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A Cost Estimate System for Gaza Strip Construction Contractors

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Dedication

*I would like to dedicate this thesis to my
wife and family for their infinite and kind
support*

Yaser Al-Shanti

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ABSTRACT

Effective estimating and tendering process is a key to the success of a construction project. The preparation of cost estimate for a project is one of the most difficult tasks in project management. Nowadays, successful cost estimating has to be based on thorough and updated information, and processed utilizing a well designed estimating software.

The aim of this thesis has been to explore the local practice in construction cost estimating and develop a cost estimating system to facilitate the local estimating practice mainly in building construction. Construction cost estimating related literature has been generally reviewed; meanwhile some estimating software packages have been reviewed also. The researcher explores *Microsoft Excel* capabilities and tries to acquire the skills needed to utilize these capabilities in developing a cost estimating system which he names "Gaza Estimator Software" (GES).

A survey questionnaire supported by personal interviews is used to explore the local practice in cost estimating. Fifty-one questionnaires are distributed to contractors of first, second, and third classes. Forty questionnaires are received and analyzed.

The study shows that most of contracting companies are still estimating the projects manually. Shortage of user friendly estimating software packages and lack of available qualified personnel in using computer-based estimating systems are considered the main obstacles in using computer in construction estimating.

GES is a PC-based system which has been designed to run under *Microsoft Windows*. *Microsoft Excel* is used in developing GES, as most companies in Gaza Strip are familiar with it. Full description of GES has been given with detailed implementation procedures. GES has been evaluated to test its suitability to local estimating practice. Evaluation of GES has addressed both conceptual and practical issues.

One of the main recommendations of this research is to encourage local contracting companies to have an estimating software package and use it in estimating the works in order to get more accurate estimates, save time, minimize error, and hopefully to have better chance to win bids.

المخلص

نظام تقدير التكلفة لمقاولي البناء في قطاع غزة

فعالية تقدير تكلفة العطاء لأي مشروع، هو أحد العوامل المهمة في نجاحه، كما إن تجهيز تقدير التكلفة للمشروع هو أحد المهام الصعبة في إدارة المشروع، في الوقت الحالي تقدير التكلفة الناجح هو الذي يعتمد على معلومات دقيقة ومحدثة تتم معالجتها بواسطة برنامج محوسب محكم لتقدير التكلفة.

غرض الدراسة هو التعرف على الواقع العملي المحلي في تقدير التكلفة لأعمال التشييد، وتطوير برنامج حاسوب متخصص في هذا المجال لكي يحسن من الممارسة المحلية في تشييد المباني، خلال البحث جرت مراجعة عامة للأدبيات المتعلقة بتقدير التكلفة، كما وتمت أيضا مراجعة بعض برامج الحاسوب المتخصصة في تقدير التكلفة، كما قام الباحث بالتعرف على بعض الامكانيات الرئيسية لبرنامج (مايكروسوفت اكسل) لمحاولة اكتساب مهارات البرمجة والتصميم والتي استخدمها في تطوير برنامج حاسوب لتقدير التكلفة و سماه "برنامج غزة لتقدير التكلفة" "Gaza Estimator Software" (GES).

لاجراء هذا البحث تم استخدام اسلوب الاستبانة المدعم بالمقابلة الشخصية حيث تم توزيع احدى وخمسين استبانة على مقاولي الدرجة الأولى والثانية والثالثة وقد تم جمع وتحليل أربعين منها.

لقد اوضحت نتائج هذا البحث أن معظم المقاولين ما زالوا يقومون بتقدير التكلفة للمشاريع يدويا، وأن أهم العوائق التي تحول دون استخدام برامج التكلفة المتخصصة هي نقص في البرامج سهلة الاستخدام والمتخصصة في تقدير التكلفة، وعدم توفر الخبراء في استخدام هذه البرامج.

"برنامج غزة لتقدير التكلفة: مصمم للاستخدام بواسطة الحاسوب الشخصي وهو يعمل في بيئة النوافذ (ويندوز)، كما تم استخدام برنامج (مايكروسوفت اكسل) في تطويره حيث إن معظم مقاولي قطاع غزة لديهم خبرة جيدة في استخدامات "الأكسل"، كما تم عمل وصف كامل للبرنامج مع مثال توضيحي، هذا وقد تم عمل تقويم للبرنامج للتأكد من ملاءمته للواقع المحلي من حيث الفكرة والتطبيق.

كان من التوصيات الرئيسة لهذا البحث، تشجيع المقاولين المحليين لاقتناء برنامج محوسب متخصص في تقدير التكلفة واستخدامه في تقدير الأعمال للحصول على تقدير أدق للتكلفة وتوفير الوقت وتقليل الأخطاء واعطاء فرصة أفضل للفوز بالعطاءات.

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LIST OF ABBREVIATION

B/Q	Bill of Quantity
CDB	Central Database
CES	Cost Estimating Software
GDP	Gross Domestic Product
GES	Gaza Estimator Software
LDB	Labor Database
MDB	Materials Database
PDB	Plant Database
PECDAR	Palestinian Economic Council for Development and Reconstruction
PNA	Palestinian National Authority
S1DB	Subcontractor1 Database
S2DB	Subcontractor2 Database
SCEA	Society of Cost Estimating and Analysis
SPSS	Statistical Package for Social Sciences
WBS	Work Breakdown Structure

CHAPTER 1 INTRODUCTION

1.1 General

Estimating is a fundamental part of construction projects. Effective estimating is one of the main factors of the success of a construction project. The successful contractor must bid low enough to obtain the work, yet high enough to make profit. Literature shows that computer-based estimating systems have gained a wide acceptance in the construction industry. In this thesis the researcher has tried to explore the estimating common practice amongst Gaza Strip contractors and develop a computerized cost estimating system.

1.2 Rationale

Estimating process is an important element of the construction industry. The success or failure of a project is dependent on the accuracy of estimates. Accurate estimates optimize good contracting (Ahuja, et al, 1994).

The increasing scope and complexity of construction projects, along with a greater number of externally imposed requirements, has expanded the challenge to project management for the successful completion of the projects. This must be accompanied by improvement in the project management. Since the cost estimate is an important factor of construction project management, it should have its significant share in this improvement.

Computer software systems are widely used in construction management in the developed countries. Yet, using of computer applications is still in its early phases of development in the developing countries. So, it is logical that computerization has emphasis in the process of improvement of project management practice in developing countries.

The success of a contractor depends upon cost estimates of projects, not only to obtain a job, but also to construct the facility with the highest profit. The result of a

high estimate would be to lose the job; the result of a low estimate could be to win the job, but to lose money in the construction process (Hendrickson, 2000).

The majority of local contractors in Gaza Strip have poor experience in cost estimating practice. Estimating software systems are not quite available and there is a shortage in qualified persons to use these software packages. The results obtained from studying the local practice in estimating is used to develop a computerized estimating system in order to improve the capabilities of local contractors in handling the estimating functions.

To the researcher knowledge, a little research effort has been done to investigate the estimating common practice of Gaza Strip contracting companies. It is important to explore and evaluate this practice, and then offer recommendations and develop practical tools to improve the existing practice.

1.3 Research Aim

The aim of this research is to explore the existing common practice in cost estimating for the building construction projects in Gaza Strip. Also the research aims at developing a computerized estimating system that suites, and hopefully improves, the local practice.

1.4 Research Objectives

The aim of this research can be broken down into the following objectives:

1. To investigate the local practice of cost estimating in contracting companies in Gaza Strip.
2. To explore the influence of the Israeli closure on material prices, materials availability, and projects cost.
3. To find out the benefits of using computerized packages in estimating the works.
4. To explore the obstacles which face the local contractors in using estimation software packages.

5. To develop a computerized system in cost estimating to improve the common existing practice.
6. To evaluate the system by experienced contractors.

1.5 Scope

This research aims at developing an estimating computerized system to improve the estimating common practice of Gaza Strip contracting companies. It is addressed to handle the cost of measured contracts with bill of quantities. The prospective main users are the general contractors, and the system should consider their own needs in the first place. The system deals with the costs incurred by the contractor from the moment s/he receives the bill of quantity (B/Q) till the time of preparing the final estimate of the project and bid submission.

1.6 Outline Methodology

The research is conducted through the following stages:

First Stage: literature Review

Cost estimate related literature is reviewed to identify the main topics to be handled in this research. This stage includes also review of available cost estimating software packages. The researcher also explores the *Microsoft Excel* capabilities.

Second Stage: Field Survey

A survey of the local estimating practice of contracting companies in Gaza Strip is made. A structured questionnaire is used and the person in charge of estimating in the company is interviewed. Statistical analysis for questionnaires is done by using Statistical Package for the Social Sciences (SPSS). Discussion is made for the obtained results.

Third Stage: Model formulation and Evaluation

An estimating computerized system is developed based on the results obtained from field survey, review estimating software packages, and exploring the *Ms Excel* capabilities. This system is evaluated by experienced contractors.

1.7 Research Importance

Cost estimate improvement is one of the main elements of improving the construction industry. The construction industry involves many parties: owners, designers, contractors, field managers, subcontractors, suppliers, craftsmen, etc. The contractor plays a central role in construction project. Enhancing the contractor's capability to manage the cost estimate of the project will surely bring an improvement to construction industry as a whole.

The construction sector has been the fastest growing sector in the Palestinian economy during the past ten years. The construction sector in the Palestinian Territories has played an important role in the economic development. It contributes around 10% of the Palestinian gross domestic product (G.D.P.) (PECDAR, 2002).

In the last few years construction industry has attracted more and more qualified personnel. Many of them are company owners, company managers, and project managers. They are more prepared to employ Information Technology in their business.

In Gaza Strip, the amount of a winning bid is almost always lower than the amount of the A/E estimate. This may refer to:

- high competition.
- poor managerial experience of contractors in management.
- inaccurate estimates.
- external factors which affect material prices and materials availability.

1.8 Thesis Contents

Apart from this chapter there are other five chapters and nine annexes. Chapter 2 presents the literature review of cost estimating for construction projects. In chapter 3, the Methodology adopted in this research including the questionnaire design and the method of analysis is introduced. Analysis of the surveyed results and discussion of these results are presented in chapter 4.

Gaza Estimator Software (GES) is discussed in detail in chapter 5. The discussion includes concept, description, implementation, and evaluation of GES. Chapter 6 presents conclusions, recommendations for many parties involved in construction, and recommendations for further studies

There are nine Annexes which supplement these chapters. They are:

- Annex 1: The questionnaire (In Arabic).
- Annex 2: The questionnaire (English Version).
- Annex 3: Review of Estimating Software Packages.
- Annex 4: Proposed Coding System.
- Annex 5: Gaza Estimator Software (GES) Sample Forms
- Annex 6: GES Implementation: Illustrated Example
- Annex 7: A proposed Summary Sheet Form.
- Annex 8: Evaluation questionnaire (In Arabic).
- Annex 9: Evaluation questionnaire (English Version).

CHAPTER 2

CONSTRUCTION COST ESTIMATING

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. 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).

The process of cost estimates needs accurate details that, needs a lot of patience. In addition, this process may determine the success or failure of the project completely, and determine the probability of gaining the bid or not, and thus this will determine the extent of the profit or the loss of the contractor (Jar-Allah 1993).

Construction estimating has been referred to as a blend of both art and science (Opfer and Son 2002) quoted (Woodward and Chen 1999, Mathis and Toole 1986). The science aspects come from the applications of mathematics and formulas to derive a cost for the proposed work. The art aspects come from the fact that judgment and experience are key elements towards the successful cost determination (Opfer and Son 2002).

The bidding, for construction contracts is the life blood of a construction company. The first step towards being awarded a construction contract is to participate in submitting bids. Most construction contracts are awarded to the lowest bidder. If a company does not bid, it will not be awarded contracts, and thus, has no chance of earning monetary return (Pannell and Murphy 1994).

2.2 Definitions

a. Cost & Price

Stewart (1991) defines the Cost as the total amount of all the resources required to perform the activity, but the price is the total amount paid for that activity. Price equals the cost plus the desired profit.

$$\text{Price} = \text{Cost} + \text{Profit.}$$

b. Cost Engineering

Hendrickson (2000) says that according to the American Association of Cost Engineers, "cost engineering is defined as that area of engineering practice where engineering judgment and experience are utilized in the application of scientific principles and techniques to the problem of cost estimation, cost control and profitability."

The responsibilities of the project cost engineer are estimating total cost of the project, budgeting, cost control, cost forecasting, cost analysis, and planning and scheduling (Patrascu 1978).

c. Cost Estimate

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. Steward (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".

As defined by (Ahuja, et al, 1994) cost estimate is "the Estimate at best is an approximation of the expected cost of the project".

2.3 Work Breakdown Structure (WBS)

The Work Breakdown Structure (WBS) describes the work elements of a project in a logical hierarchy, (Barrie and Paulson 1992). The WBS divides the project into identifiable parts that can be managed; it is graphical display of the project that shows the division of work in a multi-level system. The WBS is the foundation of a project management system (Oberlender 1993).

Figure 2.1 is a simple illustrative example of a WBS for a project.

At the highest level shown the facility to be achieved as result of the construction activity. At the lowest level is the work task or activity that can be subdivided into work assignments for individual groups (Ahuja et al. 1994).

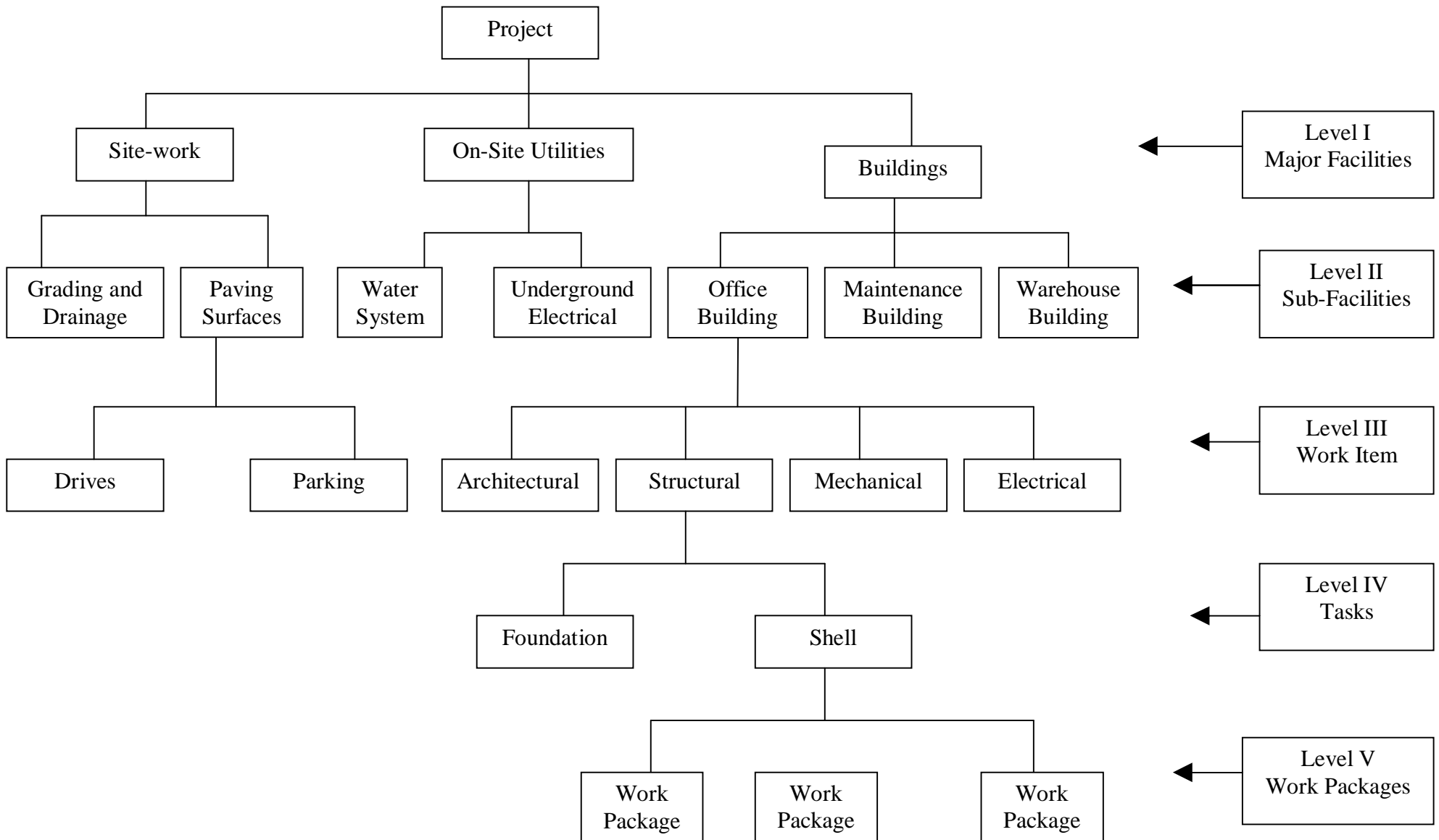


Figure 2-1 Illustrative Work Breakdown Structure (WBS).
Source: (Oberlender, 1993)

The WBS is designed to set forth a common numbering system that can be applied at various levels to structure both cost and schedule planning and reporting (Barrie and Paulson 1992).

2.4 Coding Systems

The importance of coding systems is, to provide a common language of identification and a means of communication to be used by all those concerned with project (Ahuja et al. 1994, and Hendrickson 2000). Coding not only reduces confusion but also encourages all team members to speak the same language; it is a key to computer processing (Ahuja et al. 1994). Coding systems reduce the length or complexity of the information to be recorded. Common coding systems also aid in the retrieval of historical records of cost, productivity and duration on particular activities (Hendrickson 2000).

A coding system allows data to be collected and summarized according to a pyramidal system (Ahuja et al. 1994). The coding systems used by the contractors are not standardized. Contractors often use their own individual coding systems, which they have tailored to suit their particular operations (Clough 1986).

Singh (1999) states that the coding system should be simple and flexible, but at the same time it should be such that, it is possible to identify operations which may appear similar, but are actually quite different.

2.5 Database and Information for Estimating

Database system has been developed to assist a contractor in preparing bids that improve chances of winning over the competition (AbouRizk et al. 1993). Database management systems are designed to help in the developing of cost estimate system (Oxley and Poskitt 1992). The database must contain all the necessary elements so it can be managed to generate the desired information reports and to retain historical information in a suitable format (Ahuja et al. 1994). Information for estimating is normally not recovered from the cost accounting system until after project completion, or at least not until all the work type being reported has been finished. This information is the maximum value in the future (Clough 1986).

The database should be designed to facilitate annual updates and be usable on a going forward basis (*Pension Plan Mortality, Turnover Data Base, and Table Construction*

2002). Formally, a database is a collection of stored operational information used by the management and application systems of some particular enterprise (Hendrickson 2000).

Ritz (1994) says that most contractors have complete in-house estimating departments, with extensive files of historical cost data relating to the specific types of projects done by that firm. Developing and maintaining historical cost files is expensive, and it is one of the key advantages that a contractor can offer an owner. The historical data file contains the information derived from previous projects executed by the company and is updated at the conclusion of each job. It concludes unit rates for cost elements (materials, labors, plants). These data are obtained from the cost control system (Ahuja et al. 1994).

2.6 Competition in Construction Projects

In general terms it can be stated that the owner is interested in the bidding process in order to achieve a most competitive price from the bidding contractors. The construction company bidding on the projects is interested in earning the maximum profit and also maintaining a competitive edge over its competitors (AbouRizk et al. 1993).

The competition among contractors in the area where the project is being constructed will affect the cost of the project. Factors affecting competition include:

- The number of qualified contractors operating in the project area. The more qualified contractors, the greater the potential for competitive pricing and the lower the construction cost. The key here is in the phrase "qualified contractors," contractors who can successfully complete the project.
- To obtain a competitive bid, the client must allow bidders some discretion in their pricing of the project. The drawings and specifications must be specific enough to convey to the contractor the level of quality you expect, but still leave them enough choice to provide opportunities for them to select approaches, materials and personnel which are perhaps less expensive than those which their competitors will choose. (Developing Construction Cost Estimates, 2002).

2.7 Basic Tools Required for Cost Estimating

Summarizing Stewart (1991), four basic tools required for preparation of the cost estimating which are:

a) Information

Every cost estimate must be based on complete, thorough, and modern information relating to the project. The information takes many forms, among them drawings, specifications, production schedule, actual production labor-hour and cost records, hand-books, professional and reference books, personal knowledge, and market surveys. A reliable and usable cost estimate can be formulated by selecting the right information from among this vast store of knowledge and synthesizing the information as inputs to the cost estimate.

b) Methods

Before starting to develop a cost estimate, a decision must be made concerning the estimating method or combination of methods to be used. The method chosen depends principally on the time allotted to prepare the estimate and the accuracy of estimate.

c) Schedule

Preparation a schedule for the estimating activity itself is a vital tool required for the development of a good cost estimate. For simple cost estimates a completion date is all that is required. A detailed cost estimates or cost proposal activity, however, must be supported by an estimating schedule that shows all phases of the estimating cycle.

d) Skills

A number of different skills are needed in the preparation of a cost estimate. Whether these skills are possessed by one person or by an organization, it is necessary to arrange for their availability and application to the cost estimating process during the appropriate time phase of the estimating activity.

2.8 Stages of Estimating

Estimating is generally categorized into three stages: quantity survey, pricing, and bidding.

a. Quantity Survey

"A quantity survey, or takeoff, is the detailed compilation of quantity of each elementary work item in the project. The quantity survey is the only accurate and dependable procedure for compiling a detailed estimate" (Clough 1986).

b. Pricing Activities

Kirk (1997) states that in the pricing section of an estimating, one of the goals is to obtain current and representative costs through link with the local industry. The estimator should perform activities in unit costs preparation. He must know about the materials and labor involved and how they relate to other factors, such as time and function of the project. He must obtain current prices from the industry by actually calling local material suppliers and subcontractors.

c. Bidding Strategies

Pannell and Murphy (1994) define the bid strategy as the strategy to arrive at the best bid is the bid strategy. Bidding is probably the most critical portion of an estimate. The major reason is the pressure placed upon bidders on bid day. The bidder's reaction to this pressure can directly affect the success of the bid, and ultimately the success of the company. "Bidding deals with a multiplicity of variables, i.e., the bidder makes a series of many choices. The bidder makes these choices guided by convention, experience, personal preferences and values. Evidence points to the probability that organizations can and often do fail because of poor bidding" (Kirk 1997).

2.9 Cost Estimates Categories

Clough (1986) states that there are probably as many different estimating procedures as there are contractors. He classifies the construction estimating into two major types according to their functions which are:

- Approximate (Preliminary) Estimates.
- Fixed-Price (Detailed) Estimates.

2.9.1 Approximate (Preliminary) Estimates

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."

Summarizing Clough (1986), the general contractor may wish to compute an approximate cost of work normally subcontracted, either to serve as a preliminary cost in its bid or to

check quotations already received from subcontractors. The methods which are commonly used to prepare preliminary estimates are listed here:

- a) **Cost-per function:** an analysis based on the estimated cost per item of use, such as per patient, student, seat, car space, or unit of production.
- b) **Square-foot cost estimate:** an approximate cost obtained by using an estimated price each square foot of gross floor area.
- c) **Cubic-foot cost estimate:** an estimate based on an approximated cost for each cubic foot of total volume enclosed.
- d) **Parameter cost estimate:** an estimate involving unit costs, called parameter costs, for each of several different building components or systems. The costs of site work, foundations, floors, exterior walls, interior walls, structure, roof, doors, glazed openings, plumbing, heating, and ventilating, electrical work, and other items are determined separately by the use of estimated parameter costs. These unit costs can be based on dimensions or quantities of the components themselves or on the common measure of building square footage.

2.9.2 Fixed-Price (Detailed) Estimates:

Detailed estimates sometime called final, definite, or contractor's estimates (Oberlende 1993). 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).

Hinze (1999) says that detailed estimates are generally prepared by contractors prior to submitting bids on competitively bid contracts. A detailed cost estimate includes the cost of materials, labour, equipment, subcontracted work, overhead, and profit. To prepare project estimate, the estimator conducts a breakdown of the proposed project into the necessary operation required to complete the project. As far as possible, the operation or items appear in the estimate in the order that they will be performed in the project. This reduces the danger of omitting the costs of one or more.

(Barrie & Paulson, 1992) state 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 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).

Clough (1986) classifies the fixed-price estimates into two forms which are widely used in the construction industry. These are:

- Lump-Sum Estimates.
- Unit-Price Estimates

1. Lump Sum Estimate

Lump-sum estimates are applicable only when the nature of the work and quantities involved are well defined by the bidding documents. Lump-sum estimating requires that a quantity survey or quantity takeoff be made. This is a complete listing of all the materials and items of work that will be required. Using these work quantities as basis, the contractor computes the costs of the materials, labor, plant, subcontracts, and overheads. The sum total of these individual items of cost constitutes the anticipated overall cost of the construction. Addition of a markup yields the lump-sum estimate that the contractor submits to the owner as its price for doing the work (Clough 1986).

2. Unit Price Estimate

Unit-price estimates can be compiled when quantities of work items may not precisely determinable but the nature of the work is well defined. It should be noted that an estimated quantity is shown for each item. (Clough 1986).

Hendrickson (2000) says that if the design technology for a facility has been specified, the project can be decomposed into elements at various levels of detail for the purpose of cost estimation. The unit cost for each element in the bill of quantities must be assessed in order to compute the total construction cost. This concept is applicable to both design estimates and bid estimates, although different elements may be selected in the decomposition.

The final cost is determined by multiplying the bid cost per unit by the actual quantity of work that is installed by the contractor. Thus, the price that the owner will pay to the contractor is not determined until the project has been completed, when the actual quantities are known (Oberlende 1993).

(El-Samdony et al. 1997) state, "for unit price contract, a bill of quantities is divided into individual work items, each of which is given a quantity calculated by the design team.

The tenderers are instructed to quote a unit rate for each work item and multiply it by the estimated quantity. The sum of these amounts becomes the tender price".

2.10 The Factors Affecting Construction Cost Estimate:

Some factors can individually affect construction cost estimating such as:

- a. **Project Type:** the type of the designing project has an impact on estimating construction costs. The cost of construction depends on the time the contractors will need to execute the work, the degree of specialization of the work to be done, and the cost of the materials.
- b. **Special Construction:** complexity can greatly increase the cost of the project. These conditions may include renovations, heavy loading, i.e. large quantities of files or a library, hazardous materials, etc.
- c. **Project accessibility:** sites may be difficult to access, either geographically or because the space is used during business hours, requiring that the project be scheduled for off hours.
- d. **Time of Year:** building construction is a seasonal enterprise. There are periods of the year when contractors are busy and can barely keep up and then there are periods of the year when they are likely to be looking for work.
- e. **Labor Rates:** the general state of the economy will affect the cost of a project so it is important to watch what is happening with the rate of inflation in developing accurate construction estimates
- f. **Material Costs:** the type and availability of a particular material can also affect your approach to a cost estimate (Developing Construction Cost Estimates, 2002).

2.11 The Classification of Construction Costs

The construction costs can be classified into 4 types of costs, direct costs, site (project) overheads, general (company) overheads, and markup. Classification of construction costs can be represented as shown in Figure 2.2.

