimating skills (capacity factoring, equipment factoring, cost modeling, general factor, and ratio development).
- Detailed estimating skills (material takeoffs, pricing and costing).
- General software.
- Estimating software.
- Presentation skills including report writing and listening skill
- Communications and interpersonal skills
- Organizational ability in order to communicate the estimate in a logical and clear presentation
- Well-organized work to the extent that in an unforeseen circumstance, someone else may step in, complete the estimate, and submit a proposal on the project

Construction estimating involves the determination of quantity of work to be performed and the determination of the cost of doing the work. Perhaps, of these two independent processes, the most difficult and challenging is the determination of cost. Skillful determination of the cost of doing work is not limited to the knowledge of costs of labor, material, equipment and other direct costs of doing the work. It is also dependent upon the interplay of the design variables and the estimator's choice of alternative means of construction and methods of doing the work (Ibrahim, 2003).

Factors that influence accuracy include the amount, type and quality of data available and the proficiency of the estimator and the way that the data is interpreted. The estimating expertise depends upon many factors such skill, experience, judgment, knowledge, intuition and luck (Ashworth, 1994). Regardless of the type, preparing an accurate estimate requires several skills. Akintoye (2000) mentioned that the estimator should look for various factors, which may influence the approach to pricing, such as:

1. Standard and completeness of the drawn information;
2. Tolerances required;
3. Clarity of the specification and the quality required;
4. Buildability;
5. Whether load bearing and non load bearing areas can be identified;
6. The extent of the use standard details indicating previous construction experience;

7. Evidence of design coordination of services and structural needs; and
8. The amount of information concerning ground conditions and foundation, and problems areas and restraints on construction in the design.

2.5 Types of Construction Cost Estimates

The type of estimate to be made and its accuracy depends up on many factors including the purpose of the estimates, how much is known about the project, and how much time and effort is spent in preparing the estimate (Humphreys, 2004). There are numerous methods and levels of accuracy for preparing cost estimates for a construction project. Each method has its appropriate applications and limitations, but it is important to recognize and emphasize that all estimates are approximations based upon judgment and experience (Leng, 2005).

Weatney (cited in Marjuki, 2006) classified the estimating types based on 1) How the estimate will be used. 2) The type, quality and amount of information available for preparing the estimate. 3) The range of accuracy desired in the estimate. 4) The calculation technique used to prepare the estimate. 5) The time chosen to produce the estimate. 6) The method or input and output (manual or computer) used in preparing the estimate. 7) The phase of project (feasibility, appropriation and construction) related to the estimate. 8) For whom the estimate is prepared (owner, contractor or insurance company).

Clough (1986) states that there are probably as many different estimating procedures for cost estimates depending on the purpose for which they are prepared for and the amount of information known when estimates are prepared. He classifies the construction estimating into two major types according to their functions which are:

- Conceptual (Preliminary) Estimates.
- Detailed (Definitive) Estimates.

2.5.1 Conceptual (Preliminary) Estimate

A conceptual estimate is also known as a top-down, order of magnitude, ballpark, feasibility, quickie, analogous, pre-design estimate, or preliminary estimate (Leng, 2005). It is the first serious effort made at attempting to predict the cost of the project. A

conceptual estimate is usually performed as part of project feasibility analysis at the beginning of the project. In this way, the estimate is made with limited information on project scope, and is usually made without detailed design and engineering data. The accuracy range is expected to be +50% to –30% (Al-Thunaian 1996, Leng 2005, Choon and Ali 2008).

Conceptual estimates are generally used by the owner of a project to determine the approximate cost of a project before making a final decision to construct it. The preparation of conceptual estimates requires a clear understanding of what an owner wants and a good "feel" for the probable costs (Hinze 1999). Hendrickson (2000) states, "a preliminary estimate or conceptual estimate is based on the conceptual design of the facility at the state when the basic technologies for the design are known."

2.5.2 Detailed (Definitive) Estimate

A detailed estimate is also known as a bottom-up, fair cost, or bid estimate. It can also called “quantity takeoff” because needs to tabulated of all quantities for a project or portion of a project. These quantities are then multiplied by selected or developed unit costs, and the resulting sum represents the estimated direct cost of the facility. The addition of indirect costs, plant and equipment, office overhead, profit, escalation and contingency will develop the total estimate project cost (Leng, 2005, Humphreys, 2004).

Detailed estimates are the most accurate estimate because the available information consists of working drawings, detailed specifications, and subcontractors and supplier price quotations. Detailed estimates include direct and indirect cost estimates of materials, labor, equipment, engineering, support staff, insurance, bonds, taxes, allowances, contingencies, and profit (Ahuja et al. 1994). It can be performed only when work items are identified and a takeoff of their quantities is possible. A detailed estimate requires analysis of the method of construction to be used, the quantities of work, the production rates of resources, and the factors that affect each sub-item (Choon and Ali, 2008). The expected accuracy for a detailed or definitive estimate is within a range of +15% to –5%. Contingency requirements decrease since the cost of the work is the major variable left to the estimator’s judgment (Al-Thunaian, 1996).

(Barrie and Paulson, 1992) stated that after conceptual design has been approved and after most or all of the detail design work is complete, approximate estimates are generally

supplemented by detailed estimates. The detailed estimate or definitive estimate is made when the scope of work is clearly defined and the detailed design is in progress so that the essential features of the facility are identifiable (Hendrickson 2000).

2.6 Accuracy of cost estimate

Accuracy is the degree to which a measurement or calculation varies to its actual value; thus estimate accuracy is an indication of the degree to which the final cost outcome of a project may vary from the single point value used as the estimated cost for the project (Dysert, 2006). The degree of accuracy is influenced by the experience of the person doing the estimate, the type of construction, the type of contact, and time. It is essential compare the construction with other projects that are as similar as possible in size and type (Still cited in Al-Bani, 1994)

Skitmore (cited in Aibinu and Pasco, 2008) described the accuracy of early stage estimation as comprising two aspects, namely, bias and consistency of the estimate when compared with the contract or accepted tender price. Bias is concerned with 'the average of differences between actual tender price and forecast' while consistency of estimates is concerned with 'the degree of variation around the average'.

Accurate early cost estimates for engineering and construction projects are extremely important to both the sponsoring organization and the project team. For the sponsoring organization, Oberlender and Trost (2001) stressed that early cost estimates are vital for business unit decisions that include strategies for asset development, potential project screening, and resource commitment for further project development. For the project team, the performance and overall project success are often measured by how well the actual cost compares to the early cost estimate. Inaccurate early estimates can lead to lost opportunities, wasted development effort, and lower than expected returns.

The accuracy level of the cost estimates in pre-tender stage is one of the critical indicators of effective estimation (Liu and Zhu, 2007), because in case of under-estimation, the client may getting an unpleasant shock when tenders are opened and drastically modifying or abandoning the work at that stage. On the other hand, in case of overestimation, the engineer or estimator may lose his client or his job, or in any case his confidence (Ibrahim , 2003).

Accurate estimation of construction costs is heavily dependent upon the availability of quality historical cost data and the level of professional expertise among other things. The limited information available at an early stage of a construction project may mean that the quantity surveyor must make assumptions about the design details of a project, which may not eventuate as the design, planning, and construction evolve (Liu and Zhu, 2007).

The accuracy of an estimate depends on four determinants: (1) who was involved in preparing the estimate; (2) how the estimate was prepared; (3) what was known about the project; and (4) other factors considered while preparing the estimate (Oberlender, and Trost, 2001).

2.7 Factors Affecting the Accuracy of Cost Estimating

There are two types of factors that influence and contributes to the cost of a project, control factors and idiosyncratic factors. Control factors are the factors that can be controlled by estimators to improve the performance of estimation. Idiosyncratic factors are factors that influence cost estimation but outside the control of the estimators including market condition, project complexity, weather, size of contract, site constraints, resource availability, type of procurement system, contract work type, etc (Liu and Zhu, 2007). Idiosyncratic factors are more relevant to the Gaza Strip due to the non stable political and economical situations. Elhag et al, (2005) stated that most of the significant factors affecting project costs are qualitative such as client priority on construction time, procurement methods, and market conditions including the level of construction activity.

Ashwarth (1994) summarized nine factors that have some influence on the accuracy of estimating the costs of construction work. These factors are availability of design information, type and quantity of cost data, type of project, project size, number of bidders on competitive projects, stability of market conditions, personal factors, proficiency in estimating and sheer quantitative experience.

Gunner and Skitmore (1999) reviewed previous studies and summarized the factors as follows: building function, type of contract, conditions of contract, contract sum, price intensity, contract period, number of bidders, good/bad years, procurement basis, project sector (public, private or joint), number of priced items and number of drawings. Gunner and Skitmore (1999) analyzed the estimates of 181 projects in Singapore. They found that a majority of the factors influenced the accuracy of estimates. Using data from 42 projects

in Singapore Ling and Boo (2001) found similar results when they compared five variables against Gunner and Skitmore's work.

Skitmore and Picken (2000) studied the effect that four independent variables (building type, project size, sector and year) had on estimating accuracy and tested these variables against 217 projects from a Quantity Surveyor based in the USA. They found that bias existed in project size and year, and consistency errors existed in project type, size and year.

In a study of 67 process industry construction projects around the world, Trost and Oberlender (2003) identified 45 factors contributing to the accuracy of early stage estimates. They summarized the factors into 11 orthogonal elements. Of the 11 factors, the five most important include: process design, team experience and cost information, time allowed to prepare estimates, site requirements, and bidding and labor climate.

Al-Shanti (2003) summarized the factors that affect construction cost estimating as follows: project type, special construction (complexity), project accessibility, time of year, labor rates, and material costs.

Elhag et al, (2005) stated that technological and project design, contractor's expertise and management ability, and the client's desired level of construction sophistication play an important role in determining the cost of the project.

Iyer and Jha (2005) in their analysis of factors affecting cost performance of Indian construction projects state that conflict among project participants, presence of poor project specific attributes, hostile socio economic relations and climatic conditions, aggressive competition at tender stage, and short bid preparation time adversely affect construction costs. They indicated that coordination among project participants was the most significant of all factors having maximum positive influence on cost performance.

Dysert (2006) mentioned in his study that there are many factors which affect the estimate accuracy such as level of project definition, the quality of reference cost estimating data (material pricing, labor hours, labor ware rates, etc.), the quality of the assumptions used in preparing the estimate, the state of new technology in the project, the experience and skill level of the estimator, the specific estimating techniques employed, the desired use of the estimate, the level of effort budgeted to prepare the estimate, as well as extraneous

market conditions (such as periods of rapid price escalation and labor climate factors). In addition, other factors that affect estimate accuracy are the project team's capability to control the project, and the capability to adjust the estimate for changes in scope as the project develops.

Akintoye (2000) worked on factors influencing project cost estimating practice identified complexity of design and construction as the most important factor; this is followed by scale and scope of construction.

Odusami and Onukwube (2008) studied the factors that influence the accuracy of consultant pre-tender cost estimate. They indicated that the main factors are: expertise of consultants, quality of information and flow requirements, project team's experience of the construction type, tender period and market condition, extent of completion of pre-contract design, complexity of design and construction, availability and supplies of labor and materials.

2.8 Improving the Accuracy of Cost Estimates

Improving the accuracy of estimates is important; estimators and cost engineers need to use suitable estimating techniques in order to improve the accuracy of estimates. Aibinu and Pasco (2008) concluded that the accuracy of pre-tender cost estimates has not improved over time. There may be four possible explanations for these results:

1. Estimates of new projects are based on historical cost data from past projects. Thus inaccuracies are transmitted to new estimates over time.
2. Firms do not monitor the performance of their estimates in terms of accuracy and so are not aware of any inconsistent error trend.
3. Estimating expertise and skills developed by firms based on experience with past estimates are lost, and so reflect the lack of reduction in estimate bias over time.
4. Other than technical factors such as the skill of the estimating team and their experience, team expertise, estimating techniques, or inadequate data, human-related factors such as the estimator's attitude might significantly influence the accuracy of estimates.

Ling and Boo (2001) who found that the most effective methods of improving accuracy according to Singapore quantity surveyors were, ensuring proper design documentation

and information management was found to be the most popular measure to improving estimate accuracy, followed by checking all assumptions during the estimating process and thirdly, providing a realistic timeframe in which to undertake the estimate. Ashwarth (1994) outlined three important factors to improve the accuracy of cost estimation, these factors are:

1. An improvement in the quality of designer's information, since a vague design can result only in an accurate estimate.
2. A reappraisal of the methods currently used for estimating.
3. To identify the qualities in the quantity surveyor which contribute towards accuracy in estimating and to consider how they might be improved?

Moreover, Skitmore et al, (1990) mentioned that there are five primary factors determine the quality of estimating. These factors are: (1) the nature of the target, (2) the information used, (3) the estimating technique used, (4) the feedback mechanism used and, (5) the person providing the estimates.

Improving the accuracy of estimates is vital, estimators need to use suitable estimating techniques in order to improve the accuracy of estimates. In Gaza Strip, both clients and consultants have to adopt a suitable methods in order to improve the estimate and reach the accurate taking in their consideration the specialty of Gaza Strip situation. These methods are by ensuring quality of information, ensuring quality of design documentation, and finally, checking all assumptions during the estimating process.

2.9 Studies on Pre-tender Cost Estimate

Several researches have studied the cost estimating in general, the accuracy of cost estimate and its improvement such as: Odusami and Onukwube (2008), Enshassi et al (2007), Elhag et al (2005), Shash and Ibrahim (2005), Trost and Oberlender (2003), Akintoye and Fitzgerald (2000), Akintoye (2000), Mochtar and Arditi (2001) ,and Madi (2003).

Odusami and Onukwube (2008) studied the factors affecting accuracy of pre-tender cost estimate in Nigeria. Data were collected, through the administration of questionnaire, from 50 randomly selected quantity surveyors in consulting firms. This was divided into three groups. The first group, young quantity surveyors, is those who have less than ten

years experience. The second group comprises quantity surveyors with between 11 and 20 years experience. The third group, adult quantity surveyors, has between 21 and 30 years experience. The respondents were required to rate the importance of each factor on a 5-point Likert scale using 1 for not important, 2 for of little importance, 3 for somewhat important, 4 for important and 5 for very important. Importance index for each factor was computed using mean item score. These scores were then ranked in descending order.

Table2.1: Factors influencing accuracy of pre-tender cost estimate

Factors	rank	Total index
Expertise of consultants	1	4.34
Quality of information and flow requirements	2	4.20
Project team's experience of the construction type	3	4.14
Tender period and market condition	4	4.12
Extent of completion of pre-contract design	5	3.92
Complexity of design and construction	6	3.88
Availability and supplies of labor and materials	7	3.78
Location of project	8	3.7
Form of procurement	9	3.56
Method of construction	10	3.56

Table 2.1 shows the results of analysis. From the table, the main factors influencing accuracy of consultant quantity surveyors pre-tender cost estimate are: expertise of consultants, quality of information and flow requirements, project team's experience of the construction type, tender period and market condition, extent of completion of pre-contract design, complexity of design and construction, availability and supplies of labor and materials. With the exception of expertise of consultants which is the only variable that is significant at 5% level, there is no statistically significant difference in the opinion of the respondents on all the other variables. This suggests the respondents irrespective of their experience in the construction industry generally have similar opinions regarding the factors influencing the accuracy of pre-tender cost estimate.

Enshassi et al (2007), in their case study of cost estimation practice in contracting companies in Gaza Strip, reported that the most important factors that affected contractors cost estimate are: financial status of client, type of current contractor workload and project location relative to hot areas. The results of the case study evidently support that the project's client and its financial status are playing an important role in cost estimation. The contractor preferred to work for UNRWA, which is a reliable agency with a stable financial status. Results of the case study also show how the contractor paid more attention to project's location. The more secured project's location the less tender price can be submitted to the client. Method of paying the value added tax (VAT) has a very important effect in tender's estimation practice. When the contractor collected the VAT from the client, the tender price will be decreased.

Liu and Zhu (2007) identified the factors influencing cost estimation and the appropriate control modes for each of the project stages. They group the cost factors into nine categories: Project information, team experience, cost information, estimation process, team alignment, estimation design, expected accuracy, review and acceptance of estimate and idiosyncratic factors that are beyond the control of the project team. They map the influence factors to project phases based on organizational control theory and developed a framework that identifies the critical factors for each project phase that need to be closely controlled to ensure effective cost estimation.

Elhag et al (2005) identified sixty-seven variables affecting pre-tender construction cost estimates. These factors are grouped into six categories: client characteristics; consultant and design parameters; contractor attributes; project characteristics; contract procedures and procurement methods; external factors and market conditions. Priority ranking of cost-influencing factors is carried out using a questionnaire survey commissioned amongst quantity surveyors based in the UK. Statistical analysis revealed that a strong agreement between quantity surveyors existed in the ranking of the cost factors.

The results of such research suggested that there is no significant variation in the ranking of each group. However, the category containing consultant and design parameters was ranked top followed by client characteristics with four out of the 10 top factors being related to this category. The third and forth ranks were occupied by project characteristics and external market conditions, respectively. On the other hand, the fifth group of factors

included contract procedures and procurement methods. The contractor attributes group scoring the least index occupied the bottom of the list. As shown in the following table the ten top factors that affect pre-tender construction cost estimates

Table 2.2: Ten top factors that affect pre-tender construction cost estimates

Factors	Group	Rank
Absence of alterations and late changes to design (no ‘‘design-as-we-go’’ on site philosophy)	consultant and design parameters	1
Management team (suitability, experience, performance)	contractor attributes	2
Priority on construction time/deadline requirements	client characteristics	3
Variation orders and additional works (magnitude, timing, interference level)	consultant and design parameters	4
Completeness and timeliness of project information (design, drawings, specifications)	consultant and design parameters	4
Intensity/complexity of building services	project characteristics	6
Quality of design and specifications	consultant and design parameters	7
Complexity	project characteristics	8
Level of competition and Level of construction activity	external market conditions	9
Certainty of project brief	client characteristics	10

Shash and Ibrahim (2005) investigated the early cost estimating techniques and the procedures adopted by consulting firms in Saudi Arabia. These were achieved through the administration of a structured questionnaire. Nineteen consulting firms, practicing in the Eastern Province of Saudi Arabia, participated in the survey. The participating consulting firms were asked to assess the importance of many factors potentially affecting their decision in selecting an early cost estimating technique. The importance indices, shown in Table 2.3, were calculated to reflect the relative importance of the factors.

Table 2.3: Factors that affect the choice of estimating technique

Factors	rank	Importance index
Size of the project	1	96.84
Information available	2	93.68
Client	3	83.16
Project type	4	82.11
Time available	5	81.05
Experience of estimator	5	81.05
Construction method	7	78.89
Design variables	8	77.89
Expected number of bidders	9	60.00

Table 2.3 shows that the most important factor in deciding the estimating technique to be used is the size of the project, while the least important factor is the number of bidders. This distribution follows the estimating techniques that are in common use which tend to rely on data from previously completed similar projects. Thus, the reason why factors either directly related to the characteristics of the project or the owner have more impact on the choice of estimating technique. Three firms have also suggested that both value engineering and constructability are extremely important factors.

Trost and Oberlender (2003) identified and quantified the drivers of estimate accuracy for capital projects in the process industry, and developed the estimate score procedure and Estimate Score Program (ESP) such that the procedure can function not only as a prediction tool but also as a data collection tool to facilitate future analysis. They collected extensive data on 67 completed construction projects around the world. The data included estimated costs, actual costs, and a rating system based on 45 variables, or elements, deemed potentially important to the accuracy of early estimates. Each element was rated based on a one-to-five Likert scale. The data were analyzed using factor analysis and multivariate regression analysis. The factor analysis and multivariate regression performed on the 45 elements identified five factors that exhibit a significant impact on estimate accuracy. Table 2.4 provides the most significant factors that impact on estimate accuracy.

Table 2.4: Most significant factors that impact on estimate accuracy

Factors deception	Factor weight (%)
basic process design	33.1
team experience and cost information	18.9
Time allowed to prepare the estimate	17.2
site requirements	16.4
bidding and labor climate	14.5

Akintoye (2000) worked on factors influencing project cost estimating practice. The object of his study was to gain an understanding of the factors influencing contractors' cost estimating practice. This was achieved through a comparative study of eighty-four UK contractors classified into four categories. The initial analysis of the 24 factors considered in the study shows that the main factors relevant to cost estimating practice are complexity of the project, scale and scope of construction, method of construction, market conditions, site constraints, client's financial position, type of clients buildability and location of the project as shown in the following table.

Table 2.5: Main factors relevant to cost estimating practice

Factors	Rank order	Overall Mean
complexity of the project	1	4.464
scale and scope of construction	2	4.179
method of construction	3	4.060
Tender period and market conditions	4	4.036
site constraints	5	3.964
client's financial position	6	3.927
Type of clients	7	3.917
buildability	8	3.821
location of the project.	9	3.798

Analysis of variance, which tests the null hypothesis that the opinions of the four categories of companies are not significantly different, shows that except for the procurement route and contractual arrangement factors there is no difference of opinion, at the 5% significance level, on the factors influencing cost estimating. Further analysis, based on a factor analysis technique, shows that the variables could be grouped into seven factors; the most important grouping factor being project complexity followed by technological requirements, project information, project team requirement, contact requirement, project duration and finally, market requirement.

