إقرار

أنا الموقع أدناه مقدم الرسالة التي تحمل العنوان:

Valuation of Unbalanced Bids in Construction **Projects in the Gaza Strip**

تقييم العطاءات الغير متوازنة في مشاريع البناء في قطاع غزة

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The work provided in this thesis, unless otherwise referenced, is the researcher's own work, and has not been submitted elsewhere for any other degree or qualification.

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Valuation of Unbalanced Bids in Construction Projects in the Gaza Strip

تقييم العطاءات الغير متوازنة في مشاريع البناء في قطاع غزة

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A Thesis submitted in partial fulfillment of the requirement for Degree of Master of Science in Civil Engineering – Construction Management

The Islamic University of Gaza

August, 2013



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الجامعة الإسلامية – غزة The Islamic University - Gaza

مكتب نائب الرئيس للبحث العلمى والدراسات العليا

ج س غ/35/ الرقم....ج س غ/25/ 2013/08/25 التاريخ Date

نتيجة الحكم على أطروحة ماجستير

بناءً على موافقة الدراسات العليا بالجامعة الإسلامية بغزة على تشكيل لجنة الحكم على أطروحة الباحث/ أحمد وديع يوسف دردونة لنيل درجة الماجستير في كلية الهندسة قسم الهندسة المدنية-إدارة التشبيد وموضوعها:

Valuation of Unbalanced Bid in Construction Projects in Gaza Strip

وبعد المناقشة العلنية التي تمت اليوم الأحد 18 شوال 1434هـ...، الموافق 2013/08/25م الساعة الحادية عشرة صباحاً بمبنى القدس، اجتمعت لجنة الحكم على الأطروحة والمكونة من:

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وبعد المداولة أوصت اللجنة بمنح الباحث درجة الماجستير في كلية الهندسة/ قسم الهندسة المدنية-ادارة التشييد.

واللجنة إذ تمنحه هذه الدرجة فإنها توصيه بتقوى الله ولزوم طاعته وأن يسخر علمه في خدمة دينه ووظنه

والله والتوفيق،،،

مساعد نائب الرئيس للدراسات العليا

C. 1 () أ.د. فؤاد على العاجز

Dedication

To parents peace upon them; to my mother in low who always support and love me; to my wife whose constant dedication and love enlightened me; to my sons whose innocent energy was and still is a source of inspiration; to all of my friends and colleagues who stood beside me with great commitment; I dedicate my research, hoping that I made all of them proud.

Ahmed W. Dardona



Acknowledgement

- I would like to express my gratitude to all those who gave me the possibility to complete this thesis. I am deeply indebted to my supervisor Dr. Nabil El Sawalhi from the Islamic University Gaza whose help, stimulating suggestions and encouragement helped me in all the time of research for and during writing of this thesis.
- Special thanks to construction management staff of the Islamic University of Gaza for their academic and scientific support throughout my study of MSc.
- Special thanks for the programmer (Eng. Naji Abu Mughassib) who supported me very much.
- Special thanks for procurement experts and projects mangers for their participation in structured interview and getting the information of case studies.
- Finally I would like to give my special thanks for my wife and my friends in Jabalia Municipality whose patience and support enabled me to complete this work.



Abstract

The construction sector is considered as the most important sectors in the Gaza Strip. The procurement stage including the process of analysis and evaluation of the bids considered as the most important stages in the project life cycle. The implementing company will be selected in this stage. The selection of the implementing company will be important factor for the success or the failure of the project in terms of time, quality and cost.

The aim of this study is to improve the capacity of owner institutions in the evaluation and analysis of bids in order to discover the unbalanced bids. In addition to prevent unbalanced bid occurrence in the future.

The aim of this study was achieved by reviewing previous studies regarding the definition, analysis and evaluation of unbalanced bids. Also how to detect and deal with unbalanced bids. Structured interviews with ten experts working in the field of project management and procurement were done. The interviews targeted several issues related to unbalanced bids.