2.11.1 Direct Costs:

The direct costs are mainly the labour, plant, materials and subcontractor costs involved in executing the works (McCaffer and Baldwin, 1991). Hinze (1999) defines the direct costs as the costs readily identified as being related to putting the facility components in place. They represent the costs of the resources used on the activity, such as the materials

installed, workers and equipment used, and subcontractors. The cost of materials and the cost of subcontracted work tend to be relatively fixed or not subject to considerable variance. The biggest variable concerns the costs associated with labour and equipment. If the productivity estimates are overestimated, the actual costs will be more than the estimated cost. Overestimates on the productivity will result in longer duration to complete the project. If the productivity is underestimated, the work will take more time and the actual costs for an item will be less than the allocated budget for that work item. The direct costs can be classified into four elements which are:

a. Material Cost

McCaffer and Baldwin (1991) state that the determination of the materials prices for inclusion in the direct cost estimate may be considered to be one of the most precise aspects of estimating. Due to the effects of inflation, the variance of delivery costs and quantity discount, the estimator is usually required to obtain a quoted price for every major material to include in the estimate. The estimator has to undertake the more difficult task of determining allowances for material wastage, damage, theft and delivery discrepancies in so far as they affect the cost of the works.

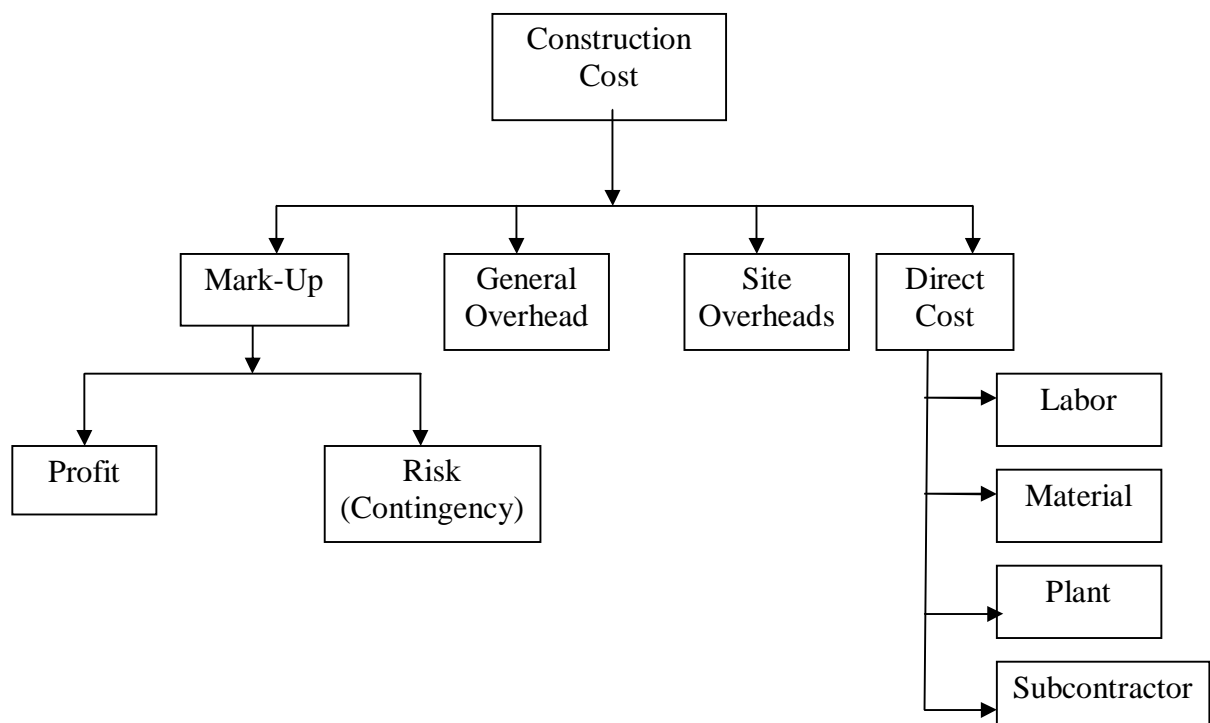


Figure 2.2 Classifications of Construction Costs

b. Labor Cost

Summarizing Clough (1986), the labor costs are difficult to evaluate and cannot be determined with the same degree of precision as can most other elements of construction cost. Hendrickson (2000) says, "the term productivity is generally defined as a ratio of the production output volume to the input volume of resources".

The contractor have to use his own system to measure labor productivity at a site, it is good practice to set up a system which can be used to track productivity trends over time and in varied locations. Considerable efforts are required to collect information regionally or nationally over a number of years to produce such results. The productivity indices compiled from statistical data should include parameters such as the performance of major crafts, effect of project size, type and location, and other major project influences.

c. Plants

Clough (1986) states that the equipment cost, like those of labor, are difficult to evaluate with any exactness. Plant accounts for a substantial proportion of the total cost of most engineering projects, but is less significant for buildings. The determination of the expense rates for the plant items to be used on a project being estimated is an important matter and requires considerable time and effort.

d. Subcontracts

Clough (1986) says that the quotations from subcontractors can be an important element in the compilation of a project estimate, especially on building construction, where subcontracting is utilized more extensively, on the average, than it is on engineering or industrial construction. Unluckily, many of these bids may not submitted to prime contractor until late in the bidding period, a factor that makes it difficult to study and analyze them. Submission by telephone of bids by subcontractors, together with the practice of making last-minute deductions, can make the final bid compilation a difficult matter during that hectic period immediately before bid opening.

2.11.2 Site (Project) Overheads

McCaffer and Baldwin (1991) define the site overheads as the costs which can be directly attributable to a contract and broadly include: site staff; transport costs; welfare and site office costs; insurances and bonds.

Site overheads are those that are not specifically identified as being associated with particular work item. These costs are generally incurred whether or not productive work is actually accomplished (Hinze 1999 and Forster 1981).

2.11.3 General (Company) Overheads

Clough (1986) states that general overhead or office overhead includes general business expenses such as office rent, office insurance, heat, electricity, office supplies, furniture, telephone, and the salaries of executives and office employees. Generally, contractors are using percentage for these costs. However, Hinze (1999) defines the general costs as the element of costs that covers the company-specific costs of running the business, such as those for corporate office personnel, office services and supplies, and administration. These costs continue even if only one job is being conducted by the company.

2.11.4 Markup

McCaffer and Baldwin (1991) state that the direct cost plus the site overheads are called the 'cost estimate'. The bid total presented in the bid is a contractor's 'selling price'.

Margin of markup, is the percentage of the bidder's estimated cost of a contract that is added to the bid amount to contribute to overhead and profit. The bid amount is the total of the cost and the markup amount. A bid strategy is used to determine percentage margin of markup to be added to the bidder's cost (Pannell and Murphy 1994).

Nassar (2002a) states, "one of the most important aspects of the bidder's price however, is the % markup it uses in its bid". Clough (1986) states that the markup or margin is added at the close of estimating process and is an allowance for profit plus other items such as contingency. Many factors must be considered in deciding a markup figure, and each can have an influence on the value chosen.

a. Risk Allowance (Contingency)

Ritz (1994) says that the amount of contingency allowance in any estimate is always a point of discussion. We must remember that contingency is a factor added to cover the two major unknowns present in all estimates:

- Errors due to inaccurate or incomplete design data.
- Errors of omission and commission in estimating.

(Ahuja et al. 1994) states that the contingency is a specific provision; it must be included to account for unforeseen elements of cost. Nassar (2002b) quoted Raftery (1994) that contractors, traditionally, build a contingency amount in their bids after parameter estimates are prepared. A contingency amount is included in each construction contract and is included in the contract price.

Clear concise documents will allow the contractor to more accurately bid the project, and reduce his concern for including a hefty contingency cost (Developing Construction Cost Estimates, 2002).

b. Profit

Silberman (1993) states that the profit margin is added to the estimated cost of contract. The basis for an estimate is the aggregate of all the direct costs of a project, site overhead, general overhead, and other costs plus a contingency, a fee (profit) is added to these costs. Clough (1986) says that the contracting firm's objective when it selects a markup figure is to include the maximum possible profit, at the same time keeping its bid at a competitive level.

2.12 The Estimating Process

It is understood that the cost estimates precedes the process of tendering, and so, it has been supposed that all contract documents (specifications, drawings, bill of quantities, etc.) are available, i.e. there is a precise description to the works that clarifies the contractor duties and limits of his responsibilities (Jar-Allah 1993).

Sha'at (1993) states that cost estimating is a main and crucial component of any contractor's work. Cost estimating for project begins, practically, when the contractor's

decision to tender and getting the tender documents and ends with the submission of the tender to the owner or her/his representative.

However, the main features of estimating procedure are quite common. Harris and McCaffer (1995) give a fairly comprehensive description of the main steps in estimating a bill of quantities contract. The summary of this description is given below:

2.12.1 Decision to Tender

The decision to tender for a particular contract is mainly the responsibility of senior management; there are three possible points during the estimating and tendering processes where this decision must be made. The first point is during the pre-selection stage. The second is after receiving all contract documents to review them and consider, in the light of fuller information, whether he wishes to proceed or not. The third and final point of decision whether to submit a tender after the estimate has been prepared and the contractor is ready to submit.

2.12.2 Programming the Estimate

After receiving the contract documents and having decided to tender, the tasks required to complete the estimate is programmed and a schedule must be prepared to show all phases of the estimating cycle. This is necessary as the time to submit a tender is limited.

2.12.3 Collection of Cost Information

The cost information required by the estimator is for

- (a) labor
- (b) Plant
- (c) materials
- (d) sub-contractors

a. Labor

The estimator is required to calculate the 'all-in' rate for each category of labor, which is an hourly rate covering all wages and emoluments paid to the operative, all statutory costs incurred and allowances for holidays and non-productive overtime. As the all-in rates are calculated by the estimator they can be established early and accurately in the estimating process.

The basis of this calculation is to determine the total worked hours in a year and the total cost for the man-year and hence the cost per worked hour. The calculation is complicated by the difference between the hours worked and the hours paid which

exceeds the hours worked by such items as overtime allowances, public holidays and inclement weather.

b. Plant

The hourly or weekly cost of equipment can either be as a result of internal calculation or as a result of quotations. Quotations for hire can either be internal rates from the equipment department or from the contractor's plant subsidiary, or they can be external hire rates from an independent equipment hire company. Calculated rates or internal hire rates can be established very early in the estimating process. External hire rates may take a little longer but it is unusual to suffer serious delays in receiving quotations.

c. Materials

Materials quotations are more difficult in that materials not only form a significant percentage of the works but to the instability of materials prices. Contractors have to send out unique enquiries for almost all materials in every estimate prepared. The materials enquiries include information such as the quantities required, the specification, the approximate delivery dates and the terms and conditions upon which the quotations are being invited.

To enable these enquiries to be sent out the estimator must go through the bill of quantities and specification and extract the relevant information and prepare his list of required materials. Because of the time taken to send out and receive quotations this task of preparing the materials lists is undertaken very early in the estimating process.

The estimator is required when checking quotations to ensure that materials meet the specification of the contract documents and can be delivered to the site at the times required by the construction programme.

The determination of the materials prices for inclusion in the direct cost estimate may be considered to be one of the most precise aspects of estimating. The process of obtaining materials prices as has been described can be seen to consist solely of contracting suppliers who have the material available and negotiating a suitable rate under satisfactory contractual conditions. In addition, the estimator has to undertake the more difficult task of determining allowances for material wastage, damage, theft and delivery discrepancies insofar as they affect the costs of the works.

d. Sub-contractor

Sub-contractor enquiries also have to be sent out early and the estimator will prepare lists of the items and work that will be sub-contracted. Following receiving the quotations, they must be compared and the sub-contractors selected. The rates for the selected sub-contractors will be included in the estimate together with allowances for attendance and other services. The profit to be added to the main contractor's own sub-contractors may be included at the estimating stage or left until the final additions following the tender meeting. The difference between materials and sub-contractors is that in most cases the materials costs are combined with equipment and labor to produce costs rates for items of work whereas the sub-contractors' rates in many cases will stand on their own together with an allowance for attendance.

The following briefly views the risk areas associated with the use of sub-contractors.

- **Attendances**

Estimating attendances when comparing and selecting sub-contractors is assuming a greater priority on estimating work. Not all quotations are constant in the attendance requirement and comparing the simple quotations is inadequate. Very often a sub-contractor will by negotiating take on more difficult attendances within his price. Estimating attendances may in itself prove critical in winning a contract or indeed in being able to execute a contract profitably.

- **Materials**

The importance of material costs is that they represent the majority of the cost profile of the construction industry. A small percentage cut in materials costs could bring sizeable increase in profits. The estimating of material cost in any tender is, therefore, an important element and any inaccuracy in their estimates is likely to affect the outcome of the tender and the profitability of the subsequent contract.

Many estimators have established within their companies standards for wastage of materials. These standards however are largely based on their experience with their own labour force or where their own labour had a large share of the work. There is potential for the wastage rates to rise with the use of sub-contractors' labor whose desire to complete the work as soon as possible is high. Thus the materials wastage allowance is likely to be a growing factor in the accuracy of an estimate.

- **Output**

The greater use of sub-contractors has reduced the importance of one of the estimator's most difficult tasks; that of estimating labor and equipment outputs. But the use of sub-contractors increases other difficulties. These difficulties lie in quantifying the penalty of sub-contractors who prove unreliable and fail to complete their work or disrupt the run of work. The contractor may not actually suffer any financial loss within the specific sub-contractor but he is left to face the cost of the disruption. Evaluating the effects of potential disruption for the purpose of a claim against the sub-contractor is difficult.

- **Management Control and Efficiency**

Site management control and efficiency have always been a major factor affecting the level of estimating accuracy. The greater use of sub-contractors does not make site management less important but it has changed its nature. The control and organization of the arrival, departure and interactions of many sub-contractors has had to be developed in companies that were previously used to make their major efforts in controlling their own labour. It has always been true that all things being equal success of a contract is determined by the quality of the site management team. The greater use of sub-contractors does not change this but has changed how it must be achieved.

2.12.4 Project Study

To gain an appreciation of the project, the estimator will start the following tasks:

- (a) A study of the drawings;
- (b) A site visit and meeting with the client's or promoter's representative;
- (c) The preparation of a method statement determining how the project will be constructed.

2.12.5 Preparing the Estimate

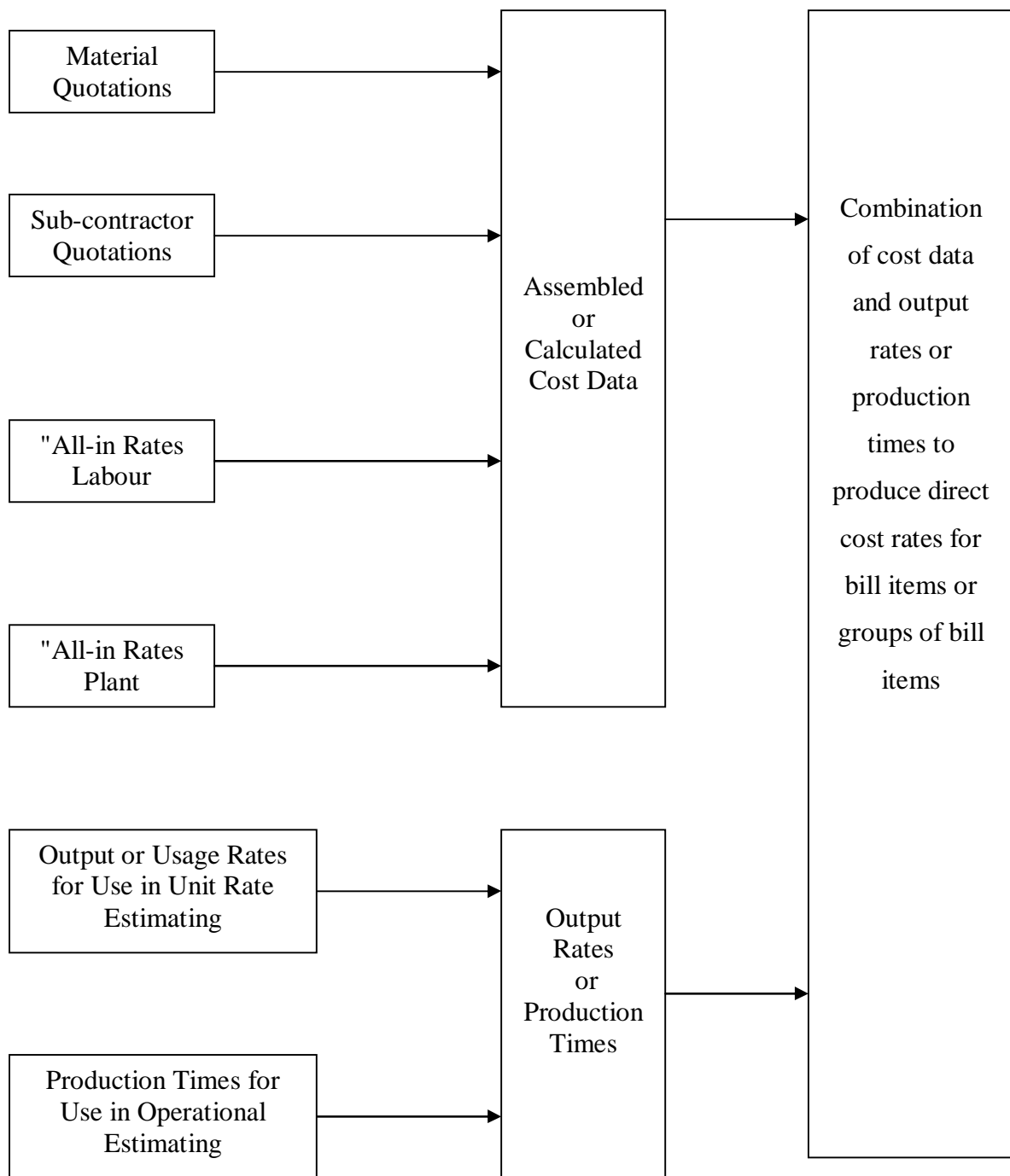
The estimator's task is to determine the cost to the contractor of executing the work defined in the contract documents. The estimator is required to establish the direct cost rates for each item in the bill of quantities. A direct cost rate is a rate for the labor, equipment, materials and sub-contractors, but exclusive of additions for site overheads, head office overheads and profit. These will be assessed and included later.

Determining a direct cost rate involves selecting the appropriate resources of labor, equipment, and materials for the item of work (either a single bill item or a group of bill items), selecting the output or usage rates for each resource or determining the elapsed time that each resource (labor and equipment) will be employed and combining this with the cost information collected. This combination of the unit cost of resources together with the usage of resources to produce a direct cost for the work described in the bill item or group of bill items is illustrated in Figure 2.3.

There are two main ways to calculate a bill item unit rates, the first is known as unit rate estimating and the second is operational estimating.

(a) Unit Rate Estimating

The use of unit rate estimating is prevailing in building works. The basic of unit rate estimating is the selection of the resources required and the selection of the output or usage rates for those resources (i.e. labor, equipment or materials) the arithmetical calculation is the output or usage rate combined with the unit cost. An output rate is expressed as work quantity per hour (e.g. labor for placing concrete m³/hr) and a usage rate is the time taken to do a fixed quantity of work (e.g. labor for placing concrete hr/m³). Thus, by combining these with the cost of the resource (\$/hr in the case of labor and equipment) the cost per unit (e.g. labor for placing concrete, \$/m³) can be determined. The sum of the cost per unit for all resources is the estimate of the direct cost rate.



(Figure 2.3: The selection of production rates and cost data and their combination to produce cost rates.) Source: Harris, and McCaffer, (1995)

The following example is quoted from Harris and McCaffer (1995) for illustration the unit rate calculation is given in Table 2.1. Supplementary cost calculations for this example are shown in Table 2.2.

Table 2.1 Example of a unit rate build-up

(a) Example of bill item

Item description	Units	Quantity	Rate	Extension
A. One brick wall in common				
bricks in 1:3 cement mortar	m2	100		

(b) Example of unit rate build-up

Labor	Cost/Hr	Output/Usage	Total Cost
Bricklayer-Commons	£4.25	1.8 hrs/m2	£7.65
Labour to unload (at 100 Minutes/1000 bricks)	£2.50	1.2 min/m2	£0.05
Total labour cost			£7.70

Materials	Qty/m2	Net mat. cost	waste	Total cost
Common Bricks	120 NR	£100/1000	10%	£13.20
Mortar (3:1)	0.045 m3	£25.10/m3	5%	£1.19
Total material cost				£14.39
Total cost / m2				£22.09

Table 2.2 Supplementary cost calculations in unit rate build-up

(a) Example of calculating the cost of one bricklayer per hour with laborer support

2 bricklayers @ £3.00/hr	= £6.00
1 laborer @ £2.50/hr	= £2.50
Total cost of gang	= £8.50
Cost of one bricklayer per hour (/2)	= £4.25

(b) Example of calculating cost of mortar per m3

Cement 0.52 tone @ £35.00/ tone	= £18.20
Sand 1.38 m3 @ £5.00/ m3	= £6.90
Total cost per m3	= £25.10

(b) Operational Estimating

In civil engineering work there is an extensive use of operational estimating. This is because this method of estimating links well with planning and is effective in allowing for idle time which is common in most plant-dominated work. For example an excavator may be on site from the start of excavation operations to the end of excavation operations but may not be working continuously throughout that time period. Operational estimating would base the costs of the excavator on the time that the excavator was on site, not on an assumed output. The time the excavator was on site would be derived from the construction programme.

The link between operational estimating, planning and the bill of quantities is that the estimator would group together the bill items he would wish to estimate as an operation. This group of bill items would be represented in the construction programme as one or more activities and so the construction programme would provide the duration of the operation. The estimator would select the resources to be used in the operation and use the duration of the activities and unit cost of each resource to produce the total cost of the operation. This total cost has to be assigned back to each bill item. The method of assignment is open to the estimator but the simplest method is to apportion the costs pro rate with the item quantity. That is, if a total of 2,550 m³ of concrete placing were contained in 40 different bill items of varying quantity and the total cost of the plant element of the operation was £13,110.0 then the rate would be £5.14/m³ and this would be set against each item together with the labor costs. An example of operational estimating is given in Table 2.3.

Table 2.3 Example of operational build-up for the plant element for placing concrete

Assumptions

Total cubic meters of concrete to be placed	2,550 m ³
Duration of concreting operations	38 weeks
Equipment required	1 No. Mobile Crane 2 No. Concrete Skips 3 No. dumpers 3 No. Vibrators

Calculations

Item	No.	Weekly Rate		No. of Weeks	Cost
Mobile Crane	1	£220.0	x	38	= £8,360.0
Concrete Skip	2	£10.0	x	38	= £760.0
Dumper	3	£25.0	x	38	= £2,850.0
Vibrator	3	£10.0	x	38	= £1,140.0
Total Cost					= £13,110.0
Cost per m3					= £5.14

This illustrates the operational built-up for the plant element for placing concrete. A similar built-up for labor and for the provision of concrete would be required to satisfy a group of bill items that include providing and placing concrete.

2.12.6 Assessment of Site Overheads

The estimator assesses the site overheads based on requirements such as:

- Site staff;
- Cleaning site and cleaning rubbish;
- Site transport facilities;
- Mechanical plant not previously included in the item rates;
- Scaffolding;
- Site accommodation;
- Small plant;
- Temporary services;
- Welfare, first aid and safety provisions;
- Final clearance and handover;
- Transport to site.

2.12.7 Assessment of General Overheads

The final decision to determine the general overheads and risk allowance is left for top management to take. General overheads based upon the volume of the company's business in the previous year and the expectations for the current year. The company's budget for the current year should include the expected turnover and general overheads. Allowance for general overheads is usually expressed as a percentage relating the annual overhead costs to the annual turnover. Monthly monitoring of a company's turnover and

expenditure may give guidance for any modification to this allowance (McCaffer and Baldwin 1991).

2.12.8 Assessment of Risk and Profit Allowances

Construction projects are risky by nature. There are many variables affecting the outcome of a construction project especially its final cost (Nassar 2002b). A risk allowance, as a lump sum or a percentage, which is usually added to the estimation to bring down that risk to an accepted level with which the contractor can live without prejudicing his competitive situation. Estimator analyses the uncertainties inborn in the project and tries to assess the resulting risks and give the recommendations in this regard. Many factors affect this assessment such as: type of contract, complexity of the project, volume of subcontracted works, climatic conditions, general economic environment, etc. The final decision to determine the risk allowance is left for top management to take (McCaffer and Baldwin 1991).

Profit allowance is usually added at the top of previously estimated costs expressed as a lump sum or as a percentage (McCaffer and Baldwin 1991). The contractor's objective when they select a markup figure is to include the maximum possible profit, at the same time keeping the bid at a competitive level (Clough 1986). However, determining the profit margin is affected by some other factors, such as the volume of the work in hand, the orders anticipated and the market conditions (McCaffer and Baldwin 1991).

2.12.9 Writing Up of the Bill for Submission

The structure of the cost and additions included in the tender price are as shown in Figure 2.4. The calculated direct cost of each bill item should be multiplied by the ratio (tender price/direct costs). Bill items for sub-contracted works may be treated differently in order to get their fair share of cost additions (McCaffer and Baldwin 1991).

2.13 Pitfalls and Common Errors to Avoid in Cost Estimating

Stewart (1991) summarizes the pitfalls and common errors encountered in the practice of cost estimating as:

- a) Failure to define fully the work activity or work output being estimated.
- b) Failure to eliminate duplications, overlaps, and omissions.
- c) Lack of a well thought out time schedule for conducting the work.
- d) Application of import skill levels and skill categories to the job.

- e) Incomplete analysis of indirect, general, and administrative costs.
- f) Failure to include adequate allowances for the "certainty" of cost growth.
- g) Failure to understand and to deal successfully with cost escalation and inflation.
- h) Failure to account for productivity improvements made possible by high technology advance (i.e.: Computer-Aided-Design Systems, Computer-Aided Software Engineering, Automation and Robotics).

DIRECT COST	CONSTRUCTION COSTS	NET COSTS	TENDER PRICE
SITE OVERHEADS			
GENERAL OVERHEADS			
PROFIT AND RISK			

(Figure 2.4 Structure of Costs and Additions in a tender Sum)

Source: McCaffer and Baldwin (1991)

2.14 Cost Estimate and Cost Control

(Ahuja et al. 1994) state, "the daily report of each work item should be accessible to the estimator". When the work is finished, the estimator has a record of man-hours, equipment usage, material consumption, overhead expenditure, comments about special progress. The following data for all work performed by in-house forces will aid the estimator greatly in estimating the cost and duration of similar work item on future projects:

- a) Crew composition and man-hours per unit measure.
- b) Equipment usage per unit measure.
- c) Materials consumed per unit measure.
- d) Overhead expenditure on various items as a percentage of the total job cost.

This data is useful for accurate estimating of projects in the future.

Singh (1999) says that the cost control is intimately related to estimating because expenditure is regulated on the basis of the estimates of works. The cost control is affected on the basis of the estimated costs of each item of work as provided in the estimates. The estimate used to reach the contract price is then converted to the project control budget for controlling the project cost. That's the most important reason for having a well-organized cost estimate based on the applicable code of accounts to facilitate converting the estimate to the budget (Ritz 1994).

A cost control system should be designed that it enables management to satisfactorily collect and produce information from which the monitoring of actual costs can be compared to the estimated costs (Forster 1981). The cost control system provides feedback to the estimating department to help in pricing new tenders more accurately. To make a better use of this feedback, it should be accompanied by a relatively full and complete description of the conditions pertaining to the particular costs. Such feedback tends to be most valuable when concerned with the output of machines and labour productivity (Pilchler 1992).

Barrie and Paulson (1992) state that estimates become the reference standard for cost control when the project is executed. Estimates often organize costs in different categories and in different levels of detail from those most appropriate for cost-control purposes. Clough (1986) concludes that the company costs system provides a reliable and systematic way of accumulating labor and equipment productivity and costs for use in estimating future jobs.