Akintoye and Fitzgerald (2000) investigated the cost estimating practice of contracts for construction project in UK. The study showed that the major causes of inaccuracy in cost estimating continue to be the lack of practical knowledge of the construction process by those responsible for the estimating function, insufficient time to prepare cost estimates, poor tender documentation and the wide variability of subcontractors' prices. Table 2.6 depicts the contractors' opinions regarding the factors responsible for inaccurate cost estimating. The most important factor is insufficient time for cost estimating, followed by poor tender documentation and insufficient tender documents analysis by the estimating team.

Table 2.6: Importance of factors that causes of inaccuracy in cost estimating

Factors	Rank order	Overall Mean
Insufficient time for cost estimating	1	3.988
Poor tender documentation	2	3.952
Insufficient tender documents analysis	3	2.829
Lack of understanding of project requirements	4	2.470
Poor communication between project team	4	2.470
Low participation in estimating by site team	6	2.458
Lack of review of cost estimate by management	7	2.398
Poor comprehension of site requirements	8	2.361
Poor feedback on accuracy previous estimates	9	2.333
Pressure from management	10	2.325

Mochtar and Arditi (2001) studied the pricing strategy in the US construction industry. They conclude that owner's characteristics, competitors' characteristics, and market demand are statistically significant external variables in making pricing strategy decisions. They based their research on a survey conducted among top 400 construction companies in the USA. Their questionnaire studied the respondents' current pricing strategies. Based on that survey, they proposed 11 important factors as a pricing strategy for the U.S. construction industry as shown in the following table.

Table 2.7: Importance of factors that affect the pricing strategy

Factors	Average importance	
	rating	Rank order
Project size / Complexity	1	4.13
Financial goals of company	1	4.13
Company's strength and weaknesses	3	4.12
Expected future project from the clients	4	3.97
Need to work	4	3.97
Client's characteristics	6	3.83
Project location	7	3.76
Demand/ economic condition	8	3.67
Competition	9	3.40
Consultant's characteristics	10	3.24
Subcontractor's characteristics	11	3.19

Madi (2003) studied the factors affecting the accuracy of cost estimation in building contracts in Gaza Strip. An exploration of these factors was conducted in order to find the degree of importance for each factor. The result of analyzing 51 factors considered in the questionnaire conclude that the main factors affecting the accuracy of cost estimation are: location of the project, segmentation of Gaza Strip and limitation of movements between areas, political situation, financial status of the owner, increasing in the unit cost of construction materials, tender currency, experience of consultant engineer, number of

competitors during tendering stage, clarity of information before execution, , and clarity of project drawings as shown in the following table.

Table 2.8: Main factors affecting the accuracy of cost estimation

Factors	Rank order	Overall Mean
location of the project	1	4.73
segmentation of Gaza Strip	2	4.58
political situation	3	4.53
financial status of the owner	4	4.39
increase in the unit cost of construction materials	5	4.11
tender currency	6	4.02
experience of consultant engineer	7	4.00
number of competitors during tendering stage	8	3.95
clarity of information before execution	9	3.89
clarity of project drawings	10	3.86

The study highlighted that contracting companies in Gaza Strip continue use traditional technique for tender cost estimation. The use of these traditional techniques is based on in-house developed computer applications using Excel spreadsheet. The contracting companies suffered from lack of special pricing software associated with database for prices of construction materials on order to analyze and improve cost estimate practice. Moreover, the study showed the need for having an experience relevant to computerized estimating in order to increase the accuracy by minimizing human based errors.

The study also concluded that the most important five benefits for considering the effective factors on accuracy of cost estimation are: executing the project with good quality, knowledge of project requirements, success in winning the tender, executing the project within budget and preparing of accurate tome schedule to execute the project.

2.10 Summary

This chapter has provided a comprehensive background for the research on cost estimating process. The literature review reveals that the estimating has been recognized as an important element of construction project. The success or failure of a project is dependent on the accuracy of several estimates throughout the course of the project, that is, from conceptual estimates through to the detailed estimates.

Accuracy of an estimate is based on three main factors: 1) knowledge and experience of the estimator; and 2) available information (which categorizes cost estimating into several stages); 3) methods of estimating. Knowledge of the estimator is strongly based on the historical records of completed built projects. Consequently, the estimator may use experience in conjunction with the available information and appropriate method to prepare the estimate.

Reviewing the literature that related to the accuracy of cost estimate and its improvement the following have been achieved: exploring the purpose of cost estimating and the estimating roles, identifying the type of cost estimate, exploring the important factors to improve the accuracy of cost estimation, and finally determining the key factors that affecting accuracy of the pre-tender cost estimate.

CHAPTER 3: RESERCH MOTHODOLOGY

3.1 Introduction

This chapter discusses the methodology that is used in this research. The adopted methodology to accomplish this study uses the following techniques: review of literature related to cost estimate, questionnaire for gathering data, data analysis, interview with experts.

This chapter provides the information about the research strategy and design, research population and sample, questionnaire design, process of data collection, and statistical data analysis. Content validity and pilot study are also summarized.

3.2 Research Flowchart

This research consists of seven phases;

1. The first one is the proposal for identifying and defining the problems and establishment of the objectives of the study and development of research plan.
2. The second phase of the research includes literature review. Literatures of the factors affecting the accuracy of cost estimate in pre-tender stage were reviewed.
3. The third phase of the research included a field survey.
4. The fourth phase of the research focused on the modification of the questionnaire design, through distributing the questionnaire to pilot study, where experts local clients and consultants were contacted. The purpose of the pilot study was to prove that the questionnaire questions are clear to be answered in a way that help to achieve the objectives of the study. The questionnaire was modified based on the results of the pilot study.
5. The fifth phase of the research was questionnaire distribution. The questionnaire was used to collect the required data in order to achieve the research objective.
6. The sixth phase of the research focused on data analysis and discussion. The Statistical Package for the Social Sciences (SPSS 15) was used to perform the required analysis.
7. The final phase of the research included the conclusions and recommendations. Figure 3.1 illustrates the methodology flow chart.

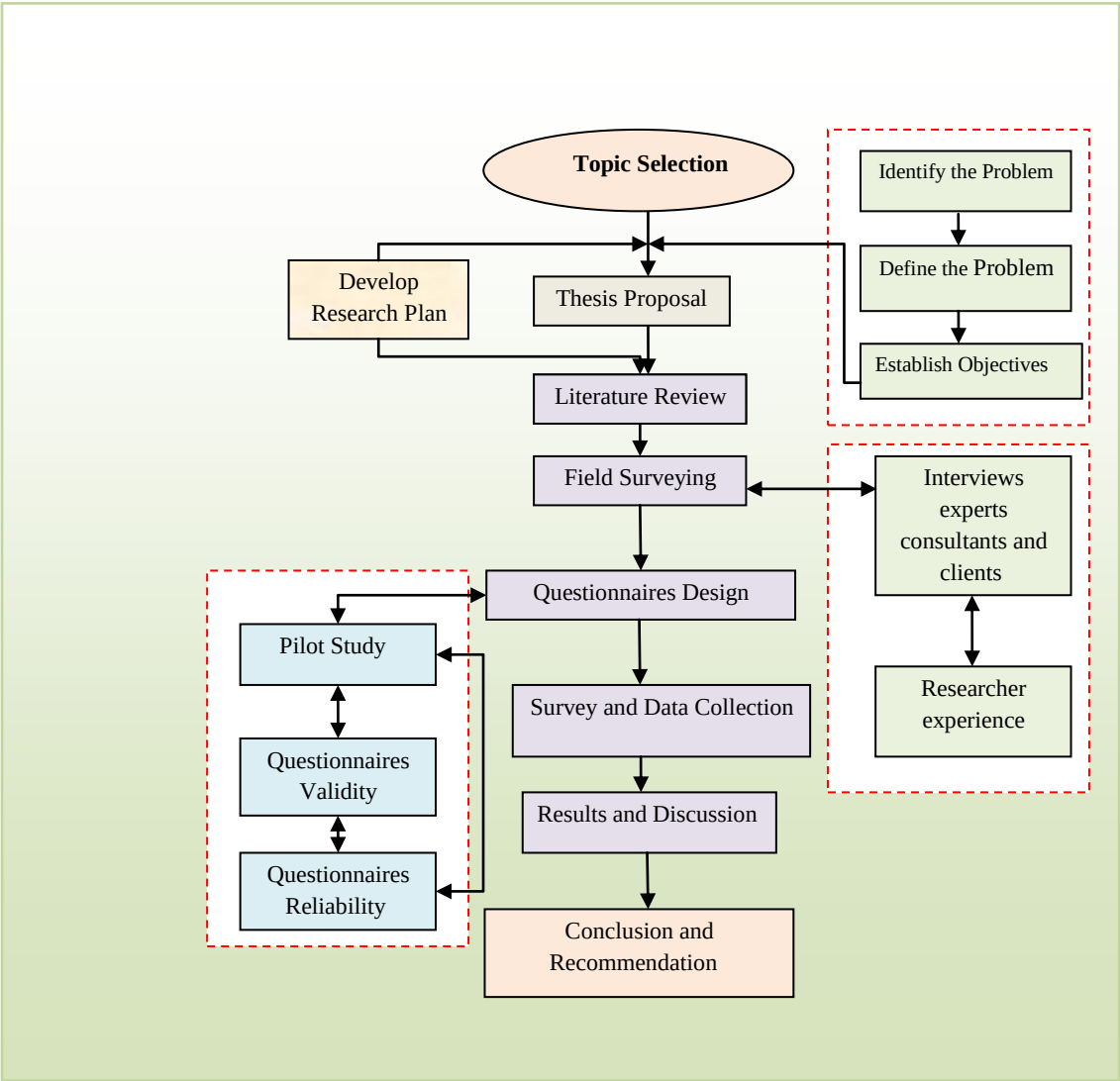

Figure 3.1: Research Methodology Flowchart

3.3 Research Period

The study started on March 2009 when the initial proposal was approved. The literature review was completed on the end of April 2009. The validity testing, piloting and questionnaire distribution and collection took two months and completed on the beginning of June 2009. The analysis, discussion, conclusion and recommendation were completed on the beginning of April 2010.

3.4 Research Population and Sample Size

The targeted population consists of experts, engineers, and managers from diverse organizations with experience and with direct contacts in their jobs to the cost estimation process, preparing estimates, and to supervisions and management of construction

projects in Gaza strip. The population members got their experiences through their extended career in consulting firms, local institutions or ministries, municipalities, implementing agencies, international agencies which implemented hundreds of projects in Gaza strip in the last years.

The targeted sample was divided into two categories:

A. Clients:
    1. Unfortunately, there is no official report mention the number of clients in Gaza Strip. About approximately 1,200 Palestinian NGOs and 200 foreign NGOs operating in the West Bank and Gaza (Tabar, 2000), about (50) governmental bodies (22) ministries of them involved in construction sector and about (25) municipalities as listed by The General Personnel Council in (2006).

    2. Only clients who have experience and works in the tendering and estimating process were approached. Only (19) clients organization were approached.

    3. A number of ministries, municipalities, governmental bodies and donors were approached, taking into consideration the distribution throughout Gaza Strip to represent the local industry.

    4. The total numbers distributed to (19) clients organizations were (50) questionnaires (i.e. managers, engineers who have experience and work in tendering and estimating process). The total number returned were (46) questionnaires from (17) organizations with response rate are 92 % as shown in Table 3.1.

B. Consultants:

    1. The total numbers of consulting firms were 50 which are obtained from the Board of Engineering Offices and Consulting Firms.

    2. Only (17) consulting firms were approached; based on the recommendation of the board of Engineering Offices that these firms provide consulting services to the clients including tenders estimation.

    3. The total numbers distributed to (17) consulting firms were (28) questionnaires (i.e. managers, engineers who have experience and work in tendering and

estimating process). The total number returned were (24) questionnaires from (15) consulting firms with response rate are 86 % as shown in Table 3.1.

Table 3.1: Classification of sample size

Title	Number of Organization	Number of distributed questionnaires	Number of respondents	Response Rate
Clients	19	50	46	92%
Consultants	17	28	24	86%
Total	38	78	70	90%

Moser and Kalton (1971) showed that a response rate of less than 30% is likely to produce results subject to non-response bias. Based on this, obtained response rates of 92% and 86% are reasonable and will reflect good results and outputs.

3.4.1 Sample Characteristics

The public clients were chosen to be those who were implementing most of public projects in Gaza Strip. Some of these institutions were: Ministry of Public Works and Housing, Ministry of Health, Ministry of Education and High Education, Palestinian Economic Council for Development & Reconstruction (PECDAR), United Nations Development Programme (UNDP), United Nations Relief and Works Agency (UNRWA), Municipality of Gaza, Municipality of Rafah, Islamic University of Gaza, Al-Azhar University-Gaza. More than one engineer were approached within each of the mentioned institutions, when possible, to obtain data based on cumulative experience and in different areas of Gaza Strip reaching (46) persons as shown in Table 3.2.

In the case of consultants, after contact the head of the board of Engineering Offices and Consulting Firms in the Engineers' Syndicate to interview professionals and practitioners in the local field of construction industry, seventeen consulting firms were selected out of 50 consulting firms in Gaza strip. This recommendation was based on the fact that these firms are the main players in public consultancy services in Gaza Strip and all of them were located in Gaza Strip. Also, more than one engineer was approached in each of those firms. A total number of (24) valid respondent was achieved. The characteristics of the (70) valid responses were illustrated in Table 3.2:

Table 3.2: Participants' Categorization.

Distribution of respondents		
No.	**Clients**	**No. of respondents**
1	Ministry of Public Works and Housing	3
2	Ministry of Education and Higher Education.	2
3	Ministry of Health.	2
4	Municipality of Gaza.	6
5	Rafah Municipality.	1
6	United Nations Relief and Works Agency-UNRWA	6
7	United Nations Development Programme – UNDP.	5
8	PECDAR	3
9	Islamic University of Gaza.	3
10	Al-Azhar University- Gaza.	1
11	University College of Applied Sciences - UCAS	1
12	Palestinian Energy and Natural Resources Authority .	2
13	Coastal Municipalities Water Utility.	3
14	Palestinian Council of Housing.	3
15	Development Alternatives Incorporative -DAI	1
16	Mercy Corps	1
17	Islamic Relief.	3
Total number of clients		**46**
No.	**Consultant**	**No. of respondents**
1	TECC – Technical Engineering Consulting Company.	2
2	UG – Universal Group.	2
3	Enfra Consultants.	2
4	EMCC – Engineering and Management Consulting Center	2
5	Home Engineering Office.	2
6	Abu Shahla & Associates – Architects and Engineers.	2
7	Dar Al Handasa Engineering Office.	1
8	Engineering and Planning Center	2
9	Efko Consulting Office	1
10	Arabesco Consulting Office	1
11	Central Consulting Office	1
12	El Waha El Khadra' Consulting Office	1
13	Modern Building Center	1
14	Dour Consulting Office	3
15	El-Resala Consulting Office	1
	Total number of consultants	**24**
	Grand total	**70**

3.5 Research Location

The research was carried out in Gaza Strip, which consists of five governorates, the North, Gaza, the middle, Khan Younus and Rafah. These five governorates are considered the southern governorates of Palestinian National Authority (PNA).

3.6 Data Collection

The questionnaire was chosen to be the method of collecting data in this research, since the questionnaire is probably the most widely used data collection technique for conducting surveys. Questionnaires have been widely used for descriptive and analytical

surveys in order to find out the facts, opinions and views (Naoum, 1998). It enhances confidentiality, supports internal and external validity, facilitates analysis, and saves resources.

Data are collected in a standardized form from samples of population. The standardized form allows the researcher to carry out statistical inferences on the data, often with the help of computers.

The used questionnaire has some limitations such as: it must contain simple questions, no control over respondents and respondents may answer generally (Naoum 1998).

3.7 Questionnaire Design

The good design of the questionnaire is a key to obtain good survey results and warranting a high rate of return (Chan and Chan 2002). The questions of the research questionnaire are constructed based on:

- Literature review.
- Several interviews with clients and consultants to obtain many basic important thoughts which can be useful for creating questions.
- The experience of the researcher in construction management in Gaza Strip.

A questionnaire survey was undertaken to determine the opinion of clients and consultants regarding factors affecting the accuracy of pre-tender cost estimate in Gaza Strip. A six page questionnaire, accompanied by a covering letter was sent to 50 clients and 28 consultants.

The letter indicated the objectives of the research and explained to the participants that the results of the questionnaire would be used to improve the ability of consultants for estimation tender at project pre-tender stage.

The questionnaire comprised of two sections to accomplish the aim of this research, as follows:

1) **Section One:** General information about the population (clients and consultants).

2) **Section Two:** Factors affecting accuracy of pre-tender cost estimate. This section aimed to achieve the second and third objectives that intend to identify and rank the

most common factors that affecting the accuracy of pre-tender cost estimate in Gaza Strip.

The final version of the questionnaire was designed in English language (attached in Annex 1), while the distributed version was in Arabic language (attached in Annex 2), since the Arabic language is much effective and easier to be understood to get more realistic results.

The foundation of all questions, whether to be mailed or to be used for interviewing, is the questions (Naoum, 1998). Based on that, questions of the draft questionnaire regarding the factors affecting accuracy of pre-tender cost estimate were derived from the literature review that presented in Chapter 2. Several previous studies have discussed factors affecting accuracy of construction cost estimate. Twelve previous studies were incorporated in this research to compile a comprehensive list of factors, e.g. Odusami and Onukwube (2008), Enshassi et al (2007), Liu and Zhu (2007), Babalola and Aladegbaiye (2006), Dysert (2006), Elhag etal (2005), Shash and Ibrahim (2005), Madi (2003), Trost and Oberlender (2003), Akintoye (2000), Al-Thunaian (1996) and Al- Khaldi (1990).

The previous studies were used to build a comprehensive list of factors affecting accuracy of pre-tender cost estimate. It was decided to divide the factors into five main groups which are:

1. Factors related to clients characteristics,
2. Factors related to consultants, design parameters and information,
3. Factors related to project characteristics,
4. Factors related to contract requirement and procurement method, and
5. External factors and market conditions.

The compiled list of factors affecting accuracy of pre-tender cost estimate contained a total of 85 factors are shown in Table 3.3.

Table 3.3: Distributing the factors adopted according to their references.

No.	Factor	Source											
		Odusami and Onukwube (2008)	Dysert (2006)	Elhag etal (2005)	Babalola and Aladegbaiye (2006)	Liu and Zhu (2007)	Enshassi et al (2007)	Madi (2003)	Akintoye (2000)	Trost and Oberlender (2003),	Shash and Ibrahim (2005)	Al-Thunaian (1996)	Al- Khaldi (1990)
	Factors related to clients characteristics												
1	Type of client	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓
2	Client experience level				✓					✓			
3	Client's ability/payment record			✓			✓	✓					✓
4	Client's financial situation and budget	✓			✓		✓	✓	✓	✓			
5	Project finance method/appropriate funding in place on time			✓			✓	✓					✓
6	Partnering arrangements			✓									
7	Priority on construction time/deadline requirements			✓									
8	Experience of procuring construction			✓									
9	Client requirements on quality			✓		✓						✓	
10	Previous relationship and communication level with the partners					✓							✓
	Factors related to consultants, design parameters and information												
1	Expertise of the consultant	✓	✓				✓	✓	✓	✓	✓		✓
2	Project team's experience in the construction type	✓	✓			✓	✓	✓	✓	✓		✓	
3	Number of estimating team members	✓	✓		✓			✓	✓				
4	Project team's capability to control the project		✓										
5	Impact of team integration and alignment					✓				✓			
6	Level of involvement of the project manger					✓				✓			
7	Quality of information and information flow requirements	✓	✓		✓			✓	✓	✓		✓	
8	Data base of bids on similar project (Historical cost data)		✓			✓				✓			
9	Completeness of cost information	✓	✓					✓	✓	✓	✓		
10	Accuracy and reliability of cost information							✓		✓			
11	Applicability of cost information									✓			
12	Procedure for updating cost information				✓					✓			
13	Utilization of checklists to ensure completeness and technical basis				✓					✓			

Table 3.3: Distributing the factors adopted according to their references.