The results obtained from interviews with experts were used to formulate a mathematical model to analyze and evaluate the balanced / unbalanced bid. Two main reasons have been identified for the occurrence of unbalanced bids. Frontloading and increasing prices of items expected to increase quantities during the implementation of the project, or vice versa. A number of references to compare prices have been studied, such as (prices estimated by owner's engineers – bidder's average prices – prices monitoring sheets). The allowable difference ratios from the prices references were determined during the study.

The proposed MS excel mathematical model would enable workers in the field of contracts evaluation to determine whether the bid is balanced or unbalanced and then selecting the appropriate bid to achieve the institution requirements.

The study recommended owners institutions working in the construction sector in the Gaza Strip to insert a special clause for unbalanced bids in the tender documents. The study also recommended to develop a written method and procedure for the analysis and evaluation of unbalanced bids. Finally to prepare legal clauses to be insert in tender documents to deal with the causes where unbalanced bid occurred.



ملخص البحث

يعتبر قطاع الإنشاءات من القطاعات المهمة في قطاع غزة ، كما تعتبر مرحلة التناقص بما فيها عمليــة تقيــيم وتحليل العطاءات من أهم المراحل في دورة حياة المشروع حيث يتم في هذه المرحلة اختيار الشركة التي ستقوم بتنفيذ المشروع وهو ما يترتب عليه نجاح أو فشل المشروع من حيث الوقت والجودة والتكلفة.

إن الهدف من هذه الدراسة هو تحسين قدرة المؤسسات المالكة في تقييم وتحليل العطاءات بهدف اكتشاف العطاءات الغير متوازنة وكيفية التعامل معها في حالة حدوثها بالإضافة إلي منع حدوثها في المستقبل وذلك لما لها من اثر سلبي على إكمال المشروع في الوقت المحدد وبالميزانية المقدرة للمشروع .

لقد تم تحقيق هدف الدراسة من خلال استعراض الدراسات السابقة الخاصة بتعريف وتحليل العطاءات الغير. متوازنة وكيفية اكتشافها والتعامل معها ، ومن ثم تم عمل مقابلات مع عدد من الخبراء العاملين في مجال إدارة المشاريع والعطاءات وذلك لمعرفة عدد من القضايا ذات العلاقة بالعطاءات الغير متوازنة .

تم الاستعانة بالنتائج التي تم الحصول عليها من المقابلات مع الخبراء في عمل نموذج رياضي لتحليل وتقييم العطاءات بغرض معرفتها هل هي متوازنة أم غير متوازنة. وقد تم تحديد سببين أساسيين لحدوث العطاءات الغير متوازنة هما التحميل الأمامي وزيادة أسعار البنود المتوقع زيادة كمياتها أثناء تنفيذ المشروع او العكس. تم دراسة عدد من المرجعيات لمقارنة الأسعار بها مثل (الأسعار التقديرية المعدة من قبل المالك – متوسط أسعار المتناقصين – أسعار معدة بناء علي مناقصات سابقة) كما تم تحديد النسب المسموحة كفرق عن أسعار المرجعية.

سيمكن النموذج الرياضي المقترح العاملين في مجال تحليل وتقييم العطاءات من تحديد هل العطاء متـوازن أم غير متوازن ومن ثم اختيار العطاء المناسب بحيث يحقق للمؤسسة المعايير المطلوبة.

أوصت الدراسة المؤسسات المالكة والعاملة في قطاع الإنشاءات في قطاع غزة بإدراج بند خاص بالعطاءات الغير متوازنة في وثائق العطاء بحيث يحتوي هذا البند علي (تعريف وتحديد العطاءات الغير متوازنة، وضع طريقة مكتوبة لتحليل وتقييم العطاءات بغرض معرفة هل هي متوازنة ام غير متوازنة، تحديد الإطار القانوني للتعامل مع العطاء الغير متوازن).