2.15 The Effect of the Israeli Closure on Construction Cost

Several factors had contributed to the growth of the construction sector in Palestine; most important is the high growth of income experienced by Palestinians due to the integration of the Palestinian Economy into the larger and wealthier Israeli economy (PECDAR, Housing in Palestine, pecdar.org, Internet). The Israeli closure on Gaza Strip is considered the most important of external shocks, which affected on the material availability (specially cement and aggregate) and material prices. This changing in the price increases the cost of projects, and may cause failure for the project.

Post 1994, Israel has adopted the closure policy under the familiar pretext of security. The political instability, closure policies and the prevailing uncertainties caused a sharp and

harmful effect on construction industry in Palestine (PECDAR, Housing in Palestine, pecdar.org, Internet).

2.16 Computer Aided Cost Estimating

(Elzarka and Dorsey 1999) state, "in recent years, computer-based estimating systems have gained wide acceptance in the construction industry. These systems offer several advantages in all the estimating phases namely takeoff, pricing, summarization and reporting". Computers use in cost estimating is a relatively recent development. Computerized estimating can offer a number of distinct advantages over manual methods. Computers can give increased accuracy by minimizing human-based errors and errors of omission. The computer can provide quick and easy access to historical unit cost and production rates (Clough 1986).

Speed and accuracy are the essence in computing a cost estimate because the computation process occurs near the end of the cost estimating process when the proposal manager, the project manager, or the sales department are putting pressure on the estimating department for quick results (Stewart 1991).

Computer aided estimating dependent on the storage, retrieval and manipulation of large quantities of data. The time available for the study and cost estimation of the project at the pretender stage is usually limited. Therefore, the use of computer software for the project cost estimates is recommended tool for more efficiency and time saving and accurate calculations (El-Samdony et al. 1997).

(Hendrickson 2000) summarizes some of the common features of computer aided cost estimation software as the following:

- Databases for unit cost items such as worker wage rates, equipment rental or material prices. These databases can be used for any cost estimate required. If these rates change, cost estimates can be rapidly re-computed after the databases are updated.
- Databases of expected productivity for different components types, equipment and construction processes.
- Import utilities from computer aided design software for automatic quantity-take-off of components. Alternatively, special user interfaces may exist to enter geometric descriptions of components to allow automatic quantity-take-off.

- Export utilities to send estimates to cost control and scheduling software. This is very helpful to begin the management of costs during construction.
- Provisions for manual review, over-ride and editing of any cost element resulting from the cost estimation system
- Flexible reporting formats, including provisions for electronic reporting rather than simply printing cost estimates on paper.
- Archives of past projects to allow rapid cost-estimate updating or modification for similar designs.

(El-Samdony et al. 1997) state that there are many commercial available estimating programs. These programs provide a range of features and facilities. Whilst different programs offer different features the majority provide the same basic facilities.

The Major Functions Are:

- A data library for storing data or resources and construction activities;
- A range of methods of pricing the items within a bill of quantities;
- The ability to enter project specific data;
- The facility to amend the data on a project at any time and produce a revised estimate for the project;
- A range of methods for adding additional monies to the direct cost estimate to produce a tender sum; and
- Comprehensive reporting facilities to enable the estimator to produce summary and detailed information from the estimate.

2.17 Cost Estimating Recent Researches

Effective management of estimating and tendering operations is a key to the success of a construction company. The measure of a successful tender is one whose value is low enough to win the contract and high enough to allow the contractor to discharge the responsibility defined in the contract and still show some profit. So, an accurate cost estimate is essential to the contractor in making a profit (El-Samdony et al. 1997).

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).

Several researches have studied the cost estimating in general, the accuracy of cost estimate, and the computer applications in cost estimating such as: El-Samdony et al. (1997), Madi (2003), El-Sawalhi (2002), Oberlender, and Trost (2001), Lau (2000), and Christofferson (1999).

El-Samadony et al. (1997) have conducted their research in Egypt which is somehow similar to Gaza Strip. They investigated the computer aided construction bid preparation in Egypt. They concluded that;

- the computers are not commonly used for tender analysis in Egyptian construction companies.
- there is no comprehensive, universal cost estimating software package that can be used in all cost estimating situations.
- the reasons behind the uncommon use of the computer software for bid preparation are;
 - the relatively high cost of software packages.
 - lack of technical support.
 - poor training courses for the existing computer programs.
 - unsuitability of the computer software for tender analysis.

Madi (2003) investigated the essential factors affecting the accuracy of cost estimating in Gaza strip to show the degree of importance of 51 factors in cost estimation practice. Madi classified the 51 factor into 8 groups.

- Group 1 related to project complexity
- Group 2 related to project information and resources
- Group 3 related to technological requirements
- Group 4 related to contract requirements
- Group 5 related to efficiency and resources of company
- Group 6 related to market requirements
- Group 7 related to project and its duration
- Group 8 related to project risks.

Madi found that the most important group in cost estimating practice is group 8 related to project risks. This group is ranked first. Group 2 related to project information and resources is ranked second and group 6 related to market requirements is ranked third. Also Madi investigated the using of computer in tender estimation. He concluded that the

main reasons for non using computer in estimating is lack of suitable software for estimating, shortage of qualified employees, the wrong belief that using computer gives inaccurate results, and difficulty in operating computer software.

El-Sawalhi (2002) explored the project management practice by public owners and contractors in Gaza strip. He investigated the using of computer applications in supporting implementation of project management in cost estimating. He concluded that the main reason for low using of computer applications in cost estimating may be referred to the inefficient using in estimating computer applications. He also referred this partly for the lack of efficient training for using such programs.

Oberlender and Trost (2001) identified 45 elements that impact the accuracy of an early estimate. A questionnaire was used to collect data on completed construction projects. The questionnaire requested estimated and actual cost information and estimate score information. Usable data were received 67 construction projects that totaled \$5.6 billion. The data were analyzed using factor analysis and multivariate regression to determine the relative weight of each element in the estimate score procedure. They explored that the five most important factors that affect estimate accuracy are: (1) basic process design; (2) team experience and cost information; (3) time allowed to prepare the estimate; (4) site requirements; and (5) bidding and labor climate.

Lau (2000) explored the current state of-the-art of information technology applications in the New Zealand construction industry. 19.7% of organizations use estimating software. The results were collected from 76 respondents. He concluded that this result seemed low.

Christofferson (1999) discussed the methods of setting up spreadsheet estimates by using the powerful functions that can increase the capability and automation of Excel spreadsheets. He gave a reference to a survey conducted in 1997 in USA by "Member Computer Survey" which concluded that 46% of respondents are using estimating software in their works. The survey was done on 612 respondents.

CHAPTER 3

METHODOLOGY

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, developing an estimating computerized system, and evaluation of this system.

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 Strategy

The research strategy can be defined as the way in which the research objectives can be questioned. The research strategy can be classified into two types namely, Quantitative approach and Qualitative approach (Naoum 1998). Quantitative approach seeks to gather factual data and to study relationship between facts and how such facts and relationships accord with theories and the findings of any research executed previously (Fellows and Liu 1997). This approach is useful for descriptive, correctional, interpretative, and evaluate purposes (Burns and Grove 1993).

Qualitative approach seeks to gain insights and to understand people's perceptions of the world-whether as individuals or groups (Fellows and Liu 1997). Naoum (1998) says that the Qualitative approach is used "subjectively" to evaluate the opinion, view, or the perception of a person, towards a particular object. It is used when you have limited amount of knowledge about the topic. The data collected under the qualitative approach can be quantified to some extent but a qualitative approach tends to value the data as qualitative (Naoum 1998 quoted from Coolican 1993). In this study both Quantitative and Qualitative approaches are used. The questionnaire of this study is designed to get the factual information about the local practice of contractors in estimating as well as the opinions of contractors about this practice.

3.3 Research Design

The purpose of this research is to explore the current practices of cost estimating and develop a computerized estimating system to use in estimating works.

A structured questionnaire with personal interview is used together in this research. The structured 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. The advantages of interviews as summarized by (Naoum 1998) are:

- The response rate is relatively high.
- Providing more accurate answers.
- Eliminating the tedium and idleness of the respondents.

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). Figure 3.1 illustrates the methodology flow chart.

3.4 Research Population

The studied population is Gaza Strip contracting companies, which are classified first, second, and third class according to Contractors Union classification in Gaza Strip. This is applied only to companies which have valid registration in January 2003 according to the Contractors Union records. According to these conditions the total population has been 73 companies. 32 of them is first class, 22 of them is second class, and 19 of them is third class.

The samples were selected randomly from each level of three contractor's classes. The contractor's union list is ordered by the company number according to their priority of registration, three lists of contractors were prepared to represent first, second, and third classes. The randomly selection among the three lists was done by the researcher using

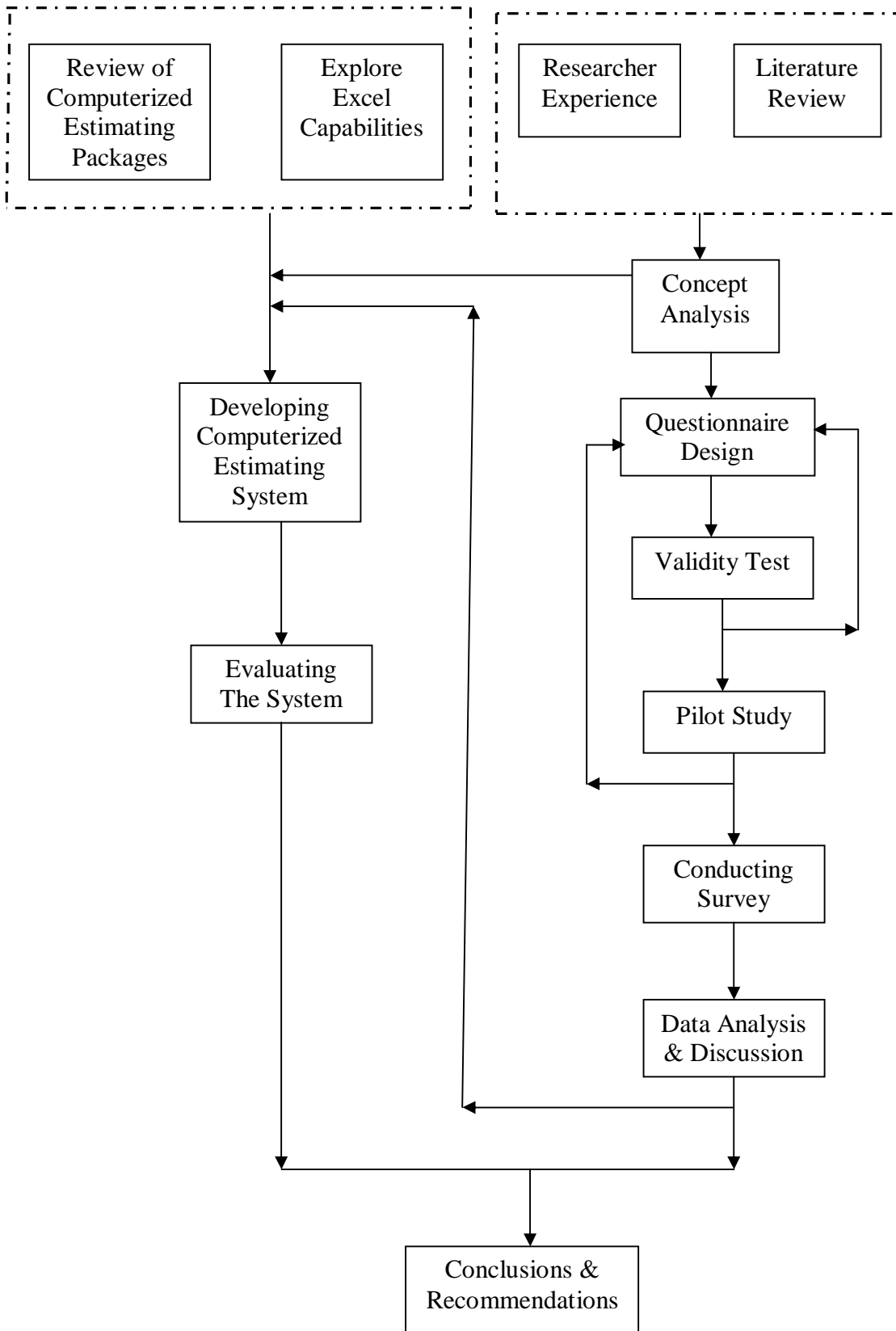


Figure 3.1: Methodology Flow Chart

non-replacement random selection. 25, 14, and 12 companies were selected from first, second, and third classes respectively to represent the total sample size.

The respondents were 40 contractors, distributed as 20, 10, and 10, from first, second, and third classes. The person in charge of estimating the works was interviewed and was asked to fill out the questionnaire. Personal interview facilitated the process of filling the questionnaire in terms of having better accuracy and more seriousness.

3.5 Questionnaire Design

Good questionnaire design is a key to obtain good survey results and warranting a high rate of return (Chan and Chan 2002, quoted from Zikmund 2000).

This research focuses on the common local practice of cost estimating, the obstacles which are facing the contractors in estimation works, and the using of computer applications in estimating in Gaza Strip. The questionnaire consists of three sections to achieve the objectives of the study. The first section is addressed to the company profile, the second covers the estimating and bid study which is divided into six parts, the first part deals with the estimating in general, the second is addressed to the estimating of the bid items, the third treats the database, the fourth is related to the indirect costs, the fifth is addressed to the effects of closure on project cost in Gaza Strip, and the last one covers the risk and contingencies. The third section deals with the use of computer estimating software.

The questionnaire was developed with closed ended questions. It based on the concepts and ideas concluded from the literature review related to cost estimating and the researcher's experience.

The original questionnaire was designed in Arabic (see Annex 1) to be more understandable. English version was attached in (Annex 2). The questionnaire was provided with a covering letter which explains the purpose of the study, the way of responding, the aim of the research and the security of the information in order to encourage a high response.

A draft questionnaire was first discussed with other colleagues who gave some useful advices. Many of these advices have been taken into consideration during the preparation of the questionnaire. Of course, the final revision of the questionnaire was discussed with the supervisor and amended according to his advice.

3.6 Instrument Validity

(Burns and Grove 1993) define the validity of an instrument as a determination of the extent to which the instrument actually reflects the abstract construct being examined. However, Lawrence and Martin (2003) give another definition, "Validity is the degree to which an instrument measures what it intends to measure, and the degree to which the "thing" that the instrument measure has meaning".

Content validity test was conducted by consulting five experts to evaluate the content of the questionnaire. In general, they agreed that the questionnaire is suitable to achieve the goals of the study. Important comments and some modifications have been done.

3.7 Pilot Study

A pilot study for the questionnaire was conducted before collecting the final data of the whole sample. It 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 1998). All questionnaires should initially be piloted; completed by small sample of respondents (Fellows and Liu 1997).

The piloting process conducted through interviewing the persons in charge of estimating. They were briefed about the questionnaire contents, inclusion of the data and the objectives of conducting this study. Five copies of questionnaire were distributed for piloting. The interviewed process generated some questions about explanation of certain terms and requested to modify some wording of the questionnaire. At the end of this process, some minor changes, modifications and addition were made and the final form of the questionnaire was constructed.

3.8 Data Coding and Data Entry

Questionnaires were numerically coded to enter the data systematically and efficiently. Data was entered using SPSS. Statistical advice was given in SPSS. Filled questionnaires have been entered after overviewing them. Data cleaning was carried out through double checking manually and by using the computer.

3.9 Statistical Analysis

Recording the information is an important step in the research process. Before starting of analysis the researcher needs to devise a data summary sheet for the data. The actual process of transferring the data from the questionnaire (after data have been collected) into a data summary sheet is called 'recording scheme' or 'producing coding' (Naoum 1998). After recording the information, the field of statistics can be applied to the raw data so that some kinds of interpretation and discussion can be made on the results.

Statistical analysis for questionnaires was done by using SPSS as follows:

- Defining and coding of variables.
- Summarizing the data on raw data sheet.
- Entering data.
- Cleaning Data.

After the above mentioned steps have been completed the descriptive statistic method has been utilized.

The descriptive statistic method is one of analysis methods which provide a general overview of the results. It gives an idea of what is happening (Naoum 1998). It either analyzes the responses in percentages, or contains actual numbers.

In this study, the Frequency distribution is used to describe aspects of a group of data. The researcher uses this method because of large amounts of raw data. It is often useful to distribute the data into categories and to determine the number of individuals or cases belonging to each category (Naoum 1998). This is called 'category frequency'. In this study the data is presented in the form of tabulation, bar charts, and pie charts.

3.10 Developing and Evaluation of the Computerized System

The results of this study show that the existing common practice in estimating is simple where most of contractors were still estimating their bids manually. The computer applications were rarely used for bid analysis in construction companies. This enhanced the goal of this study to develop a computerized estimating system.

The development process of computerized estimating system was based on some ideas which were concluded from the literature review related to cost estimating and the experience of researcher in construction industry. Also review of estimating software packages and *Ms Excel* capabilities provided other ideas in developing the system.

The researcher started to develop and implement a system that suited the Gaza Strip construction industry which is named GES. A test was conducted for the system after finishing the development process and some improvements were made by the researcher.

A structured questionnaire was used for evaluation the system, to find out the opinions of contracting companies about GES. The evaluation questionnaire was designed in Arabic (see Annex 8) to be more understandable. English version was attached in (Annex 9). The questionnaire was discussed with the supervisor and amended accordingly to his advice. Statistical analysis for questionnaires was done by using SPSS. The questionnaire consists of two sections to achieve the objectives of system evaluation. The first section is addressed to the performance of GES indicators and the second section covers the contracting companies' comments about the system.

The evaluation process was conducted to ensure that GES performance indicators were suitable for local practice. Also the evaluation process illustrated contractors' positive and negative comments about the system. Five first class contractors were selected for evaluating the system. The evaluation conducted through interviewing the persons in charge of cost estimating in the contracting companies. They were briefed about the aim and the components of the system. The researcher explains all steps for operating the system and how the system processes. They asked some questions for clarification. One week is given for contractors for training and testing the system. They were asked to fill the questionnaire at the end of this process. Some improvements are made in response to their comments.

3.11 Study Boundaries

The study has the following limitations:

- The study focuses on the construction estimating practice for Gaza Strip contracting companies.
- The target population of this study is first, second, and third class contractors. The fourth and fifth classes are excluded from this study.

- The contracting companies who have only valid completed registration according to the contractor's union records in January 2003 are included in the study. There are many contracting companies who are working in building works and they have not valid registrations.
- The computerized estimating system concentrates mainly on building construction projects.
- The bad effect of political situation during El Aqsa Intifada might affect the results of the survey; especially the volume of the works is low during the last three years of the Intifada.

CHAPTER 4

SURVEY RESULTS

4.1 Introduction

This chapter introduces the survey results which are analyzed by using SPSS. They are represented and discussed to give a better picture about the local construction estimating practice in Gaza strip. Comparison between these results and other recent studies in cost estimating are also made.

4.2 Results and Discussion

This section shows the result analysis which is obtained from the surveyed companies. The survey results are discussed in more details in this section, to explore the local practice in cost estimate.

4.2.1 Study Population Characteristics

The characteristics of study population comprise of year of establishment, the field of work of population, classification of respondent contractors, number of employees and their qualifications, number of executed projects and their values during the last five years, and the person in-charge-of estimating in contracting companies.

a. Year of Establishment

Table 4.1 shows that only (22.5%) of the contracting companies were established before 1994. (57.5%) of companies were established from 1994 to 1997, while (20%) of them were established after 1997. This indicates that most companies are relatively newly established having less than 10 years of experience.

Table 4.1 Year of establishment of contracting companies

Variable		Contractors		
		No.	%	Cumulative %
Year of establishment	Before 1994	9	22.5	22.5
	1994-1997	23	57.5	80
	After 1997	8	20	100

The total number of respondents=40 contractors.

b. Field of Work

Table 4.2 demonstrates that all respondents (100%) are involved, in a way or another, in building works, 80% of them are involved in water and sewage works, and 85% are involved in roads. This show how important is the building construction to the construction industry in Gaza Strip.

Table 4.2 Field of Company Specialization

Field of Company Specialization		Contractors		
		No.	%	Cumulative %
Building Works	Main	33	82.5	82.5
	Sub-main	7	17.5	100
	Non	0	0	100
Sewage & Water Works	Main	17	42.5	42.5
	Sub-main	15	37.5	80
	Non	8	20	100
Roads Works	Main	22	55	55
	Sub-main	12	30	85
	Non	6	15	100

The total number of respondents=40 contractors.

c. Classification of Contractors

Table 4.3 illustrates that about half of contractors (47.5%) are classified in first class in building works. (17.5%) of them are classified in first class in sewage and water works and (20%) of the respondents are classified in first class in roads works.

Considering the highest classification of the respondents, the researcher finds that 50% of the companies are classified in the first class, 30% of them are classified in the second class, while 20% of respondents are classified in the third class. This distribution shows that, the first class companies are much more the companies of other categories (see Figure 4.1).

Table 4.3 Degree of Classification

Variable		Contractors		
		No.	%	Cumulative %
Building Works	First Class A	13	32.5	32.5
	First Class B	6	15	47.5
	Second Class	9	22.5	70
	Third Class	12	30	100
Sewage & Water Works	First Class A	5	12.5	12.5
	First Class B	2	5	17.5
	Second Class	9	22.5	40
	Third Class	24	60	100
Roads Works	First Class A	8	20	20
	First Class B	-	-	20
	Second Class	11	27.5	47.5
	Third Class	21	52.5	100

The total number of respondents=40 contractors.

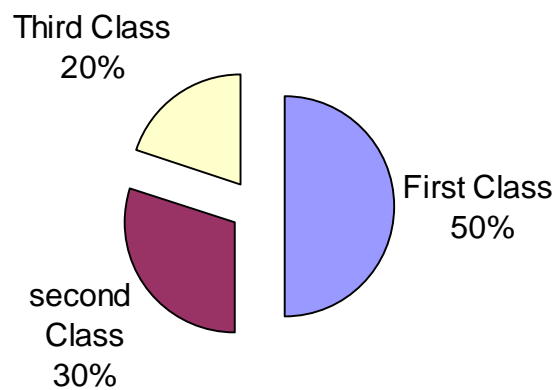


Figure 4.1 The general classification of respondent contractors

d. Number of Employees and Their Qualification

From Table 4.4, it has been found that all respondents employ civil engineers, while 30% of them employ architects, and 25.7% employ electrical and mechanical engineers.

Table 4.4 Qualification of employees in the contracting companies

Variable		Contractors	
		No.	%
Employees Specialization	Civil Eng.	40	100
	Architect Eng.	12	30
	Electrical Eng.	11	27.5
	Mechanical Eng.	11	27.5
	Others Eng.	2	5
	Technician	40	100

The total number of respondents=40 contractors.

Table 4.5 demonstrates that (50%) of respondents have 10 employees or less, whilst none of the contractors have more than 40 employees. The other 50% of companies have from 11-40 employees with the distribution illustrated in Figure 4.2.

Table 4.5 Distribution of respondents by number of employees

Variable		Contractors	
		No.	%
Number of employees	Equal or less than 10	20	50
	From 11 to 20.	15	37.5
	From 21 to 30.	3	7.5
	From 31 to 40	2	5
	More than 40	0	0

The total number of respondents=40 contractors.

These results reveal how small the organization size of contracting companies in Gaza Strip is generally. This means that more than half of contractors execute their projects mainly using subcontractors. One may expect that none of the contractors execute their

works completely with his own crew. In fact, subcontracting is an essential component of almost any project.

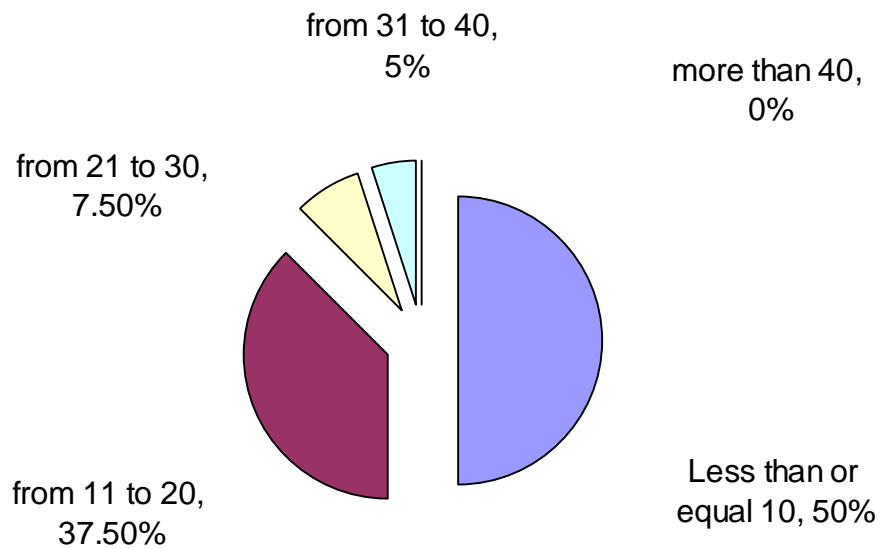


Figure 4.2 Distribution of respondents by number of employees

e. No. of Executed Projects and Their Value During the Last Five Years

Table 4.6 shows that 42.5% of contractors have executed less than 20 projects during the last five years and only one contractor has executed more than 40 projects. The majority of contracting companies (55%) have executed from 20-40 projects.

As illustrated in Table 4.6, (27.5%) of respondents executed projects with value less than 3 million dollars during the last five years. (40%) of contracting companies executed projects with value between 3 and 5 million dollars, and 32.5% of contractors executed projects with value more than 5 million dollars. This indicates that most of the executed projects are of small size. This may be referred to the effect of Aqssa Intifatah on the construction industry through the last three years.

Table 4.6 Distribution of number and value of executed project

Number and Value of Projects		Contractors	
		No.	%
Number of executed projects during (1998-2002)	<20	17	42.5
	20-40	22	55
	>40	1	2.5
Value of executed projects during (1998-2002) in millions \$	<3.0	11	27.5
	3.1-5.0	16	40
	>5.0	13	32.5

The total number of respondents=40 contractors.

f. Distribution of Respondent's Person In-Charge-Of Estimating

Figure 4.3 shows that 15% of contracting companies have estimating sections. For other companies estimating, the person in-charge-of estimating is the director in (62.5%) of companies and the technical director in (22.5%) of companies.

Regarding the existence of estimation sections in the contracting companies, it is worth noting that this study seems to be more realistic than the one done by Madi (2003). Madi finds that 53% of surveyed companies have an estimation section.

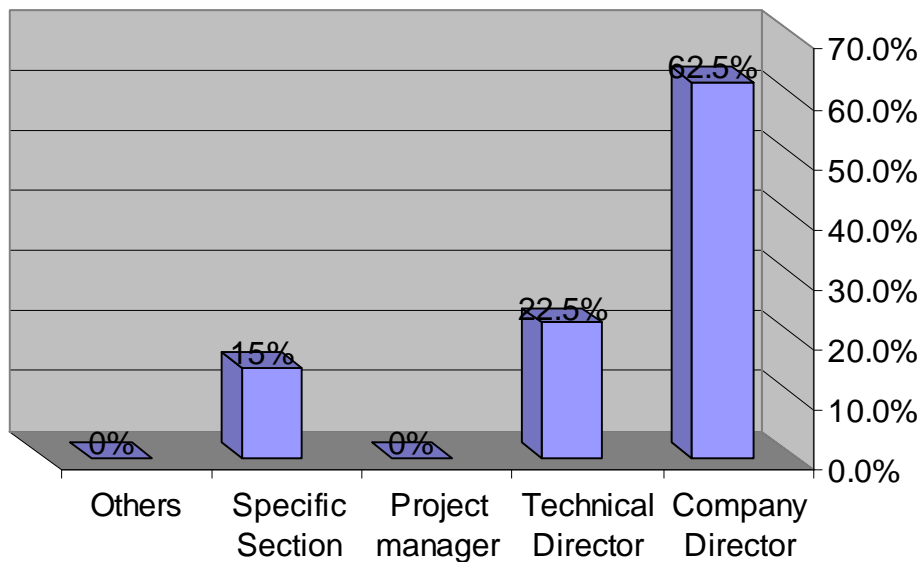


Figure 4.3 Distribution of respondent's in charge of estimating

The researcher believes that this may be referred to the type of the question where the question related to estimating section in Madi's study has limited answers (yes or no), where the respondent has to choose one answer. Another reason may be referred to the wrong understanding of contractors about the meaning of estimation division.