No.	Factor	Source											
		Odusami and Onukwube (2008)	Dysert (2006)	Elhag etal (2005)	Babalola and Aladegbaiye (2006)	Liu and Zhu (2007)	Enshassi et al (2007)	Madi (2003)	Akintoye (2000)	Trost and Oberlender (2003),	Shash and Ibrahim (2005)	Al-Thunaian (1996)	Al- Khaldi (1990)
14	Quality of the assumptions used in preparing the estimate									✓			
15	Estimating method used		✓	✓	✓	✓				✓			✓
16	Volume of consultant's workload during estimation		✓										
17	Time allowed for preparing the cost estimate									✓			✓
18	Completeness and timeliness of project information (design, drawings, specifications)		✓	✓		✓		✓		✓			✓
19	Quality of design and specifications	✓		✓		✓		✓	✓	✓	✓		
20	Buildability of design	✓		✓				✓	✓	✓			
21	Inspection, testing and approval of completed works (Type and number)			✓				✓					
22	Frequency of construction variations	✓			✓				✓				
23	Variation orders and additional works							✓					
24	Working relationships with client/contractors/other design team consultants (previous/present)			✓									
25	Submission of early proposals for costing/cost planning			✓									
26	Absence of alterations and late changes to design			✓									
	Factors related to project characteristics												
1	Type of project (residential, commercial, industrial,….etc)			✓						✓	✓		
2	Type of structures (concrete, steel, masonry…etc)	✓			✓			✓	✓				
3	Scale and scope of construction	✓	✓		✓	✓	✓	✓	✓			✓	
4	Expected project organization	✓			✓			✓	✓				
5	Project size	✓		✓	✓	✓		✓	✓		✓		
6	Project duration	✓			✓			✓	✓		✓	✓	✓
7	Location of project	✓		✓	✓		✓	✓	✓	✓		✓	✓
8	Site conditions/site topography			✓				✓				✓	
9	Site constraint	✓		✓	✓	✓		✓	✓				
10	Site requirements			✓									
11	Project complexity	✓		✓	✓	✓		✓	✓			✓	
12	Construction method/technology/construction techniques	✓		✓	✓			✓	✓		✓	✓	

Table 3.3: Distributing the factors adopted according to their references.

No.	Factor	Source											
		Odusami and Onukwube (2008)	Dysert (2006)	Elhag etal (2005)	Babalola and Aladegbaiye (2006)	Liu and Zhu (2007)	Enshassi et al (2007)	Madi (2003)	Akintoye (2000)	Trost and Oberlender (2003),	Shash and Ibrahim (2005)	Al-Thunaian (1996)	Al- Khaldi (1990)
13	Technology required		✓		✓								
14	Phasing requirements (areas to be handed over first or initial non-availability)			✓									
15	Impact of project schedule									✓			
	Factors related to contract requirement and procurement method												
1	Type of contract	✓		✓	✓	✓		✓	✓	✓			✓
2	Tender selection method (open, selected, negotiation, etc.)			✓									
3	Method of procurement (traditional, design and build, etc)			✓		✓							
4	Form of procurement	✓			✓			✓	✓				
5	Spread of risk between construction parties (client/consultant/contractors)			✓									
6	Claims and disputes resolution methods (litigation/arbitration/others)			✓				✓					✓
7	Amount of specialist work	✓			✓			✓	✓				
8	Advanced payment							✓					
9	Tax and insurance				✓					✓			✓
10	Type and value of insurance							✓					
11	Bid Bonds amount and maintenance period							✓					
12	Project including Vat or excluding Vat						✓	✓					
13	Retention ratios of the value of contractor payments							✓					
14	Liquidated damages amount							✓					
	External factors and market conditions												
1	Material (prices/availability/supply/quality/imports)	✓	✓	✓	✓	✓	✓	✓		✓			
2	Labor (costs /availability/performance/productivity)	✓		✓	✓	✓	✓	✓					
3	Equipment (costs/availability/supply/condition /performance)	✓	✓	✓	✓	✓	✓	✓		✓			
4	Availability and supplies of labor and materials	✓			✓				✓				
5	Weather condition			✓		✓		✓					

Table 3.3: Distributing the factors adopted according to their references.

No.	Factor	Source											
		Odusami and Onukwube (2008)	Dysert (2006)	Elhag etal (2005)	Babalola and Aladegbaiye (2006)	Liu and Zhu (2007)	Enshassi et al (2007)	Madi (2003)	Akintoye (2000)	Trost and Oberlender (2003),	Shash and Ibrahim (2005)	Al-Thunaian (1996)	Al- Khaldi (1990)
6	Impact of government regulations requirement			✓						✓		✓	
7	Number of competitors in the market			✓			✓				✓		
8	Classification and level of competitors in the tendering			✓			✓			✓		✓	✓
9	Economic situation					✓		✓					
10	Stability of market conditions	✓	✓	✓	✓	✓			✓	✓		✓	✓
11	Bidding climate comprising of competitiveness				✓					✓			
12	Inflation rate			✓				✓					✓
13	Closure and blockade						✓	✓					
14	Political situation							✓					
15	Bank interest rate							✓					
16	Currency exchange						✓	✓					✓
17	Type of tender's currency							✓					
18	Price of the tender documents							✓					✓
19	Method of paying value added tax (VAT)						✓	✓					
20	Social and cultural impact												✓
	Total factors	27	16	38	29	22	17	48	24	31	9	12	19

A draft questionnaire was discussed with the supervisor who requested adding more factors and to test validity content by the knowledge of experts in construction management in Gaza Strip. Content validity test was conducted by sending the draft questionnaire with covering letter to ten experts. The ten experts are two lectures in the Islamic University, four clients and four consultants each with minimum experience of 15 years in construction and excellent knowledge of project management. The experts are requested to evaluate the content validity of questionnaire, to check readability, offensiveness of the language and to delete or add more factors and information if needed.

In general, the experts agreed that the questionnaire is suitable to achieve the goals of the study. Table 3.4 shows the comments and some modifications have been done:

Table 3.4: List of factors affecting accuracy of pre-tender cost estimate

Factors from literature		Selected factors
1. Factors related to clients characteristics		
Type of client	Modified	Type of client (Government/ UN Agencies/ NGOs …etc)
Client experience level	Selected	Client experience level
Client's financial situation and budget	Modified	Financial capabilities of the client
Client's financial situation/ ability/payment record	Modified	Client's method of payment
Project finance method/appropriate funding in place on time	Merged	
Partnering arrangements	Deleted	
Priority on construction time/deadline requirements	Deleted	
Experience of procuring construction	Selected	Experience of procuring construction
Client requirements on quality	Modified	Clear scope definition for the client
Previous relationship and communication level with the partners	Deleted	
	Added	Client's evaluation and awarding policy
2. Factors related to consultants, design parameters and information		
Expertise of the consultant	Modified	The experience and skill level of the consultant
Project team's experience in the construction type	Selected	Project team's experience in the construction type
	Added	Designer's experience level
Number of estimating team members	Selected	Number of estimating team members
	Added	Availability of all fields of specialization in a project team
Project team's capability to control the project	Selected	Project team's capability to control the project
Impact of team integration and alignment	Selected	Impact of team integration and alignment
Level of involvement of the project manger	Selected	Level of involvement of the project manger
Quality of information and information flow requirements	Selected	Quality of information and information flow requirements
Data base of bids on similar project (Historical cost data)	Selected	Data base of bids on similar project (Historical cost data)
Completeness of cost information	Selected	Completeness of cost information
Accuracy and reliability of cost information	Selected	Accuracy and reliability of cost information
Applicability of cost information	Selected	Applicability of cost information
Procedure for updating cost information	Selected	Procedure for updating cost information
Utilization of checklists to ensure completeness and technical basis	Selected	Utilization of checklists to ensure completeness and technical basis
Quality of the assumptions used in preparing the estimate	Selected	Quality of the assumptions used in preparing the estimate
Estimating method used	Selected	Estimating method used

Factors from literature		Selected factors
Volume of consultant's workload during estimation	Selected	Volume of consultant's workload during estimation
Time allowed for preparing the cost estimate	Selected	Time allowed for preparing the cost estimate
Completeness and timeliness of project information (design, drawings, specifications)	Modified	Completeness of project documents
Quality of design and specifications	Selected	Clear and detail drawings and specifications
Buildability of design	Selected	Buildability of design
Inspection, testing and approval of completed works (Type and number)	Deleted	
Frequency of construction variations	Deleted	
Variation orders and additional works	Deleted	
Working relationships with client/contractors/other design team consultants (previous/present)	Modified	Level of communication with Client and other design team consultants
Submission of early proposals for costing/cost planning	Deleted	
Absence of alterations and late changes to design	Deleted	
3. Factors related to project characteristics		
Type of project (residential, commercial, industrial,….etc)	Selected	Type of project (residential, commercial, industrial,….etc)
Type of structures (concrete, steel, masonry…etc)	Selected	Type of structures (concrete, steel, masonry…etc)
Scale and scope of construction	Deleted	
Expected project organization	Deleted	
Project size	Selected	Project size
Project duration	Selected	Project duration
Location of project	Selected	Location of project
Site conditions/site topography	Modified	Site conditions (topography, hot area,..etc)
Site constraint (access, storage, electricity..etc)	Selected	Site constraint (access, storage, electricity..etc)
Site requirements	Selected	Site requirements
Project complexity	Selected	Project complexity
Construction method/technology/construction techniques	Modified	Method of construction /construction techniques requirements
Technology required	Deleted	
Phasing requirements (areas to be handed over first or initial non-availability)	Deleted	
Impact of project schedule	Selected	Impact of project schedule
4. Factors related to contract requirement and procurement method		
Type of contract	Selected	Type of contract
Tender selection method (open, selected, negotiation, etc.)	Selected	Tender selection method (open, selected, negotiation, ..etc.)
Method of procurement (traditional, design and build, etc)	Selected	Method of procurement (traditional, design and build, etc)
Form of procurement	Merged	
Spread of risk between construction parties (client/consultant/contractors)	Modified	Risk sharing between construction parties
Claims and disputes resolution methods	Modified	Content of disputes resolution methods clause

Factors from literature		Selected factors
(litigation/arbitration/others)		(litigation/arbitration/others)
Amount of specialist work	Selected	Amount of specialist work
Advanced payment	Selected	Advanced payment
Tax and insurance	Modified	The taxes and other financial requirements on tender
	Added	Clear contract conditions
Type and value of insurance	Merged	
Bid Bonds amount and maintenance period	Merged	
Project including Vat or excluding Vat	Merged	
Retention ratios of the value of contractor payments	Merged	
Liquidated damages amount	Merged	
5. External factors and market conditions		
Material (prices/availability/supply/quality/imports)	Selected	Material (prices /availability /supply /quality /imports)
Labor (costs/availability/performance/productivity)	Selected	Labor (costs/availability/performance/productivity)
Equipment (costs/availability/supply/condition /performance)	Selected	Equipment (costs/availability/supply/condition /performance)
Availability and supplies of labor and materials	Merged	
Weather condition	Modified	Timing of advertisement (weather effects)
Impact of government regulations requirement	Selected	Impact of government regulations requirement
Number of competitors in the market	Selected	Number of competitors in the market
Classification and level of competitors in the tendering	Selected	Classification and level of competitors in the tendering
Economic situation	Modified	The prevailing economic climate
Stability of market conditions	Merged	
Bidding climate comprising of competitiveness	Selected	Bidding climate comprising of competitiveness
Inflation rate	Merged	
Closure and blockade	Selected	Closure and blockade
Political situation	Merged	
	Added	Multiple projects being advertised at the same time
Bank interest rate	Deleted	
Currency exchange	Modified	Currency exchange fluctuation
Type of tender's currency	Merged	
Price of the tender documents	Deleted	
Method of paying value added tax (VAT)	Deleted	
Social and cultural impact	Selected	Social and cultural impact
	Added	Donor type

As shown in Table 3.4, there are some factors descriptions were slightly changed, merged and deleted. The following is a discussion of the experts' remarks for each factor:

1. Factors related to clients characteristics: two factors were selected, four were modified, " Client's evaluation and awarding policy " was added, " Project finance method/appropriate funding in place on time " was merged to factor " Client's method of payment ", and three were deleted. "Previous relationship and communication level with the partners ", " Priority on construction time/deadline requirements " were seen to have a minor effect in accuracy cost estimate, and" Partnering arrangements " is not common in Gaza strip.

2. Factors related to consultants, design parameters and information: eighteen factors were selected, three were modified, "Designer's experience level ", and "Availability of all fields of specialization in a project team" were added. These factors " Inspection, testing and approval of completed works"," Frequency of construction variations " ," Variation orders and additional works ", " Submission of early proposals for costing/cost planning ", and " Absence of alterations and late changes to design " were not seen as a main determinant of accuracy of cost estimate.

3. Factors related to project characteristics: nine factors were selected, two were modified. The factor " Scale and scope of construction " was seen to be presented in the Clients characteristic group under the "Clear scope definition for the client". The factors " Expected project organization ", " Technology required (areas to be handed over first or initial non-availability) " and " Phasing requirements " were seen to limit the effect in accuracy cost estimate and not common in Gaza Strip.

4. Factors related to contract requirement and procurement method: five factors were selected, three were modified. The factor "Form of procurement" was merged under the " Method of procurement ". Also factors "Type and value of insurance", "Bid Bonds amount and maintenance period "," Project including Vat or excluding Vat "," Retention ratios of the value of contractor payments " and" Liquidated damages amount " were merged under the new factor " Clear contract conditions".

5. Factors related to market conditions: nine factors were selected, three were modified. " Availability and supplies of labor and materials " was merged under the " Material ", and " labor ". Moreover " Stability of market conditions ", " Inflation rate " , and " Political situation " were merged under modified factor "

The prevailing economic climate ". Also " Type of tender's currency " was merged under the modified factor " Currency exchange fluctuation ". Both " Multiple projects being advertised at the same time " and " Donor type " were added. The factors " Bank interest rate ", "Method of paying value added tax " and " Price of the tender documents " were seen to have a minor in accuracy cost estimate.

As a results, good comments were taken into consideration and 6 addition factors were added to reflect the nature of construction industry in Gaza Strip. While 15 factors were deleted, 15 factors were modified, and 12 factors were merged. A total of 64 factors were distributed into five groups as advised by experts.

3.8 Pilot Study

A pilot study provides a trial run for the questionnaire, which involves testing the wording of question, identifying ambiguous questions, testing the techniques that used to collect data, and measuring the effectiveness of standard invitation to respondents (Naoum, 1998q). All questionnaires should initially be piloted; completed by small sample of respondents (Fellows and Liu, 1997).

After modifying the questionnaire according to the notes of the supervisor and before collecting the final data from the whole sample, a pilot study is accomplished and ten copies of the questionnaire are distributed to six clients and four consultants to fill them. The purpose of this step is to discover if the questions are well understandable or not, also to find out any problem that may raise in filling the questionnaire. From the pilot study it appears that questions are generally clear. However, it seems some clients and consultants find difficulties in understanding some questions. Therefore, the researcher modifies these questions to be clearer.

3.9 Instrument Validity

Heffner (2004) explained that, validity refers to the degree in which our test or other measuring device is truly measuring what we intended it to measure. Burns and Grove (1993) defined the validity of an instrument as a determination of the extent to which the instrument actually reflects the abstract construct being examined.

Polit and Hungler (1985) give another definition; "Validity refers to the degree to which an instrument measures what it is supposed to be measuring". Validity has a number of different aspects and assessment approaches. There are two ways to evaluate instrument validity: (1) content validity and (2) statistical validity, which include criterion-related validity and construct validity.

3.9.1 Content Validity of the Questionnaire

The content validity of the questionnaire was tested by a panel consisting of ten experts. The ten experts are two lectures in the Islamic University, four clients and four consultants each with minimum experience of 15 years in construction and excellent knowledge of project management. Each expert was requested to evaluate content validity for each item based on rating the index of content validity. Based on comments of the experts many factors were added, modified or deleted. All additions, omission and the new factors were discussed and approved by the supervisor and then the questionnaire was finalized to include 64 factors distributed into five groups.

3.9.2 Statistical Validity of the Questionnaire

Statistically, to insure the validity of the questionnaire, two statistical tests should be applied. The first test is criterion-related validity test (Spearman test) which measures the correlation coefficient between each paragraph in one group and the whole groups. The second test is structure validity test (Spearman test) that used to test the validity of the questionnaire structure by testing the validity of each group and the validity of the whole questionnaire. It measures the correlation coefficient between one group and all the groups of the questionnaire that have the same level of similar scale (Abu-Saleh, 2001).

Spearman rank correlation coefficient is used to determine whether there is evidence of a linear relationship between two ordinal variables, or, if both variables are interval and the normality requirement may not be satisfied.

The sample spearman correlation coefficient is denoted r_s and is given by:

$$r_s = 1 - \frac{6\sum_{i=1}^{n} d_i^2}{n\left(n^2 - 1\right)}$$

where:

r_s = Spearman's rank correlation coefficient

d = the difference in ranking between the usage and effectiveness of factors

n = the number of factors

To evaluate the hypothesis testing to verify the association between two variables, the following equation is used (Abu-Saleh, 2001):

$$t = r_s \sqrt{\frac{n-2}{1-r_s^2}}$$

3.9.2.1 Criterion Related Validity

Internal consistency of the questionnaire is measured by a scouting sample, which consisted of 30 questionnaires through measuring the correlation coefficients between each paragraph in one group and the whole group.

The correlation coefficient and p-value were calculated for each for of all groups (clients' characteristics, consultants, design parameters and information, project characteristics, contract requirement and procurement method, and external factors and market conditions). It was found that the p- values are less than 0.05, so the correlation coefficients of the field are significant at $\alpha = 0.05$ ($0.01 <$ p-value < 0.05), so it can be said that the factors of all groups are consistent and valid to be measure what it was set for. (attached in the Annex 3).

3.9.2.2 Structure Validity of the Questionnaire

Structure validity is the second statistical test that used to test the validity of the questionnaire structure by testing the validity of each group and the validity of the whole questionnaire. It measures the correlation coefficient between one group and all the groups of the questionnaire that have the same level of Likert scale.

As shown in Table 3.5, the significance values are less than 0.05, so the correlation coefficients of all the groups are significant at $\alpha = 0.05$ ($0.01 <$ p-value < 0.05), so it can

be said that the groups are valid to measure what it was set for to achieve the main aim of the study.

Table 3.5: Correlation coefficient between one group and all the groups

No.	Group	Spearman Correlation Coefficient	P-Value (Sig.)
1	Factors related to clients characteristics	0.629	0.000
2	Factors related to consultants, design parameters and information	0.696	0.000
3	Factors related to project characteristics	0.762	0.000
4	Factors related to contract requirement and procurement method	0.768	0.000
5	External factors and market conditions	0.847	0.000

3.10 Reliability of the Research

The reliability of an instrument is the degree of consistency which measures the attribute; it is supposed to be measuring (Polit and Hunger, 1985). The less variation an instrument produces in repeated measurements of an attribute, the higher its reliability. Reliability can be equated with the stability, consistency, or dependability of a measuring tool. The test is repeated to the same sample of people on two occasions and then compares the scores obtained by computing a reliability coefficient (Polit and Hunger, 1985).

It is difficult to return the scouting sample of the questionnaire-that is used to measure the questionnaire validity to the same respondents due to the different work conditions to this sample. Therefore Cronbach's Coefficient Alpha test can be applied to the scouting sample in order to measure the consistency of the questionnaire.

3.10.1 Cronbach's Coefficient Alpha

This method is used to measure the reliability of the questionnaire between each group and the mean of the whole groups of the questionnaire. Chronbach's alpha (George D. and Mallery P, 2003) is designed as a measure of internal consistency, that is, do all items within the instrument measure the same thing? Alpha typically varies between 0 and 1. The closer the Alpha is to 1, the greater the internal consistency of items in the instrument being assumed.

Cronbach's Alpha can be written as a function of the number of test items and the average inter-correlation among the items. Below, for conceptual purposes, we show the formula for the standardized Cronbach's alpha:

$$\alpha = \frac{k\,r}{1+(k-1)r}$$

Here k is equal to the number of items; r is the average inter-item covariance among the items.

One can see from this formula that if you increase the number of items, you increase Cronbach's alpha. Additionally, if the average inter-item correlation is low, alpha will be low. As the average inter-item correlation increases, Cronbach's Alpha increases. This makes sense intuitively - if the inter-item correlations are high, and then there is evidence that the items are measuring the same underlying construct. This is really what is meant when someone says they have "high" or "good" reliability.

The normal range of Cronbach's coefficient alpha value between 0.0 and + 1.0, and the higher values reflects a higher degree of internal consistency. Table 3.6 shows the values of Cronbach's Alpha for each grouped of the questionnaire and the entire questionnaire. For the groups, values of Cronbach's Alpha were in the range from 0.676 and 0.841. This range is considered high; the result ensures the reliability of each group of the questionnaire. Cronbach's Alpha equals 0.911 for the entire questionnaire which indicates an excellent reliability of the entire questionnaire.

Table 3.6: Cronbach's Alpha for each group of the questionnaire and all the questionnaire

No.	Group	Cronbach's Alpha
1	Factors related to clients characteristics	0.676
2	Factors related to consultants, design parameters and information	0.770
3	Factors related to project characteristics	0.841
4	Factors related to contract requirement and procurement method	0.785
5	External factors and market conditions	0.833
	Total	**0.911**

Thereby, it can be said that the researcher proved that the questionnaire was valid, reliable, and ready for distribution for the population sample.