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List of Abbreviation

AASHTO	American Association of State Highway and Transportation Officials.
BOQ	Bill Of Quantities
CMWU	Costal Municipal Water Utility
СРМ	Critical Path Method
DOT	Department Of Transportation.
EMCC	Engineering & Management Consultant Center
FHWA	Federal Highway Administration
ICRC	The International Committee of the Red Cross
JICA	Japan International Cooperation Agency
MDLF	Municipal Development and Lending Fund
MDP	Municipal Development Program
NCB	National Competitive Bidding
NPV	Net Present Value
РА	Palestinian Authority
PECDAR	Palestinian Economic Council for Development and Reconstruction
PWA	Palestinian Water Authority



PW	Present Worth
TDOT	Tennessee Department Of transportation
UBDM	Unbalanced Bid Detection Model
UG	Universal Group
UNDP	United Nations Development Program
UNRWA	The United Nations Relief and Work Agency



CHAPTER ONE: INTRODUCTION

1.1 Background

The diversity of Construction activities and complexity of engineering cost bring certain difficulties to the owners in calculating the project cost. At present, under the mode of Code of Valuation with Bill Quantity of construction works, it has been a trend that contractors use the method of unbalanced bid to sustain the profit rate and competition power. For contractors, unbalanced bid is a strategy; but for the owners, unbalanced bid will lead to the low contract price but high settlement price, which will seriously damage the interests of the owners. Therefore unbalanced bid should be strictly eliminated and prevented. (Yi-lin et al., 2010).

The successful execution of construction projects and keeping them within original budget and proposed time schedules depend on number of factors before and during the project implementation process. Dislike of owners, and consultant, many projects exposed to number of variation orders during the project implementation that may lead to unwanted results such as delay, increase of the budget and may be claims and disputes. This problem is more evident in the unbalanced bid contracts in which the contract is awarded to the lowest bidder- according to the strategy of the majority of public procurement entities in Gaza Strip. Although the lowest bidder may has the potential for difficulty in execution according to the timed bombed in their bid that what we can say unbalanced bid.

The unbalancing of a bid is the shifting of part of the cost of work for one element of the work to another element of the work. The degree to which this is accomplished determines whether a bid is simply mathematically unbalanced or materially unbalanced. In public sector contracts, an unbalanced bid is objectionable because it:

- Constitutes an advance payment.
- May not ultimately prove to be the best offer.
- Is detrimental to the concepts of competitive bidding. (Frank and Steven, 1997).
- Unbalanced bid may be one of the important reasons that cause change order in construction project.



1

Therefore, improving of the procurement system in the public procurement entities and create a new method to enable these entities to avoid awarding the contracts to the lowest bidder is so important issue in improving the construction process, saving public money and avoiding changes in construction projects in Gaza Strip.

1.2 Procurement and unbalanced bid in the Gaza Strip

The public procurement system in Gaza Strip is suffering from many problems especially in bid evaluation and contractor selection process which may be lead to select the unsuitable bidder that may has bad impact in the construction process, according to my experience as expert in this field these problems can summarized as follow :

- The public procurement entities tend toward awarding the contracts to the lowest bid to avoid justification and accountability;
- In the bid evaluation process, the evaluation committee did not consider the reasonableness of price allocations and so do the bidders;
- The owners and contractors stand at the opposite position how to collect engineering cost, owners pursue to minimization of engineering cost and maximizing of profits and so do the bidders;
- Uncertainty of tender quantities and inadequate study for the project site conditions;
- Unstable economic situation and its correlation with Israeli occupation one cause to the shortage of material in local market and uncertainty in bids pricing;
- Inadequate knowledge of the procurement entities staffs in the computer application and software used for bids evaluations and price analyses.

The unbalanced bid is one of the most important problem that found during the contract awarding process, as the total bid price is fixed, the contractor could adjust the unit of some items, for one thing he could draw back the capital, increase the cash flow, raise the speed of cash flow and lower the construction risk, for another side the contractor could obtain extra benefit through the design variation, construction modification, defects of bill of quantities etc, the contractor could get a reasonable economy benefit and realize the purpose of getting money early and getting more money (Yi-lin et al.,2010).



The problem of unbalanced bid and the problems followed it such as changes, claims and disputes can be found in every project at Gaza Strip indicating that this problem didn't receive enough attention by both researches and responsible authorities.