4.2.2 Bid Pricing

a. General

Considering the necessity and degree of using of some tools in estimating process in general, Table 4.7 shows that almost all of respondents (95%) consider the site visit is necessary, while 77.5% of contractors usually visit the site during the estimation process.

Another observation from Table 4.7, again almost all of contractors (97.5%) believe that inquiring about subcontractors' rates is necessary and 85% of contractors usually use this method. 52.5% of contracting companies consider that pricing the item according to each group of floors is necessary while only (22.5%) of respondents usually use this tool in tender estimating.

Table 4.7 Degree of necessity and using of pricing tools in general

Tool		Necessity Degree			Usage Degree		
		N	N s	Un	U	O	R
Site visit during estimating process	No.	38	2	0	31	9	0
	%	95	5	0	77.5	22.5	0
Quantity survey	No.	31	8	1	20	19	1
	%	77.5	20	2.5	50	47.5	2.5
Estimating waste material in general	No.	32	8	0	17	23	0
	%	80	20	0	42.5	57.5	0
Inquiring about materials prices in general	No.	39	1	0	34	6	0
	%	97.5	2.5	0	85	15	0
Inquiring about subcontractors rates in general	No.	12	24	4	8	25	7
	%	30	60	10	20	62.5	17.5
In multi-stories, using estimating process for each group of floors (grd. - 4 th , 5 th - 9 th , 10 and above)	No.	21	15	4	9	18	13
	%	52.5	37.5	10	22.5	45	32.5

(N = Necessary, N.s = Necessary somehow, Un = Unnecessary)

(U = Usually, O = Occasionally, R=Rarely)

The results illustrate that the most important tool and most used tool in pricing is inquiring about materials prices. This may be referred to the instability of materials prices and the fact that the materials form a significant percentage of the works.

The survey results demonstrate that the least important tool in estimating is inquiring about subcontractors' rates. This may be referred to most projects are executed by subcontracts excluding material prices where there is unnoticeable changes in labor rates.

Generally, in multi storey building, the unit rate is not the same for all floors. The higher the floor in the building is, the more the unit rate cost will be. The results show that about half of contracting companies (52.5%) consider that the item rate should be calculated for each group of floors is necessary but less than half of them usually use this tool. This result may be related to the limited time available for estimating process, or to the fact that most projects which are executed are small buildings.

It is noticed that (80%) of respondents consider the estimating of waste materials is necessary, but about half of them (42.5%) are usually practice this tool. This indicates the low realization of contractors about the cost of waste materials. From the experience of researcher, the waste materials have a noticeable effect on project cost, and the percentage of waste materials is high in Gaza Strip projects.

b. Pricing the Items

From the information in Table 4.8 it is clear that most of contracting companies (92.5%) consider that using detailed analysis for all elements of each item is necessary, but 82.5% of contractors usually use this tool. (40%) of companies usually calculate the secondary materials for each item, while 65% of contractors consider this tool is necessary.

From the results obtained, it is apparent that contracting companies consider the detailed analysis in estimating is the most important tool in bid estimation and it is the most used tool in estimating practice. This trend may be referred to their desire to get more accurate estimate, and minimize the risk and errors.

This comes in line with El-Sawalhi's study (2002) who concludes that disclosed 91.7% of the respondents use "detailed estimating" in estimating in Gaza Strip.

Other observation, the least used tool in estimating is using the price for the same item rate from a previous project. This may be referred to the fluctuation in material prices and

the instability of political and security situation in Gaza strip which affect much on item prices.

Table 4.8 Degree of necessity and usage of estimating the item tools

Tool		Necessity Degree			Usage Degree		
		N	N s	Un	U	O	R
By using the same item rate from previous projects.	No.	1	21	18	1	25	14
	%	2.5	52.5	45	2.5	62.5	35
By using detailed analysis only for big value items.	No.	13	17	10	14	9	17
	%	32.5	42.5	25	35	22.5	42.5
By using detailed analysis for all components of single item (material, labor, plant, subcontractor)	No.	37	3	0	33	5	2
	%	92.5	7.5	0	82.5	12.5	5
By calculating all secondary elements of materials for every item	No.	26	12	2	16	18	6
	%	65	30	5	40	45	15

(N = Necessary, N.s = Necessary somehow, Un = Unnecessary)

(U = Usually, O = Occasionally, R=Rarely)

The results demonstrate that 65% of companies consider the calculation cost of secondary materials for each item is necessary. About two thirds of them (45%) usually practice this. this result may be referred to the limited time available for estimating.

c. Database

As illustrated in Table 4.9 most respondents (92.5%) agree that building materials database is necessary for estimating process, while about two thirds of them usually use this tool. It is also noticed that 72.5% of respondents believe that building labor database is necessary but this tool is usually used by less than half of them (35%).

It is noticed that the most important tool in estimating process is building materials database which is also the most used tool in estimating. This result may be referred to the fact that in Gaza Strip materials cost has the lion's share of project cost. Moreover, regarding contractors' opinion of the importance of building database, materials database is ranked first, labors databases is ranked second, plants database is ranked third, and subcontractors' database is ranked fourth.

Table 4.9 Degree of necessity and usage of the database

Tool		Necessity Degree			Usage Degree		
		N	N s	Un	U	O	R
Building materials database	No.	37	2	1	24	13	3
	%	92.5	5	2.5	60	32.5	7.5
Building labor database	No.	29	10	1	14	22	4
	%	72.5	25	2.5	35	55	10
Building plant database	No.	19	17	4	9	23	8
	%	47.5	42.5	10	22.5	57.5	20
Building subcontracting database	No.	16	15	9	9	13	18
	%	40	37.5	22.5	22.5	32.5	45
Updating the database due to a noticeable change in prices	No.	17	14	9	11	8	21
	%	42.5	35	22.5	27.5	20	52.5
Updating the database when estimating a new project	No.	35	4	1	35	2	3
	%	87.5	10	2.5	87.5	5	7.5
Updating the database directly due to any changes in prices	No.	13	12	15	8	6	26
	%	32.5	30	37.5	20	15	65

(N = Necessary, N.s = Necessary somehow, Un = Unnecessary)

(U = Usually, O = Occasionally, R=Rarely)

As for frequency of updating the database, the results show that most of contracting companies (87.5%) believe that updating the database when estimating new a project is the most important tool. The same percentage of contractors (87.5%) usually uses this tool. It seems that contractors find it more practical to consider updating database at the beginning of estimating new project rather than any other time.

d. Indirect Costs (Site and general)

The results show in Table 4.10 that majority of contractors (82.5%) calculate the site overheads in details as required by tender documents, while the rest calculates the site overheads as a percentage of total cost of the project.

Table 4.11 illustrates that 40% of respondents estimate the general (company) overheads as required by tender documents, while 37.5% of them estimate the overheads as percentage of total project cost, and 7.5 % of contractors calculate the overhead as a lump sum.

Table 4.10 Estimating site overheads distribution

Variable		Contractors	
		No.	%
Calculating site overhead	As a % age of direct costs	7	17.5
	As a lump sum	0	0
	In details as specified in bid documents.	33	82.5
	No affect on cost	0	0

The total number of respondents=40 contractors.

The rest (15%) of contractors do not calculate the general overheads at all. The researcher believes that in this case most contracting companies include the general overheads in the profit margin.

Table 4.11 Estimating general overheads distribution

Variable		Contractors	
		No.	%
Calculating general overhead	As a % age of direct costs	15	37.5
	As a lump sum	3	7.5
	In details as specified in bid documents.	16	40
	No affect on cost	6	15

The total number of respondents=40 contractors.

In general, from the interview with respondents, the researcher concludes that most of contractors believe that the general overheads have little effect on project cost. This may be referred to the fact that most companies are small organization, with small number of employees.

e. Effect of Security Closure on Construction Cost

Table 4.12 represents the effect of closure on projects cost in Gaza strip as expressed by respondents. These results show 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. However, about one third of contractors (35%) believe that the closure has a little effect on other materials cost.

Table 4.12 The effect of security closure on cost

The Factor		S.A	A	\sum S.A + A	N	D	S.D
The closure causes a noticeable increase in the main material prices specially cement and aggregate	No.	27	13	40	0	0	0
	%	67.5	32.5	100	0	0	0
The closure causes an increase in other material prices (painting, electrical, sewage material)	No.	2	12	14	24	2	0
	%	5	30	35	60	5	0
The closure causes an increase of the labor rates	No.	0	1	1	1	29	9
	%	0	2.5	2.5	2.5	72.5	22.5
The closure causes an increase of the plant rates	No.	0	1	1	14	20	5
	%	0	2.5	2.5	35	50	12.5
The closure increases the subcontractors rates	No.	0	0	0	7	27	6
	%	0	0	0	17.5	67.5	15
The closure causes a delay of a project completion	No.	11	25	36	4	0	0
	%	27.5	62.5	90	10	0	0
The closure causes an increase of the total project cost	No.	13	27	40	0	0	0
	%	32.5	67.5	100	0	0	0

(S.A= Strongly Agree, A=Agree, N=Neutral, D= Disagree, S.D= Strongly Disagree)

On the other hand, the results show that most of contractors disagree with the statement that the closure causes an increase in the labor, plant, and subcontractors rates. One may find these results normal as it noticed that closure leads to high unemployment rate in Gaza Strip which causes a general drop in labor related wages.

A further observation, most respondents (90%) consider that the closure causes project delays. This may be referred to the fact that due the non availability of raw materials causes an increase in material prices, and causes project delays. These two reasons increase the project cost. However there is a consensus that closure causes an increase of the total project cost. This ascertains that the net effect of closure on construction is negative.

These results are supported by the study done by Madi (2003) about the factors affecting the accuracy of estimating. He concludes that the factor of continuous increase in unit cost of construction materials was ranked at the first position in the group of the factors related to market requirements. Also he mentioned that of continuous increase in materials rate may be justified by the repeated closure on Gaza Strip and the instability of local market.

f. Risk Factor

From the results obtained, it is apparent that in Table 4.13 the Israeli closure is ranked first in affecting determination of risk factor. Almost all of contractors (97.5%) believe that the closure affects risk factor. This may be referred to the increasing of materials price, non availability of materials during the closure period, and project delays.

Increasing material prices is ranked second (87.5%) in affecting determination of risk factor. This result may be partially related to the instability of political situation and the fluctuation of foreign currency exchange rates. The consultant is ranked third (65%) in affecting risk factor. The researcher thinks that this trend may be referred to the fact that many of contractors work without supervision. This is besides that consultants do not have the necessary practice experience. So for such contractors the supervision of the consultant represents a source of risk. On the other hand consultant supervision is not always practical and fair.

Project location is ranked fourth (52.5%). This result may be referred to the political situation, internal closure, and the segmentation (segmentation is dividing the area of Gaza Strip into parts by the Israeli forces, and the limitation of movements between these parts). This increases the effect of location in determining the risk factor especially if a projects is located near Israeli settlements or check points.

Table 4.13 The factors which are affecting the risk

The Factor		V.H	H	\sum V.H +H	A	L	V.L
The closure	No.	15	24	39	1	0	0
	%	37.5	60	97.5	2.5	0	0
The owner	No.	4	7	11	22	7	0
	%	10	17.5	27.5	55	17.5	0
The consultant	No.	5	21	26	11	3	0
	%	12.5	52.5	65	27.5	7.5	0
Project type	No.	5	6	11	21	7	1
	%	12.5	15	27.5	52.5	17.5	2.5
Project location	No.	7	14	21	15	3	1
	%	17.5	35	52.5	37.5	7.5	2.5
Increase in material prices	No.	12	23	35	4	1	0
	%	30	57.5	87.5	10	2.5	0
Increase in labor rates	No.	2	5	7	25	6	2
	%	10	12.5	22.5	62.5	15	5
Delay in project execution time	No.	3	16	19	13	8	0
	%	7.5	40	47.5	32.5	20	0

(V.H= very high, H=high, A=average, L= low, V.L= very low)

In general, the results show most of respondents (80%) consider that the risk factor in Gaza Strip is high as shown in Table 4.14. The main reason for this result is the instability situation in the area as indicated by contractors.

Table 4.14 Risk Factor

The Factor		V.H	H	A	L	V.L
The risk factor in construction projects in Gaza Strip is considered to be	No.	4	28	8	0	0
	%	10	70	20	0	0

Table 4.15 shows the distribution of respondents' estimation of the risk factor. The majority of contracting companies (67.5%) think that they calculate the risk in a balanced way, while 25% of them think that they under-estimated it. 5% of respondents think that they over-estimated the risk factor.

Table 4.15 Estimating the risk factor

Variable		Contractors	
		No.	%
Calculating risk factor	Risk value is 0	1	2.5
	less than it should be	10	25
	In balanced way	27	67.5
	more than it should be	2	5

The total number of respondents=40 contractors.

4.2.3 Using Computer Applications to Support Cost Estimating

a. Using Cost Estimating Software (CES) Packages in Bid Estimating

As illustrated in Figure 4.3, the results show that none of contractors are doing their estimating mentally, and at the other end one respondent (2.5%) uses cost estimating software (CES) in bid estimating.

This study seems to be more realistic than the one done by Madi (2003). Madi finds that 62.1% of surveyed companies use computer application in estimating. The researcher believes that this may be referred to the contractors' knowledge about the use of computer applications in estimating where they may think that the using of *Ms-Word* is a type of computer applications in estimating.

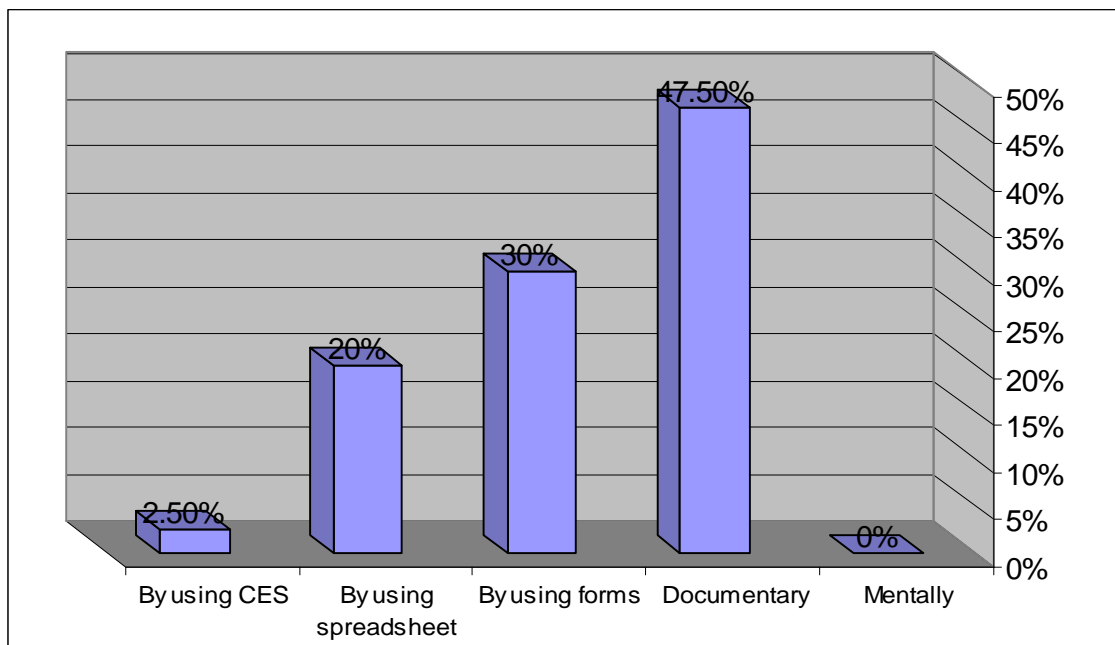


Figure 4.4 Estimating Method Distribution

Table 4.16 shows contractors' use of estimating computer applications in different areas. The results show that there is a gradation in the percentage of users of estimating software. This gradation is almost consistent with the standard of living in each country and the development of construction industry. This may stimulate researchers to provide the local practice with the suitable computer software applications in construction to fill a wide gap existed in this area.

Table 4.16 Using computer applications in different areas

Cost Estimating Tool	Al-Shanti (2003) Gaza Strip (This research)	Samadony and Al-Labbad (1997) Egypt	Lau (2000) New Zealand	Christofferson (1999) USA
	% of Use	% of Use	% of Use	% of Use
Using Software In Cost Estimate	2.5	7	19.7	46

b. Obstacles that are facing the local companies in using Cost Estimating Software

Table 4.17 represents the obstacles which are facing the contractors in using Cost Estimating Software (CES). These results show that the majority of respondents (87.5) consider lack of availability of user friendly cost estimating software is the most important obstacle that affects the using of computerized estimating packages. 60% of respondents think that shortage of qualified persons in using CES is another obstacle that has big effect on the using of computerized estimating packages.

Another observation noted from Table 4.17, most of contractors believe that shortage of CES consultants, the high cost of CES, and possibility of increasing the bid cost due to using CES have low effect on using computer applications in estimating.

The researcher notices that the most important obstacles are technical ones which are (third and fourth obstacles), while the least important one are the cost related obstacles (fifth, seventh, and eighth). The culture related obstacles have medium effect on using computerized estimating systems such as: realization and convincement for the importance of using computerized estimating system.

Table 4.17 The obstacles which are affecting on the usage of CES

The Obstacles		V.H	H	\sum V.H +H	A	L	V.L
No realization for the importance of CES	No.	6	12	18	14	5	3
	%	15	30	45	35	12.5	7.5
No convincement in using CES	No.	2	16	18	10	10	2
	%	5	40	45	25	25	5
Shortage of user friendly CES	No.	23	12	35	3	2	0
	%	57.5	30	87.5	7.5	5	0
Shortage of qualified persons in using CES	No.	6	18	24	10	4	2
	%	15	45	60	25	10	5
Shortage of CES consultants	No.	4	10	14	20	4	2
	%	10	25	35	50	10	5
Simplicity of manual estimating	No.	2	15	17	12	8	3
	%	5	37.5	42.5	30	20	7.5
The high cost of CES	No.	1	4	5	3	28	4
	%	2.5	10	12.5	7.5	70	10
Increasing the bid cost	No.	1	2	3	20	12	5
	%	2.5	5	7.5	50	30	12.5

(V.H= very high, H=high, A=average, L= low, V.L= very low)

The importance of technical obstacles has been supported by Madi (2003). He concludes that the main reason for non using computer in cost estimating is lack of suitable software for estimating.

c. Factors that Are reducing the Accuracy of Bid Estimation

Table 4.18 represents the factors which are negatively affecting the accuracy of bid estimation. The results show that majority of contracting companies believe that the most important factors which have a big effect on reducing the accuracy of estimating are the limited time allowed for estimating process (80%), unclear project plans (80%), and the estimating overload in the company (65%). On the other hand, the factors which have low effect on reducing the accuracy of estimating are difficulty of getting subcontractors rates (12.5%), and difficulty in getting updated materials price from the suppliers (25%).

Table 4.18 Factors that reduce the accuracy of bid estimation

The Factors		V.H	H	\sum V.H +H	A	L	V.L
Limited time available for bidding process	No.	11	21	32	3	3	2
	%	27.5	52.5	80	7.5	7.5	5
Difficulty of getting subcontractors rates	No.	3	2	5	11	20	4
	%	7.5	5	12.5	27.5	50	10
The estimating overload in the company	No.	8	18	26	9	4	1
	%	20	45	65	22.5	10	2.5
The existence of many executed projects in the company	No.	0	13	13	15	8	4
	%	0	32.5	32.5	37.5	20	10
Difficulty in getting updated materials price from the suppliers	No.	4	6	10	14	16	0
	%	10	15	25	35	40	0
Estimating the bid manually	No.	1	17	18	14	7	1
	%	2.5	42.5	45	35	17.5	2.5
Unclear project plans	No.	8	24	32	3	5	0
	%	20	60	80	7.5	12.5	0

(V.H= very high, H=high, A=average, L= low, V.L= very low)

d. Benefits of Using Estimating Software Packages

Table 4.19 shows the benefits obtained by using computerized estimation. The results indicate that most of contractors surveyed believe that using of computer estimating software will be very beneficial in general. These benefits are:

- Simplicity of updating data.
- Building archive for previous projects.
- Minimizing errors and minimizing human omission.
- Building general prices database.
- Maximizing accuracy of cost estimate.
- Fast cost estimating and saving time.

Table 4.19 Benefits obtained by using CES

The benefits		V.I	I	Σ V.I +I	N	N.I	N.I.A
Building` general prices database (materials, labors, plants, subcontractors)	No.	24	12	36	1	3	0
	%	60	30	90	2.5	7.5	0
Establishing archive for previous projects	No.	10	29	39	0	1	0
	%	25	72.5	97.5	0	2.5	0
Simplicity of prices updating	No.	14	26	40	0	0	0
	%	35	65	100	0	0	0
Fast cost estimating and saving time	No.	8	26	34	4	2	0
	%	20	65	85	10	5	0
Saving efforts in bid estimate	No.	6	15	21	16	2	1
	%	15	37.5	52.5	40	5	2.5
The contractors prices are approximate	No.	6	7	13	17	10	0
	%	15	17.5	32.5	42.5	25	0
Maximizing accuracy of cost estimate	No.	7	28	35	3	2	0
	%	17.5	70	87.5	7.5	5	0
Minimizing errors	No.	8	29	37	2	1	0
	%	20	72.5	92.5	5	2.5	0
Minimizing human omission	No.	7	30	37	2	1	0
	%	17.5	75	92.5	5	2.5	0
Preparing total cost of materials, labors, plants, and subcontractors separately	No.	6	16	22	14	4	0
	%	15	40	55	35	10	0

(V.I= very important, I=important, N=neutral, N.I not important, N.I.A= not important at all)

e. Respondents' Efficiency of Using Popular Computer Software

Table 4.20 shows the respondents efficiency of using popular computer software. These results illustrate that all companies (100%) have good to very good capabilities in using *Ms-Excel* Spreadsheet and *Ms-Word*, where 85% of respondents have very good capabilities in using *Ms-Excel* Spreadsheet and 67.5% of them have very good capabilities in using *Ms-Word*. 45% of contractors have very good capabilities in using

Ms-Project. While only 7.5% of respondents have very good capabilities in using *Ms Access*.

The distinguishing place of *Excel* may be referred to its advantages which are stated by Christofferson (1999) as the following:

- it is inexpensive.
- it is easy to use.
- it can be customized to the company style of doing business.
- it is very powerful.

Table 4.20 Efficiency of respondents in using popular computer software

		Very Good	Good	Average	Low	Very Low
Ms-Word	No.	27	13	0	0	0
	%	67.5	32.5	0	0	0
Ms-Excel	No.	36	6	0	0	0
	%	85	15	0	0	0
Ms-Access	No.	3	5	9	17	6
	%	7.5	12.5	22.5	42.5	15
Ms-Project	No.	18	19	2	1	0
	%	45	47.5	5	2.5	0

f. Contractors' Opinions Regarding Willingness to Get Estimating Software Packages

In general, all contractors surveyed (100%) are willing to get and use user friendly and low cost inexpensive cost estimating software in bid estimation. Table 4.21 shows that 40% and 60% of contractors surveyed are strongly agree and agree, respectively, to get and use user friendly and inexpensive cost estimating software in bid estimation.

Table 4.21 Contractors' willingness to get estimation software packages

The Factor		S.A	A	N	D	S.D
The opinion of respondents regarding willingness to get and use user friendly and inexpensive cost CES.	No.	16	24	0	0	0
	%	40	60	0	0	0

(S.A= Strongly Agree, A=Agree, N=Neutral, D= Disagree, S.D= Strongly Disagree)

4.3 Conclusions

From the results obtained, analyzed, and discussed, the researcher concludes that:

- The contracting companies in Gaza Strip are:
 - relatively newly established.
 - involved mainly in building works.
 - small size organizations.
 - depending heavily on subcontractors.
- Most contractors are interested in using some tools in projects estimation such as:
 - detailed analysis pricing items.
 - using forms in estimating process
 - using spreadsheet in estimate calculations.
- The Israeli closure has big effect on continues increasing of material rates and this causes an increase of the total project cost.
- Item pricing for each group of floors is partially utilized in bid estimation.
- Site overheads are calculated in details as per bid documents.
- All contractors consider the risk factor is relatively high in construction project in Gaza Strip. However, most of contracting companies consider calculating the risk in balanced way. This may be referred to the high competition in construction.
- Most of contracting companies are still estimating projects completed manually.
- The limited time available to the bidding process is the most effecting factor that reduces the accuracy of estimation.
- Building and updating database are considered very important in estimating process.
- Many benefits can be obtained from using user friendly and inexpensive computerized estimating system such as:
 - Building database.
 - Simplicity of updating data.
 - Fast cost estimating and saving time.
- Some obstacles that face the contractors in using computerized estimating systems are:
 - Shortage of qualified persons in using computerized estimating.
 - Shortage of user friendly estimating software.

CHAPTER 5

GAZA ESTIMATOR SOFTWARE (GES)

Concepts, Description, Implementation, and Evaluation

5.1 Introduction

In developed countries, computers have played an important role in the construction industry, particularly in cost estimating. Many of software packages in estimating are developed and they are available to assist the contractors in preparing the bids. Gaza Estimator Software (GES) aims at improving the local practice in cost estimating. This chapter presents the concepts, description, implementation, and evaluation of GES.

5.2 Underlying Philosophy

Out of the many parties involved in a construction project, the contractor plays an important and central role. S/he prices the bid and makes his best to finish the work as specified on time and within the budget.

As concluded in the previous chapter, most contractors in Gaza Strip do not use computers in cost estimating of construction projects. The researcher believes that in this way they miss the opportunity to have more accurate estimate and consequently a better chance to win bids. The researcher hopes that construction industry in Gaza Strip will benefit from GES as it aids in developing a more accurate cost estimate. Also the researcher hopes that GES satisfies some of the needs of local building construction contractors in cost estimating and fills some gaps in local practices of pricing the bids.

The researcher begins developing GES based on cost estimating related literature, the results obtained from field survey, reviewing available cost estimating software packages (see Annex 4), and exploring the *Microsoft Excel* spreadsheet capabilities.

GES is a computerized system designed to help the local contracting companies in coping with the difficulties they face to produce a more accurate estimate. This system has been designed aiming at:

- saving contractor's time.

- decreasing estimating staff efforts.
- simplicity in building and updating database.
- improving contractor's chances in competition.
- making the contractors more self confident.

GES deals with the costs incurred by the contractor from the moment s/he receives the bill of quantity (B/Q) till the time of preparing the final estimate of the project and bid submission. GES is addressed to handle the costs of measured contracts with bill of quantities. This type of contract is very popular in Gaza Strip projects. It is also the most used type of contract in neighboring countries such as Jordan and Egypt. Moreover, this type of contracts is widely used in developed countries such as United Kingdom (McCaffer and Baldwin 1991).

In multi storey building, the unit rate is not the same for all floors. The higher the floor in the building is, the more the unit rate cost will be. However, it is not practical for preparing a unit rate for each floor. So, the researcher develops a new B/Q which he calls "Stratified B/Q". This B/Q makes a provision to include different average unit rate for each group of floors, where the floors are divided into three groups of floors. The ground floor to and including 4th floors are grouped in the first group. The second group comprises to 5th to and including 9th floors. And the last group includes the tenth floors upwards. This way provides the user more accurate unit rate for different floors.