3.11 Data Processing and Analysis

The questionnaire quantitative data analysis was done by using the Statistical Package for the Social Sciences (SPSS 15) and the following statistical tools were used:

1. Frequency and Descriptive analysis
2. The relative importance index
3. Cronbach's Alpha for Reliability Statistics
4. Spearman Rank correlation for Validity
5. Kendall's Coefficient of Concordance
6. Mann-Whitney test

3.11.1 The Relative Importance Index

The relative index technique has been widely used in construction research for measuring attitudes with respect to surveyed variables. Several researches such as Odusami and Onukwube (2008), Elhag etal (2005), Madi (2003), and Akintoye (2000) used the relative importance index in their analysis of factors affecting the accuracy of cost estimate.

Likert scaling was used for ranking questions that have an agreement levels. The respondents were required to rate the importance of each factor on a 5-point Likert scale using 1 for not important, 2 for of little importance, 3 for somewhat important, 4 for important and 5 for very important. Then, the relative importance index was computed using the following equation:

$$\text{Relative Importance Index} = \frac{\sum w}{AN} = \frac{5n_5 + 4n_4 + 3n_3 + 2n_2 + 1n_1}{5N}$$

Where W is the weighting given to each factor by the respondent, ranging from 1 to 5, (n1 = number of respondents for not important, n2 = number of respondents for little importance, n3 = number of respondents for somewhat important, n4 = number of respondents for important, n5 = number of respondents for very important). "A" is the highest weight (i.e 5 in the study) and N is the total number of samples. The relative importance index ranges from 0 to 1 (Tam and Le, 2006).

3.11.2 Non-parametric Test

Non-parametric methods are widely used for studying populations that take on a ranked order. The use of non-parametric methods may be necessary when data have a ranking but no clear numerical interpretation, or for data on an ordinal scale (Siegel and Castellan, 1988).

As non-parametric methods make fewer assumptions, their applicability is much wider than the corresponding parametric methods. In particular, they may be applied in situations where less is known about the application in question. Also, due to the reliance on fewer assumptions, non-parametric methods are more robust.

Another justification for the use of non-parametric methods is simplicity. In certain cases, even when the use of parametric methods is justified, non-parametric methods may be easier to use. Due both to this simplicity and to their greater robustness, non-parametric methods are seen by some statisticians as leaving less room for improper use and misunderstanding (Corder and Foreman, 2009).

3.11.2.1 Kendall's Coefficient of Concordance

Kendall's coefficient of concordance (W) is a non-parametric statistic used to evaluate the degree of agreement between clients and consultants regarding the ranking of key factors, and to determine whether there is a significant degree of agreement between the clients and consultants opinions for each of the factors. Kendall's (W), ranges between 0 (no agreement) and 1 (complete agreement) (Siegel and Castellan, 1988).

To determine whether there is degree of agreement among the levels of each of the factors affecting accuracy of pre-tender cost estimate for each consultants and clients. Kendall's coefficient of concordance is illustrated by :

$$W = \frac{12U - 3m^2 n(n-1)^2}{m^2 n(n-1)}$$

Where: $$U = \sum_{i=1}^{n} \left(\sum R\right)^2$$

n = number of factors; m = number of groups; j = the factors 1,2,…,N.

W is related to the mean value of the Spearman's rank correlation coefficients between all pairs of the rankings over which it is calculated.

If the test statistic W is 1, then all the survey respondents have been unanimous, and each respondent has assigned the same order to the list of concerns. If W is 0, then there is no overall trend of agreement among the respondents, and their responses may be regarded as essentially random. Intermediate values of W indicate a greater or lesser degree of unanimity among the various responses (Abdi, 2007).

3.11.2.2 Mann-Whitney Test

The Mann-Whitney test is one of the most powerful of the nonparametric tests for comparing two populations. It is used to test the null hypothesis that two populations have identical distribution functions against the alternative hypothesis that the two distribution functions differ only with respect to location (median), if at all (Siegel and Castellan, 1988).

The Mann-Whitney test does not require the assumption that the differences between the two samples are normally distributed. It can be applied when the observations in a sample of data are ranks, that is, ordinal data rather than direct measurements.

Mann-Whitney test is used to determine whether there is a significant difference at $\alpha \leq 0.05$ in rank means of the respondents agreement between clients and consultants. Mann-Whitney test formula is given by:

$$U_x = n_1 n_2 + \frac{n_1(n_1+1)}{2} - T_x, U_y = n_1 n_2 + \frac{n_2(n_2+1)}{2} - T_y$$

$$U = \min\{U_x, U_y\}, T_x \text{ and } T_y : \text{Rank sum of } x \text{ and } y, \text{respectively}$$

n1 is the sample size for sample 1, n2 is the sample size for sample 2

CHAPTER 4: RESULTS AND DISCUSSION

4.1. Introduction

This chapter discusses the results that have been deduced from a field survey of seventy questionnaires, forty-six clients, and twenty-four consultants. Section one will present the clients and consultants profiles and all necessary information about the respondents. Section two was designed to attain the second and third objectives in this research. These objectives intend to study the perspectives of both clients and consultants of the factors affecting accuracy of pre-tender cost estimate in Gaza Strip. The third section was designed to attain the fourth objective in this research. This objective intend to study the relationship between the perspective of clients and consultants of the essential factors affecting accuracy of pre-tender cost estimate in Gaza Strip.

4.2. Section One: Organizational Profiles (Client and Consultants)

This section mainly designed to provide general information about the respondents in terms of the major type of work involved, position and experience of respondent, experience of organization, number of projects that organization prepared pre-tender cost estimate for within the last five years and size of these projects.

4.2.1. Type of Works

Figure 4.1 shows that, 34% (24) consultants and 66% (46) clients such as ministries, municipalities, NGO's and International Institutions were participated in the questionnaire.

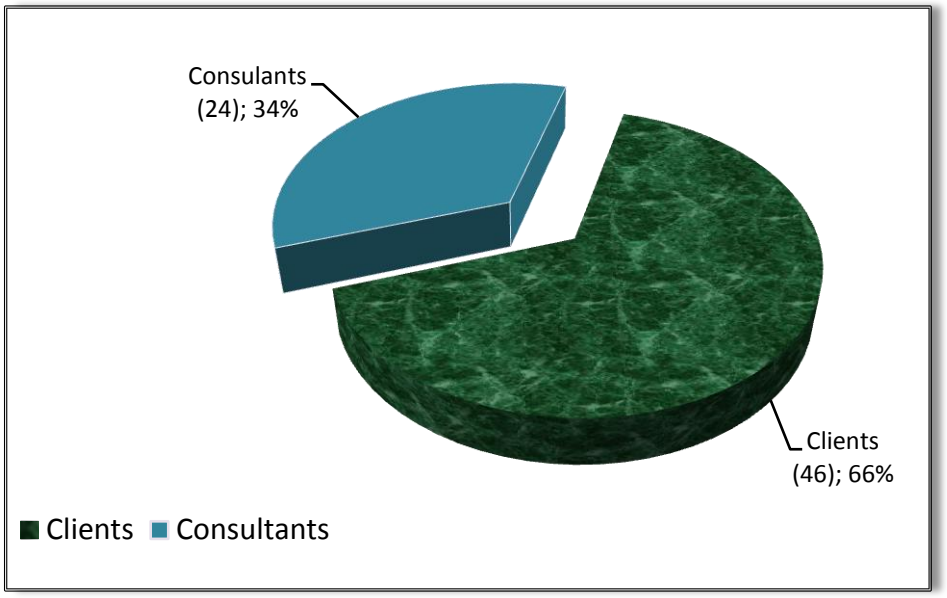

Figure 4.1: The type and the percent of the targeted groups

4.2.2. Position of Respondent

Table 4.1 shows that, 26.1% (12) the clients' respondents and 33.3% (8) of the consultants' respondents were project managers. 34.8% (16) of clients' respondents and 12.5% (3) of the consultants' respondents were heads of department. 19.6% (9) of clients' respondents and 20.8% (5) of the consultants' respondents were office engineers. 6.5% (3) of clients' respondents and 8.3% (2) of the consultants' respondents were estimators. And 13% (6) of clients' respondents and 25% (6) of the consultants' respondents were others such as firm owner, general manager and firm director. It can been seen that more than 50% of the respondents have key positions that insure quality information.

Table 4.1: Position of respondent in organization

Position of respondent	Clients		Consultants		Total	
	Freq.	Percent. (%)	Freq.	Percent. (%)	Freq.	Percent. (%)
Project Manager	12	26.1	8	33.3	20	28.6
Head of Department	16	34.8	3	12.5	19	27.1
Office Engineer	9	19.6	5	20.8	14	20.0
Estimator	3	6.5	2	8.3	5	7.1
Other	6	13.0	6	25.0	12	17.2
Total	46	100	24	100	70	100

4.2.3. Respondent's years of experience

Table 4.2 shows that, 21.7% (10) of clients' respondents and 20.8% (5) of the consultants' respondents (21.4% from the total sample) have years of experience between 5-10 years. 15.2% (7) of clients' respondents and 16.7% (4) of the consultants' respondents (15.7% from the total sample) have years of experience between 11-15 years. And 63.1% (29) of clients' respondents and 62.5%(15) of the consultants' respondents (62.9% from the total sample) have years of experience more than 15 years.

Table 4.2: Respondent's years of experience

Experience	Clients		Consultants		Total	
	Freq.	Percent. (%)	Freq.	Percent. (%)	Freq.	Percent. (%)
5-10 years	10	21.7	5	20.8	15	21.4
11-15 years	7	15.2	4	16.7	11	15.7
More than 15 years	29	63.1	15	62.5	44	62.9
Total	46	100	24	100	70	100

These results illustrate that, approximately, more than half of the samples (62.9 %) in the clients and consultants has an experience more than 15 years, besides, and more than 15% of the respondents have experience more than 10 years. These results will also provide a level of satisfaction that the obtained data will reflect what it was designed for. Those respondents have good positions in their organizations to provide an accurate and precise data.

4.2.4. Years of Experience for the Organization (Client and consultant)

Working experience is measured the number of years of both clients and consultants have been operating in the construction industry. Table 4.3 shows that, 17.65% (3) of clients' organization respondents and 6.67% (1) of the consultants' firm respondents (12.5% from the total sample) have years of experience less than 10 years, 29.41% (5) of clients' organization respondents and 33.33% (5) of the consultants' firm respondents (31.25% from the total sample) have years of experience between 10-15 years, 17.65% (3) of clients' organization respondents and 20% (3) of the consultants' firm respondents

(18.75% from the total sample) have years of experience between16-20 years. And 35.29% (6) of clients' organization respondents and 40% (6) of the consultants' firm respondents (37.5% from the total sample) have years of experience more than 20 years.

Table 4.3: Years of experience for the organization (client and consultant)

Experience	Clients organizations		Consulting firm		Total	
	Freq.	Percent. (%)	Freq.	Percent. (%)	Freq.	Percent. (%)
Less than 10 years	3	17.65	1	6.67	4	12.5
10-15 years	5	29.41	5	33.33	10	31.25
16-20 years	3	17.65	3	20	6	18.75
More than 20 years	6	35.29	6	40	12	37.5
Total	17	100	15	100	32	100

The fact that at least 37.5% of the respondents have more than 20 years experience was reflected in the level of completeness, consistency and precision of the information provided, and provides further validity for the survey results.

4.2.5. Number of Projects that the Respondents Organization Prepared Pre-tender Cost Estimate in the Last Five Years

Number of projects that organization preparing pre-tender cost estimate for within the last five years is also measured. Table 4.4 shows that, 43.75% (14) of both surveyed clients and consultants have been prepared pre-tender cost estimate for more that 30 projects in the last five years. In fact, obtaining data from such experienced organizations increases the reliability of the general results.

Table 4.4: Number of projects prepared within the last five years

Number of projects	Clients organizations		Consulting firm		Total	
	Freq.	Percent. (%)	Freq.	Percent. (%)	Freq.	Percent. (%)
Less than 10	4	23.53	4	26.67	8	25
10-20	3	17.65	4	26.67	7	21.88
21-30	1	5.88	2	13.33	3	9.37
More than 30	9	52.94	5	33.33	14	43.75
Total	17	100	15	100	32	100

It is important to mention that clients respondents who prepared cost estimate for more than 30 projects are big organization such as UNDP, UNRWA, Ministry of Public Works and Housing, Municipality of Gaza, and PECDAR.

4.2.6. Size of Projects that the Respondents Organization Prepared Pre-tender Cost Estimate in the Last Five Years

From the data collected 35.3% (11) of the projects estimated cost has been prepared with in last five years by both the clients and consultants had estimated no more than 5 million US Dollars, 23.52% (8)of the projects had estimated between 5 million and 10 million US Dollars, 5.88%(2) of the projects had estimated between 5 million and 10 million US Dollars, while 35.3%(11) of the projects had estimated over 15 million US Dollars as shown in Table 4.5.

Table 4.5: Size of projects prepared within the last five years (Where M=Million in $)

Size of projects	Clients organizations		Consulting firm		Total	
	Freq.	Percent. (%)	Freq.	Percent. (%)	Freq.	Percent. (%)
Less than 5M	6	34.38	5	33.33	11	35.3
From 5 to less than 10M	4	25	4	26.67	8	23.52
From 10 to less than 15M	1	6.25	1	6.67	2	5.88
15M or over	6	34.37	5	33.33	11	35.3
Total	17	100	15	100	32	100

It is important to point view that most of the projects were implemented before 2007. However, both clients and consultants organizations during the last three years prepared several projects including tender documents and cost estimate but unfortunately these projects were not implemented due to the closure and bad political situation.

4.2.7. Satisfaction with the Current Level of Pre-tender Cost Estimate Accuracy

Low percentage of the respondents indicated that they were not very satisfied with the current level of estimate accuracy. 11.4%(8) by both the clients and consultants indicated they were dissatisfied, or neither satisfied, while 70% (49) by both the clients and consultants indicated that they were satisfied as shown in Table 4.6.

Table 4.6: Satisfaction with the current level of pre-tender cost estimate accuracy

Satisfaction	Clients		Consultants		Total	
	Freq.	Percent. (%)	Freq.	Percent. (%)	Freq.	Percent. (%)
Not very satisfied	1	2.2	0	0	1	1.5
Not satisfied	4	8.7	4	16.7	8	11.4
Neutral	2	4.3	2	8.3	4	5.7
Satisfied	33	71.7	16	66.7	49	70.0
Very satisfied	6	13.1	2	8.3	8	11.4
Total	46	100	24	100	70	100

4.2.8. Estimating Unit

Table 4.7 shows that, 47.06% (8) of clients' respondents and 26.67% (4) of the consultants' respondents (37.5% from the total sample) have cost estimating unit while 52.94% (9) of clients' respondents and 73.33% (11) of the consultants' respondents (62.5% from the total sample) have no cost estimating unit, They stated that cost estimation practice is meshed with other engineering services, or volume of the work is small, so there is no need for estimating unit.

Table 4.7: Existing estimating unit in the organization

Estimating unit	Clients organizations		Consulting firm		Total	
	Freq.	Percent. (%)	Freq.	Percent. (%)	Freq.	Percent. (%)
Yes	8	47.06	4	26.67	12	37.5
No	9	52.94	11	73.33	20	62.5
Total	17	100	15	100	32	100

4.2.9. Number of Employees Working in Estimating Unit

Table 4.8 shows that, (50%) of both the clients and consultants have less than 3 employees in estimating unit, (33.33%) of the them have an average 3-4 employees while (16.67%) have an average number more than 4 employees. The result indicate that most common estimating unit size in Gaza strip has less than three employees.

Table 4.8: Number of Employees working in estimating unit in the organization

No. of employees	Clients organizations		Consulting firm		Total	
	Freq.	Percent. (%)	Freq.	Percent. (%)	Freq.	Percent. (%)
Less than 3	3	37.5	3	75	6	50
3-4	3	37.5	1	25	4	33.33
More than 4	2	25	0	0	2	16.67
Total	8	100	4	100	12	100

4.3. Section two: Factors Affecting Accuracy of Pre-tender Cost Estimate

The main objectives of this section are to study the perspective of both clients and consultants of the essential factors affecting accuracy of pre-tender cost estimate in Gaza Strip and to study the relationship between the perspective of both clients and consultants regarding the essential factors affecting accuracy of pre-tender cost estimate. This section contains five groups which include 64 factors affecting accuracy of pre-tender cost estimate, these groups are: factors related to the client characteristics, factors related to the consultant, design parameters and information, factors related to the project characteristics, factors related to the contract requirement and procurement method, while the fifth group related to the external factors and market conditions.

4.3.1. Factors related to clients characteristics (Group 1)

Table 4.9 shows the relative importance indices and ranks of factors related to client characteristics. This group contains 7 factors. In this part, only the most important factors and the least important factors will be discussed.

Table 4:9: Rank and RII of factors related to clients characteristics

Factors	Clients		Consultants		Both clients and consultants		Overall Rank
	RII	Rank	RII	Rank	RII	Group Rank	
Type of client (Government/ UN Agencies/ NGOs …etc)	0.662	6	0.717	3	0.683	6	54
Client experience level	0.889	1	0.758	2	0.843	1	12
Clear scope definition for the client	0.844	2	0.783	1	0.826	2	16
Financial capabilities of the client	0.693	4	0.717	3	0.697	4	50
Client's method of payment	0.644	7	0.700	5	0.666	7	59
Experience of procuring construction	0.764	3	0.650	7	0.723	3	45
Client's evaluation and awarding policy	0.676	5	0.700	5	0.686	5	52
All factors	**0.739**		**0.718**		**0.732**		

From Table 4.9, it is shown that, "Client experience level" was ranked in the first position by both clients and consultants as a critical factor affecting the accuracy of pre-tender cost estimate for this group with relative important index of (0.843) and ranked 12th on the overall ranking. The responding clients ranked this factor in the first position with RII of (0.889) while the consultants ranked it in the second position with RII of (0.758). The

results for this factor show that the clients' point of view is deeper than the consultants' point of view. This result illustrates clearly the influence of the clients experience level in accuracy of cost estimate once that most of the clients already have an estimating unit such as UNRWA, and UNDP which is responsible in preparing the cost estimate. If the staff of clients is well experienced in the construction projects this will reflect in the accuracy of estimate. On the other hand, other clients have to hire a consulting firm in order to prepare the required estimate. The estimate which is prepared by the consultant will by more accurate if the client have good experience in the construction sector. The experienced client will provide an accurate required information of project and also have ability to check and assess the consultants' works to make sure that it is correct and acceptable. The obtained results are in line with the findings of Trost and Oberlender (2003), Babalola and Aladegbaiye (2006) who shown that, the client experience level plays a significant role in estimate accuracy.

"Clear scope definition for the client" was ranked in the second position by both the clients and consultants with RII of (0.826) and ranked 16th on the overall ranking. The responding clients ranked this factor in the second position with RII of (0.844) while the consultants ranked it in the first position with RII of (0.783). These results reflect a very close agreement between the respondents. This result is justified because project scope describes the work to be performed in a project and so a cost estimate highly depends on this scope definition. Also lack of proper scope definition has stated to be a major source of bad estimates and creates a potential for change or growth in scope during construction. The obtained results are in line with Odusami and Onukwube (2008), Liu and Zhu (2007), Babalola and Aladegbaiye (2006), Dysert (2006), Creedy (2005), Trost and Oberlender (2003), and Akintoye (2000) stated that the accuracy of a cost estimate is highly dependent on the level of detail and adequate project scope because it is a definition of the client's requirements for space, function, and quality of the proposed project.

"Experience of procuring construction" was ranked in the third position by both the clients and consultants with RII of (0.723) and ranked 45th on the overall ranking. The responding clients ranked this factor in the third position with RII of (0.764) while the consultants ranked it in the seven positions with RII of (0.650). The results demonstrate that, client in the construction process have diverse needs. To accommodate these

differing needs, various options for project delivery methods have evolved. Methods of procurement range from the basic (design and build) to the more complex (turnkey construction). Each method has its own benefits and disadvantages, and some methods are better suited for certain kinds of projects. This may likely affect the accuracy of the pre-tender cost estimate. The obtained results are very close to the results obtained by Elhag et al (2005) who ranked this factor in the 49th position out of 67 factors with severity index of (67.63%). Moreover, for the overall ranking, the obtained results are in line with results obtained by Akintoye (2000) who stated that this factor become less significant in the estimating function because the estimator must have considered this issue very carefully as part of his work. While, the obtained results are lower than the results obtained by Aibinu and Pasco (2008) who considered that this factor is the most significant affect on consistency of estimates with relative important index of (0.750). The difference in the opinions could be returned to the characteristics of the construction industry in Gaza Strip and the construction industry in Australia.