Reasons for lake of interests in studying unbalanced bids in public procurements in Gaza Strip

- Lack of knowledge and awareness about unbalanced bid evaluations and impacts ;
- The procurement regulations and restrictions in public sector ;
- The tendency of the public procurement entities to award the contracts to the lowest bid price to avoid justification and accountability;
- The bids evaluation committees concentrate in the total bid price and neglect the unit price analysis.

1.3 Research problem

Project finishing without changes and disputes is considered as one of the most important factors of successful project, that help to decrease problems for all parties and make good environment to execute similar projects in future. It also helps on increasing the profits and development of construction industry in Gaza Strip.

Most construction projects in Gaza Strip are exposed to change order and may be developed into disputes' during the construction process, causing loss of project's profit, increasing cost and execution time and leading to technical and managerial problems between project's parties. Selecting the lowest bidder price with unbalanced bidder is considered to be one of the most important factors that cause the variation and disputes during construction process.

This problem is a result of lack of efficiency in procurement system in public sector in Gaza Strip, the solving of this problem by the formulation of mathematical model that enable the procurement decision makers in public entities to in bid evaluation process, assisting in selection of the best bidder regarding it is price.



1.4 Research aim

The aim of this research is to improve the capacity of the owners in evaluation and analysis of bids in order to discover the unbalanced bid.

1.5 Research objectives

- 1. To identify the factors affecting unbalanced bid in construction projects.
- 2. Investigate the reasons of the unbalanced bid generation in construction projects in Gaza Strip.
- 3. To evaluate the impacts of unbalanced bid in the construction projects.
- 4. To formulate a model to select the best evaluated bidder regarding the effects of the unbalanced bid.

1.6 Important of the study

- This is the first research in the Gaza Strip that deals with the phenomenon of unbalanced bids in construction projects in terms of definition, causes, types, and negative effects of unbalanced bids on the life cycle of construction projects in the Gaza Strip.
- The important of this study is to develop a practical method to detect this phenomenon and reduce its occurrence, in order to eliminate the negative effects on the implementation of construction projects regarding the projects costs and duration.

1.7 Research limitation

- The difficulty of preparing accurate cost estimation due to the variation of construction material prices as result of the closure imposed on the Gaza Strip.
- 2. There is no previous research in Gaza strip regards the unbalanced bids.
- 3. There is no formal or unified cost estimation reference for unit items.



- 4. Religious culture that prevents dealing with the banks and their impact on cash flow accounts.
- 5. Small size and short duration of construction projects in Gaza Strip.



CHAPTER TWO: LITERATURE REVIEW

In this chapter a number of previous studies related to the thesis subject will be reviewed through definition and identification of unbalanced bids, study the causes and mechanism of occurrence of unbalanced bids, evaluation and analysis and detection, the study of mathematical models that used in the analysis of unbalanced bids and finally how to prevent unbalanced bids in the future and how to deal with the case of unbalanced bid occurrence.

Unbalanced bids constitute a serious problem for construction owners. In competitive bidding, awarding a contract to an unbalanced bid may cause the owner's overall project cost to get higher. In some cases, it generates contentious change orders .The owner has the right to reject unbalanced bids, but it is hard to detect unbalancing, So it is essential to define the actual causes of unbalanced bid occurrence and find the wright methods to detect it in order to avoid any increasing in the project cost and any future changes and disputes. This chapter reviews literature concerning the major issues of unbalanced bid in order to recognize the related information regard those issues.

2.1 Definition of unbalanced bid

Before defining and examining what exactly constitutes an "unbalanced bid," it is worthwhile to first explain what a balanced bid is. Phernambucq,(1996) defined A balanced bid as an offer whereby, for each line item included in the bid, the quoted unit price for the item includes a proportionate share of costs and profit in relation to the overall bid price.

Unbalanced bid is a bid based on prices significantly less than cost for some work and prices which are significantly overstated for other work.

Yi-Lin et al., (2010) defined the unbalanced bid as a tool which is to realize the pursuit of obtaining the project with low price and settle with high price to pursuit the profit maximization.