GES is a PC-based system. *Microsoft Windows 98* has been adopted as the environment under which GES is to be run. The software used in developing GES is *Microsoft Excel 2000*, as most companies in Gaza Strip are more familiar with *Ms Excel* than any other software as observed from the results of this research. The researcher has tried to develop the system to be as friendly to use as possible utilizing the facilities available through *Excel*. GES gives the user enough flexibility and freedom throughout the program.

5.3 Overview of Gaza Estimator Software "GES"

Figure 5.1 illustrates the overall picture of GES within its environment which shows the interactive relationships between the different components. The project unpriced B/Q is the initial input to GES. The eventual output is the bid priced B/Q. Of course, this is produced after processing in GES with continuous interaction with the user and the database.

5.4 Database Management

The researcher assumes that there will be a central database for the company which is made available for application. The central database contains data ready for direct use in estimating the bid i.e. the data is suitably formatted to deal with GES. It should be also up-to-date data. The central database can be developed from the historical data generated from actual records of finished projects. It can also be arbitrarily changed to reflect the changes in the materials, labor, plant, and subcontractors' rates.

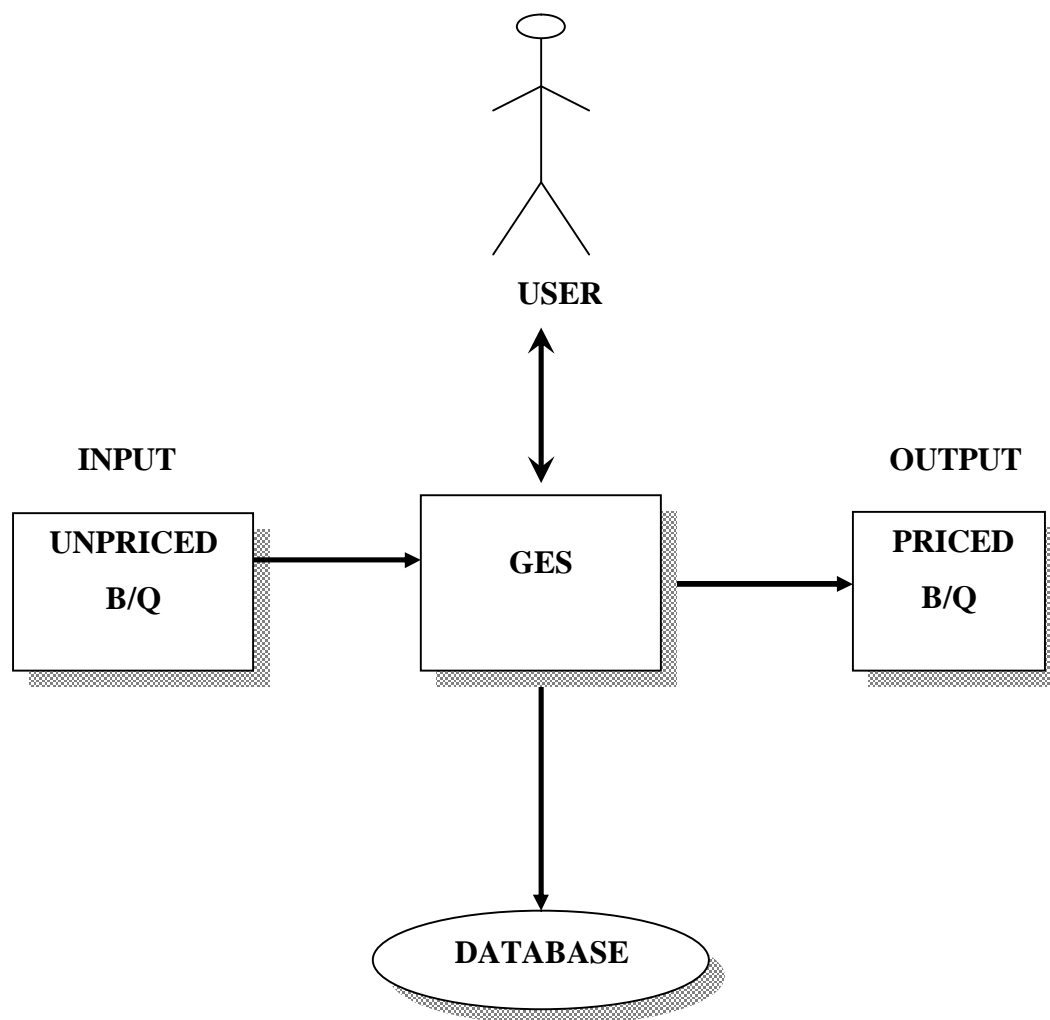


Figure 5.1: GES Overall Interactions

5.5 Coding and Numbering System

Coding in computer is necessary as a way for identification. Preparing information in a Pre-coded form saves a lot of time and effort in inputting and processing it in computer (Sha'at

1993). Due to the lack of standard coding system for building construction in Palestine, the researcher suggests numbering system only for the main bill items and some of sub-items, to be used in GES (see Annex 4). Each contractor can use these numbering items and prepare a code system in numbering the other sub-items.

5.6 System Interface

The user's interface begins right from the moment s/he runs the program by double clicking on its icon (Ges.xls) that is located typically in the GES folder (Figure 5.2). GES begins with an *Excel* sheet view (Figure 5.3) having an introductory 'Welcome to Gaza Estimator Software' message explaining to the user how to deal with GES.

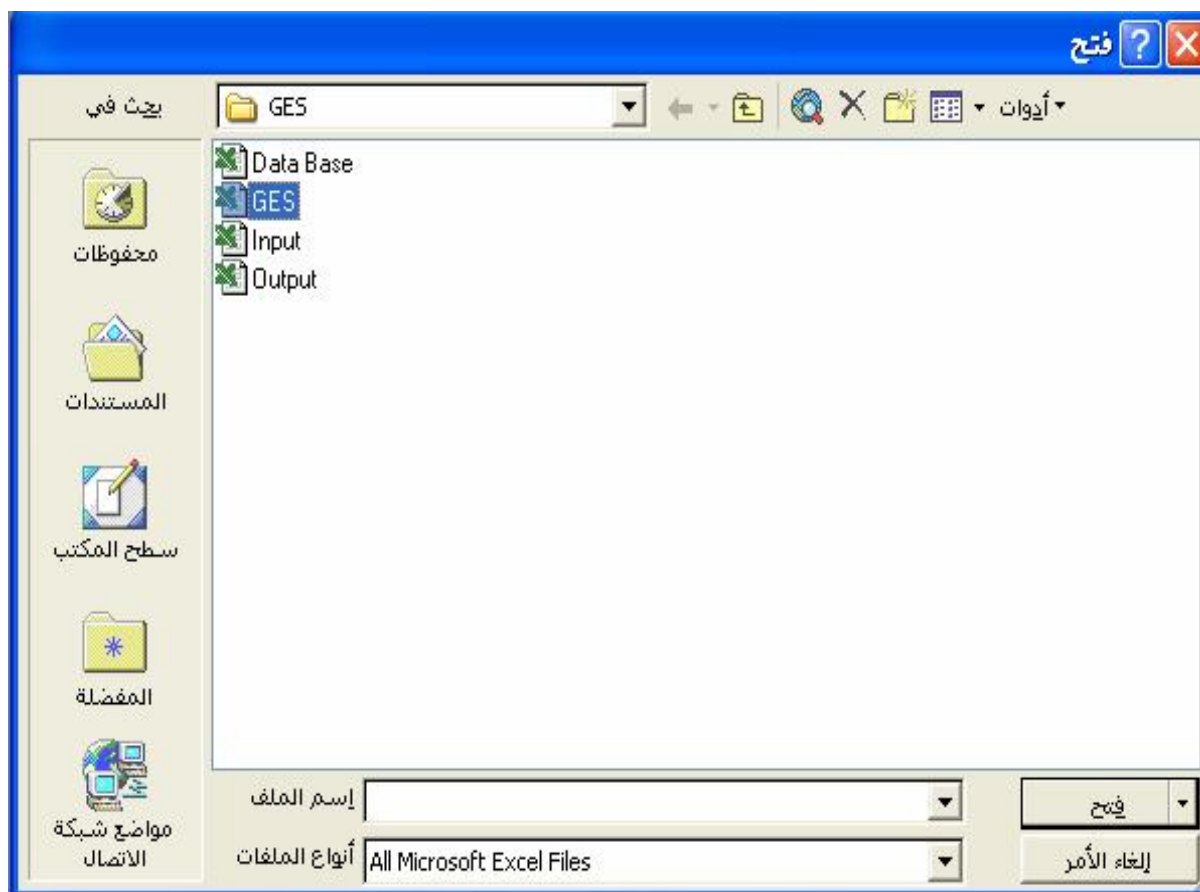


Figure 5.2: Entering to GES

GES has two main Menus, the first for a new user (see Figure 5.4), and the second for the old user (see Figure 5.5). The menu for new user is used only for input data, but the menu for an old user is used for preparing cost estimate and cost reports. The new user has to use the two menus, but the old user needs to use the second menu only.

5.7 GES Concepts

One objective of GES is to help the user in pricing the Bill of Quantities (B/Q) and make it ready for bid submission. The project initial input is assumed to include the B/Q of the project. The estimator is requested to enter a unit rate against each bid item.

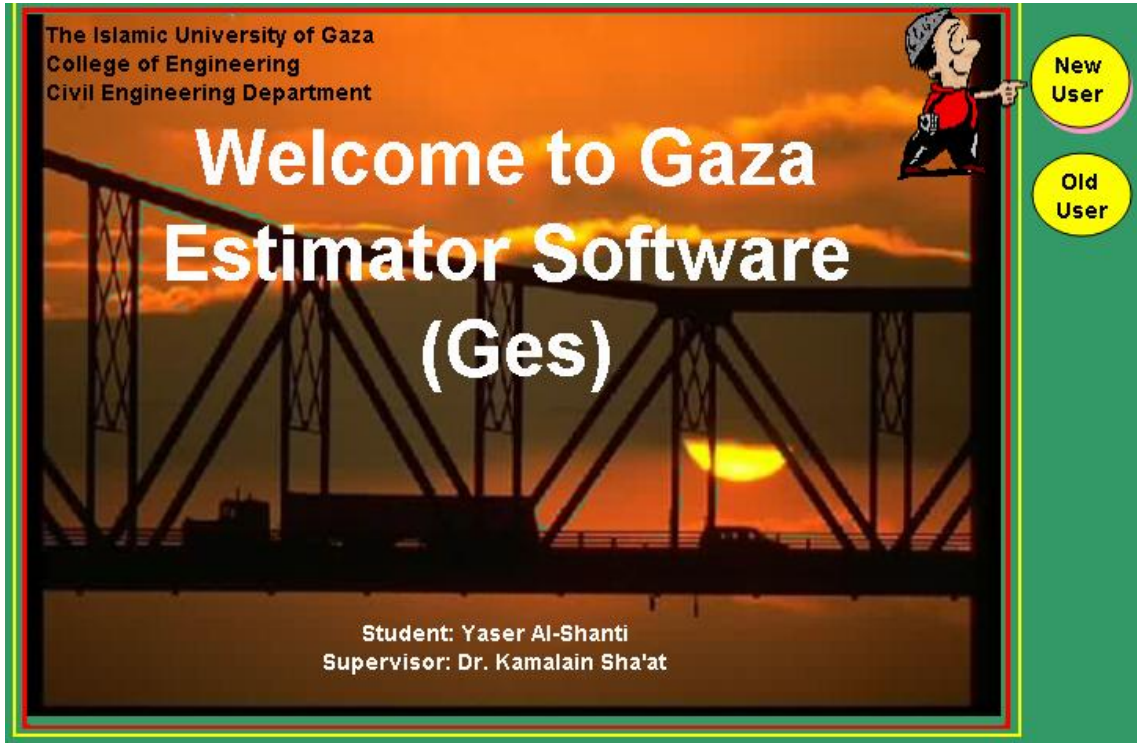


Figure 5.3: GES Interface

The traditional B/Q consists of one column for the items quantity and one column for unit rate. In this way B/Q considers the item unit rate is the same for all different floors. From the researcher's experience and the local practice in Gaza strip, the unit rates are not the same in all building's floors. The item unit rate for any item executed in the sixth floor is higher than the corresponding one executed in the first floor. The materials, labor, plant, and subcontractor's costs increase when we are going upward.

To get more accuracy in bid estimation, the researcher begins developing quantities analysis sheet according to each group of floors for each item. For this purpose the researcher develops the Stratified B/Q as shown in Figure 5.6.

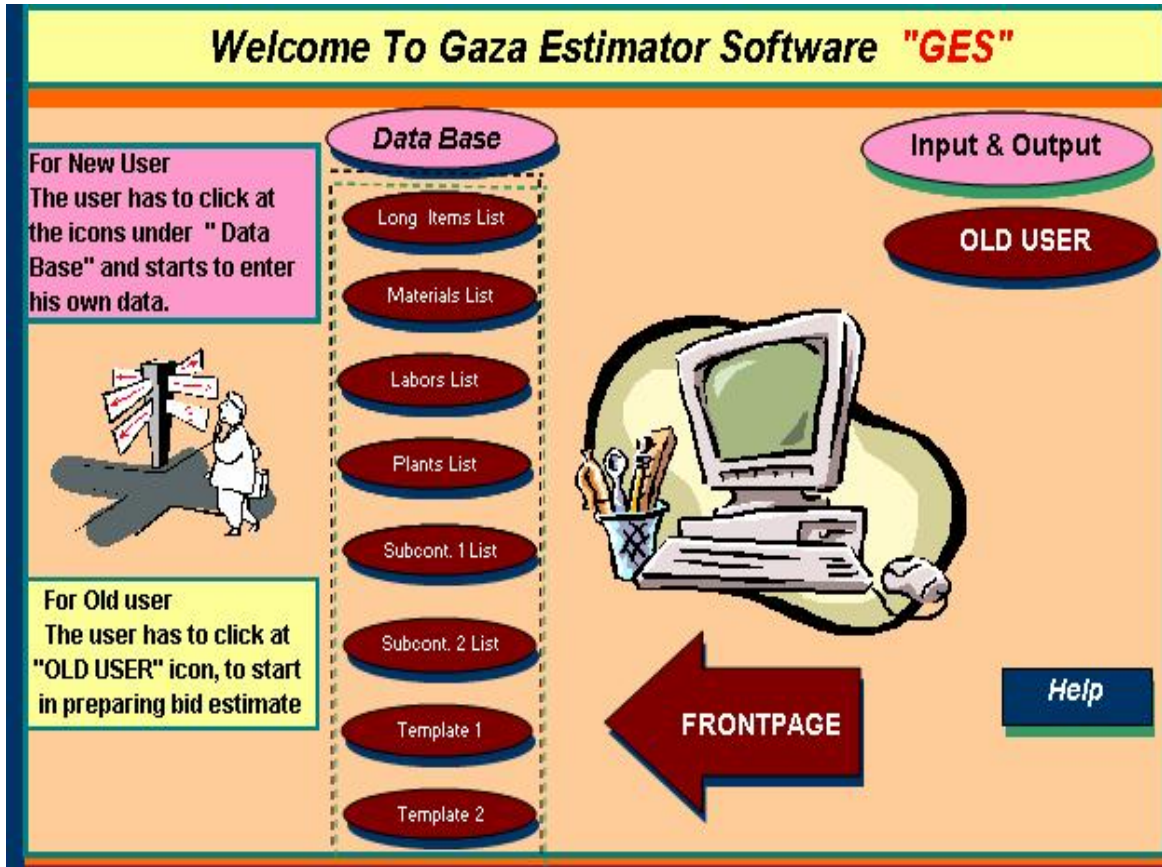


Figure 5.4: GES Menu (New User)

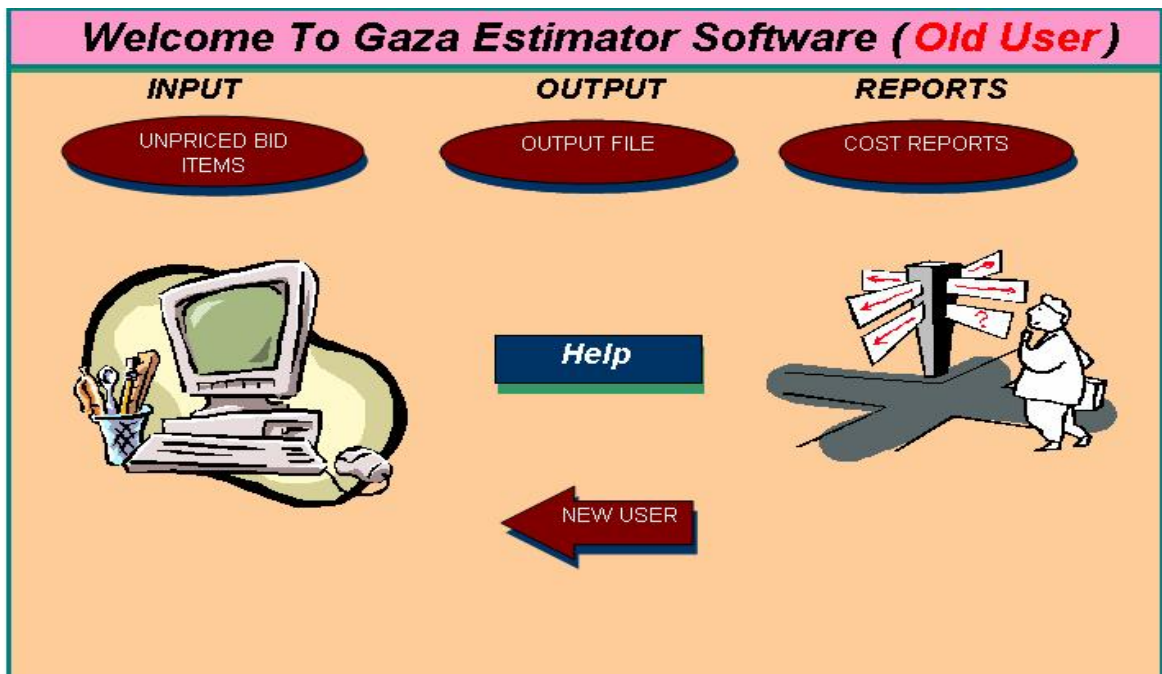


Figure 5.5: GES Menu (Old User)

The Stratified B/Q contains three columns for quantity instead of the one provided in the traditional B/Q. The item quantity has to be distributed according to the quantities of each group of floors. The first column is allocated for first group quantity. The second column is allocated for the second group quantity and the last column is allocated for the third group quantity. The Stratified B/Q also provides three columns for unit rate; each column for each group of floors. The estimator is requested to enter three quantities and three unit rates against each bid item in Stratified B/Q. From these six columns the user obtains the extended totals and the average unit rates for each item. These totals are added together to give the bid total of project direct cost. Also this Stratified B/Q contains the total indirect costs which are obtained from separate sheet. Risk (Contingency) and profit are specially itemized in this Stratified B/Q, as a percentage of total cost (direct and indirect cost).

5.7.1 Data handling

As it has been shown in subsection 2.12.5 under preparing the estimate, there are two main methods to calculate bill item unit rates: unit rate estimating and operational estimating. Unit rate estimating is considered in GES with an exception that, the user begins to fill the Stratified B/Q to get the average unit rate for each group of floors and after adding the indirect costs, risk, and profit, the user gets the final unit rate for each item to be used in pricing the B/Q for bid submission.

GES gives the flexibility to let the user to enter selected risk factor (contingency), and the mark-up percentages. In this way the user can change the percentages according to the conditions of the contract, and the competition status.

5.7.2 Time Saving in Bid Period

The time is very crucial factor in bidding process and the allowed time available for bid estimating is limited. On the other hand, producing an accurate and comprehensive estimate needs a lot of time. GES helps in saving the estimating staff efforts.

It is a significant feature of GES that it enables the estimator to deal separately with bill of quantities for different floors. The user can utilize 80/20 Pareto's Rule. This rule means that about 80% of the project cost is attributed to almost only 20% of the B/Q items (Sha'at 1993 quoted O'Neill 1989, Ritz 1994, McCaffer and Baldwin 1991).

FIGURE 5.6: Stratified Bill of Quantity

FIGURE 5.6: Stratified Bill of Quantity

FIGURE 5.6: Stratified Bill of Quantity

FIGURE 5.6: Stratified Bill of Quantity

FIGURE 5.6: Stratified Bill of Quantity

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FIGURE 5.6: Stratified Bill of Quantity

FIGURE 5.6: Stratified Bill of Quantity

In applying Pareto's rule the user can first use the Stratified B/Q as traditional B/Q having one unit rate and one quantity for each item. By multiplying the unit rate by the quantity, the result is the total cost for each item. The user sorts the bid items according to their value and determines the items which have high values. The user can compute quantities and calculate the cost for only these items. The user needs to redistribute the item quantity into three quantities according to the groups of floors and to fill these quantities into the Stratified B/Q to get the average unit rate for these items which have high values. This process is considered one of the main advantages of GES, especially when the available time is limited for bid estimation. GES helps the estimating team to complete the project estimating with the allowable time, and achieving the estimating goal.

5.8 Description of GES

The program structure is divided into four files; each of which is assigned separate sheets.

With reference to Figure 5.2, the main components of GES are:

- a. Ges file which is used for operating the program.
- b. Input file which is used only for entering the unpriced B/Q.
- c. Database file which is used as store for all data of the company which is up-to-date data.
- d. Outputs file which is used for estimating the bids and giving cost reports for materials, labor, plant, and subcontracts cost.

In each file there is a help sheet for guiding the user how to enter the data.

GES sample forms are exhibited in Annex 5 (see Figure A5.1 to A5.22). Figure 5.7 shows GES system. GES components are described as the following:

a) Ges File

Ges file is used for operating the system. It directs the user in operating the system as described in section 5.6.

b) Input File

This file contains two sheets which are the Unpriced B/Q and Help.

1. Unpriced B/Q

Figure A5.1 shows a sample of B/Q input sheet. In dealing with any project the system requires the Unpriced B/Q file. The user has to enter in GES his own numbering system for

the Unpriced B/Q items when he uses the system for the first time. The Unpriced B/Q is the B/Q which is included in the bid documents. It will be more helpful if the tenderers receive the B/Q digitally.

2. Help sheet

Figure A5.2 shows the help sheet for input unpriced B/Q. The purpose of this sheet is to guide the user in filling the data in this file (Input file).

c) Output file

Output file contains five sheets which are:

1. Stratified B/Q

Figure A5.3 shows a sample of Stratified B/Q. The purpose of this sheet is to facilitate calculating the average unit rate for each group of floors. It calculates also the final unit rates for the bid after adding the indirect cost and mark-up. The user calculates the quantities of each group of floors and enters these quantities to the corresponding columns of Stratified B/Q. Other data such as the item no. the item description, unit of measure, the bid item quantity are automatically imported from the unpriced B/Q sheet in the input file. The data is imported by using VLookup (vertical lookup) function in *Excel*. Also the unit rates of each group of floors are automatically imported from central database (CDB) sheet in Database file by using Visual Basic tools in *Excel*. The total bid direct cost will be calculated. After adding the indirect cost which is imported from indirect cost sheet we get the total direct and indirect cost. By inserting risk factor and profit as a percentage, the total bid price will be calculated. By dividing the total bid price by total direct cost we get the adjusted factor. By multiplying this factor with the average unit rate for each item we get the final bid unit rates. These rates are automatically exported to the priced B/Q by VLookup function to get the final bid price.

2. Indirect Costs

Figure A5.4 shows a sample of Indirect Costs. The aim of this sheet is to calculate the indirect costs of the project. It consists of three elements;

- site overheads;
- general (Company) overheads and
- financial costs

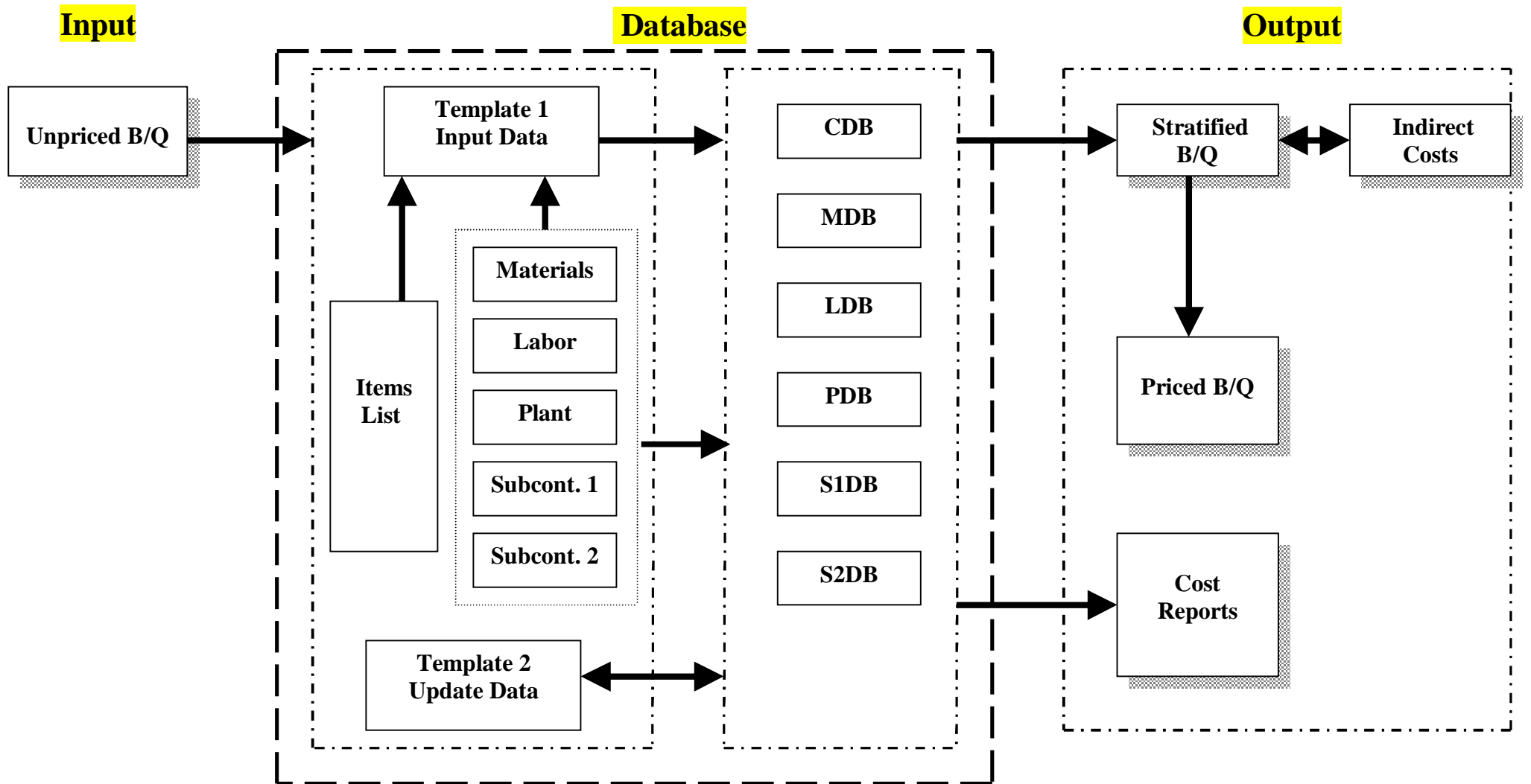


Figure 5.7: GES System

The first element is site overheads and it is calculated in details according to bid documents requirements e.g. (consultant requirements, staff salaries, site facilities, provision of utilities, contractor's offices, office consumables, safety requirements, photographic costs and expenses, laboratory, field testing, inspection costs, and office service equipment).