"Financial capabilities of the client" was ranked in the forth position by both the clients and consultants with RII of (0.697) and ranked 50th on the overall ranking. The responding clients ranked this factor in the forth position with RII of (0.693) while the consultants ranked it in the third position with RII of (0.717). This result reflects the satisfaction of both clients and consultants regarding the importance of the financial capabilities of the client for the accuracy of cost estimate. The results demonstrate that, clients who have the strong financial capabilities will be able to pay the payments on time for the contractors which mean build mutual trust and confidence among parties. This is because if clients are unable to pay contractors on time, contractors' cash flow and financial health will be affected. These results were far away in a similar study carried out by Odusami and Onukwube (2008) in Nigeria on factors influencing the accuracy of pretender cost estimate, they found that respondents ranked this factor in the 15th position with relative important index of (3.38). The results also are not in line with Enshassi et al (2007) who reported that this factor is the most important factors that affected contractors cost estimate in Gaza strip. The different in results could be return to the different targeted group by Enshassi et al (2007) and the current research. While it is compatible with results obtained with Elhag et al (2005) who ranked this factor in the 50th position out of 67 factors with severity index of (65.73%).

"Type of client" was ranked in the sixth position by both the clients and consultants with RII of (0.683) and ranked 54th on the overall ranking. The responding clients ranked this factor in the sixth position with RII of (0.662) while the consultants ranked it in the third position with RII of (0.717). The results revealed in a clear manner that, the consultants point of view regarding this factor is more important than clients. This because that the type of clients reflect his payment policy, and his financial capability. This result is in line with Akintoye (2000) who stated that the information on the client type is important as a part of project assessment. However, he indicated that this factor has not been weighted highly because the estimator must have considered this issue very carefully as part of his work. This result is not in line with other researchers who considered "Type of client" factor is one of the important factors such as Elhag et al (2005) who ranked this factor in the 16th position out of 67 factors with severity index of (80.53%). Enshassi et al (2007) who argued that when companies are satisfied with the project client such as UNRWA, which has a stable and very good financial position, they try to reduce their markup in order to win the bid. Moreover, supported by Skitmore and Drew (2003) that this factor is one of the most important factors that affect the pre-tender estimating.

"Client's method of payment" was ranked in the last position by both clients and consultants for this group with relative important indices of (0.666) and ranked 59th on the overall ranking respectively. The clients and consultants perceptions showed that, this factor does not play a significant role in pre-tender cost estimate accuracy. This result is justified, because the client has a role to arrange finances for the project and make predictions of the total cost of the project and the associated fees and charges. One of the main problems faced by contractors is delay in receiving payments from the client. This, in turn, has a knock on effect on suppliers and subcontractors who may not be paid until the main contractor has received the relevant interim payment from the client. This factor has not been weighted highly because the estimator must have considered this issue very carefully during preparing the pre-tender cost estimate. This result is not in line with similar study carried out by Al- Khaldi (1990) in Saudi Arabia on factors affecting the accuracy of construction costs estimating, it was concluded that client's method of payment have a very strong effect on the accuracy of the estimated cost.

4.3.1.1. Kendall's Coefficient of Concordance Test for degree of agreement between the clients and consultants (factors related to client characteristics)

To determine whether there is a significant degree of agreement among the both clients and consultants in the factors related to client characteristics, Kendall's coefficient of concordance is used as a measure of agreement among respondents.

Null Hypothesis: Ho: There is insignificant degree of agreement among the clients and consultants.

Alternative Hypothesis: H1: There is significant degree of agreement among the clients and consultants.

The Kendall's coefficients of concordance (WK) found equal 0.760 with P-value (Sig.) which is less than the level of significance, $\alpha = 0.05$, which lead to reject the null hypothesis, Ho. Therefore, it was concluded that there is sufficient evidence to support the alternative hypothesis, H1. Hence, there is a significant degree of agreement among the clients and consultants in this group.

4.3.1.2. Mann-Whitney Test for the differences between means (factors related to client characteristics)

The results illustrated in Table 4.10 shows that the p-value (Sig.) is greater than the level of significance $\alpha = 0.05$ for this group, As such, there is insignificant difference between the clients and consultants respondents means toward the factors related to client characteristics.

Table 4.10: Mann-Whitney test of clients' characteristics group and their p-value

Group	Clients			Consultants			P-value
	Mean	RI	Std. Deviation	Mean	RI	Std. Deviation	
Clients characteristics	3.695	0.739	0.633	3.589	0.718	0.668	0.352

4.3.2. Factors related to consultants, design parameters and information (Group 2)

Table 4.11 shows the relative importance indices and ranks of factors related to consultants, design parameters and information. This group contains 23 factors. In this part, only the most important factors and the least important factors will be discussed.

Table 4.11: Rank and RII of factors related to consultants, design parameters and information

Factors	Clients		Consultants		Both clients and consultants		Overall Rank
	RII	Rank	RII	Rank	RII	Group Rank	
The experience and skill level of the consultant	0.916	3	0.933	2	0.917	2	4
Project team's experience in the construction type	0.933	1	0.950	1	0.937	1	3
Designer's experience level	0.836	11	0.800	9	0.823	9	17
Number of estimating team members	0.631	23	0.550	23	0.600	23	63
Availability of all fields of specialization in a project team	0.840	10	0.842	7	0.840	8	13
Project team's capability to control the project	0.689	22	0.733	19	0.706	21	48
Impact of team integration and alignment	0.764	16	0.758	14	0.766	15	29
Level of involvement of the project manger	0.733	18	0.767	13	0.743	18	39
Availability of data base of bids on similar project (Historical cost data)	0.849	8	0.742	18	0.814	11	20
Quality of information and flow requirements	0.886	5	0.904	3	0.894	4	6
Completeness of cost information	0.884	6	0.900	4	0.891	5	7
Accuracy and reliability of cost information	0.902	4	0.867	6	0.891	5	7
Applicability of cost information	0.804	13	0.783	10	0.797	12	23
Procedure for updating cost information	0.805	12	0.757	15	0.788	13	25
Utilization of checklists to ensure completeness and technical basis	0.733	18	0.717	20	0.729	19	43
Quality of the assumptions used in preparing the estimate	0.764	16	0.748	17	0.759	17	34
Estimating method used	0.844	9	0.775	11	0.823	9	17
Volume of consultant's workload during estimation	0.698	21	0.650	22	0.677	22	55
Time allowed for preparing the cost estimate	0.796	14	0.775	11	0.786	14	26
Buildability of design	0.773	15	0.750	16	0.766	15	29
Clear and detail drawings and specifications	0.929	2	0.883	5	0.914	3	5
Completeness of project documents	0.876	7	0.833	8	0.863	7	11
Level of communication with Client and other design team consultants	0.733	18	0.717	20	0.729	19	43
All factors	**0.809**		**0.788**		**0.802**		

From Table 4.11, it is shown that, "Project team's experience in the construction type" was ranked in the first position by both clients and consultants for this group with relative important index of (0.933) and ranked 3rd on the overall ranking. Also, each of them separately ranked it in the first position with RII of (0.950) and (0.937) respectively. Both clients and consultants have a strong conformity at this factor to be in the first position. This emphasizes that, this factor is considered to be one of major factors that affect the accuracy of pre-tender cost estimate. The obtained results are agreed with Odusami and Onukwube (2008) where their results respondents ranked this factor in the third position out of 21 factors with a relative index of (4.14), and who emphasized that, if the project teams are well experienced in the construction of the proposed type of the project it will reflect in the detail that will be provided in the design. Moreover, the results also compatible with results obtained with Trost and Oberlender (2003) where their results respondents ranked this factor in the second significant factor and accounts for 13.3% of the estimate score. This factor emphasizes the importance of the experience level not only of the estimating team but also of the engineering staff (Trost and Oberlender, 2003).

"The experience and skill level of the consultant" was ranked in the second position by both the clients and consultants with RII of (0.917) and ranked 4th on the overall ranking. The responding clients ranked this factor in the third position with RII of (0.916) while the consultants ranked it in the second position with RII of (0.933). This emphasize that, to produce an accurate estimate the relevant persons involved with the estimating process must have the knowledge to support the estimating process. Experience not only in estimating but in all phases of project eg. planning, design, construction, local knowledge materials, conditions and prices. The results are in line with Odusami and Onukwube (2008) where their results respondents ranked this factor in the first position with a relative index of (4.34). Moreover, the obtained results are in line with Aibinu and Pasco (2008), Trost and Oberlender (2003), and Madi (2003) who stated that the accuracy of a cost estimate is highly dependent on the level of estimator experience. An experienced estimator may be the fastest method to produce quality cost estimate. Moreover, with Dysert (2003) who stated that if estimator was more professional, budget and other problems of the construction industry would be greatly reduced.

" Clear and detail drawings and specifications " was ranked in the third position by both the clients and consultants with RII of (0.914) and ranked 5th on the overall ranking. The

responding clients ranked this factor in the second position with RII of (0.929) while the consultants ranked it in the fifth position with RII of (0.883). This result illustrates clearly the influence of clear and detail drawings and specifications. The results revealed that, the more precise and clear drawings and specification are applied the more accurate cost estimate are setup. The obtained results are agreed with Odusami and Onukwube (2008) where their results respondents ranked this factor in the 5th position out of 21 factors with a relative index of (3.92), and who emphasized that, the more detailed the pre-contract design, the more accurate the pre-tender estimate. Moreover, the results also compatible with results obtained with Elhag et al (2005) who ranked this factor in the 5th position out of 67 factors, and emphasized that a job covered by drawings that are complete, intelligible, accurate, details, and well correlated can be priced much more realistically.

" Quality of information and flow requirements " was ranked in the fourth position by both the clients and consultants with RII of (0.894) and ranked 6th on the overall ranking. The responding clients ranked this factor in the fifth position with RII of (0.886) while the consultants ranked it in the third position with RII of (0.904). This results illustrate that, the estimator should gather enough project information for this function to be performed effectively and efficiency. Some of this information includes basic information on the client, project details, drawings, market conditions, environmental considerations, and other estimate-specific conditions that are often uncertain and difficult to assess. The obtained results are agreed with Odusami and Onukwube (2008) where their results respondents ranked this factor in the second most important with a relative index of (4.20), and who emphasized that, the more detailed information/cost data the more accurate the pre-tender estimate. Moreover, this result is matched with Liu and Zhu (2007) who stated that accurate prediction of construction costs is heavy dependent upon the availability of quality historical cost data and the level of professional expertise. In addition, the results are in line with Dysert (2006), Elhag et al (2005), Trost and Oberlender (2003), Akintoye (2000), and Ibrahim (2003) who argued that the accuracy of estimating is highly dependent on the amount and quality of information available to the estimator.

" Completeness of cost information " was ranked in the fifth position by both the clients and consultants with RII of (0.891) and ranked 7th on the overall ranking. The responding clients ranked this factor in the sixth position with RII of (0.884) while the consultants

ranked it in the fourth position with RII of (0.900). This result illustrates clearly that with completed cost information the estimator will make sure that every item in the project will be provided for and nothing will be left out in the estimate. The accuracy of a cost estimate will reflect the information available at the time of estimation. The obtained results are in line with Trost and Oberlender (2001), Babalola and Aladegbaiye (2006), and Dysert (2006) who stated that the accuracy of a cost estimate is highly dependent on the level of quality of cost information such as materials pricing, labor hours, labor ware rate, etc.

" Accuracy and reliability of cost information " was ranked in the fifth position by both the clients and consultants with RII of (0.891) and ranked 7th on the overall ranking. The responding clients ranked this factor in the forth position with RII of (0.902) while the consultants ranked it in the sixth position with RII of (0.867). This result illustrates clearly that the accuracy of estimate will not achieved once the cost information is not true or reliable. The obtained results are in line with Oberlender, and Trost (2001) where their results respondents ranked this factor in the second significant factor and accounts for 14.3% of the estimate score. Moreover, Hegazy (2002) stated that the construction process is heavily information dependent. Well-maintained and organized data is crucial to support the timely and cost-effective planning, bidding and control of projects.

" Volume of consultant's workload during estimation " and " Number of estimating team members " were ranked in the last two positions by both clients and consultants for this group with a low relative important indices of (0.600), (0.677) respectively and 55th and 63th in the overall ranking respectively. The clients and consultants are satisfied that these factors could not affect the accuracy of cost estimate. These results are justified because the volume of construction projects in last five years in Gaza was very limited, so there is enough time for consultants to prepared the required cost estimate very well. Moreover, the number of estimating team members is not important if the estimating team members are well qualified or experienced. These results were completely matched with Odusami and Onukwube (2008) and Akintoye (2000) where their results respondents ranked " Number of estimating team members " factor in the last position with a relative index of (2.72) and mean rank (2.857) respectively.

4.3.2.1. Kendall's Coefficient of Concordance Test for degree of agreement between the clients and consultants (factors related to consultants, design parameters and information)

To determine whether there is a significant degree of agreement among the both clients and consultants in the factors related to consultants, design parameters and information, Kendall's coefficient of concordance is used as a measure of agreement among respondents.

Null Hypothesis: Ho: There is insignificant degree of agreement among the clients and consultants.

Alternative Hypothesis: H1: There is significant degree of agreement among the clients and consultants.

The Kendall's coefficients of concordance (WK) found equal 0.894 with P-value (Sig.) which is less than the level of significance, $\alpha = 0.05$, which lead to reject the null hypothesis, Ho. Therefore, It was concluded that there is sufficient evidence to support the alternative hypothesis, H1. Hence, there is a significant degree of agreement among the clients and consultants in this group.

4.3.2.2. Mann-Whitney Test for the differences between means (factors related to consultants, design parameters and information)

The results illustrated in Table 4.12 shows that the p-value (Sig.) is greater than the level of significance $\alpha = 0.05$ for this group, As such, there is insignificant difference between the clients and consultants respondents means toward the factors related to consultants, design parameters and information.

Table 4.12: Mann-Whitney test of consultants, design parameters and information group

Group	Clients			Consultants			P-value
	Mean	RI	Std. Deviation	Mean	RI	Std. Deviation	
Consultants, design parameters and information	4.047	0.809	0.313	3.941	0.788	0.340	0.394

4.3.3. Factors related to project characteristics (Group 3)

Table 4.13 shows the relative importance indices and ranks of factors related to project characteristics. This group contains 11 factors. In this part, only the most important factors and the least important factors will be discussed.

Table 4.13: Rank and RII of factors related to project characteristics

Factors	Clients		Consultants		Both clients and consultants		Overall Rank
	RII	Rank	RII	Rank	RII	Group Rank	
Type of project (residential, commercial, industrial,….etc)	0.653	10	0.692	8	0.669	9	58
Type of structures (concrete, steel, masonry…etc)	0.618	11	0.667	9	0.637	11	62
Project size	0.786	2	0.700	6	0.759	5	34
Project duration	0.676	8	0.700	6	0.686	8	52
Location of project (town , village camp)	0.671	9	0.592	11	0.646	10	61
Site conditions (hot area,..etc)	0.769	3	0.750	3	0.766	2	29
Site constraint (access, storage, electricity..etc)	0.760	4	0.750	3	0.760	3	32
Site requirements	0.711	7	0.650	10	0.694	7	51
Project complexity	0.814	1	0.783	1	0.806	1	22
Method of construction /construction techniques requirements	0.756	5	0.767	2	0.760	3	32
Impact of project schedule	0.738	6	0.748	5	0.743	6	39
All factors	**0.723**		**0.709**		**0.720**		

From Table 4.13, it is shown that, " Project complexity " was ranked in the first position by both clients and consultants for this group with relative important index of (0.806) and ranked 22^{ed} on the overall ranking. Also, each of them separately ranked it in the first position with RII of (0.814) and (0.783) respectively. Both clients and consultants have a strong conformity at this factor to be in the first position. Complexity of design and construction entail the technical complexity of the task, the amount of overlap and interdependences in construction stage, project organization, site layout, and unpredictability of work and site construction, all of which can hinder performance on site. This result is supported by study carried by Madi (2003) in Gaza Strip on factors affecting accuracy of cost estimation building contractors, who illustrated that the complexity of project in Gaza Strip is likely to increase construction costs and was ranked as 28th out of 51 factors. In a similar study carried out by Odusami and Onukwube (2008)

in Nigeria, it was established that respondents ranked this factor as the sixth most important factor with a relative index of (3.88). Other study carried out by Akintoye (2000) in UK on factors influencing contractors cost estimating practice, it was established that this factor was the most important. Madi (2003) and Akintoye's (2000) study was based on contractor's estimating while this study is based on clients and consultants pre-tender estimate. It is expected that this factor will be considered as important by respondents in this group because pre-tender estimate is an attempt to forecast contractor tender sum. So some factors that may affect accuracy of contractors cost estimate may also affect accuracy of consultants pre-tender estimate. The project complexity issue has already been addressed by Elhag et al (2005) who considered it as a key factor. It was ranked as 8th out of 67 factors. The difference in ranking between this research and other researches is probably due to the type of respondents.

" Site conditions " was ranked in the second position by both the clients and consultants with RII of (0.766) and ranked 29th on the overall ranking. Also, each of them separately ranked it in the third position with RII of (0.769) and (0.750) respectively. This emphasizes that, to produce an accurate estimate the estimator must have the knowledge of site conditions such as hot area, topography, soil ...etc. The result is matching with Enshassi et al (2007) case study, in which the winning contractor decreased his estimate because the project location was classified as quit area. Moreover, this result is very close to the result obtained with Elhag et al (2005) who ranked this factor in the 26th position out of 67 factors.

" Method of construction /construction techniques requirements " was ranked in the third position by both the clients and consultants with RII of (0.760) and ranked 32^{ed} on the overall ranking. The responding clients ranked this factor in the fifth position with RII of (0.756) while the consultants ranked it in the second position with RII of (0.767). The results revealed in a clear manner that, the consultants point of view regarding this factor is more important than clients. This because that this factor mainly depend on some factors which are related to the client such as the scope of the work, characteristic of the project, and the size of the project. This result is very close to the results obtained with Elhag et al (2005) where their results respondents ranked this factor in the 36th position out of 67 factors. Moreover, this result is supported by Madi (2003) who illustrated that 34.8% of surveyed companies rated the method of construction with a moderate degree of

effect on the accuracy of tender cost estimating in Gaza Strip and was ranked as 24th out of 51 factors with mean rank (3.02). However in the similar study carried out by Odusami and Onukwube (2008) in Nigeria, it was established that respondents ranked this factor as the tenth most important factor with a relative index of (3.56). And also not supported by Akintoye (2000) where his results respondents ranked this factor in the third most important out of 24 factors. The difference in ranking between this research and other researches is probably due different construction industry between Gaza and other country like UK and Nigeria.

" Site constraint " was ranked in the third position by both the clients and consultants with RII of (0.760) and ranked 32ed on the overall ranking. The responding clients ranked this factor in the fourth position with RII of (0.760) while the consultants ranked it in the third position with RII of (0.750). The results revealed that, the information about the site is very important to reach the accurate estimate. The site constraints were concerned with the project site need temporary roads, access to the site, surface topography and drainage, storage limitation, the availability of electricity, water, and other services, and the expected difficulties associated with site. This result is supported by Madi (2003) who illustrated that the site constraints factor have a moderate effect on the accuracy of cost estimating in Gaza Strip. However Odusami and Onukwube (2008) where their results respondents ranked this factor in the sixteen position with a relative index of (3.36).

" Project size " was ranked in the fifth position by both the clients and consultants with RII of (0.759) and ranked 34th on the overall ranking. The responding clients ranked this factor in the second position with RII of (0.786) while the consultants ranked it in the sixth position with RII of (0.700). This result showed that the size of project has a week effect on the accuracy of cost estimation in Gaza Strip due to its small size and simple scope. This result is very close to the results obtained with Elhag et al (2005) where their results respondents ranked this factor in the 30th position out of 67 factors. Moreover, it is supported by Skitmore and Drew (2003) who stated that this factor is one of the most determinant factors of project costs.

" Location of project (town , village, camp)" and " Type of structures (concrete, steel, masonry…etc) " were ranked in the last two positions by both clients and consultants for this group with a low relative important indices of (0.646), (0.637) respectively and 61th

and 62th in the overall ranking respectively. The clients and consultants are satisfied that these factors could not affect on the accuracy of pre-tender cost estimate. These results are justified because all cities and villages in Gaza Strip are accessible by means of suitable roads infrastructure, and the size of projects in Gaza Strip are small and simple execution so these factors have a little affect in tender estimation. These results were completely matched with Elhag et al (2005) where their results respondents ranked these two factors in the last position in project characteristics group. While, the results are not in line with Odusami and Onukwube (2008) who ranked "Project Location" factor in the 8th position out of 21 factors with a relative index of (3.70), and ranked " Type of structures " factor in the 14th position out of 21 factors with a relative index of (3.44). Moreover, the results are not in line with Akintoye (2000) who stated that the remoteness of site must be analyzed completely for cost elements that are unique to the location and have the greatest effect on the cost estimate. He ranked "Project Location" factor in the 9th position out of 24 factors with mean rank (3.798), and ranked " Type of structures " factor in the 12th position out of 24 factors with mean rank (3.76).

4.3.3.1 Kendall's Coefficient of Concordance Test for degree of agreement between the clients and consultants (factors related to project characteristic)

To determine whether there is a significant degree of agreement among the both clients and consultants in the factors related to project characteristic, Kendall's coefficient of concordance is used as a measure of agreement among respondents.

Null Hypothesis: Ho: There is insignificant degree of agreement among the clients and consultants.