In its classical definition, bid-unbalancing is a process by which the overall project actual cost and the project profits are intelligently distributed among the project



activities while not affecting the total bid price for the project (a balanced bid, by extension, is one where project costs are accurately assigned to the project activities and the project profits are evenly distributed among such activities) (Christodoulou, 2008)

2.1.1 Mathematically unbalanced bid

A mathematically unbalanced bid is a bid that contains some line items' unit price determined to be significantly overstated or understated. This can be determined by comparing the unit price of the line item with the engineer's estimate, the unit prices quoted by the other bidders, or other historical data of costs.

(According to the Federal Highway Administration (FHWA) guidelines reported by Heinz (1988), the meaning of a mathematically unbalanced bid is 'one containing lump sum or unit bid items which do not reflect reasonable actual cost plus a reasonable proportionate share of the bidder's anticipated profit, overhead costs, and other indirect costs' (cited in David and Chotibhongs ,2009).

(mathematically unbalanced bids) refers to bids for which bid items do not carry their proportionate share of overhead and profit in addition to bid items' actual costs. In essence, mathematically unbalanced bids are structured on the basis of nominal

Prices for some work and inflated prices for other work so that they can jointly constitute a bid that is more advantageous to the contractor (Christodoulou ,2008)

Tennessee Department Of transportation (TDOT) policy defined the mathematically unbalanced bid as follow: Mathematically unbalanced bid means a bid containing lump sum or unit bid items which do not reflect reasonable actual costs plus, a reasonable proportionate share of the bidder's anticipated profit, overhead costs, and other indirect costs.

2.1.2 Materially unbalanced bid

A materially unbalanced bid is a mathematically unbalanced bid that may cost more money to the owner.

According to Heinz's (1988) interpretation of FHWA guidelines, the materially unbalanced bid is defined as a bid which generates 'a reasonable doubt that award to the bidder submitting a mathematically unbalanced bid will result in the lowest ultimate cost to the Government' (cited in David and Chotibhongs ,2009).



(Materially unbalanced bids) refers to bids for which not only a disproportionate amount of overhead and profit has been shifted to chosen activities, but also a portion of the actual work (and cost) of some activities is shifted to other activities. This is the case where a contractor anticipating overruns in certain activities (for instance work related to excavation) shifts a percentage of the cost of other activities (for which the contractor is more certain about their volume of work) to activities whose volume of work is wrongly stated in the contract documents and for which the contractor expects additional compensation (typically on a unit-price contract). (Christodoulou, 2008)

Tennessee Department Of transportation (TDOT) policy defined the materially unbalanced bid as follow: - Materially unbalanced bid means a bid which generates a reasonable doubt that award to the bidder submitting a mathematically unbalanced bid will result in the lowest ultimate cost.

2.2 Reasons of unbalanced bid generation

Yi-Lin et al., (2010) summarize the reasons of unbalanced bid as follow:

1) The owners and contractors stand at opposite position of how to collect engineering cost, which accumulate the generation of unbalanced bid. Owners pursue minimization of engineering cost and maximization of profits at the precondition of insurance of project cost and time limit.

2) In the evaluation process, business premises influence the tender who will be awarded. Some out-contracting units in order to reduce the investment and survive in the competition, they indiscriminately pursue acceptance with low price and even lower project cost down to cost price, which is the reason directly cause unbalanced bid.

3) The contract should be unit price contract. The progress price and settlement price are based on actual completed quantities and price in tender documents." The unit price and quantities are separated" does offer conditions for unbalanced bid, change and claim.

4) The relevant laws and regulations have not expressly effective restrictive clauses on unbalanced bid. According to regulations of the 2008 edition of Code of

Valuation with Bill Quantity of construction works, List of contract suitable for a unit price contract. Progress payments and settlement prices are based on actual completed work and quoted price in the tender documents, "Separation of the quantity and price"



provide the conditions for unbalanced bid, change, claim. Especially on the absence of clear Provision, relevant laws and regulations for unbalanced bid.