The second element is general overheads. It is distributed on the projects that expected to be implemented around the year according to ratios proportional to project amount. To calculate the company overheads the user has to calculate company overheads per year and dividing this value by the expected total projects to be executed by the company throughout the specified year. By multiplying the result by the total cost of the project, we get the estimated company overheads. The total project cost equals direct cost multiplied by 125% (the overheads is considered 25% of direct cost and this is an arbitrary percentage that the user can enter).

The third element is the financial costs, and it is calculated in details according to bid documents requirements e.g. bank charges, performance bond, advance payment, retention, bid bond, and insurance.

The indirect costs are the summation of the three elements (site, general, and financial costs) which are exported to the Stratified B/Q as mentioned before to generate the total bid price.

3. Priced B/Q

This sheet is used for bid submission after pricing the bid items. It is prepared automatically after entering all data in the Stratified B/Q. The data of this sheet is imported from the Unpriced B/Q by VLookup function. The user can save the output file with project name or with any name distinguishable to the user by using the "Save as" tool after finishing the estimating process or directly after opening the output file. Figure A5.5 shows a sample of Priced B/Q.

4. Cost Reports

The purpose of this sheet is to calculate the total cost of project materials, labor, plant, and subcontractor. Figure A5.6 shows a sample of Cost Reports.

5. Help sheet

Figure A5.7 shows the help sheet for estimating the bid. The purpose of this sheet is to guide the user in filling data in this file (Output file).

d) Database file

This file consists of two groups of data. The first type is for basic data while the second is for database. They are:

- Basic data sheets
- Database sheets

Basic data sheets are eight sheets. They are:

1. Items List

Figure A5.8 shows a sample of items list. This list contains a long list of B/Q items with their item numbers, item description, and unit of measure according to the standard list if it is available. In Palestine there is no standard list, so each contractor should prepare his own standard list to use in his construction works.

2. Materials List

Figure A5.9 shows a sample of Materials list. This sheet contains all data related to materials. The first column is designated for serial number, and the second is designated for material name. The third, fourth, and fifth columns are designated for group of materials, purchasing unit from the supplier, and purchasing unit rate respectively. Opposite to each purchasing unit rate column, there are three divisions for each group of floors (from grd. floor to and including 4th floor, from 5th floor to and including 9th floor and for more than 9th floors). In each division there are three columns; the first column is allocated for waste material as a percentage, the second is allocated for lifting material from ground to the specified floor, and the third is allocated for the total material unit rate. The user has to enter all the columns except the total unit rate in each division; which will be automatically calculated. These rates are eventually transferred to Material Database (MDB) sheet by using Visual Basic tools in *Excel*.

3. Labor List

Figure A5.10 shows a sample of Labor list. This sheet contains all data of the company's labors. The purpose of it is to calculate the actual labor rate per day. To get this labor rate we need to estimate the yearly non working days to get the actual working days. By dividing the gross salary per year by the working days in a year, we get the actual rate per day. The inputs data in the labors list are: labor trade, group, salary/ month, annual salary, pension allowance, other fringe benefits, the working and non working days. The salary/day will be calculated

automatically. This salary is eventually transferred to Labors Database (LDB) sheet by using Visual Basic tools in *Excel*.

4. Plant List

Figure A5.11 shows a sample of Plant list. This sheet contains all hired plants data. In GES, all plants are assumed to be hired. The inputs data in this sheet are: plant name, hired unit, hired rate, and the group of plant. The hired rate is eventually transferred to Plants Database (PDB) sheet by using Visual Basic tools in *Excel*.

5. Subcontractor 1 List

Figure A5.12 shows a sample of Subcontractor1 list. Most projects in Gaza Strip are executed throughout two types of subcontracting; with/without materials. For this reason the researcher prefers to divide the subcontractors into the two types. Subcontractors1 List is prepared for subcontracting with materials. The inputs data in this sheet are the subcontractor work, trade, unit, unit rate for each group of floors for each item. The unit rates are eventually exported to Subcontractor1 Database (S1DB) sheet by using Visual Basic tools in *Excel*.

6. Subcontractor 2 List

Figure A5.13 shows a sample of Subcontractor2 list. This list is similar to the previous one but the unit rates in this sheet excludes the materials price and these rates are eventually exported to Subcontractor2 Database (S2DB) sheet by using Visual Basic tools in *Excel*.

7. Template 1 (Input Data) Sheet

Figure A5.14 shows a sample of Template 1. This sheet is used for entering the data related to item cost elements (materials, labors, plants, sub. 1, and sub. 2). The new user has to fill template 1 (input data) related to the expected items that may be used throughout the company work, and store the output data in database sheets. In this sheet the user has to enter the followings:

- In the first box, the user has to enter the item number in the specified cell. The item description and unit of measure are displayed automatically. These data are imported from the items list by using VLookup function in *Excel*.
- In the second box, the user has to enter all materials names needed for executing the specified item with the quantities needed to produce an item unit. The purchasing unit will appear automatically by using VLookup function in *Excel*.

- In the third box, the user has to enter the composition of the crew (worker trade and number) and the crew production rate in unit/hr for each group of floors for executing an item unit.
- In the fourth box, the user has to enter the plant name, the number of plants needed, and the productivity of the plant unit/hr for executing the specified item.
- In the fifth and sixth boxes, the user has to enter the subcontractor work and his trade for the two types of subcontractors for executing the specified item.

After entering all these data the user can transfer these data to different database sheets (MDB, LDB, PDB, S1DB, and S2DB) by one click on the "**To Database**" cell. The data is transferred by using Visual Basic tools in *Excel*. To fill new data for new item, the user can click on the "**New Item**" cell, all data are deleted and the sheet becomes ready for entering new data.

8. Template 2 (Update Data) Sheet

This sheet is similar to template 1, but it is used for updating the data which is entered in template 1.

To use this template, the user has to do the following steps:

- a. Entering the item number in the specified cell.
- b. Clicking on the "**Request Data**" icon. All data related to the item elements which are filled in template 1 are displayed by importing these data from different database sheets (MDB, LDB, PDB, S1DB, and S2DB).
- c. Updating the data as the user wants.
- d. Exporting these data again to the same database sheets by clicking on the "**To Database**" icon.

To update data for another item, the user can click on the "**Updating Another Item**" icon, all data are deleted and the sheet becomes ready for requesting new data (see Figure A5.15).

9. Materials Database (MDB) Sheet

This sheet is used as a store for all data related to materials for all entered items. All data in this sheet is imported from template 1 (input data) by using Visual Basic tools, and from the materials list sheet by using VLookup function in *Excel*. The aim of this sheet is to generate material unit rates to export these rates to CDB (see Figure A5.16).

10. Labor Database (LDB) Sheet

This sheet is used as a store for all data related to labors for all entered items. All data in this sheet is imported from template 1 (input data), and from the labor list. The aim of this sheet is to generate labor unit rates to export these rates to CDB (see Figure A5.17).

11. Plant Database (PDB) Sheet

This sheet is used as a store for all data related to plants for all entered items. All data in this sheet is imported from template 1 (input data), and from the plant list sheet. The aim of this sheet is to generate plants unit rates to export these rates to CDB (see Figure A5.18).

12. Subcontractor 1 Database (S1DB) Sheet

This sheet is used as a store for all data related to subcontractor1 (including supplying materials) for all entered items. All data in this sheet is imported from template 1 (input data), and from the subcontractors1 list sheet. The aim of this sheet is to generate subcontractor unit rates to export these rates to CDB (see Figure A5.19).

13. Subcontractor 2 Database (S2DB) Sheet

This sheet is used as a store for all data related to subcontractor2 (excluding supplying materials) for all entered items. All data in this sheet is imported from template 1 (input data), and from the subcontractor2 list sheet. The aim of this sheet is to generate subcontractor unit rates to export these rates to CDB (see Figure A5.20).

14. Central Database (CDB) Sheet

This sheet is used as a store for all unit rate elements (materials, labor, plant, subcontractor1, and subcontractor2) related to all entered item. All data in this sheet are imported from MDB, LDB, PDB, S1DB, and S2DB sheets. The aim of this sheet is to generate item unit rates for each group of floors. In estimating process, these rates are transferred to Stratified B/Q. Also these different rates are exported to Cost Reports sheet to generate total materials cost, total labors cost, total plants cost, and total subcontractors cost (see Figure A5.21).

15. Help Sheet

The purpose of this sheet is to guide the user in to filling data in this file (see Figure A5.22).

5.9 GES Implementation: Illustrated Example

The researcher finds that the best way to show the implementation of the system is to apply it to an example. This makes it easier for the researcher to explain and for the reader to understand. Some items are chosen for this purpose to prepare cost estimating. Annex 6 shows an illustrated example.

The main *Ms Excel* tools and functions that are used in developing GES are:

- **Macros tool:** macro is a series of commands and functions that are stored in a Microsoft Visual Basic module and can be run whenever you need to perform the task.
- **VLookup (vertical lookup) tool:** is a most powerful and useful functioning. This function allows the user to look up a value based on some input value.
- **Data Validation tool:** a database containing a list of options which can be entered into an Excel spreadsheet as a list. The database can be entered into any worksheet of the workbook.
- **IS Functions, ISERROR (value), and ISNA (value) tools.** These functions check the type of value and returns TRUE or FALSE depending on the outcome.

All of these tools and functions are used for making the system more professional and easy to use and deal with.

Figure 5.8 shows the flowchart of GES system.

5.10 GES Evaluation

In the context of discussing system validation, Sha'at (1993) quoted Neelmakavil (1987) "that since we operate with imperfect information, we can not achieve ultimate reality and therefore models should be judged in terms of their relative rather than absolute contribution in improving our understanding of the universe. He suggests that the best strategy seems to be to test models to increase or decrease our confidence in them by exploring their limitations in comparison with other known alternatives".

Face Validity is used as a test for model evaluation. Face validity makes to ask well experienced people about the system whether the model and/or its behavior are reasonable. This technique can be used in determining if the logic in the conceptual model is correct and if a model's input-output relationships are reasonable (Sargent, 2000).

Face validity is used in GES evaluation by asking five contractors who are experts in building construction. The contractors are given one week for program training. Then the contractors give their points of view in GES system and about GES' input-output relationships. Five first class contractors were selected for evaluating the model. The evaluating process conducted through interviewing the persons in charge of estimating in the contracting companies.

They were briefed about the aim of the system and its components. The researcher explains all steps for operating the system and how it works (entering basic data, filling template 1 input data, how to update the data, how to export the data to database files, how to calculate the indirect costs, and how to price the B/Q). Of course, they asked about the clarifications of certain steps. At the end of this process, the contractors have to fill a questionnaire for evaluating the system. The questionnaire is mainly designed to get a feedback about GES performance and also to have contractors' comments. They make some suggestions to modify GES. The researcher tries to make the final version of GES modified accordingly.

5.10.1 GES Performance Indicators

Table 5.1 shows GES performance indicators. The results illustrate that most contractors who contributed in system evaluation are satisfied with GES performance. They indicate that it is suitable for use in the local estimating practice.

The results show that the average mean percentage for GES performance indicators equals (88.8%). This result is considered high and good result for system evaluation.

Many advantages can be obtained by using GES according to the contractors' opinion. They are:

- GES offers the possibility for a detailed estimating.
- GES prices the bid items according to classification of building stories.
- Simplicity in updating the data by using GES.
- GES makes the provision to handle indirect costs in detail.
- GES gives a foundation for constructing database.
- GES makes the provision to handle secondary materials.

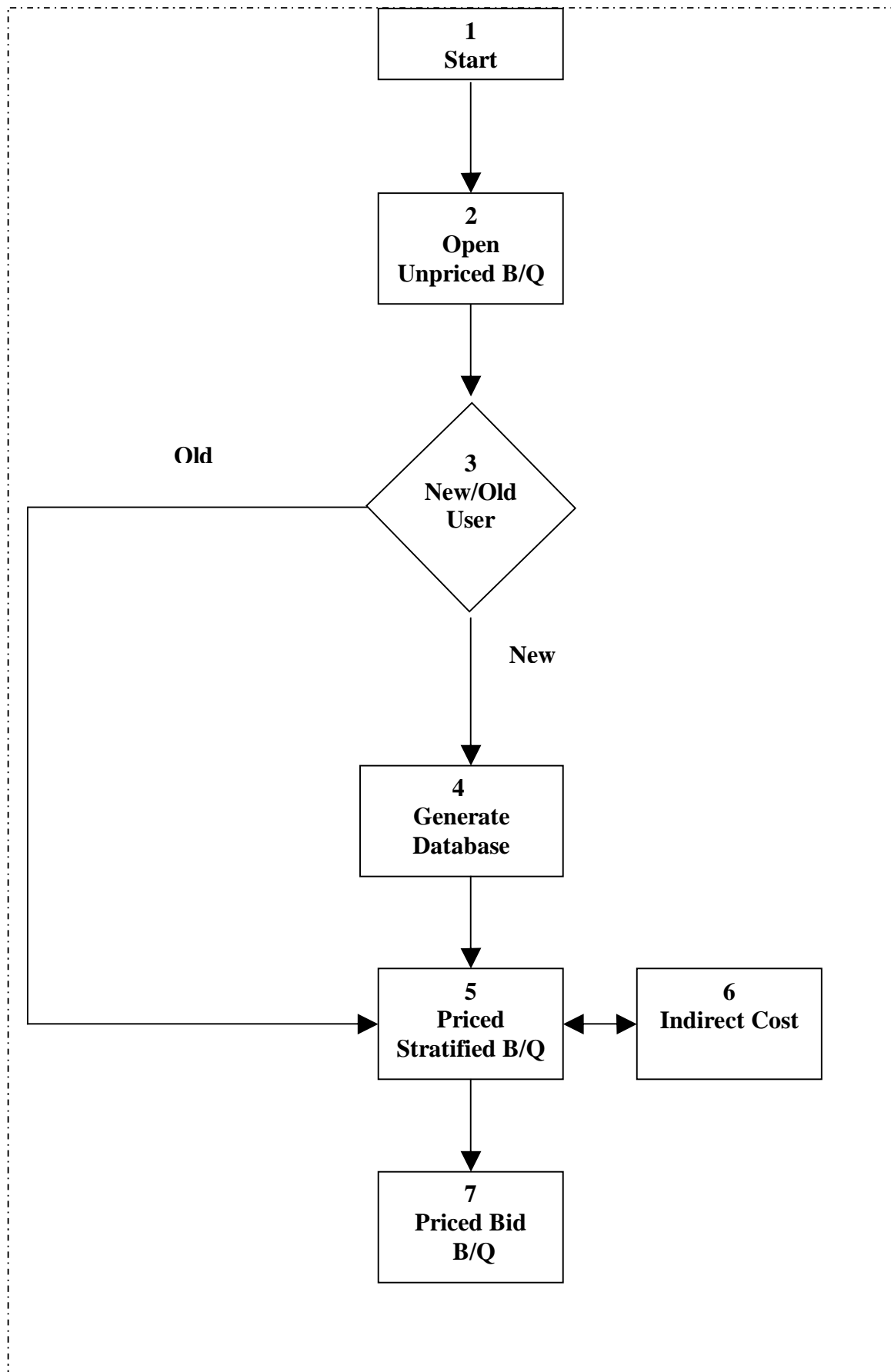


Figure 5.8: GES Flowchart

As shown in Table 5.1, few indicators have average percentages 80% or less. They are:

- GES minimizes the efforts that done by estimating staff.
- Simplicity in using GES.
- GES is considered a suitable for construction industry in Gaza Strip.

These results may be referred to the fact that in general, the contractors are not with GES. These results are useful, because they help to improve the system to proceed more efficiently.

5.10.2 Evaluators' Comments

The local contracting companies who contributed in system evaluation have some negative and positive comments about GES. The main ones are illustrated bellow:

Positive Comments

- Simplicity in updating database.
- The program prices the indirect costs in details.
- The program takes into account the risk factor.
- The model prices the bid items according to the classification of building floors.
- The program takes into account the wasted materials in estimating.
- GES' input-output relationships are reasonable.

Negative Comments

- Choosing the material name in filling Template 1 (Input Data) from the materials list needs some of time especially if the materials list is very long. The researcher agrees with this comment.
- Estimating the indirect costs is considered a relatively difficult process especially in calculating the company overheads. This may be referred to the fact that the user needs to shift from sheet to another and s/he needs to estimate some costs to calculate the indirect costs.
- The training time (one week) is not enough. The contracting companies required more time for training.

Table 5.1 GES performance indicators

Techniques		S.A	A	N	D	S.D	Mean (%)
GES offers the possibility for a detailed estimating.	No	4	1				(%96)
GES prices the bid items according to classification of the building stories.	No	4	1				(%96)
GES gives a foundation for constructing database.	No	3	2				(%92)
Simplicity in updating the data by using GES.	No	4	1				(%96)
GES treats the estimate of secondary materials.	No	3	2				(%92)
GES gives the opportunity for an easy dealing with wasted materials during the cost estimate.	No	2	3				(%88)
GES contributes in gaining more accuracy in bid estimating.	No	2	3				(%88)
GES saves the time.	No	2	2	1			(%84)
GES minimizes the efforts that done by estimating staff.	No	1	2	2			(%76)
GES treats the repeated change in materials price.	No	3	2				(%92)
GES deals with indirect cost precisely	No	4	1				(%96)
GES takes into account the risk factor.	No	2	3				(%88)
Simplicity in using GES.	No		5				(%80)
GES helps developing the cost estimate in Gaza Strip.	No	3	1	1			(%88)
GES is considered a suitable for construction industry in Gaza Strip.	No	1	3	1			(%80)
Average Mean %							(%88.8)

(S.A= Strongly Agree, A=Agree, N=Neutral, D= Disagree, S.D= Strongly Disagree)

5.11 GES Limitations

- Some tools are used in developing GES system such as "**Macro**" tools. The security level in *Ms Excel* should be medium or low to make full use of GES.
- The researcher tries to make use of the full capacity of *Excel 2000*. however, the following are the limits which are directly affect the functions of GES:
 - Maximum number of B/Q items list is 65,536 (affected by the capacity of *Excel 2000*).
 - Maximum number of materials, labor, plant, subcontractor1, and subcontractor2 lists is also 65,536 (affected by the capacity of *Excel 2000*).
 - The number of material that the user can enter in tempalte1 in the second box is 10, for labors is 8 in third box, for plants is 4 in the forth box, for sub.1 is 4 in the fifth box, and for sub.2 is 4 in the sixth box. These numbers can be increased by inserting new rows as the user needs. The user can copy the functions which are in the existing cells and paste them in the new cells.

CHAPTER 6

CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

Gaza Estimator Software (GES) has been developed to satisfy some needs of Gaza Strip contracting companies in cost estimating. This chapter introduces the research conclusions and recommendations for many parties involved in construction to improve the local practices in cost estimating. It also introduces recommendations for further studies.

6.2 Conclusions

- The survey results show that most of contractors are interested in using many tools in estimating process. The results confirm that the most used tools are inquiring about materials prices and using detailed analysis in estimating bid items. On the other hand, the least used tools are estimating bid items for each group of floors in multi-story buildings and the using of same item rate from previous projects. Also calculating of secondary elements of materials for each item is rarely used.
- The method adopted in estimating site overheads cost for most of companies is acceptable. The existing common practice in estimating general overhead costs indicates that most of contractors considered the general costs as a part of profit.
- All surveyed contractors believe that the Israeli closure on Gaza Strip is considered the main element that affects risk factor. Also dividing Gaza Strip into three parts is another element which affects risk factor because of the difficulties in movement between these parts. These elements increase the final cost of the project.
- Most of contracting companies are still estimating their bids manually. Shortage of suitable estimating software is considered the main obstacle for estimating computerization. Another important factor is lack of availability of qualified persons in using computerized estimating packages. Also the results reveal that the level of using computer applications in Gaza Strip is low in comparison with other countries.

- There is consensus amongst contractors on the importance of using computerized cost estimating. The main advantages that can be obtained from using estimating software are:
 - § Building database.
 - § Building archive for previous projects.
 - § Simplicity of updating the prices.
 - § Fast estimating and saving time.
 - § Minimizing errors and human omission.
- In response to the main needs of contractors in estimating, GES has been developed. It is a computerized system in cost estimating which designed to improve the local practice in estimating the works in Gaza Strip. *Microsoft Excel 2000* is used in developing GES. Most of contractors have relatively good capabilities in using *MS Excel*. In this way, the user is expected to welcome using GES as he is quite familiar with its environment.
- GES is designed especially for building construction contracts and addressed to handle the costs of measured contracts with bill of quantities. This may be referred to the fact that most of contracting companies in Gaza Strip are involved in building works. Also the contracts with B/Q are still prevailing in the area and the world as literature suggests.
- GES provides the provision to calculate the subcontracting works with/without supplying materials. This is a prominent feature of GES as both of methods are usually used in construction projects in Gaza Strip.
- GES stimulates the contractors to include the construction material waste in their estimates. This is quite important for Gaza Strip contractors, where about half of contractors estimate the material waste occasionally according to the survey results.
- In a multi-storey building, the unit rate is not the same for all floors. Usually, the higher the floor in the building is, the more the unit rate cost will be. The researcher finds that it is more practical to group the floors of multi-storey building into three groups and GES is designed accordingly.
- GES gives the possibility of estimating the secondary materials. This stimulates the contracting companies to include the secondary materials in their estimates, where more than half of contractors neglect the prices of secondary materials as indicated from the survey results.

6.3 Recommendations

To Owners, Contractors' Union, and Association of Engineers

a) Introducing Modified Summary Sheet

The risk factor is considered an important element in the bid price. It should be calculated in details and separated from profit. It is necessary to develop a modified summary sheet by the owners or A/E which accommodates separately risk factor and profits. This stimulates the contractors to estimate the risk factor and profit in more accurate way. This will benefit the main construction parties; the owner, A/E, and the contractor. The owner and the A/E will be in a better position in awarding the contract. The researcher suggested a modified summary sheet as shown in Annex 7.

b) Training Courses, Seminars, and Workshops in Cost Estimating

There are many factors that influence cost estimating, such as the estimating process and itself the instability of political situation. The estimating process is divided into different steps. If each step is completed accurately, the final bid estimate will be more accurate. It is very important to conduct training courses, seminars, and workshops for contracting companies in Gaza Strip to explain the estimating process in details and clarify the various problems of estimating process.

Training courses, seminars, and workshops should address also the political and socio-economical factors such as security closure and segmentation. Impact of these factors should be tackled in details in such courses.

c) Computer Based Training Courses in Cost Estimating

The contractors union should focus more on conducting training courses in using computer applications in construction industry particularly in cost estimating. This training aims at improving the local practice in cost estimating and increases the capabilities of qualified persons in using these estimating software packages.

To Construction Contracting Companies

- a. The more accurate estimate is naturally based on realistic information. It is recommended that each contracting company continuously keeps records for all cost related data and

built a historical database for the company. This unique database should be the main source of information that will be used in estimating future projects.

- b. The contractors are invited to calculate the risk factor in more accurate way. This gives the contractor a better chance to win the bid. It also decreases the possibility of having a loss and increases the possibility of having a profit
- c. It is recommended that the estimators in contracting companies attend courses in using estimating software to improve their capabilities in this field. This may stimulate the top management of the contracting companies to have and use estimating software package in their works.
- d. The local contracting companies are invited to have an estimating software package and use it in estimating the works in order to get more accurate estimate, save time, minimize error, and hopefully to have better chance to win bids.

6.4 Recommendations for Further Studies

- As we do not have locally a standard bill of quantity the researchers are invited to study this aspect and develop B/Q which satisfies the local needs of construction industry. Code numbering system for B/Q items is a vital pre-requisite for cost engineering system that to be used in cost estimating and cost control. Researchers are invited to develop a suitable local standard numbering system to be adopted by the construction industry. Of course, such system should be easily computerized.
- Researchers are also invited to develop computerized software aiming at facilitating integration of estimating and cost control functions as performed by contractors.
- More research effort should be addressed towards development of software that handle determining realistic risk factor. The right modeling of real life situation related to construction industry is the main challenge in this regard.
- More researches on productivity related factors are needed. Local circumstances deserve a special attention from researchers.

- Different construction processes need more attention for study and research in order to determine the more realistic waste percentage for each process. The resulted data will be helpful for estimators in preparing more accurate estimates.
- GES is a deterministic system. It does not represent completely the real life situations of estimating which are, by nature, probabilistic. Development of probabilistic version of GES will enhance it and make it more realistic and viable.

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Annex 1

The questionnaire (In Arabic)

بسم الله الرحمن الرحيم



الجامعة الإسلامية - غزة
قسم الهندسة المدنية

استبيان

حول تقدير تكلفة (تسعير) مشاريع التشييد لدى مقاولي قطاع غزة

جزء من البحث التكميلي لنيل درجة الماجستير
في إدارة التشييد

الباحث / م. ياسر عبد الرحمن الشنطي

المشرف / د. كمالين شعت

فبراير ٢٠٠٣

استبيان

حول واقع تقدير تكلفة (تسعير) مشاريع التشييد لدى مقاولي قطاع غزة

السادة المقاولون المحترمون/

نشكر تعاونكم ومساهماتكم في تعبئة هذا الاستبيان الذي يعتبر جزء من البحث التكميلي لنيل درجة الماجستير في إدارة المشاريع. من خلال الاستبيان نرجو التعرف على الواقع المحلي في تقدير تكلفة (تسعير) مشاريع التشييد لدى مقاولي قطاع غزة ومن ثم محاولة حل مشاكل هذا النظام من خلال تطوير برنامج حاسوب متخصص يقوم بعمل تسعير لمشاريع التشييد بقطاع غزة.

المعلومات الواردة في الاستبيان يتم الاستفادة منها لغرض البحث العلمي فقط ولن تنتقل لأي جهة أخرى، ويتم التعامل معها كمعلومات منفصلة عن مصدرها.

شاكرين حسن تعاونكم

الباحث م.ياسر عبد الرحمن الشنطي

استبيان

حول واقع تقدير تكلفة (تسعير) مشاريع التشييد لدى مقاولي قطاع غزة

الجزء الأول: معلومات عن الشركة

- ١ - سنة تأسيس الشركة _____
- ٢ - مجال عمل الشركة
- أعمال مباني رئيسي فرعي لا يوجد
- أعمال مياه وصرف صحي رئيسي فرعي لا يوجد
- أعمال طرق رئيسي فرعي لا يوجد
- ٣ - درجة تصنيف الشركة حسب تصنيف اتحاد المقاولين
- أعمال مباني درجة أولى أ درجة أولى ب درجة ثانية درجة ثالثة
- أعمال مياه وصرف صحي درجة أولى أ درجة أولى ب درجة ثانية درجة ثالثة
- أعمال طرق درجة أولى أ درجة أولى ب درجة ثانية درجة ثالثة
- ٤ - متوسط إجمالي عدد الموظفين خلال الخمس سنوات الماضية _____
- ٥ - متوسط عدد الموظفين الفنيين حسب مجالات التخصص الهندسي خلال الخمس سنوات الماضية
م.مديني _____ م.معماري _____ م.كهرباء _____ م.ميكانيكي _____ مهندس ذو تخصص غير ذلك _____ فني _____
- ٦ - عدد المشاريع المنفذة خلال الخمس سنوات الماضية
 ١٠ فأقل ١١ - ٢٠ ٢١ - ٣٠ ٣١ - ٤٠ أكثر من ٤٠
- ٧ - إجمالي قيمة المشروعات المنفذة خلال الخمس سنوات الماضية. (بالمليون دولار أمريكي)
 ١ فأقل ١,١ - ٣,٠ ٣,١ - ٥,٠ ٥,١ - ٧,٠ ٧,١ فأكثر
- ٨ - الشخص المخول بإعداد دراسة وتسعير المشروع
 مدير الشركة المدير الفني مدير المشروع قسم خاص بذلك غير ذلك حدد _____

• أولاً: بشكل عام

٩- يرجى إبداء رأيكم في درجة ضرورة ومدى استخدامكم فعلياً للوسائل التالية في تسعير العطاء:

الرقم	الوسائل	درجة الضرورة			مدى الاستخدام		
		ضروري	ضروري نوعاً ما	غير ضروري	تستخدم عادة	تستخدم أحياناً	تستخدم نادراً
أ	زيارة الموقع أثناء دراسة العطاء.						
ب	حساب كميات المشروع أثناء دراسة العطاء.						
ج	احتساب الفاقد (Waste) في المواد عند التسعير بشكل عام.						
د	الاستفسار عن أسعار المواد بشكل عام.						
هـ	الاستفسار عن أسعار مقاولي الباطن بشكل عام .						
و	في مشاريع الأبنية متعددة الطوابق يتم تسعير البند لكل مجموعة من الطوابق على حدة (مثلاً من الطابق الأرضي حتى الطابق الرابع - من الطابق الخامس حتى الطابق التاسع - الطابق العاشر وما فوق).						