Alternative Hypothesis: H1: There is significant degree of agreement among the clients and consultants.

The Kendall's coefficients of concordance (WK) found equal 0.768 with P-value (Sig.) which is less than the level of significance, $\alpha = 0.05$, which lead to reject the null hypothesis, Ho. Therefore, It was concluded that there is sufficient evidence to support the alternative hypothesis, H1. Hence, there is a significant degree of agreement among the clients and consultants in this group.

4.3.3.2 Mann-Whitney Test for the differences between means (factors related to project characteristic)

The results illustrated in Table 4.14 shows that the p-value (Sig.) is greater than the level of significance $\alpha = 0.05$ for this group, As such, there is insignificant difference between the clients and consultants respondents means toward the factors related to project characteristic.

Table 4.14: Mann-Whitney test of project characteristic group and their p-value

Group	Clients			Consultants			P-value
	Mean	RI	Std. Deviation	Mean	RI	Std. Deviation	
project characteristic	3.614	0.723	0.580	3.545	0.709	0.609	0.781

4.3.4. Factors related to contract requirement and procurement method (Group 4)

Table 4.15 shows the relative importance indices and ranks of factors related to contract requirement and procurement method. This group contains 9 factors. In this part, only the most important factors and the least important factors will be discussed.

Table 4.15: Rank and RII of factors related to contract requirement and procurement method

Factors	Clients		Consultants		Both clients and consultants		Overall Rank
	RII	Rank	RII	Rank	RII	Group Rank	
Type of contract	0.782	3	0.767	4	0.774	4	28
Tender selection method (open, selected, negotiation, ..etc.)	0.813	2	0.833	2	0.814	2	20
Clear contract conditions	0.858	1	0.875	1	0.866	1	10
Method of procurement (traditional, design and build, project management, etc)	0.711	6	0.750	6	0.723	6	45
Risk sharing between construction parties	0.742	5	0.758	5	0.749	5	37
Content of disputes resolution methods clause (litigation/arbitration/others)	0.689	8	0.642	9	0.674	9	56
Amount of specialist work	0.769	4	0.825	3	0.791	3	24
The taxes and other financial requirements on tender	0.711	6	0.725	7	0.717	7	47
Advanced payment	0.689	8	0.725	7	0.703	8	49
All factors	**0.752**		**0.767**		**0.757**		

From Table 4.15, it is shown that, "Clear contract conditions" was ranked in the first position by both clients and consultants for this group with relative important index of (0.866) and ranked 10th on the overall ranking. Also, each of them separately ranked it in the first position with RII of (0.858) and (0.875) respectively. Both clients and consultants have a strong conformity at this factor to be in the first position. This emphasize that, this factor is considered to be one of major factors that affect the accuracy of pre-tender cost estimate because many types of defects could occur to contract documents such as the omission of certain general conditions, special provisions, arrangement of contact divisions, ambiguous wording in the arbitration clause, etc. The obtained results is agreed with Dysert (2006) who stated that clear contract conditions and specifications ensure the proper delivery of service by the contractors, and protect the organization from loss or damages.

"Tender selection method" was ranked in the second position by both clients and consultants for this group with relative important index of (0.814) and ranked 20th on the overall ranking. Also, each of them separately ranked it in the second position with RII of (0.813) and (0.833) respectively. Both clients and consultants have a strong conformity at this factor to be in the second position. The result is in line with results obtained with Elhag et al (2005) where their results respondents ranked this factor in the 2ed position in contract requirement group and 24th position out of 67 factors. From the statistics computed for this group, it is evident that respondents regarded the factors contained within the group as having little effect upon construction cost estimates. This concluded that no evidence was found to favor the management contracting procurement system over the traditional contracting method in reducing the overall construction costs.

" Amount of specialist work " was ranked in the third position by both the clients and consultants with RII of (0.791) and ranked 24th on the overall ranking. The responding clients ranked this factor in the fourth position with RII of (0.769) while the consultants ranked it in the third position with RII of (0.825). The result is in line with results obtained with Madi (2003) where their results respondents ranked this factor in the 22th position out of 51 factors with mean rank (3.12). Moreover, it is very close to the results obtained with Odusami and Onukwube (2008) where their results respondents ranked this factor in the 18th position out of 21 factors with a relative index of (3.22). And similar result was found by Akintoye (2000) study in which this factor was ranked in the in the

20th position out of 24 factors. He stated that specialist works are most likely to be undertaken by subcontractors, in addition to work that requires off-site production such as steel and concrete prefabrication.

" Type of contract " was ranked in the fourth position by both the clients and consultants with RII of (0.774) and ranked 28th on the overall ranking. The responding clients ranked this factor in the third position with RII of (0.782) while the consultants ranked it in the fourth position with RII of (0.767). This emphasize that, type of project affects the cost of project because of the risk involved in some type of contact (i.e lump sum contact). The obtained result is agreed with Elhag et al (2005) where their results respondents ranked this factor in the 5th position in contract requirement group and in 46th position out of 67 factors.

" Advanced payment" and " Content of disputes resolution methods clause " were ranked in the last two positions by both clients and consultants for this group with a low relative important indices of (0.703), (0.674) respectively and 49th and 56th in the overall ranking respectively. The clients and consultants are satisfied that these factors could not affect on the accuracy of pre-tender cost estimate. These results are justified because the projects in Gaza Strip are generally small sizes and the contracts usually do not include a clause of advanced payment in their conditions. These results were supported by Madi (2003) who argued that these two factors have a moderate effect under the group of contract requirement. Moreover, these results were completely matched with Elhag et al (2005) where their results respondents ranked " Content of disputes resolution methods clause " factor in the 55th position out of 67 factors with severity index (62.83).

4.3.4.1. Kendall's Coefficient of Concordance Test for degree of agreement between the clients and consultants (factors related to contract requirement and procurement method)

To determine whether there is a significant degree of agreement among the both clients and consultants in the factors related to contract requirement and procurement method, Kendall's coefficient of concordance is used as a measure of agreement among respondents.

Null Hypothesis: Ho: There is insignificant degree of agreement among the clients and consultants.

Alternative Hypothesis: H1: There is significant degree of agreement among the clients and consultants.

The Kendall's coefficients of concordance (WK) found equal 0.800 with P-value (Sig.) which is less than the level of significance, $\alpha = 0.05$, which lead to reject the null hypothesis, Ho. Therefore, It was concluded that there is sufficient evidence to support the alternative hypothesis, H1. Hence, there is a significant degree of agreement among the clients, and consultants in this group.

4.3.4.2. Mann-Whitney Test for the differences between means (factors related to contract requirement and procurement method)

The results illustrated in Table 4.16 shows that the p-value (Sig.) is greater than the level of significance $\alpha = 0.05$ for this group, As such, there is insignificant difference between the clients and consultants respondents means toward the factors related to Contract requirement and procurement method.

Table 4.16: Mann-Whitney test of contract requirement and procurement method group

Group	Clients			Consultants			P-value
	Mean	RI	Std. Deviation	Mean	RI	Std. Deviation	
Contract requirement and procurement method	3.758	0.752	0.609	3.833	0.767	0.558	0.662

4.3.5. External factors and market conditions (Group 5)

Table 4.17 shows the relative importance indices and ranks of factors related to external factors and market conditions. This group which is related to the external factors and market conditions contains 14 factors. In this part, only the most important factors and the least important factors will be discussed. The overall factors are shown in Table 4.17.

Table 4.17: Rank and RII of factors related to market conditions

Factors	Clients		Consultants		Both clients and consultants		Overall Rank
	RII	Rank	RII	Rank	RII	Group Rank	
Material (prices /availability /supply /quality /imports)	0.947	1	0.967	1	0.954	1	1
Labor (costs /availability /performance /productivity)	0.840	4	0.800	5	0.829	5	15
Equipment (costs/availability/supply/condition /performance)	0.827	6	0.800	5	0.820	6	19
Impact of government regulations requirement	0.667	13	0.608	12	0.649	13	60
Number of competitors in the market	0.800	8	0.633	11	0.746	9	38
Classification and level of competitors in the tendering	0.809	7	0.708	8	0.777	7	27
Bidding climate comprising of competitiveness	0.796	9	0.683	10	0.757	8	36
Multiple projects being advertised at the same time	0.764	10	0.692	9	0.743	10	39
The prevailing economic climate	0.836	5	0.842	4	0.840	4	13
Currency exchange fluctuation	0.889	3	0.850	3	0.877	3	9
Timing of advertisement (weather effects)	0.711	12	0.574	13	0.670	12	57
Social and cultural impact	0.551	14	0.508	14	0.540	14	64
Closure and blockade	0.947	1	0.958	2	0.951	2	2
Donor type	0.738	11	0.725	7	0.734	11	42
All factors	**0.794**		**0.740**		**0.778**		

From Table 4.17, it is shown that, " Material (prices/availability/supply/quality/imports)" was ranked in the first position by both clients and consultants for this group with relative important index of (0.954) and ranked 1st on the overall ranking. Also, each of them separately ranked it in the first position with RII of (0.947) and (0.967) respectively. Both clients and consultants have a strong conformity at this factor to be in the first position. This result is justified, because any problem of materials in price, availability, supply, quality, and imports would significantly affect the progress of project. In case of borders closures, construction materials are run out from markets, leading to elevated prices by suppliers, in addition, the quantity of materials entering Gaza Strip are limited. During any closure the construction process is suspended, so this factor has to be considered very carefully by estimators in preparing their pre-tender estimate. These results are supported by Enshassi et al (2007) who stated that continuous increase in materials rate may be justified by the repeated closure on Gaza Strip and the instability of local market. And with Elhag et al (2005) where their results respondents ranked this factor in the 2^{ed} position in market conditions group but in the 17th position out of overall ranking. Besides, the obtained results from this study at this factor is higher than Odusami and

Onukwube (2008) results that ranked this factor in the seventh position out of 21 factors with a relative important index of (3.78). The discriminations between the obtained results in this research and others could be return to the different environmental conditions between Gaza strip and UK and Nigeria.

" Closure and blockade " was ranked in the second position by both the clients and consultants with RII of (0.951) and ranked 2^{ed} on the overall ranking. The responding clients ranked this factor in the first position with RII of (0.947) while the consultants ranked it in the second position with RII of (0.954). Both clients and consultants have a strong conformity that the closure affects the accuracy of pre-tender cost estimate. This may be effects the increasing of materials price, non availability of materials during the closure period. The obtained results are in line with Al-Shanti (2003) who studied the effect of closure on projects cost in Gaza strip. He revealed that all respondents (100%) agree that the closure has big effect on the prices of the basic materials such as cement and aggregate, which result in an increase of project cost. Moreover, the results are supported by Madi (2003) who ranked this factor in third position out of all ranking with mean rank (4.53). The results of the survey regarding the factors of market conditions shown that these factors have the most important effect the accuracy of pre-tender cost estimate in Gaza Strip.

" Currency exchange fluctuation " was ranked in the third position by both the clients and consultants with RII of (0.877) and ranked 9th on the overall ranking. Also, each of them separately ranked it in the third position with RII of (0.889) and (0.850) respectively. Both clients and consultants have a strong conformity at this factor to be in the third position. The results revealed in a clear manner that, the clients and consultants point of view regarding this factor is more intensive and important. Gaza Strip currency is new Israeli shekel. However most construction projects financing by US Dollars. Any severely changes in the currency exchange rates and huge inflations of the currencies force many contractors to increase their tender price in order to minimize the risk of any potential increase in the unit price of construction materials. The obtained result is matching with Enshassi et al (2007) case study, in which the winning contractor did not pay any attention to currency exchange fluctuations, since the tender's currency was in US Dollars. He also mentioned that if the tender's currency was in the local currency, he might have increased his tender's. This factor was ranked in the eighth position out of

highest ten factors affecting tender cost estimate. Besides, the obtained results from this study at this factor is higher than Madi (2003) results that ranked this factor in the sixth position out of 51 factors with mean rank (4.02).

" The prevailing economic climate " was ranked in the fourth position by both the clients and consultants with RII of (0.840) and ranked 13th on the overall ranking. The responding clients ranked this factor in the fifth position with RII of (0.836) while the consultants ranked it in the fourth position with RII of (0.842). This emphasized that, when the economy in Gaza Strip is buoyant and stable contractors tend to be less competitive in tendering and when there is economic recession they are more competitive, since the pre-tender estimate is an attempt to forecast the contractor's tender sum. The obtained results are lower than Akintoye (2000) results that ranked this factor in the fourth position out of 24 factors. And Odusami and Onukwube (2008) study in which this factor was ranked in the in the fourth position out of 21 factors with a relative important index of (4.12) and indicated that, this factor has to be considered by estimators in preparing their pre-tender estimate.

" Impact of government regulations requirement " and " Social and cultural impact " were ranked in the last two positions by both clients and consultants for this group with a low relative important indices of (0.649), (0.540) respectively and 60th and 64th in the overall ranking respectively. The clients and consultants are not satisfied that these factors could affect on the accuracy of pre-tender cost estimate. These results were supported by Al-Kaldi (1990) who argued that these two factors have a low significance on estimating process and scored 50% and 61% respectively. Moreover, these results were completely matched with Elhag et al (2005) where their results respondents ranked " Impact of government regulations requirement " factor in the 60th position out of 67 factors with severity index (60.00).

4.3.5.1. Kendall's Coefficient of Concordance Test for degree of agreement between the clients and consultants (factors related to external factors and market conditions)

To determine whether there is a significant degree of agreement among the both clients and consultants in the factors related to external factors and market conditions, Kendall's coefficient of concordance is used as a measure of agreement among respondents.

Null Hypothesis: Ho: There is insignificant degree of agreement among the clients and consultants.

Alternative Hypothesis: H1: There is significant degree of agreement among the clients and consultants.

The Kendall's coefficients of concordance (WK) found equal 0.842 with P-value (Sig.) which is less than the level of significance, $\alpha = 0.05$, which lead to reject the null hypothesis, Ho. Therefore, It was concluded that there is sufficient evidence to support the alternative hypothesis, H1. Hence, there is a significant degree of agreement among the clients, and consultants in this group.

4.3.5.2. Mann-Whitney Test for the differences between means (factors related to external factors and market conditions)

The results illustrated in Table 4.18 shows that the p-value (Sig.) is greater than the level of significance $\alpha = 0.05$ for this group. As such, there is insignificant difference between the clients and consultants respondents means toward the factors related to external factors and market conditions.

Table 4.18: Mann-Whitney test of external factors and market conditions group

Group	Clients			Consultants			P-value
	Mean	RI	Std. Deviation	Mean	RI	Std. Deviation	
External factors and market conditions	3.971	0.794	0.420	3.698	0.740	0.569	0.058

4.3.6. Comparison between all groups of ranking of factors affecting accuracy of pre-tender cost estimate in Gaza Strip

Table 4.19 shows the comparison of results of all groups of factors affecting accuracy of pre-tender cost estimate in Gaza Strip according to relative importance index of each group.

Table 4.19: Rank and RII of all groups

Group	Clients		Consultants		Both clients and consultants	
	RII	Rank	RII	Rank	RII	Rank
Factors related to consultants, design parameters and information	0.809	1	0.788	1	0.802	1
Factors related to external factors and market conditions	0.794	2	0.740	3	0.778	2
Factors related to contract requirement and procurement method	0.752	3	0.767	2	0.757	3
Factors related to clients characteristics	0.739	4	0.718	4	0.732	4
Factors related to project characteristics	0.723	5	0.709	5	0.720	5

From Table 4.19, it is shown that, " Factors related to consultants, design parameters and information " was ranked in the first position by both the clients and consultants with RII of (0.802). Also, each of them separately ranked it in the first position with RII of (0.809) and (0.788) respectively. Six factors out of the 10 top factors being related to this group. This emphasized that, this is the most important group of factors affecting the accuracy of pre-tender cost estimate. Also it emphasized that, the consultants, design parameters and information are crucial in accurate estimation of construction costs at the pre-tender stage. Also these findings indicated that construction project costs were more affected by architects and consultants than by others. This result is in line with Trost and Oberlender (2003) and Elhag et al (2005).

On the other hand, it is shown that, " Factors related to external factors and market conditions " was ranked in the second position by both the clients and consultants with RII of (0.778). The responding clients ranked this group in the second position with RII of (0.794) while the consultants ranked it in the third position with RII of (0.740). This group consist of fourteen factors, three factors out of the 10 top factors being related to

this group. Two of them which are " Material (prices/ availability/ supply/ quality/ imports)" and " Closure and blockade" were ranked as the most important factor by both the clients and consultants respectively. Gaza Strip is an occupied territory that suffers from bad political and economic situations, and closure of borders which are under Israeli control. Frequent closures of borders lead to shortage of materials which are necessary for construction processes. Also closures lead to escalate the prices of these materials and eventually result in economic inflation side. Closure of borders largely contributes to the paralysis of construction related activities and consequently leads to damage the construction industry in Gaza Strip. This result is in line with At and Okintoye and Fitzgerald (2000) who stated that external factors have significant influence on the accuracy of estimation..

On the other hand, it is shown that, " Factors related to contract requirement and procurement method " was ranked in the third position by both the clients and consultants with RII of (0.757). The responding clients ranked this group in the third position with RII of (0.752) while the consultants ranked it in the second position with RII of (0.767). Nine factors are included in this group. The top factor in this group is " Clear contract conditions " which rank 10th overall. This is an indicate that the clear contact conditions have a clear effect on tender prices.

Moreover, it is shown that, " Factors related to clients characteristics " was ranked in the fourth position by both the clients and consultants with RII of (0.732). Also, each of them separately ranked it in the fourth position with RII of (0.739) and (0.718) respectively. This group contains seven factors. The top ranked factors in this group are " Client experience level " which rank 12th overall and " Clear scope definition for the client " which rank 16th overall. It is evident that both clients and consultants regarded the factors contained within the group as having little effect upon the accuracy of pre-tender cost estimate in Gaza Stip.

Finally, it is shown that, " Factors related to project characteristics " was ranked in the last position by both the clients and consultants with RII of (0.720). Also, each of them separately ranked it in the last position with RII of (0.723) and (0.709) respectively. This group includes eleven factors. The top ranked factors in this group are " Project complexity " which rank 22ed overall and " Site conditions " which rank 29th overall.

All factors of this group have low importance index with respect to other factors in this research. It is evident that, factors related to this group having exert little influence in the preparation of construction estimates.

4.3.7. Comparison among clients and consultants regarding to the important factors affecting accuracy of pre-tender cost estimate in Gaza Strip

Table 4.20 shows the most important ten factors affecting accuracy of pre-tender cost estimate in Gaza Strip organized by both clients and consultants.

Table 4.20: Ten most important factors affecting accuracy of pre-tender cost estimate in Gaza Strip

Rank	Overall results	RII	Clients	RII	Consultants	RII
1	Material (prices/ availability/ supply/ quality/ imports)	0.954	Material (prices/ availability/ supply/ quality/ imports)	0.947	Material (prices/ availability/ supply/ quality/ imports)	0.967
2	Closure and blockade	0.951	Closure and blockade	0.947	Closure and blockade	0.958
3	Project team's experience in the construction type	0.937	Project team's experience in the construction type	0.933	Project team's experience in the construction type	0.950
4	The experience and skill level of the consultant	0.917	Clear and detail drawings and specifications	0.929	The experience and skill level of the consultant	0.933
5	Clear and detail drawings and specifications	0.914	The experience and skill level of the consultant	0.916	Quality of information and flow requirements	0.904
6	Quality of information and flow requirements	0.894	Accuracy and reliability of cost information	0.902	Completeness of cost information	0.900
7	Completeness of cost information	0.891	Client experience level	0.889	Clear and detail drawings and specifications	0.883
8	Accuracy and reliability of cost information	0.891	Currency exchange fluctuation	0.889	Clear contract conditions	0.875
9	Currency exchange fluctuation	0.877	Quality of information and flow requirements	0.886	Accuracy and reliability of cost information	0.867
10	Clear contract conditions	0.866	Completeness of cost information	0.884	Currency exchange fluctuation	0.850

From Table 4.20, it is shown that, " Material (prices/availability/supply/quality/imports)", " Closure and blockade ", and ' Project team's experience in the construction type " were identified as the three most important factor affecting accuracy by both clients and consultants. These results show how these factors can greatly affect the accuracy of pre-tender cost estimate in Gaza Strip.

In addition, there are six more factors between clients and consultants; these factors are " The experience and skill level of the consultant "," Clear and detail drawings and specifications "," Quality of information and flow requirements "," Completeness of cost information "," Accuracy and reliability of cost information ", and " Currency exchange fluctuation ".

" Clear contract conditions " was ranked eighth according to consultants' results and it was not listed within the ten important factors in the clients' results. On the hand, " Client experience level " was ranked seventh according to clients' results and it was not listed within the ten important factors in the consultants' results. This conclude that, there are no big differences between both clients and consultants perspectives regarding the ranking of most important ten factors affecting accuracy of pre-tender cost estimate in Gaza Strip.

4.3.8. Ranking of all factors affecting accuracy of pre-tender cost estimate in Gaza Strip

Table 4.21 shows the rank of all factors affecting accuracy of pre-tender cost estimate in Gaza Strip from point view of clients and consultants.

Table 4.21: Ranking of all factors affecting accuracy of pre-tender cost estimate in Gaza Strip

All Factors	RII	Rank	Group
Material (prices/ availability/ supply/ quality/ imports)	0.954	1	External factors and market conditions
Closure and blockade	0.951	2	External factors and market conditions
Project team's experience in the construction type	0.937	3	Consultants, design parameters and information
The experience and skill level of the consultant	0.917	4	Consultants, design parameters and information
Clear and detail drawings and specifications	0.914	5	Consultants, design parameters and information
Quality of information and flow requirements	0.894	6	Consultants, design parameters and information
Completeness of cost information	0.891	7	Consultants, design parameters and information
Accuracy and reliability of cost information	0.891	7	Consultants, design parameters and information
Currency exchange fluctuation	0.877	9	External factors and market conditions
Clear contract conditions	0.866	10	Contract requirement and procurement method
Completeness of project documents	0.863	11	Consultants, design parameters and information
Client experience level	0.843	12	Clients characteristics
Availability of all fields of specialization in a project team	0.840	13	Consultants, design parameters and information
The prevailing economic climate	0.840	13	External factors and market conditions

All Factors	RII	Rank	Group
Labor (costs/availability/performance/productivity)	0.829	15	External factors and market conditions
Clear scope definition for the client	0.826	16	Clients characteristics
Designer's experience level	0.823	17	Consultants, design parameters and information
Estimating method used	0.823	17	Consultants, design parameters and information
Equipment (costs/availability/supply/condition/performance)	0.820	19	External factors and market conditions
Availability of data base of bids on similar project (Historical cost data).	0.814	20	Consultants, design parameters and information
Tender selection method (open, selected, negotiation, ..etc.)	0.814	20	Contract requirement and procurement method
Project complexity	0.806	22	Project characteristics
Applicability of cost information	0.797	23	Consultants, design parameters and information
Amount of specialist work	0.791	24	Contract requirement and procurement method
Procedure for updating cost information	0.788	25	Consultants, design parameters and information
Time allowed for preparing the cost estimate	0.786	26	Consultants, design parameters and information
Classification and level of competitors in the tendering	0.777	27	External factors and market conditions
Type of contract	0.774	28	Contract requirement and procurement method
Impact of team integration and alignment	0.766	29	Consultants, design parameters and information
Buildability of design	0.766	29	Consultants, design parameters and information
Site conditions (topography, hot area,..etc)	0.766	29	Project characteristics
Site constraint (access, storage, electricity..etc)	0.760	32	Project characteristics
Method of construction /construction techniques requirements	0.760	32	Project characteristics
Quality of the assumptions used in preparing the estimate	0.759	34	Consultants, design parameters and information
Project size	0.759	34	Project characteristics
Bidding climate comprising of competitiveness	0.757	36	External factors and market conditions
Risk sharing between construction parties	0.749	37	Contract requirement and procurement method
Number of competitors in the market	0.746	38	External factors and market conditions
Level of involvement of the project manger	0.743	39	Consultants, design parameters and information
Impact of project schedule	0.743	39	Project characteristics
Multiple projects being advertised at the same time	0.743	39	External factors and market conditions
Donor type	0.734	42	External factors and market conditions
Utilization of checklists to ensure completeness and technical basis	0.729	43	Consultants, design parameters and information
Level of communication with Client and other design team consultants	0.729	43	Consultants, design parameters and information
Experience of procuring construction	0.723	45	Clients characteristics
Method of procurement (traditional, design and build, project management, etc)	0.723	45	Contract requirement and procurement method
The taxes and other financial requirements on tender	0.717	47	Contract requirement and procurement method

All Factors	RII	Rank	Group
Project team's capability to control the project	0.706	48	Consultants, design parameters and information
Advanced payment	0.703	49	Contract requirement and procurement method
Financial capabilities of the client	0.697	50	Clients characteristics
Site requirements	0.694	51	Project characteristics
Client's evaluation and awarding policy	0.686	52	Clients characteristics
Project duration	0.686	52	Project characteristics
Type of client (Government/ UN Agencies/ NGOs …etc)	0.683	54	Clients characteristics
Volume of consultant's workload during estimation	0.677	55	Consultants, design parameters and information
Content of disputes resolution methods clause (litigation/arbitration/others)	0.674	56	Contract requirement and procurement method
Timing of advertisement (weather effects)	0.670	57	External factors and market conditions
Type of project (residential, commercial, industrial,….etc)	0.669	58	Project characteristics
Client's method of payment	0.666	59	Clients characteristics
Impact of government regulations requirement	0.649	60	External factors and market conditions
Location of project (town , village camp)	0.646	61	Project characteristics
Type of structures (concrete, steel, masonry…etc)	0.637	62	Project characteristics
Number of estimating team members	0.600	63	Consultants, design parameters and information
Social and cultural impact	0.540	64	External factors and market conditions

From Table 4.21, the respondents of clients and consultants ranked the " Material (prices/availability/supply/quality/imports)" in the first position. " Closure and blockade " was ranked as the second important factor affecting accuracy of pre-tender cost estimate. The results as shown in table 4.20 illustrate that the both clients and consultants agreed that "Material (prices/ availability/ supply/ quality/ imports) " , "Closure and blockade ", " Project team's experience in the construction type "," The experience and skill level of the consultant ", " Clear and detail drawings and specifications ", " Quality of information and flow requirements ", " Completeness of cost information " ," Accuracy and reliability of cost information ", " Currency exchange fluctuation ", and " Clear contract conditions " were the top ten and most important factors affecting pre-tender cost estimate in Gaza Strip. The discussion and analysis of most important factors was mentioned in the previous paragraphs at this chapter.

4.4. Section Three : Clients / Consultants relationship

One of the research objectives is to study the relationship between the perspective of clients and consulting firms of the essential factors affecting accuracy of pre-tender cost estimate in Gaza Strip. In order to reach the requirements, two type of tests were used.

4.4.1. Kendall's Coefficient of concordance test for degree of agreement between the clients and consultants

To determine whether there is a significant degree of agreement among the both clients and consultants, Kendall's coefficient of concordance is used as a measure of agreement among respondents. The calculated Kendall's Coefficients of concordance for each group are listed in Table 4.22.

Null Hypothesis: Ho : There is insignificant degree of agreement among the clients and consultants.

Alternative Hypothesis: H1: There is significant degree of agreement among the clients and consultants.

The results illustrated in Table 4.22 shows that the p-values (Sig.) are less than the level of significance $\alpha = 0.05$, which lead to reject the null hypothesis, Ho. Therefore, It was concluded that there is sufficient evidence to support the alternative hypothesis, H1. Hence, there is a significant degree of agreement among the clients, and consultants.

Table 4.22: Kendall's Coefficient of concordance

Group	KW	Sig.
Factors related to clients characteristics	0.760	0.000*
Factors related to consultants, design parameters and information	0.894	0.000*
Factors related to project characteristics	0.768	0.000*
Factors related to contract requirement and procurement method	0.800	0.000*
Factors related to external factors and market conditions	0.842	0.000*
All groups	0.872	0.000*

* The agreement is significant at level of significant $\alpha = 0.05$

4.4.2. Mann-Whitney Test for the differences between means

Mann-Whitney test to examine if there is a statistical significant difference between the clients and consultants respondents means toward the factors affecting accuracy of pre-tender cost estimate in Gaza Strip.

Ho: There is no difference of the opinions between clients, and consultants in the factors related to the all factors affecting pre-tender cost estimate in Gaza Strip at significance level $\alpha = 0.05$.

The results illustrated in Table 4.23 shows that the p-value (Sig.) is greater than the level of significance $\alpha = 0.05$ for each group, which lead to accept the null hypothesis and then there is insignificant difference between the clients and consultants respondents means toward the factors affecting pre-tender cost estimate in Gaza Strip.

Table 4.23: Mann-Whitney test of each groups and their p-values

Group	Clients			Consultants			P-value
	Mean	RI	Std. D.	Mean	RI	Std. D.	
Factors related to clients characteristics	3.695	0.739	0.633	3.589	0.718	0.668	0.352
Factors related to consultants, design parameters and information	4.047	0.809	0.313	3.941	0.788	0.340	0.394
Factors related to project characteristics	3.614	0.723	0.580	3.545	0.709	0.609	0.781
Factors related to contract requirement and procurement method	3.758	0.752	0.609	3.833	0.767	0.558	0.662
Factors related to external factors and market conditions	3.971	0.794	0.420	3.698	0.740	0.569	0.058
All groups	3.877	0.775	0.328	3.766	0.753	0.394	0.217

CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS

5.1. Introduction

This chapter includes the conclusions and practical recommendations to improve the cost estimation practice in the Gaza Strip in the pre-tender stage, and additional studies in this subject are proposed. This research aimed to assist clients and consultants in Gaza Strip in improving the predictive ability of the pre-tender cost estimate by exploring the affecting factors of estimate accuracy.

This research had four primary objectives, which were achieved through the data collection using survey techniques and the detail analysis of the survey results. The first objective was to identify the factors affecting accuracy of pre-tender cost estimate in Gaza Strip. The second objective was to study the perspective of clients of the essential factors affecting accuracy of pre-tender cost estimate in Gaza Strip. The third objective was to study the perspective of consulting firms of the essential factors affecting accuracy of pre-tender cost estimate in Gaza Strip. The last objective was to study the relationship between the perspective of clients and consulting firms of the essential factors affecting accuracy of pre-tender cost estimate in Gaza Strip.

These objectives were achieved through two interdependent phases. The first phase included an intensive literature review. This phase was necessary to identify potential factors that affect the accuracy of pre-tender cost estimate. The literature review and pilot interviews helped in identifying 64 potential factors which are grouped into five groups. These groups are client characteristics, consultant, design parameters and information, project characteristics, contract requirement and procurement method, and external factors and market conditions.

The second phase included the necessary steps in collecting all required information. A questionnaire was sent to 50 clients and 28 consultants in Gaza Strip. Only 46 clients and 24 consultants participated in the survey.

5.2. Conclusions:

Based on the results obtained from this research, the following conclusions of the research are drawn:

- An exploration of factors affecting the accuracy of pre-tender cost estimate was conducted in order to find the degree of importance for each factor. The result of analysis of 64 factors considered in the questionnaire filled by representative sample of professional clients and consultants concluded that the ten most important factors affecting the accuracy of pre-tender cost estimate are:

  1. Material (prices/ availability/ supply/ quality/ imports)
  2. Closure and blockade
  3. Project team's experience in the construction type
  4. The experience and skill level of the consultant
  5. Clear and detail drawings and specifications
  6. Quality of information and flow requirements
  7. Completeness of cost information
  8. Accuracy and reliability of cost information
  9. Currency exchange fluctuation
  10. Clear contract conditions

These findings show how these factors can greatly affect the accuracy of pre-tender cost estimate. Both clients and consultants have to be aware for these factors during preparing the pre-tender estimate.

- The five least important factors as agreed by two professionals clients and consultants are Impact of government regulations requirement, Location of project (town , village camp), Type of structures (concrete, steel, masonry…etc), Number of estimating team members, and Social and cultural impact. The results show that these factors have a little affecting on the accuracy of pre-tender cost estimate. However, it is preferable to be considered by both clients and consultants during preparing cost estimate.

- "Material (prices/ availability/ supply/ quality/ imports)" is given the highest rank of all the 64 factors. This result was expected, and this might be due to the borders closures and instability of political situations in Gaza Strip.

- " Closure and blockade" is the second important factor affecting accuracy of pre-tender cost estimate. This result will reflect that, the closure has big effect on the prices of the basic materials such as cement and aggregate, which result in an increase of project cost. This factor ranked in this position due to the current political situation in Gaza Strip.

- The major factors in the client characteristics group which affect accuracy pre-tender cost estimate are " Client experience level "," Clear scope definition for the client ", and " Experience of procuring construction ". From these results it can be concluded that, the client experience plays a significant role in estimate accuracy. Moreover, Clients should clearly identify their requirements and needs whither they will be able to achieve them with their financial ability.

- The major factors in the consultants, design parameters and information group which affect accuracy pre-tender cost estimate are " Project team's experience in the construction type ", " The experience and skill level of the consultant", and " Clear and detail drawings and specifications". From these results it can be concluded that, the accuracy of a cost estimate is highly dependent on the level of estimator experience, project team's experience, and architects experience. Such experiences may be the fastest method to produce quality cost estimate.

- The major factors in the project characteristics group which affect accuracy pre-tender cost estimate are, " Project complexity "," Site conditions ", " Site constraint" and " Method of construction /construction techniques requirements". From these results it can be concluded that, to produce an accurate estimate the estimator must have the high knowledge of project characteristics such as the project complexity, site conditions, site constraint and method of construction.

- The major factors in the contract requirement and procurement method group which affect accuracy pre-tender cost estimate are," Clear contract conditions ", " Tender selection method ", and " Amount of specialist work ". These results

reflect the importance of contact requirement and procurement method, and how affect in cost estimating accuracy.

- The major factors in the external factors and market conditions group which affect accuracy pre-tender cost estimate are," Material (prices /availability /supply /quality/imports)","Closure and blockade", and "Currency exchange fluctuation ". This result indicates the materials are considered the main factor that affects the project price. In Gaza Strip and according to extra ordinary political and economic situation, there are great difficulties to get materials, specially because the borders of Gaza Strip is controlled by Israeli occupation. Moreover, the Israeli closure on Gaza Strip is another factor which affects the prices of the basic materials such as cement and aggregate. These factors increase the final cost of the project.

- The overall results in the five groups indicated that, the factors that are related to consultants, design parameters and information were ranked in the first position among other groups with a relative important index of (0.802). The factors that are related to external factors and market conditions were ranked in the second position with a relative important index of (0.778). The factors that are related to contract requirement and procurement method were ranked in the third position with a relative important index of (0.757). The factors that are related to clients characteristics were ranked in the fourth position with a relative important index of (0.732), while the factors that are related to project characteristics were ranked in the last position with a relative important index of (0.720). This emphasized that, the consultants, design parameters and information are crucial in accurate estimation of construction costs at the pre-tender stage.

- Six out of the 10 top factors being related to the consultants, design parameters and information group. These findings indicated that construction project costs were more affected by architects and consultants than by others.

- From the results, it was concluded that, two parties clients and consultants generally agree in the ranking order of the factors affecting accuracy of pre-tender cost estimate. This was proven by high Kendall's coefficients of concordance achieved within each group. The results revealed that, both clients

and consultants have the same concerns on factors that affect the accuracy of pre-tender cost estimate.

- From the results by used Mann-Whitney test, it was concluded that, there is no difference of the opinions between clients and consultants in the factors affecting accuracy of pre-tender cost estimate at significance level of 0.05.

5.3. Recommendations

The following recommendations are the most important ones that can be deduced by this research:

- Clients and consultants should give more attention to cost estimating process in order to enhance productivity and accuracy. They should monitor the performance of their estimates in terms of accuracy and hire a qualified technical staff in order to obtained the accurate estimate.

- A clear identification of the construction project requirements is essential before the start of the estimate. Care by clients should be taken to keep changes in the scope of work as minimum as possible.

- Clients and consultants should prepare cost estimates using as complete a set of drawings and specifications as possible

- The consultant must efficiently manage the design process to provide the best information possible to the client for effective decision making.

- Clients and consultants should obtain accurate information from manufacturers and suppliers about the cost of materials or systems.

- Clients and consultants should review drawings, specifications, and construction sequences and durations to determine total construction costs. A site visit is strongly recommended to enable the cost engineer to relate the physical characteristics of the project to the available design parameters and details. This is particularly important on projects with unusual site conditions, major maintenance and repair projects.

- After every project is complete, clients and consultants have to compare actual costs with projected costs to evaluate their cost estimating proficiency and improve their skill.

- Clients and consultants are recommended to use keep continuously records for all cost related data and built a historical database of finished project. This unique database should be the main source of information that will be used in estimating future projects. This information should be organized in a computerized system to improve the accuracy of cost estimation practice in Gaza Strip.

- Estimates based on updated price information should be considered in order to come up with accurate estimate and avoid any wrong estimation.

- Strong control in the material price by the Government should be made to minimize or eliminate the supplier manipulation.

- Government is recommended to adopt material prices list to enable estimators, if there is a change in the costs of certain items, to come up with the best estimates.

- It is recommended to conduct training courses, seminars, and workshops in estimating methods, estimating process and computer applications in estimating. This training, seminars, and workshops aim to improve the local practice in cost estimating and increases the capabilities of estimators in using estimating software packages.

5.4. Recommendations for future studies

1. It is suggested to that the boundaries of such a study should be widened to include West Bank.

2. The same study might be conducted to analysis previous actual completed projects

3. It is suggested that a study might be conducted on the effects of the construction industry demand on the availability and cost of the material.

4. A study could be performed to find factors affecting materials cost in Gaza strip.

5. The same study might be conducted to include the other factors affecting the estimated cost that were important but were not listed in the questionnaire.

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Annex (1): The Questionnaire (Arabic Version)

The Islamic University
Faculty of Engineering
Deanery of Graduate Studies

الجامعة الإسلامية – غزة
كلية الهندسة
عمادة الدراسات العليا

العوامل المؤثرة على دقة تقدير التكلفة في مرحلة ما قبل العطاء في قطاع غزه

Factors Affecting Accuracy of Pre-tender Cost Estimate in Gaza Strip

الأخ المالك / الأخ الاستشاري الفاضل.....بعد التحية

بداية أتقدم بجزيل الشكر والتقدير للمساهمة بجزء من وقتكم وجهدكم في تعبئة هذا الاستبيان.

إن هذا الاستبيان يهدف إلى دراسة العوامل المؤثرة على دقة تقدير التكلفة في مرحلة ما قبل العطاء في قطاع غزه وهو جزء من البحث التكميلي لنيل درجة الماجستير في إدارة المشاريع الهندسية من الجامعة الإسلامية بغزه، آملين أن تؤدي نتائج هذا البحث لتحسين أداء المهندسين العاملين في مجال تقدير تكلفة العطاءات قبل مرحلة إنشاء المشروع.

الفئة المستهدفة: المهندسون ذوي الخبرة في مجال تقدير تكلفة العطاءات والعاملين في المكاتب الاستشارية والمؤسسات الحكومية والغير حكوميه.

المعلومات الواردة في الاستبيان:
إن كافة المعلومات الواردة في هذا لاستبيان سوف يتم استخدامها لأغراض البحث مع الالتزام التام بالمحافظة على السرية المطلقة للمعلومات الخاصة بكم.

مكونات الاستبيان :
ينقسم هذا الاستبيان إلى قسمين رئيسين لكي يحقق الهدف الذي وضع من اجله :

القسم الأول : معلومات عامه بمعبأ الاستبيان
القسم الثاني : العوامل المؤثرة على دقة تقدير التكلفة في مرحلة ما قبل العطاء

تحت إشراف
الأستاذ الدكتور/ عدنان انشاصي

الباحث
منذر احمد عبد الهادي

2009

القسم الأول: معلومات عامه بمعبأ الاستبيان:

1.1 طبيعة العمل ☐ مكتب استشاري ☐ مالك (وزارة، بلدية، مؤسسة دولية،NGO's ...)

1.2 تخصص معبئ الاستبيان

☐ مدير مشروع ☐ مدير دائرة ☐ مهندس مكتب ☐ مقدر تكاليف ☐ غير ذلك (ما هي).....

1.3 سنوات الخبرة لمعبئ الاستبيان

☐ اقل من **5** سنوات ☐ من **(5- 10)** سنوات ☐ من **(11- 15)** سنة ☐ أكثر من **15** سنة

1.4 عدد سنوات خبرة المؤسسة

☐ اقل من **10** سنوات ☐ من **(10-15)** سنوات ☐ من **(16-20)** سنة ☐ أكثر من **20** سنة

1.5 عدد المشاريع التي قامت مؤسستكم بتقدير تكاليف لها في مرحلة التحضير للعطاء خلال السنوات الخمس الأخيرة

☐ اقل من **10** ☐ من **(10- 20)** ☐ من **(21- 30)** ☐ أكثر من **30**

1.6 حجم المشاريع التي قامت مؤسستكم بتقدير تكاليف لها في مرحلة تحضير العطاء خلال السنوات الخمس الأخيرة (مليون دولار)

☐ اقل من **5** ☐ من **5** إلى اقل من **10** ☐ من **10** إلى اقل من **15** ☐ **15** فما فوق

1.7 هل أنت راض عن المستوى الحالي لدقة تقدير التكلفة في مرحلة تحضير العطاء؟

☐ راض جداً ☐ راض ☐ محايد ☐ غير راض ☐ غير راض جداً

1.8 هل يوجد قسم لتقدير التكلفة في مؤسستكم ؟ ☐ نعم ☐ لا

1.9 كم عدد الموظفين الذين يعملون في قسم تقدير التكلفة في مؤسستكم؟

☐ اقل من **3** ☐ من **(3- 4)** ☐ أكثر من **4**

1.10 في حالة عدم وجود قسم تقدير التكلفة في مؤسستكم، في رأيك، ما هي الأسباب الرئيسية لعدم وجود هذا القسم؟

☐ ليس ضرورياً.