• ثانياً: تسعير البنود

١٠- يرجى إبداء رأيكم في درجة ضرورة ومدى استخدامكم للوسائل التالية في تسعير العطاء:

الرقم	الوسائل	درجة الضرورة			مدى الاستخدام		
		ضروري	ضروري نوعاً ما	غير ضروري	تستخدم عادة	تستخدم أحياناً	تستخدم نادراً
أ	تسعير العطاء استرشاداً بسعر نفس البند في مشاريع سابقة ومماثلة.						
ب	عمل تحليل تفصيلي في التسعير فقط للبنود ذات المبالغ الكبيرة في العطاء.						
ج	تسعير العطاء عن طريق التحليل التفصيلي لجميع عناصر البند الواحد (مواد- عمالة - آليات - مقاول باطن).						
د	احتساب جميع العناصر الهامشية (الثانوية) التي تدخل في تكلفة البند الواحد (مثل المسامير - سلك التريبط - السلك المجدول).						

• ثالثا: قاعدة البيانات

١١- يرجى إبداء رأيكم في درجة ضرورة ومدى استخدامكم للتقنيات التالية في تسعير العطاء:

الرقم	التقنيات	درجة الضرورة			مدى الاستخدام		
		ضروري	ضروري نوعا ما	غير ضروري	تستخدم عادة	تستخدم أحيانا	تستخدم نادرا
أ	إنشاء قاعدة بيانات لأسعار المواد.						
ب	إنشاء قاعدة بيانات لأسعار العمالة.						
ج	إنشاء قاعدة بيانات لأسعار الآليات.						
د	إنشاء قاعدة بيانات لأسعار مقاولي الباطن.						
هـ	تحديث قواعد البيانات (المواد - العمالة - الآليات - مقاولي الباطن) عند حدوث تغيير ملحوظ في الأسعار.						
و	تحديث قواعد البيانات (المواد - العمالة - الآليات - مقاولي الباطن) عند تسعير مشروع جديد.						
ز	تحديث قواعد البيانات (المواد - العمالة - الآليات - مقاولي الباطن) عند حدوث أي تغيير في الأسعار مباشرة.						

• رابعا: التكلفة غير المباشرة

١٢- ضع علامة x على الاختيار الصحيح في المجالات التالية وذلك حسب ممارستكم الفعلية لاحتساب التكلفة غير المباشرة:

أ	قيمة التكاليف غير المباشرة للبنود والخاصة بمجمل المشروع يتم احتسابها: <input type="radio"/> بنسبة مئوية من التكلفة المباشرة. <input type="radio"/> بمبلغ مقطوع. <input type="radio"/> بالتفصيل حسب متطلبات المشروع. <input type="radio"/> ليس لها تأثير على التكلفة.
ب	حصة المشروع من المصاريف العامة الخاصة بالشركة يتم احتسابها: <input type="radio"/> بنسبة مئوية من تكلفة المشروع. <input type="radio"/> بمبلغ مقطوع. <input type="radio"/> بالتفصيل حسب متطلبات المشروع. <input type="radio"/> ليس لها تأثير على التكلفة.

• خامسا: تأثير الإغلاق الأمني على التكلفة في قطاع غزة

١٣- يرجى إبداء رأيكم في تأثير الإغلاق الأمني على العوامل التالية:

الرقم	العامل	موافق جدا	موافق	لا فرق	غير موافق	غير موافق جدا
أ	يؤدي الإغلاق الأمني للقطاع إلى زيادة ملحوظة في أسعار بعض المواد الأساسية وخاصة الأسمت والحصمة.					
ب	يؤدي الإغلاق الأمني للقطاع إلى زيادة ملحوظة في أسعار بعض المواد الأخرى مثل (مواد الدهان - مواد الكهرباء - المواد الصحية-.....الخ).					
ج	يؤدي الإغلاق الأمني للقطاع إلى زيادة ملحوظة في أسعار العمالة.					
د	يؤدي الإغلاق الأمني للقطاع إلى زيادة ملحوظة في أجرة الآليات.					
هـ	يؤدي الإغلاق الأمني للقطاع إلى زيادة ملحوظة في أسعار مقاولي الباطن.					
و	يؤدي الإغلاق الأمني إلى تأخير تنفيذ المشروع عن الوقت المحدد له.					
ز	يؤدي الإغلاق الأمني للقطاع إلى زيادة ملحوظة في تكلفة المشروع بشكل عام.					

• سادسا: عامل المخاطرة

١٤- قيم العوامل التالية من حيث أهمية تأثيرها على تقديركم لعامل المخاطرة:

الرقم	العامل	كبير جدا	كبير	متوسط	ضعيف	ضعيف جدا
أ	الإغلاق الأمني.					
ب	طبيعة المالك.					
ج	طبيعة الاستشاري.					
د	طبيعة المشروع.					
هـ	مكان المشروع.					
و	ارتفاع أسعار المواد.					
ز	ارتفاع أسعار العمالة.					
ح	احتمالات تأخير تنفيذ المشروع.					

الرقم	العامل	كبير	كبير	متوسط	ضعيف	ضعيف
		كبير	كبير	متوسط	ضعيف	ضعيف
		جدا	جدا			جدا
١٥	يعتبر عامل المخاطرة (Risk) في مشاريع التشييد في قطاع غزة.					

١٦- تقومون فعليا بتقدير عامل المخاطرة بشكل:

- متحفظ خوفا من المخاطر.
- متوازن.
- أقل مما ينبغي بسبب المنافسة.
- لا يتم احتسابه.

الجزء الثالث: حول استخدام الحاسوب في تسعير العطاءات

١٧- تقومون بتسعير العطاء بالحساب:

- ذهنيا.
- كتابيا.
- كتابيا باستخدام نماذج.
- باستخدام جداول الكترونية (Spreadsheets).
- باستخدام برامج حاسوب متخصصة في التسعير.

١٨- بين رأيك في تأثير المعوقات التالية على استخدام برامج الحاسوب المتخصصة في التسعير:

الرقم	المعوقات	كبير	كبير	متوسط	ضعيف	ضعيف
		كبير	كبير	متوسط	ضعيف	ضعيف
		جدا	جدا			جدا
أ	عدم إدراك أهمية استخدام برامج الحاسوب المتخصصة في التسعير.					
ب	عدم وجود قناعة في استخدام برامج الحاسوب المتخصصة في التسعير.					
ج	عدم توفر برامج حاسوب متخصصة في التسعير وتكون سهلة الاستخدام.					
د	عدم وجود أشخاص مؤهلين لاستخدام برامج الحاسوب المتخصصة في التسعير.					
هـ	عدم وجود أشخاص ذو خبرة يمكن استشارتهم.					
و	سهولة التسعير اليدوي عن استخدام الحاسوب.					
ز	التكلفة المالية للبرنامج (الشراء-الصيانة-التحديث-التدريب).					
ح	زيادة تكلفة العطاء.					

١٩- بين رأيك في تأثير العوامل التالية على إعاقة الدقة في تسعير العطاءات:

الرقم	العامل	كبير جدا	كبير	متوسط	ضعيف	ضعيف جدا
أ	ضيق الوقت المخصص لدراسة وتسعير العطاء.					
ب	صعوبة الحصول على أسعار مقاولي الباطن.					
ج	وجود عدد كبير من العطاءات لدى الشركة قيد التسعير.					
د	وجود عدد كبير من المشاريع لدى الشركة تحت التنفيذ.					
هـ	صعوبة من الموردين الحصول على أسعار المواد ذات الطابع الجديد.					
و	إجراء عملية تسعير العطاء يدويا (دون الاستعانة بقدرات الحاسوب).					
ز	عدم وضوح مخططات المشروع.					

٢٠- بين رأيك في مدى أهمية الفوائد التالية المرجوة من استخدام برامج حاسوب متخصصة في تسعير العطاء:

الرقم	الفوائد	مهم جدا	مهم	لا أدرى	غير مهم	غير مهم جدا
أ	إنشاء قاعدة بيانات عامة للأسعار (المواد والعمالة والمعدات ومقاولي الباطن).					
ب	إنشاء أرشيف لتسعير المشاريع السابقة.					
ج	سهولة تحديث الأسعار.					
د	السرعة في تقدير التكلفة وتوفير الوقت.					
هـ	قلة المجهود في تسعير العطاء.					
و	تقارب أسعار المقاولين.					
ز	زيادة في دقة تقدير التكلفة.					
ح	تقليل فرصة ارتكاب أخطاء.					
ي	عدم نسيان تسعير أحد البنود.					
ك	تقدير لإجمالي تكلفة العمالة والمواد ومقاولي الباطن والآليات كل على حدة.					

٢١- بين كفاءة شركتكم في استخدام برامج الحاسوب التالية:

Word	<input type="radio"/> جيد جدا	<input type="radio"/> جيد	<input type="radio"/> مقبول	<input type="radio"/> ضعيف	<input type="radio"/> ضعيف جدا
Excel	<input type="radio"/> جيد جدا	<input type="radio"/> جيد	<input type="radio"/> مقبول	<input type="radio"/> ضعيف	<input type="radio"/> ضعيف جدا
Access	<input type="radio"/> جيد جدا	<input type="radio"/> جيد	<input type="radio"/> مقبول	<input type="radio"/> ضعيف	<input type="radio"/> ضعيف جدا
Ms-Project	<input type="radio"/> جيد جدا	<input type="radio"/> جيد	<input type="radio"/> مقبول	<input type="radio"/> ضعيف	<input type="radio"/> ضعيف جدا

٢٢- سأكون مستعدا لاقتناء واستخدام برنامج متخصص في تسعير العطاءات في حال كونه سهل الاستخدام وقليل التكاليف

موافق جدا موافق لا أدرى غير موافق غير موافق جدا

Annex 2

Questionnaire (English version)



THE ISLAMIC UNIVERSITY- GAZA
Civil Engineering Department

Questionnaire about
Cost Estimate Practice of Gaza Strip
Construction Contractors

In Fulfillment of MSc. Degree Requirement
in Construction Management

Student: Yaser Al-Shanti
Supervisor: Dr. Kamalain Sha'at
Feb, 2003

Section (1): organization Profile

1. Year of establishment -----
2. Main Field of Company Specialization
 - Building works Main Secondary Doesn't exist
 - Sewage & water works Main Secondary Doesn't exist
 - Roads works Main Secondary Doesn't exist
3. Degree of Classification by Contractor Union
 - Building works First Class A First Class B Second Class Third Class
 - Sewage & water works First Class A First Class B Second Class Third Class
 - Roads works First Class A First Class B Second Class Third Class
4. Average Total number of employees in your company during the last five years-----
5. Average number of technical staff according to their field of study during the last five years
 - Civil Eng. --- Architecture Eng. --- Electrical Eng.
 - Mechanical Eng. --- Others engineering fields --- Technician
6. Total number of executed projects during the last five years
 - Less than or equal 10 11-20 21-30 31-40 above 40
7. Value of executed projects during the last five years (in million dollars)
 - Less than or equal 1 1.1-3.0 3.1-5.0 5.1-7.0 above 7.0
8. The person in charge of estimating process
 - Company Director Technical Director Project Manager Specific section
 - Others. Determine -----

Section (2): Pricing and Bid Study

First: In General

9. To which extent you evaluate the necessity and degree of usage of the next tools in bid estimating

No.	Tool	Necessity degree			Usage degree		
		Necessary	Necessary somehow	Unnecessary	Usually	Occasionally	Rarely
A	Site visit during estimating process						
B	Quantity survey						
C	Estimating the materials waste in general						
D	Inquiring about materials prices in general						
E	Inquiring about subcontractors rates in general						
F	In multi-stories projects, using estimating process for every group of floors (grd. - 4 th , 5 th - 9 th , 10 and above)						

Second: Estimating the Items

10. To which extent you evaluate the necessity and degree of usage of the next tools in bid estimating

No.	Tool	Necessity degree			Usage degree		
		Necessary	Necessary somehow	Unnecessary	Usually	Occasionally	Rarely
A	By using the same item rate from previous projects.						
B	By using detailed analysis only for big value items.						
C	By using detailed analysis for all components of a single item (material, labor, plant, subcontractor)						
D	By calculating all secondary elements of materials for every item						

Third: Database

11. To which extent you evaluate the necessity and degree of usage of the next techniques in bid estimating

No.	Technique	Necessity degree			Usage degree		
		Necessary	Necessary somehow	Unnecessary	Usually	Occasionally	Rarely
A	Building materials database						
B	Building labor database						
C	Building plant database						
D	Building subcontracting database						
E	Updating the database due to a noticeable change in prices						
F	Updating the database when estimating a new project						
G	Updating the database directly due to any changes in prices						

Forth: Indirect Costs

12. Tick (X) in the correct choice in the following fields according to your practice for estimating indirect costs

a. Site overhead costs are calculating by:

- As a % age of direct costs
- As a lump sum
- In detail, as specified in bid documents
- Has no affect on cost

b. General overhead costs are calculating by:

- As a % age of direct costs
- As a lump sum
- In detail, as specified in bid documents
- Has no affect on cost

Fifth: The effect of Closure in Gaza Strip on Cost

13. To which extent you evaluate the effect of closure on the next factors

No.	Factor	Strongly Agree	Agree	Neutral	Disagree	Strongly disagree
A	The closure causes a noticeable increase in the main material prices specially cement and aggregate					
B	The closure causes an increase in other material prices (painting, electrical, sewage material)					
C	The closure causes an increase of the labor rates					
D	The closure causes an increase of the plant rates					
E	The closure increases the subcontractors rates					
F	The closure causes a delay of a project completion					
G	The closure causes an increase of the total project cost					

Sixth: Risk Factor

14. To which extent you evaluate the importance effect of the next factors on risk factor

No.	Factor	Very high	High	Average	low	Very low
A	The closure					
B	The owner					
C	The consultant					
D	Project type					
E	Project location					
F	Increase in material prices					
G	Increase in labor rates					
H	Delay in project execution time					

No.	Factor	Very high	High	Average	low	Very low
15	The risk factor of construction projects in Gaza Strip is considered to be					

16. You estimate the risk

- More than it should be
- In balanced way
- Less than it should be.
- No estimation for risk

Section (3): Cost Estimate Software

17. You estimate the bid by

- Mentally
- Documentary without forms
- Using forms
- Using spreadsheet
- Using cost estimate packages

18. To which extent you evaluate the next obstacles effect on the usage of cost estimate software

No.	Obstacles	Very high	High	Average	low	Very low
A	No realization for the importance of CES					
B	No convincement in using CES					
C	Shortage of user friendly CES					
D	Shortage of qualified persons in using CES					
E	Shortage of CES consultants					
F	Simplicity of manual estimating					
G	The high cost of CES					
H	Increasing the bid cost					

19. To which extent you evaluate the effect of the next factors on reducing the accuracy of the bid estimate

No.	Factor	Very high	High	Average	low	Very low
A	Limited time available for bidding process					
B	Difficulty of getting subcontractors rates					
C	The estimating overload in the company					
D	The existence of many executed projects in the company					
E	Difficulty in getting updated materials price from the suppliers					
F	Estimating the bid manually					
G	Unclear project plans					

20. To which extent you evaluate the following benefits obtained from using cost estimate software in the bid estimate

No.	Benefit	Very important	Important	Neutral	Not important	Not important at all
A	Building` general prices database (materials, labors, plants, subcontractors)					
B	Establishing archive for previous projects					
C	Simplicity of prices updating					
D	Fast cost estimating and saving time					
E	Saving efforts in bid estimate					
F	The contractors prices are approximate					
G	Maximizing accuracy of cost estimation					
H	Minimizing errors					
I	Minimizing human omission					
J	Preparing total cost of materials, labors, plants, and subcontractors separately					

21. State the efficiency of your company in using popular computer software

- Word V. good good Acceptable Low V. Low
- Excel V. good good Acceptable Low V. Low Access V.
- good good Acceptable Low V. Low
- Ms-Project V. good good Acceptable Low V. Low

22. I'm ready to get and use user friendly and inexpensive cost CES.

- Strongly agree Agree Neutral Disagree Strongly disagree

Annex 3

Review of Estimating Software Packages

Estimating Software Packages

Introduction

Competition in the construction industry is stiffer than ever. The margin of error is slim to none, and a day's delay can be costly, a fast and accurate estimate must be the foundation for any profitable project (Internet, www.winestimator.com 2000). Computers use in cost estimating is a relatively recent development. Computers can give increased accuracy by minimizing human-based errors and errors of omission. The computer can provide quick and easy access to historical unit cost and production rates. Numerous computer aided cost estimation software systems are now available. The advantage of these programs is the consistent organization and format for estimating. The researcher reviews some of these systems before beginning of development of GES. These packages are:

1. C2 Chooser MS Excel Add-in

C2 chooser is an easy way of entering construction materials into your estimates. Instead of typing in your material description, the C2 chooser lets you choose them from a list (CSI). As well as being for easier than typing, this allows your computer to recognize the product you are after. In a soon-to-be-released feature, this will then allow C2 to search the web for the best worldwide price for your construction material or service.

Technically, the C2 chooser is an Ms Excel add-on that allows you to:

- Pick up material information from a hierarchical index (database) in Excel, and place it directly in your Estimate.
- Use your own Excel files as a materials database source, or
- Download "global" database from Web sites
- Refresh your Excel worksheets with new data from update database.

The C2 Chooser allows you to choose - rather than type-your construction materials for your estimate. Our database contains nearly every construction item, all categorized according to the popular CSI format. Updates to this are easily downloadable, and free.

2. General Construction Cost Estimator (for MS Excel)

The world's best way to create office productivity is now the easiest way to build accurate construction cost estimates. The user can now work in a single *MS Excel* environment to quickly create, build, and manage his estimates. Automatically adjust costs for the user's area. Utilize built-in reporting or use Excel's reporting functions. It's all in one complete, integrated solution – General COST Estimator for Excel.

By automatically improving estimating accuracy, efficiency and eliminating errors, General COST Estimator for Excel is the right tool to save you time and money.

Key Benefits

- Convenient *MS Excel* based estimating
- Customizable, flexible, built-in unit cost data in industry-standard CSI format (MasterFormat)
- Local cost data updated quarterly
- Start-up wizard for creating fast estimates
- Cost data includes all standard construction cost categories
- Modifiable overhead and profit applications
- Accurate construction cost estimates in minutes
- No initial training necessary... you already know how to use it
- Comprehensive Online Help system
- Free software updates... no recurring costs... ever.

3. WinEstimator

WinEstimator software is a construction cost estimating software for Windows-based PCs. A WinEstimator software solution is designed to be easy to learn and use, with the intuitive 'point-and-click' and 'drag-and-drop' simplicity of Windows. It is also designed to make your day-to-day estimating process easier, faster and more productive, paving the way for increased profitability.

Though originally developed to serve the complex estimating needs of the A/E industry, WinEstimator solutions have also branched into general-purpose project estimating, budgeting and cost knowledge management. These solutions are expertly designed to improve productivity by eliminating burdensome repetition and facilitating better business 'cost' communications, while providing the valuable insight and information necessary for better decision-making, planning and project management.

4. BID2WIN

Benefits

BID2WIN's beauty is not just skin deep. The software goes beyond its impressive and powerful feature set to provide a number of benefits virtually undeliverable by other packages and truly invaluable to its users. These benefits include:

* The Microsoft Windows Standard

* Standardization

* Accuracy and Efficiency

* Flexibility

* Ease of Use

Features

A host of powerful features make estimating with BID2WIN an entirely different experience. Because our development process incorporates the input of estimators who use the software on a regular basis, these features truly address the needs and wants of today's construction industry professionals. Here is just a handful of the capabilities BID2WIN possesses:

- Adheres to the Microsoft Windows design guide
- Has the same look and feel as all Microsoft Office applications such as Excel and Word
- Customize all resource databases, including labor, equipment, crews, task templates, subcontractors, vendors, materials, and more
- Create and utilize custom embedded Microsoft Excel spreadsheets
- Create and store task structure with the item for use in future bids
- Set up unlimited private or public item databases
- Create file-based bids
- Copy items and item detail from old bids to your current bid
- Toggle the bid between metric and imperial with one mouse click using built-in metric conversion factors
- View bid items in customizable spreadsheet
- View and edit items and any level of detail from one screen utilizing the powerful Windows tree-view
- Create an unlimited cost structure with tasks and sub tasks
- Establish and distribute Indirect Costs
- Balance and unbalance bid
- Customize the bid summary screen
- Access pre-loaded costing reports and various other reports, including work orders
- Produce private bid forms

- Estimate Check Wizard: Automatically scans the bid for dozens of potential user errors or omissions
- Modify cost components globally within the bid
- Create unlimited item phase groups within the bid to analyze specific bid pricing requirements and markup by grouping
- Advanced security features

5. DeccaPro Cost Estimating Software

Main Benefits

- Quick, accurate cost estimates for any product
- Winning bids through detailed and optimized costing
- Less risk by doing new product pricing and feasibility
- Increased sales by showing benefits in customer's applications
- Lower costs through process cost analysis
- Save money by avoiding uneconomical projects
- Anyone can do costing
- Save time - easy to use Windows software with extensive help file

6. Deneb Software

Deneb Software specializes in the development of software for construction. Deneb Construction Accounting and Estimating is designed for small to medium-sized contractors.

Features:

Customizable data views: With customizable data views, the user can label own fields using his own terminology.

Security: Information is made available by login with security and by User level security. The user has complete control over the accessing of secured data.

Schedules: Helps the user to schedule his resources, it can be labor or it be an equipment. The user always knows what resources he has on hand.

In touch: Schedules to the Employee or Technician, to keep them updated.

Application Integration Tools: Import – Export data from and into different formats. Share information among a different variety of applications.

Application Flow: 'Hot Keys' allow you to jump to the relevant information and input and still retain the current working status.

Lookups: the user does not have to memorize codes or carry lists (which have to be updated), it's available online.

Advanced Technologies: Utilizes the latest technological advances such as COM, Client/Server architecture, and a SQL Database Engine. Minimize downtime, and maximize efficiency with scaleable, robust and versatile technology.

7. Esti-Mate Software

Esti-Mate is a powerful, user-friendly software for building material dealers on the market today. It provides an easy way to improve sales, profit, and productivity.

Features:

- Simple to learn user friendly software system, designed by and for building professionals who don't have time to learn new procedures or complicated hardware.

- Designed by and for home builders, estimators and the home center industry.

- Program does the most time consuming and normally not exactly error free part of hand-written takeoffs, lists all lumber and building material items needed that require estimating formulas, math calculations, math conversions and adding waste factors.

- Complex stick built roof systems require only two length entries, pitch, rafter size and material type selection per easily managed roof section.

- Review, update any estimate on file in minutes, prints customer or selected estimate lists or pick list for separate sub-system delivery.

- Price includes three system installations per purchase and per location.

- Minimal amount of information needed from blueprints for entry to program screens.
Rapid point and click selection of material types and sizes.

- Provide your customers with faster service, more accurate onsite deliveries, while allowing your sales staff more time and opportunity to increase customer base and sales.

-Economical and portable for use on office-home-laptop Windows PC.

8. ESTIMATING SOLUTIONS

This system is simple to operate and allows producing a Bid in a similar way to hand written pricing sheets, but is only as good as the estimator using it.

By taking the drudgery out of producing hand written pricing sheets and the inevitable mistakes with the calculator and the guess work in establishing labour install rates, the user will soon be producing more consistent bids. The user will then be able to better evaluate the market and fine tune his rates to get his amongst the winners. Producing a bid with this system should take less time. Time which can be more productively spent either on more bids or seeking better prices for your materials.

It is assumed that the user is conversant with the Microsoft Windows operating system as this software is configured to run under Microsoft Windows.

The estimate files are configured to the Microsoft Access Database system. The advantage of using a database is that all additions, deletions and edits are written to the hard disk immediately. Therefore in the event of a power failure or crash, no information is lost.

The disadvantage of using a database is lack of speed as the system is constantly reading and writing to the disk. This should not cause you a problem if you keep your Master Database sections and Estimate sections to a reasonable length.

The Master database can be placed on a server and networked to individual PC's. The speed of transfer of data will, however be slowed down due to the speed of the network.

9. EstimaX

A system that minimizes the time and effort taken to develop an estimate for any type or size of project whilst providing maximum control and flexibility.

EstimaX is a generic project estimating system designed around methods used for large construction projects although it is applicable in any organization for jobs of any size. The system also includes extra efficiency features when using.

The system is designed to:

- § Reduce estimating time & costs
- § Increase estimating accuracy
- § Increase confidence in estimate accuracy

§ Increase tendering success rate

§ Increase the overall efficiency of an organization's knowledge management warehouse by incorporating configurable information interface facilities.

EstimaX is used to build project estimates with work or material items structured in sections and sub-sections. Items are entered at "cost" rates and then standardized, uplift percentages are applied relevant to the type of item to calculate basic "sale" rates. Allowances can be applied to add "pad" quantities and further mark-up adjustments may be applied at the various levels in the estimate and all the totals are immediately recalculated and displayed. A lump sum addition or reduction (discount) can also be applied to an Estimate.

EstimaX features the ability to pre-build standardized groups of items referred to as a "spread" that may easily be copied in as an estimate item. An example of using a "spread" may be the daily cost for a work boat where individual rates can be entered for each of the crew, the various equipment hire /rental costs and consumables. Standardized basic uplift percentages are applied to items and the system calculates the total for the "spread" to give a daily cost rate and daily selling rate for the vessel. In a similar manner, frequently repeated sets of work activities can be built up as standard spreads to give a rate for any relevant unit of measure. There is no limit to the use of the spread features in construction, manufacturing, services; in fact any business sector needing to tender / bid for jobs or to establish sound estimated budgets for in-house projects.

A "price" catalogue is included as an integral component in EstimaX allowing items to be priced very quickly, easily and consistently. The price catalogues are simple to maintain with item prices being applied according to time period validity.

Functions are included to import estimate information and a framework is provided to automate a lot of the work involved in estimates for very large construction projects. For example, it is quite straightforward to import basic Bill of Material lists from drawing takeoffs, obtain the purchase prices and then generate items with cost / sale rates.

EstimaX is designed to operate as a modular component within existing company systems and, most significantly, to apply item cost allocation to the normal company cost codes. Features are included to allow controlled synchronization of cost codes with standard chart of account tables.

"Classification", "type" and user definable references can be applied to enable data analysis. They are included with other criteria on list selection facilities allowing rapid access to information.

For successful tenders, there is the capability to generate information to establish budgets in a project control system. Also, an option is provided that can enable "actual" data to be imported back into the system so that the original estimate accuracy can be monitored for the project, sections, sub-sections and items.