☐ حجم العمل قليل، لذلك لا يوجد هناك حاجه لوجود قسم تقدير العطاءات.

☐زيادة النفقات العامة للمؤسسة.

☐أسباب أخرى،----------

القسم الثاني : العوامل المؤثرة على دقة تقدير التكلفة في مرحلة ما قبل العطاء في قطاع غزه

من الدراسات السابقة، لوحظ أن هناك مجموعة من العوامل التي تؤثر في دقة تقدير التكلفة في مرحلة ما قبل العطاء ، من هذه العوامل متصلة بخصائص المالك ومنها ما يتعلق بالاستشار ي وعناصر التصميم والمعلومات، والمجموعة الثالثة تتعلق بخصائص المشروع، والمجموعة الرابعة تتعلق بشروط العقد وطرق الشراء، أما المجموعة الأخيرة فـتتعلق بعوامل خارجية وظروف السوق

الرجاء حسب رأيك تحديد مدى أهمية هذه العوامل التي تؤثر في دقة تقدير التكلفةفي مرحلة ما قبل العطاء :

الرقم	العوامل المؤثرة على دقة تقدير التكلفة في مرحلة ما قبل العطاء	درجة الأهميـــة				
		مهم جداً	مهم	مهم الى حد ما	مهم بدرجة قليله	غير مهم
1	***عوامل تتعلق بخصائص المالك***					
1.1	نوع المالك (حكومة / الوكالات التابعة للأمم المتحدة / المنظمات غير الحكومية... الخ)					
1.2	مستوى خبرة المالك					
1.3	وضوح تعريف نطاق العمل لدى المالك					
1.4	القدرة المالية للمالك					
1.5	سياسة الدفعات المالية للمالك					
1.6	خبرة المالك في طرق استدراج العروض					
1.7	سياسة المالك في تقييم العطاءات والترسيه					
2	***عوامل تتعلق بالاستشاري وعناصر التصميم والمعلومات***					
2.1	مستوى خبرة ومهارة الاستشاري					
2.2	خبرة فريق المشروع لدى الاستشاري في نوعية التشييد المراد تقدير تكلفته					
2.3	مستوى خبرة المصمم					
2.4	عدد أعضاء فريق التقدير					
2.5	توفر جميع التخصصات في فريق المشروع					
2.6	قدرة فريق المشروع للتحكم في المشروع					

الرقم	العوامل المؤثرة على دقة تقدير التكلفة في مرحلة ما قبل العطاء	درجة الأهميـــة				
		مهم جداً	مهم	مهم الى حد ما	مهم بدرجة قليله	غير مهم
2	***عوامل تتعلق بالاستشاري وعناصر التصميم والمعلومات***					
2.7	تأثير تكامل وانتظام فريق المشروع					
2.8	مستوى مشاركة مدير المشروع في عملية التقدير					
2.9	وجود قاعدة بيانات لمناقصات لمشروع مماثل (بيانات التكلفة التاريخية)					
2.10	جودة وتدفق المعلومات المطلوبة أثناء تقدير التكلفة					
2.11	اكتمال معلومات التكلفة					
2.12	دقة وثقة المعلومات المتعلقة بالتكاليف					
2.13	قابلية المعلومات المتعلقة بالتكاليف للتطبيق					
2.14	الإجراءات المتبعة لتحديث المعلومات المتعلقة بالتكاليف					
2.15	استخدام قوائم التدقيق لضمان الاكتمال والأساس التقني للمطلوب تقديره					
2.16	جودة الافتراضات المستخدمة في إعداد التقديرات					
2.17	الطريقة المستخدمة في تقدير التكلفة					
2.18	حجم العمل لدى الاستشاري أثناء فترة التقدير					
2.19	الوقت المتاح لإعداد تقدير التكلفة					
2.20	إمكانية تنفيذ المخططات					
2.21	وضوح وتفاصيل المخططات والمواصفات					
2.22	اكتمال وثائق المشروع					
2.23	مستوى التواصل مع المالك و فريق التصميم التابع لاستشاريين آخرين					

الرقم	العوامل المؤثرة على دقة تقدير التكلفة في مرحلة ما قبل العطاء	درجة الأهميـــــة				
		مهم جداً	مهم	مهم الى حد ما	مهم بدرجة قليله	غير مهم
3	***عوامل تتعلق بخصائص المشروع***					
3.1	نوع المشروع (سكني، تجاري، صناعي،.....الخ)					
3.2	نوع المنشأة (باطون، حديد، طوب، .....الخ)					
3.3	حجم المشروع					
3.4	مدة المشروع					
3.5	موقع المشروع (مدينه، قرية، مخيم)					
3.6	ظروف الموقع (طبوغرافية ، مناطق ساخنة بجانب الحدود.....الخ)					
3.7	معوقات موقع المشروع (الطرق، المخازن، الكهرباء،..الخ)					
3.8	احتياجات ومتطلبات الموقع					
3.9	صعوبة المشروع					
3.10	طريقة البناء / تقنيات التشييد المطلوبة					
3.11	تأثير الجدول الزمني للمشروع					
4	***عوامل تتعلق بمتطلبات العقد وطريقة الشراء***					
4.1	نوع العقد					
4.2	طريقة طرح المناقصة (مفتوحة ، بالاختيار ، بالتفاوض ، ...غير ذلك)					
4.3	وضوح شروط العقد					
4.4	طريقة استدراج العروض (تقليدي، تصميم وبناء، إدارة المشروع ....الخ)					
4.5	توزيع المخاطر بين أطراف العقد (المالك/الاستشاري / المقاولين)					
4.6	احتواء العقد على بند أساليب حل المنازعات (التحكيم / التقاضي / أخرى)					
4.7	قيمة الأعمال التي تحتاج إلى خبرات خاصة					
4.8	قيمة الضرائب والمكوس المطلوبة عن العطاء					
4.9	دفعات متقدمه					

الرقم	العوامل المؤثرة على دقة تقدير التكلفة في مرحلة ما قبل العطاء	درجة الأهميـــة				
		مهم جداً	مهم	مهم الى حد ما	مهم بدرجة قليله	غير مهم
5	***عوامل خارجية وظروف السوق***					
5.1	المواد (أسعار ، توفر، التوريد، جودة، استيراد من الخارج)					
5.2	العمالة (تكاليف، توفر، الأداء، الإنتاجية)					
5.3	المعدات (تكاليف، توفر، التوريد، الحاله، الأداء)					
5.4	تأثير متطلبات القوانين الحكومية					
5.5	عدد المتنافسين الموجودين في السوق					
5.6	تصنيف ومستوى المتنافسين في العطاء					
5.7	المناخ التنافسي للعطاء					
5.8	حجم المشاريع المعلن عنها في نفس الوقت					
5.9	الوضع الاقتصادي السائد					
5.10	تقلب صرف العملات					
5.11	وقت الاعلان عن العطاء					
5.12	تأثير العوامل الاجتماعية والثقافية					
5.13	الإغلاق والحصار					
5.14	نوع الممول					

شاكرين مشاركتكم في تعبئة هذا الاستبيان ، ودمتم

الباحث/ منذر احمد عبد الهادي

Annex (2): The Questionnaire (English Version)

The Islamic University

Faculty of Engineering

Deanery of Graduate Studies

الجامعة الإسلامية – غزة

كلية الهندسة

عمادة الدراسات العليا

Factors Affecting Accuracy of Pre-tender Cost Estimate in Gaza Strip

Dear Client/Consultant,

To start, I would like to present my appreciation and thanks to you for taking part of your time and effort to complete this questionnaire.

This questionnaire aims to study the factors affecting accuracy of pre-tender cost estimate in Gaza Strip. This is part of partial fulfillment of the requirements for degree f master of science in construction management from the Islamic University-Gaza. We are hoping that the result of this questionnaire will improve the ability of consultants for estimation tender at project pre-tender stage

Information in the questionnaire :
The information in the questionnaire will be used for academic research with complete commitment foe absolute confidence to your information.

Content of questionnaire :
This questionnaire is divided into two sections to accomplish the aim which was put for:-

Section (1) : Respondents' general information.
Section (2) : Factors affecting accuracy of pr-tender cost estimate.

Researcher **Supervisor**

Munther Abdel-Hadi **Prof. Dr. Adnan Enshassi**

2009

Section One:	Respondents' general information

1.1 Type of Works ☐ Consultant ☐ Client (Ministry, municipality, International Institutions, NGO's..)

1.2 Position of Respondent

☐ Project Manager ☐Head of Department ☐ Office Eng. ☐ Estimator ☐ Other (Mention pls) ----

1.3 Respondent's years of experience

☐Less than 5 years ☐ 5-10 years ☐11-15 years ☐More than 15 years

1.4 Client/Consultant's years of experience

☐Less than 10 years ☐10-15 years ☐16-20 years ☐ More than 20 years

1.5 The number of projects that your organization preparing cost estimate for in the pre-tender stage during the last five years

☐Less than 10 ☐From (10-15) ☐ From (21-30) ☐ More than 30

1.6 The size of projects that your organization preparing cost estimate for in the pre-tender stage during the last five years (Million Dollars)

☐Less than 5 ☐From 5 to less than 10 ☐ From 10 to less than 15 ☐ 15 or over

1.7 Are you satisfied with the current level of pre-tender cost estimate accuracy?

☐ Very satisfied ☐ Satisfied ☐ Neutral ☐ Not satisfied ☐ Very not satisfied

1.8 Is there an estimating unit in your organization /firm? ☐ Yes ☐ No

1.9 How many employees are working in estimating unit in your organization / firm?

☐ Less than 3 ☐ 3-4 ☐4 or more

1.10 In case of there is no an estimating unit in your organization/firm, in your opinion, what are the main reasons for not existing of an estimating unit?

☐ Estimating unit is not necessary.

☐Volume of the work is small, so there is no need for estimating unit.

☐Increase the general overhead of the organization / firm

☐ Other reasons, ----------

Section Two:	Factors affecting accuracy of pre-tender cost estimate

From the literatures and the adopted pilot study, it was found that, five groups can be categories as a factors affecting accuracy of pre-tender cost estimate . Group of these factors related to the client characteristics. The second group related to the consultant, design parameters and information. The third group, related to the project characteristics. The fourth group, related to the contract requirement and procurement method, while the fifth group related to the external factors and market conditions.

Please express your opinion on how the degree of importance of these factors affecting the accuracy of pre-tender cost estimate.

No.	Factors affecting accuracy of pre-tender cost estimate	Degree of Importance				
		Very Important	Important	Somewhat important	Little Importance	Not Important
1	*Factors related to clients characteristics*					
1.1	Type of client (Government/ UN Agencies/ NGOs …etc)					
1.2	Client experience level					
1.3	Clear scope definition for the client					
1.4	Financial capabilities of the client					
1.5	Client's method of payment					
1.6	Experience of procuring construction					
1.7	Client's evaluation and awarding policy					
2	*Factors related to consultants, design parameters and information*					
2.1	The experience and skill level of the consultant					
2.2	Project team's experience in the construction type					
2.3	Designer's experience level					
2.4	Number of estimating team members					
2.5	Availability of all fields of specialization in a project team					
2.6	Project team's capability to control the project					

No.	Factors affecting accuracy of pre-tender cost estimate	Degree of Importance				
		Very Important	Important	Somewhat important	Little Importance	Not Important
2	*Factors related to consultants, design parameters and information (continue)*					
2.7	Impact of team integration and alignment					
2.8	Level of involvement of the project manger					
2.9	Availability of data base of bids on similar project (Historical cost data)					
2.10	Quality of information and flow requirements					
2.11	Completeness of cost information					
2.12	Accuracy and reliability of cost information					
2.13	Applicability of cost information					
2.14	Procedure for updating cost information					
2.15	Utilization of checklists to ensure completeness and technical basis					
2.16	Quality of the assumptions used in preparing the estimate					
2.17	Estimating method used					
2.18	Volume of consultant's workload during estimation					
2.19	Time allowed for preparing the cost estimate					
2.20	Buildability of design					
2.21	Clear and detail drawings and specifications					
2.22	Completeness of project documents					
2.23	Level of communication with Client and other design team consultants					

No.	Factors affecting accuracy of pre-tender cost estimate	Degree of Importance				
		Very Important	Important	Somewhat important	Little Importance	Not Important
3	*Factors related to project characteristics*					
3.1	Type of project (residential, commercial, industrial,….etc)					
3.2	Type of structures (concrete, steel, masonry…etc)					
3.3	Project size					
3.4	Project duration					
3.5	Location of project (town , village camp)					
3.6	Site conditions (topography, hot area,..etc)					
3.7	Site constraint (access, storage, electricity..etc)					
3.8	Site requirements					
3.9	Project complexity					
3.10	Method of construction /construction techniques requirements					
3.11	Impact of project schedule					
4	*Factors related to contract requirement and procurement method*					
4.1	Type of contract					
4.2	Tender selection method (open, selected, negotiation, ..etc.)					
4.3	Clear contract conditions					
4.4	Method of procurement (traditional, design and build, project management, etc)					
4.5	Risk sharing between construction parties					
4.6	Content of disputes resolution methods clause (litigation/arbitration/others)					
4.7	Amount of specialist work					
4.8	The taxes and other financial requirements on tender					
4.9	Advanced payment					

No.	Factors affecting accuracy of pre-tender cost estimate	Degree of Importance				
		Very Important	Important	Somewhat important	Little Importance	Not Important
5	*External factors and market conditions*					
5.1	Material (prices/availability/supply/quality/imports)					
5.2	Labor (costs/availability/performance/productivity)					
5.3	Equipment (costs/availability/supply/condition /performance)					
5.4	Impact of government regulations requirement					
5.5	Number of competitors in the market					
5.1	Material (prices/availability/supply/quality/imports)					
5.6	Classification and level of competitors in the tendering					
5.7	Bidding climate comprising of competitiveness					
5.8	Multiple projects being advertised at the same time					
5.9	The prevailing economic climate					
5.10	Currency exchange fluctuation					
5.11	Timing of advertisement (weather effects)					
5.12	Social and cultural impact					
5.13	Closure and blockade					
5.14	Donor type					

Annex (3): Questionnaire Validity

A. Factors related to the clients' characteristics:

Table (1) clarifies the correlation coefficient for each factor of clients' characteristics and the total of this group. The p-values (Sig.) are less than 0.05, so the correlation coefficients for all factors of this group are significant at $\alpha = 0.05$, so it can be said that the factors of this group are consistent and valid to be measure what it was set for.

Table 1: Correlation coefficient of each factor of clients' characteristics and the total of this group

No.	Factor	Spearman Correlation Coefficient	P-Value (Sig.)
1	Type of client (Government/ UN Agencies/ NGOs …etc)	0.605	0.000*
2	Client experience level	0.285	0.008*
3	Clear scope definition for the client	0.327	0.003*
4	Financial capabilities of the client	0.604	0.000*
5	Client's method of payment	0.650	0.000*
6	Experience of procuring construction	0.660	0.000*
7	Client's evaluation and awarding policy	0.638	0.000*

***** The agreement is significant at level of significant $\alpha = 0.05$

B. Factors related to the consultants, design parameters and information:

Table (2) clarifies the correlation coefficient for each factor of consultants, design parameters and information and the total of this group. The p-values (Sig.) are less than 0.05, so the correlation coefficients for all factors of this group are significant at $\alpha = 0.05$, so it can be said that the factors of this group are consistent and valid to be measure what it was set for.

Table 2: Correlation coefficient of each factor of consultants, design parameters and information and the total of this group

No.	Factor	Spearman Correlation Coefficient	P-Value (Sig.)
1	The experience and skill level of the consultant	0.222	0.032*
2	Project team's experience in the construction type	0.250	0.018*
3	Designer's experience level	0.513	0.000*
4	Number of estimating team members	0.330	0.003*
5	Availability of all fields of specialization in a project team	0.344	0.002*
6	Project team's capability to control the project	0.588	0.000*
7	Impact of team integration and alignment	0.403	0.000*
8	Level of involvement of the project manger	0.224	0.031*
9	Availability of data base of bids on similar project (Historical cost data)	0.293	0.007*

Table 2: Correlation coefficient of each factor of consultants, design parameters and information and the total of this group (continue)

No.	Factor	Spearman Correlation Coefficient	P-Value (Sig.)
10	Quality of information and flow requirements	0.259	0.015*
11	Completeness of cost information	0.217	0.036*
12	Accuracy and reliability of cost information	0.266	0.013*
13	Applicability of cost information	0.493	0.000*
14	Procedure for updating cost information	0.423	0.000*
15	Utilization of checklists to ensure completeness and technical basis	0.620	0.000*
16	Quality of the assumptions used in preparing the estimate	0.333	0.003*
17	Estimating method used	0.280	0.009*
18	Volume of consultant's workload during estimation	0.461	0.000*
19	Time allowed for preparing the cost estimate	0.492	0.000*
20	Buildability of design	0.459	0.000*
21	Clear and detail drawings and specifications	0.501	0.000*
22	Completeness of project documents	0.350	0.002*
23	Level of communication with Client and other design team consultants	0.594	0.000*

***** The agreement is significant at level of significant $\alpha = 0.05$

C. Factors related to the project characteristics

Table (3) clarifies the correlation coefficient for each factor of project characteristics and the total of this group. The p-values (Sig.) are less than 0.05, so the correlation coefficients for all factors of this group are significant at $\alpha = 0.05$, so it can be said that the factors of this group are consistent and valid to be measure what it was set for.

Table 3: Correlation coefficient of each factor of project characteristics and the total of this group

No.	Factor	Spearman Correlation Coefficient	P-Value (Sig.)
1	Type of project (residential, commercial, industrial,….etc)	0.671	0.000*
2	Type of structures (concrete, steel, masonry…etc)	0.736	0.000*
3	Project size	0.659	0.000*
4	Project duration	0.657	0.000*
5	Location of project (town , village camp)	0.525	0.000*
6	Site conditions (topography, hot area,..etc)	0.544	0.000*
7	Site constraint (access, storage, electricity..etc)	0.648	0.000*
8	Site requirements	0.577	0.000*
9	Project complexity	0.540	0.000*
10	Method of construction /construction techniques requirements	0.561	0.000*
11	Impact of project schedule	0.569	0.000*

***** The agreement is significant at level of significant $\alpha = 0.05$

D. Factors related to the contract requirement and procurement method

Table (4) clarifies the correlation coefficient for each factor of contract requirement and procurement method and the total of this group. The p-values (Sig.) are less than 0.05, so the correlation coefficients for all factors of this group are significant at $\alpha = 0.05$, so it can be said that the factors of this group are consistent and valid to be measure what it was set for.

Table 4: Correlation coefficient of each factor of contract requirement and procurement method and the total of this group

No.	Factor	Spearman Correlation Coefficient	P-Value (Sig.)
1	Type of contract	0.608	0.000*
2	Tender selection method (open, selected, negotiation, ..etc.)	0.711	0.000*
3	Clear contract conditions	0.459	0.000*
4	Method of procurement (traditional, design and build, project management, etc)	0.666	0.000*
5	Risk sharing between construction parties	0.544	0.000*
6	Content of disputes resolution methods clause (litigation/arbitration/others)	0.530	0.000*
7	Amount of specialist work	0.455	0.000*
8	The taxes and other financial requirements on tender	0.572	0.000*
9	Advanced payment	0.468	0.000*

***** The agreement is significant at level of significant $\alpha = 0.05$

E. External factors and market conditions

Table (5) clarifies the correlation coefficient for each factor of external factors and market conditions and the total of this group. The p-values (Sig.) are less than 0.05, so the correlation coefficients for all factors of this group are significant at $\alpha = 0.05$, so it can be said that the factors of this group are consistent and valid to be measure what it was set for.

Table 5: Correlation coefficient of each factor of external factors and market conditions and the total of this group

No.	Factor	Spearman Correlation Coefficient	P-Value (Sig.)
1	Material (prices/availability/supply/quality/imports)	0.474	0.000*
2	Labor (costs/availability/performance/productivity)	0.474	0.000*
3	Equipment (costs/availability/supply/condition/performance)	0.546	0.000*
4	Impact of government regulations requirement	0.560	0.000*
5	Number of competitors in the market	0.700	0.000*
6	Classification and level of competitors in the tendering	0.572	0.000*
7	Bidding climate comprising of competitiveness	0.545	0.000*

Table 5: Correlation coefficient of each factor of external factors and market conditions and the total of this group (continue)

No.	Factor	Spearman Correlation Coefficient	P-Value (Sig.)
8	Multiple projects being advertised at the same time	0.682	0.000*
9	The prevailing economic climate	0.508	0.000*
10	Currency exchange fluctuation	0.555	0.000*
11	Timing of advertisement (weather effects)	0.639	0.000*
12	Social and cultural impact	0.571	0.000*
13	Closure and blockade	0.333	0.002*
14	Donor type	0.508	0.000*

***** The agreement is significant at level of significant $\alpha = 0.05$