In common with all the **MatriX** modules, there are numerous features enabling deployment in any size of organization and maximizing efficiency, such as:

- Rapid access to information is enabled through 'selector' windows, applying criteria that includes standardized and user-definable classifications
- Copy / Paste facilities increase efficiency e.g. copying of previous estimates · Multiple companies in an organization are supported
- Bids can be created in any currency and rate conversions are automated
- Hours and weights can be monitored (weight conversions are automated)
- Cost codes can be formatted to match any ledger style
- System Security is an important feature, managed effectively and easily
- On-line listings can be grouped, sorted, exported (as XLS, CSV, XML or HTML) and printed
- Various inquiries and reports are provided
- "Workflow" operation gives fast access to the most-used next window
- The database is designed to integrate easily into any organization's knowledge management suite
- A comprehensive system guide is available on-line and as hard copy.

10.JOBPOWER Software for Contractors

JOBPOWER was designed specifically for the construction industry. It includes powerful features which contractors need - features such as job cost, AIA billing, retainage, certified payroll, and much, much more. The comprehensive, flexible job management reports give you up-to-date information you need to manage your jobs and make your business more profitable.

Estimating Program

JOBPOWER Estimating is a flexible, general purpose estimating program that allows contractors to prepare quick, accurate bids and estimates. It allows the user to enter his own labor and material costs, his own takeoff formulas, and his own bid templates into a database, and then uses that information to compute the cost of the project.

A starter database comes with the software that serves as an example and gives the user a framework with which to start. The user can add his own prices to this database and add additional items as he wishes.

Some features of JOBPOWER Estimating:

- Prepares bids in a fraction of the time
- Serves as a check list to make sure that nothing is forgotten
- Reduces errors - the program does all the calculations
- Can make last minute revisions in minutes instead of hours
- Prints a professional bid to submit to the customer
- Updates bids if there are price changes - one command and the program does the rest
- You can quickly prepare alternate bids
- You can organize the bid in your own way
- Interfaces with JOBPOWER Accounting software. A successful bid can become the budget for the job
- Gives you the flexibility you need for special cost items and labor situations
- Labor estimate can be based either on hours or calculated from anticipated productivity
- Can be used for quick bids and estimates as well as detailed bids

11. ProEst General Construction Estimating

The ProEst general construction software was designed for General Contractors, Residential Builders, and any other contractor that performs general construction work.

The ProEst system is a full 32-bit system designed using exclusively Microsoft Tools. The system will work with all Microsoft Windows programs and exchanging data is very simple.

The Estimate List is pictured to the right. The ProEst system can store 10,000 estimates for quick easy access to your estimate information.

The Estimate sheet in ProEst can be setup to look exactly like your current spreadsheet or ledger. The column layout is completely user-definable. The estimate selling price is always displayed on the top bar

for quick reference and any changes made to the estimate are reflected instantly in your total.

ProEst allows the user to takeoff single items and assemblies. The master database contains Items and Assemblies organized in an "explorer-like" tree structure for quick access. The system comes with a complete general construction database as well as having interfaces to many industry pricing services.

The power in ProEst is in the Assembly takeoffs. The Assemblies allow the user to takeoff many related items from a construction unit in one quick step and they are completely user-definable.

12. AdvancedBid 2000

AdvancedBid 2000 offers many features that will assist the user in project estimating these features are:

- Operating principles and functions are easily understood within just a few hours.
- Inexperienced estimators can quickly learn practical method of accurate and precise estimating and the Veterans will marvel at it's sophistication and time saving features
- Applies sophisticated OH&P percentages and Performance Bond costs with a single click
- Offers Multiple User, Networking and Password Protection options
- Powerful Template feature for estimating multiple construction projects simultaneously, and from within a single project
- Provides pre-designed Administrative Forms, Address Book and handy Note Pad for project reminders
- Technical support fees are non-existent because AdvancedBid 2000 "support itself"

13. Fast Estimate (software for professionals)

Key Benefits of fast Estimate

- Added confidence: if the user do not get the job, he probably did not want it
- Huge time saving when compared to manual systems
- Organization all pricing information in one place
- Communication: clear, concise working documents for the clients and on-site staff

Key Features of fast Estimate

- Resource library: keep your costs up-to-date and in one place

- Suppliers: allocate resources to individual suppliers
- Flexibility: works for builders, contractors, sub-contractors and specialists
- Output to Ms Applications: export data to Word, Excel, etc.

14. Buildsoft Electronic Tendering System (BETS)

The Buildsoft BETS allows the user to produce a document that will be easily e-mailed or mailed to subcontractors for viewing and entering of their prices for you to use in a tender.

BETS is intended to be used in conjunction with the Subbies Comparison System. BETS allows the following:

- § Coding of items so that it is selected for a supplier to price.
- § Allows items to be multi coded, so as to be priced by different subbies.
- § Creates a separate pricing document for each supplier in BOQ format.
- § Allows definable notes to be added to the subbies BOQ print out.
- § Retains the BOQ numbering for ease of entering prices.
- § Creates a common accessible document (PDF) that is read with a free viewer.
- § Allows the Supplier to print their part of the BOQ.
- § Uses a common supplier list with the Subbies Comparison System.
- § Keep a default, preferred list of suppliers that can be applied to new jobs.

Annex 4

Item Numbering

Item Numbering

S.No	Item No.	Item Description	Unit
1	1000	General Works	
2	1100	Demolition Works	l.s
3	2000	Earth Works	
4	2100	Excavation & Backfilling	m3
5	2200	Supply and Fill with compacted clean sand	m3
6	3000	Concrete Works	
7	3200	R.Concrete B300 for Foundation	m3
8	3300	R.Concrete B300 for Ground Beams	m3
9	3400	R.Concrete B300 for Column Necks & Columns	m3
10	3500	R.Concrete B300 For Slabs (25cm thick)	m2
11	4000	Block Works	
12	4100	20 cm thick. Brickwork	m2
13	4200	15 cm thick. Brickwork	m2
14	4300	10 cm thick. Brickwork	m2
15	5000	Plastering Works	
16	5100	3-face internal plastering for walls	m2
17	5200	3-face internal plastering for ceiling	m2
18	5300	External plastering for walls with Tyrolean	m2
19	6000	Tiling Works	
20	6100	(25x25 cm) Terrazzo tiles for floors with skirting	m2
21	6200	(20x30 cm) White ceramic tiles for walls	m2
22	6300	(20x20 cm) White ceramic tiles for floor	m2
23	7000	Painting Works	
24	7100	Internal Painting- Polside for Ceiling	m2
25	7200	Internal painting- Supercryle for Walls	m2
26	8000	Carpentry Works	
27	9000	Metal and Aluminum Works	
28	10000	Electrical Works	
29	11000	Mechanical Works	
30	12000	Isolation Works	
31	13000	Special Works	
32	14000	Finishing Works	

Annex 5

Gaza Estimator Software (GES) Sample Forms

Gaza Estimator Software (GES) Sample Forms

Figure A5.1 shows a sample of B/Q input sheet.

Figure A5.2 shows a sample of the help sheet for input unpriced B/Q

Figure A5.3 shows a sample of Stratified B/Q

Figure A5.4 shows a sample of Indirect Costs

Figure A5.5 shows a sample of Priced B/Q

Figure A5.6 shows a sample of Cost Reports

Figure A5.7 shows a sample of the help sheet for estimating the bid

Figure A5.8 shows a sample of Items list

Figure A5.9 shows a sample of Materials list

Figure A5.10 shows a sample of Labor list

Figure A5.11 shows a sample of Plant list

Figure A5.12 shows a sample of Subcontractor1 list

Figure A5.13 shows a sample of Subcontractor2 list

Figure A5.14 shows a sample of Template 1

Figure A5.15 shows a sample of Template 2

Figure A5.16 shows a sample of MDB.

Figure A5.17 shows a sample of LDB

Figure A5.18 shows a sample of PDB

Figure A5.19 shows a sample of S1DB

Figure A5.20 shows a sample of S2DB

Figure A5.21 shows a sample of CDB

Figure A5.22 shows a sample of the help sheet for database file

Figure A5.1: A sample of B/Q input sheet.

Figure A5.2: A sample of the help sheet for input unpriced B/Q

Figure A5.3: A sample of Stratified B/Q

Figure A5.4: A sample of Indirect Costs

Figure A5.4: A sample of Indirect Costs

Figure A5.5: A sample of Priced B/Q

Figure A5.6: A sample of Cost Reports

Figure A5.7: A sample of the help sheet for Estimating the bid

Figure A5.8: A sample of Items list

Figure A5.9 shows a sample of Materials list

Figure A5.10 shows a sample of Labor list

Figure A5.11 shows a sample of Plant list

Figure A5.12 shows a sample of Subcontractor1 list

Figure A5.13: A sample of Subcontractor2 List

Figure A5.14: A sample of Template 1

Figure A5.15: A sample of Template 2

Figure A5.16: A sample of MDB.

Figure A5.17: A sample of LDB

Figure A5.18: A sample of PDB

Figure A5.19: A sample of S1DB

Figure A5.20: A sample of S2DB

Figure A5.21: A sample of CDB

Figure A5.22: A sample of Help Sheet for Database File

Annex 6

GES Implementation: Illustrated Example

GES Implementation: Illustrated Example

A6.1 Introduction

An illustrated example is used to show the implementation of the system. The goal of this example is to price Bill of Quantity (B/Q) for "Gaza School project" as shown in Table 6.1. In this example the concrete works will be executed by contractor's crew, while the painting works will be executed by subcontractors¹ including materials price. The blocks, plastering, and tiles works will be executed by subcontractors² excluding materials supply.

Table A6.1 B/Q Items

Item No.	Code No	Item Description	Unit	Qty	Unit Price	Total Price
1	2000	Earth Works				
2	2100	Excavate to level -2.0	m ³	600		
3	3000	Concrete Works				
4	3100	R.Concrete B150 for Plain Concrete	m ³	35		
5	3200	R.Concrete B300 for Foundation	m ³	350		
6	3300	R.Concrete B300 for Ground Beams & Steps	m ³	55.0		
7	3400	R.Concrete B300 for Necks & Columns	m ³	70.0		
8	3500	R.Concrete B300 For Slabs 25cm thick.	m ²	4,000		
9	4000	Block Works				
10	4100	(20 cm thick) Brickwork for walls	m ²	6,000		
11	4200	(15 cm thick) Brickwork for internal walls	m ²	3,000		
12	4300	(10 cm thick) Brickwork for internal walls	m ²	10,000		
13	5000	Plastering Works				
14	5100	3-face internal plastering for walls	m ²	20,000		
15	5200	3-face internal plastering for ceiling	m ²	4,000		
16	5300	External plastering for walls with Tyrolean	m ²	4,000		
17	6000	Tiling Works				
18	6100	(25x25 cm) terrazzo tiles for floor with skirting	m ²	3600		
19	6200	(20x30 cm) White ceramic tiles for walls	m ²	1,200		
20	6300	(20x20 cm) White ceramic tiles for floor	m ²	400		
21	7000	Painting Works				
22	7100	Internal painting- Polisid for ceiling	M2	4000		
23	7200	Internal painting- Supercryle for walls	M2	20,000		
Total						

The user can open GES by double clicking on its icon (Ges.xls) that is located typically in the GES folder. Figure A6.1 illustrates the dialog box which asking for the use to enable or disable macros. The user has to enable macros to full use of GES. To start in entering the user's basic data, s/he should click on the icons list under "**Data Base**" icon in the New user menu. Automatically macro command runs to activate Database file. A dialog box appears (see Figure A6.2) asking the user to determine if s/he wants to update the data or to run without updating.

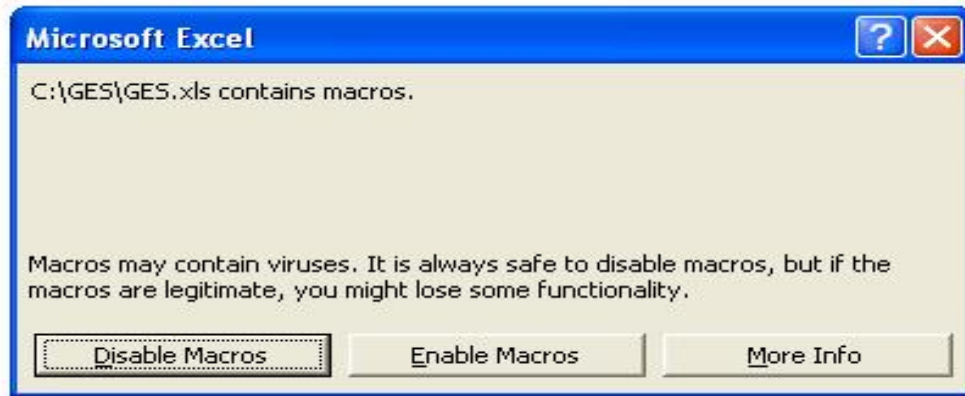


Figure A6.1

The user has to choose "Update" icon to update the links and to retrieve the latest data, and after that another dialog box appears (see Figure A6.3) asking the user to determine if s/he wants to continue for opening the file or to edit links. The user has to choose "continue" to open the Database file.

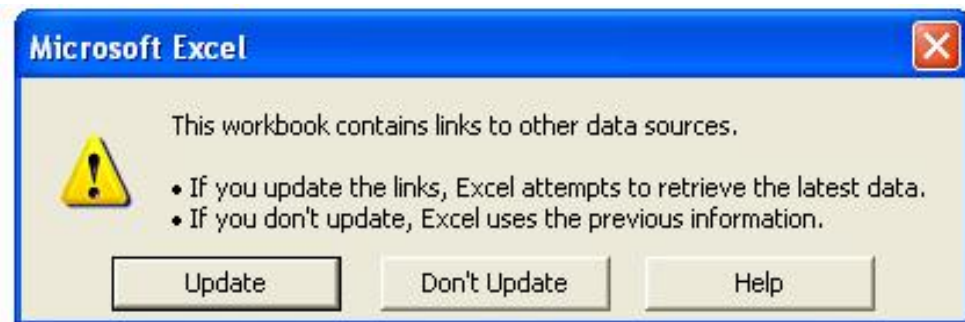


Figure A6.2

A6.2 Generating Database

To enter the data the user has to proceed with the following:

A6.2.1 Entering the Items List

The user has to activate this sheet by clicking at "Items list" icon in the New user menu. The user has to feed the item numbers, item descriptions, and item units according to his own code numbering system in the long list. The researcher suggests a numbering system for some items to use in GES.

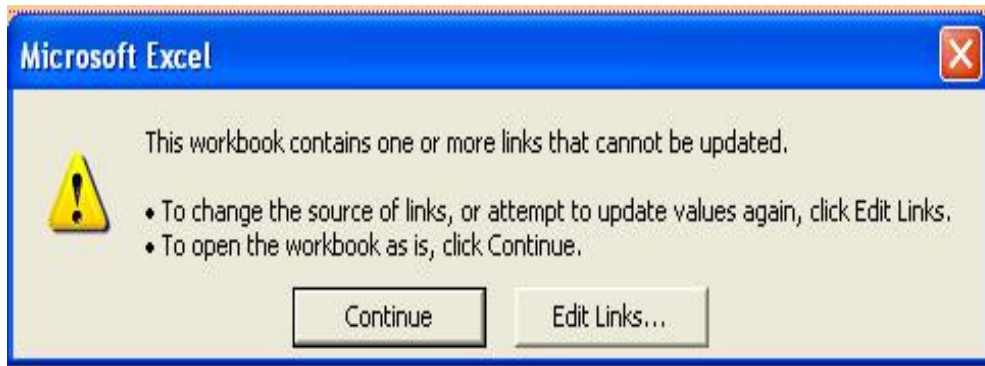


Figure A6.3

A6.2.2 Feeding the basic data

Each company has available basic database for application. The basic database contains data ready for direct use in estimating the bids. The user has to input his own data related to materials, labor, plant, and subcontractor with/without supplying materials (see Annexes A5.8-A5.13) into the Database file. The user can shift from sheet to another by clicking at the wanted list icon in the New user menu. The user can return to the New user menu by clicking on "Menu" icon in each sheet before shifting to another sheet. The user can update this data according to any change in prices.

A6.2.3 Filling Template 1 (input data) for each item in the Items list

After generating basic data, the user has to shift to template 1 (input data) sheet and starts to input this sheet. The data in this template is imported from items, materials, labor, plant, suncontractor1, and subcontractor2 lists. The user can fill any item as he needs.

How to fill template 1

The user has to follow the following steps for entering the data in Template 1. For example, we want to feed the data related to the item no. (5300), and description is "External Plastering with Tyrolean". Figures A6.4-A6.7 show template1 for different items.

- a. In the first box, the user has to enter only the item no. (5300) in the white cell as described in items list sheet. The item description and unit of measure automatically are displayed.
- b. The second box is developed for required materials for executing one unit of the item. The user has to fill 2 cells in the row in the first and third columns; the first cell is material name. To choose the material name, the user has to select the cell; the down arrow for the pop-down-list will appear as shown in Figure A6.8. When down arrow is clicked with the mouse the list of materials is displayed. For the selected material the purchasing unit will be automatically displayed. And so on for other materials. The second cell to be filled is material quantity. The user has to enter the material quantity needed to execute one unit of the item in the third column. (in our example, for plasterer net cloth, purchasing unit is m2, the quantity needed of plasterer net cloth for executing 1 m2 of external

Figure A6.4

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Figure A6.5

Figure A6.7

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plastering is 1.0 m²), and so on for other materials (Cement, 10 Kg.), (Sand, 0.03 m³), (Glue, the quantity needed is 0.15 Gallon), (lime, 0.40 Kg), (galvanized angles, 0.50 L.M), (Plastering Plastic Mesh, 0.50 m²), (Quartz, 0.40 bag), and (White cement, 2.0 Kg.). This will be eventually transferred to Materials Database (MDB) sheet.

- c. The third box is designed to determine the labor crew. If the item will be executed by the company's crew, the user has to fill this box. In the same way used in choosing the materials, the user can choose the crew composition (the labor trade and number of worker), and the productivity of the crew for each group of floors (unit/hr). In our example the external plastering will not be executed by company's crew. It will be executed by Subcontractors without supplying materials (Subcontractor2). The data will be eventually transferred to Labors Database (LDB) sheet.
- d. The fourth box is designed for plant. The user determines the plant name, number, and productivity (unit/hr). This data will be eventually transferred to Plants Database (PDB) sheet. In our example no need for plant in executing the external plastering works.

Required materials for executing one unit of the Item		
Material Name	Purchasing Unit	Required Qty/Unit
Concrete B200		
Concrete B250		
Concrete B300		
Block 20x20x40 cm		
Block 15x20x40 cm		
Block 10x20x40 cm		
Cement		
Clean Sand		

Figure A6.8 Choosing Material in Feeding Template 1 (Input Data)

- e. The fifth box is developed for the subcontracting (workmanship including materials), the user will fill this box by choosing the subcontractor work and his trade. This will be eventually transferred to Subcontractors 1 Database (S1DB) sheet.
- f. The sixth box is designed to show subcontracting (workmanship excluding materials). In the same way used in the previous step, but this data will be ultimately transferred to Subcontractors 2 Database (S2DB) sheet. In our example external plastering subcontractor and scaffolding will be needed to execute the activity external plastering.
- g. All data will be ultimately transferred to different database sheets by clicking on the "To Database" icon. And so on for other items in the items list.

- h. After feeding all data for all items in the items list, the unit rate for each item in the items list will be ready to use in preparing bid estimating.

A6.2.4 Updating the data by using the Template 2 (update data)

If the user wants to update the inputs which are entered in template 1 for any item, the user can open Template 2 sheet and request the data by entering the item no. in the specified cell. By clicking on "**Request Data**" icon, automatically all input data will be displayed in the different boxes. The user can change any data and s/he can again export this data after updating to database sheets by clicking on "**To Database**" icon.

A6.3 Estimating the Bid

To start in bid estimating, the user should go to the Old user menu (see Figure 5.5) from the main menu or from the New user by clicking on the "Old User" icon.

A6.3.1 Input Unpriced B/Q

The user has to open the input file. By clicking on "Unpriced Bid Items" icon automatically macro command runs and two files are activate. The first is Output file and a dialog box appears (see Figure A6.2) asking the user to determine if s/he wants to update the data or to run without updating. The user should choose "Update" to update the links and to retrieve the latest data, and after that another dialog box appears (see Figure A6.3) asking the user to determine if s/he wants to continue for opening the file or to edit links. The user should choose "continue" to open the Output file and after that the Input file opens.

Before feeding the Unpriced B/Q, the user has to feed his own numbering system to the B/Q. If an electronic version of Unpriced B/Q is available which is received from A/E with tender documents, the user can transferred directly to input file (bid items sheet). Otherwise, the user can feed all data of B/Q in the bid items sheet. The use has to input the name of B/Q input file by using "**Save as**" tool under a name related to the chosen project (say Gaza School Input).

A6.3.2 Pricing the B/Q

As described in sub-section 5.8.2, Outputs file contains three sheets, the first one is "**Stratified B/Q**", the second is "**Indirect Cost**", and the third is "**Priced B/Q**". The output file can be saved by using "**Save As**" tool under a name related to the chosen project (say Gaza School Output).

a. Generating Stratified B/Q

To fill the Stratified B/Q (see Figure A6.9) the user has to activate this sheet by using the sheet tabs and s/he should follow the following steps:

- a) All data (item no., item description, item unit, item quantity, and unit rates for each group of floors) are automatically displayed.
- b) The user has to input the quantities according to each group of floors (say 1600, 1600, and 800 for external plastering) in the columns 5, 7, 9. The extended item total (\$26,741.82) and the average unit rate (\$6.69) are displayed. The same method for each item. The extended item totals is displayed and the total direct cost (\$507,813.01) is displayed also. This total direct cost will be transferred to the indirect cost sheet to calculate the general overhead.
- c) After this step the user has to fill the indirect costs, by moving to the indirect cost sheet. By clicking on "**To Indirect Cost**" icon or by using the sheets tab. The detail of this process is shown in sub-section "**b**" bellow.
- d) After filling the indirect cost, the user has to return back to Stratified B/Q, the total indirect cost (\$33,039.16) automatically is displayed in Stratified B/Q.
- e) The user has to fill the risk (contingency) factor (say 3% in our example) and the profit (say 10% in our example) as percentage of total (direct and indirect costs = \$540,852.16) of the bid.
- f) The total project cost (\$601,534.79) is calculated and accordingly, the adjusted unit rate factor (1.20) equals by dividing the total project by total direct cost. The final unit rate will be displayed in this sheet (\$8.05 for external plastering) in the column no. 13, and this rate will be used for bid submission.
- g) The user has to shift to the Priced B/Q by clicking on "**To Final Bid Price**" icon or by using sheet tabs. All data in this sheet is automatically filled, and it is ready for bid submission (see Figure A6.10).

b. Filling the Indirect costs

- a) In this sheet the user has to fill all indirect costs, which are site, general, and financial costs. The site and financial costs are calculated in details as bid documents required (see Figure A6.11).
- b) The general overheads are distributed on the projects that expected to be implemented in a year according to ratios that are based upon the project amount. The steps to determine the general overheads are as follow:
 - i. Calculating the expected total cost of the project by multiplying the total direct cost (\$507,813.01) which is imported from the Stratified B/Q by 1.25. The researcher considered that all overheads = 25% of total direct cost. This is an arbitrary percentage that the user can enter. In our example the expected total cost = \$ 507,813*1.25 = \$ 634,766.26

- ii. Calculating the expected total projects costs per year, consider \$2,000,000.0.
- iii. Calculating the company overheads per year, consider \$ 50,000.0 After dividing the expected project cost by the expected total projects cost and multiplying the result by the company overheads, the generated result is the general overhead for the project =
- $$\frac{((634,766.26)/(2,000,000.0)) * (50,000.0)}{}$$
- = \$ 15,869.16.
- c) In our example, the summation of the site, financial, and general cost (\$33,039.16) is displayed and automatically this total will be transferred to the "Stratified B/Q", after clicking on "**To Stratified B/Q**" icon or by using sheet tabs.

Figure A6.10

Figure A6.11

Figure A6.11

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Annex 7

Modified Summary Sheet

Modified Summary Sheet

No.	Item	Total
1.	General Works
2.	Earth Works	.....
3.	Concrete Works	.....
4.	Block Works	.....
5.	Plastering Works	.....
6.	Tiling Works	.....
7.	Painting Works	.....
8.	Carpentry Works	.....
9.	Metal & Aluminum Works	.....
10.	Electrical Works	.....
11.	Mechanical Works	.....
12.	Isolation Works	.....
13.	Special Works	.....
14.	Finishing Works	.....
	Total Costs Including V.A.T	.....
	Risk Factor (Contingency)	.....
	Profit	.....
	Total Bid Price	.....

Contractor Name.....

Signature

Annex 8

System Evaluation Questionnaire (In Arabic)

استبيان لتقويم "GES"

١ - بين رأيك في معالجة الأمور التالية المتعلقة في تقدير التكلفة لمشاريع البناء في قطاع غزة باستخدام برنامج الحاسوب "GES" Gaza Estimator Software:

الرقم	التفتيات	موافق ١٤	موافق	موافق بدرجة متوسطة	موافق بدرجة ضعيفة	موافق بدرجة ضعيفة جدا
أ -	يوفر البرنامج الإمكانية لتسعير البند تفصيليا.					
ب -	يقوم البرنامج بتسعير البنود حسب تصنيف طوابق البناء.					
ج -	يوفر البرنامج أرضية جيدة لإنشاء قاعدة بيانات.					
د -	يتم تحديث البيانات من خلال البرنامج بسهولة.					
هـ -	يعالج البرنامج تسعير المواد الثانوية.					
و -	يوفر البرنامج سهولة التعامل مع هوالك المواد أثناء التسعير.					
ز -	يساهم البرنامج في زيادة دقة تسعير العطاء.					
ح -	يوفر البرنامج الوقت.					
ط -	يوفر البرنامج في المجهودات التي يبذلها طاقم التسعير.					
ي -	يعالج البرنامج مشاكل التغيير المتكرر لأسعار المواد.					
ك -	يتناول البرنامج تقدير التكلفة غير المباشرة بصورة دقيقة.					
ل -	يأخذ البرنامج في الاعتبار عامل المخاطرة.					
م -	استخدام البرنامج سهل.					
ن -	يساعد البرنامج في تطوير تسعير العطاءات في قطاع غزة.					
ص -	البرنامج ملائم لصناعة التشييد في قطاع غزة.					

٢ - ما هي ملاحظاتك (انتقاداتك) من خلال استخدام البرنامج ؟

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Annex 9

System Evaluation Questionnaire (English Version)

Questionnaire for System Evaluation

1. To which extent you evaluate the treatment of GES for the next techniques?

No.	Techniques	Strongly Agree	Agree	Neutral	Disagree	Strongly disagree
A	The program GES offers the possibility for a detailed estimating					
B	GES prices the bid items according to classification of the building stories.					
C	GES gives a foundation for constructing database.					
D	Simplicity in updating the data by using GES.					
E	GES treats the estimate of secondary materials.					
F	GES gives the opportunity for an easy dealing with wasted materials during the cost estimate.					
G	GES contributes in gaining more accuracy in bid estimating.					
H	GES saves the time.					
I	GES minimizes the efforts that done by estimating staff.					
J	GES treats the repeated change in materials price.					
K	GES deals with indirect cost precisely.					
L	GES takes into account the risk factor.					
M	Simplicity in using GES.					
N	GES helps developing the cost estimate in Gaza Strip.					
O	GES is considered a suitable for construction industry in Gaza Strip.					

(S.A= Strongly Agree, A=Agree, N=Neutral, D= Disagree, S.D= Strongly Disagree)

2. What are your comments about GES?

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3. What are the merits of GES from your point of view?

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