Griffiths, (2007) stated that there are a number of reasons why a bidder may unbalance its prices in a bid including the likelihood of receiving large payments at the beginning of a contract (front-end loading). Secondly, a bidder may submit an unbalanced bid in order to maximize his profits. The bidder is able to do this by overpricing bid items he believes will be used in greater quantities than estimated in the tender bid document and underpricing items he believes will be used in significantly lesser quantities.

2.3 Mechanism for the cause of unbalanced bid

Considering the time value of capital, the contractor can adjust different pay cycle of the price, in order to obtain sub-project of engineering cost, so as to achieve maximum current profits.

The below Figure 2.1 show the mechanism for the cause of unbalanced bid (Yi-Lin et al., 2010).





Figure 2.1: Mechanism for cause of unbalanced bid (Yi-Lin et al., 2010).

2.4 Types of unbalanced bid

The unbalanced bid is classified into three types according to the reasons and mechanism of the unbalanced bid as follow:

A. Time unbalanced bid

Yi-Lin et al., (2010) defined the time unbalanced bid as a method that contractor mainly use the contract of construction measure, which is as early the project finished as the pay, also combined with the construction schedule rule in order to acquire the time value of money through increasing the early construction's items and reduce the delay.

David and Chotibhongs, (2009) defined "frontloading" as the most common way to unbalance a bid. Frontloading refers to increasing unit prices on items to be completed in the early period of the project and decreasing the unit prices on items that are to be completed in the later stages. The main purpose of frontloading on the part of the contractor is to relieve the financial problems that contractors face early in the project



such as the initial expenses of mobilization and setting up. But if a contractor is set to be paid out in the early stages of the project, the owner ends up paying more when the time value of money is taken into consideration (McGreevy, 2002 cited in (David and Chotibhongs, 2009) Gave example for this situation.

The bidder whose offer is presented in Table 2.1 appears to have inflated the cost of early activities such as the 'site clearing' and 'mobilization' items when compared with the cost of the very same items offered by another bidder whose offer is presented in Table 2.2 The bidder in Table 2.1 also deflated the cost of other items that are to be carried out later in the project such as 'concrete' and asphalt'. This balancing operation allows the bidder to make a bottom-line offer that is still competitive. In the example presented in Tables 2.1 and 2.2, the offer of the lowest bidder is lower than the second lowest bidder by 472 830 - 470 610 = 2220. But if the time value of money is considered with a discount rate of 1% compounded monthly, the present worth of the offers can be calculated as follows

PW2(1%)=\$30000(P/F,1%,3)+\$8000(P/F,1%,4)+\$6330(P/F,1%,5)+\$144000(P/F,1%,6)

+\$162500(P/F, 1%, 7) +\$125000(P/F, 1%, 8) = \$442700.55.

PW1(1%)=\$12000(P/F,1%,3)+\$25000(P/F,1%,4)+\$12660(P/F,1%,5)+\$108000(P/F,1%,6)+\$97500(P/F,1%,7)+\$107000(P/F,1%,8)=\$444009.24.

Where P/F appropriate present worth factor. PW: Present Worth

Item	Unit price	No. of units	Total cost	Time of payment
Site clearing	\$2000/day	60 days	\$120 000	End of the 3rd month
Mobilization	\$1200/day	10 days	\$25 000	End of the 4th month
Fencing	\$30/yard	422 yards	\$12 660	End of the 5th month
Formwork	\$9/feet ²	12 000 feet ²	\$108 000	End of the 6th month
Concrete	\$150/yard ³	650 yard ³	\$97 500	End of the 7th month
Asphalt	\$12/feet ²	10 000 feet ²	\$107 000	End of the 8th month
Sum (bid price)			\$470 610	

Table 2.1: Bid submitted by the lowest bidder



Item	Unit price	No. of units	Total cost	Time of payment
Site clearing	\$500/day	60 days	\$30 000	End of the 3rd month
Mobilization	\$800/day	10 days	\$8000	End of the 4th month
Fencing	\$15/yard	422 yards	\$6330	End of the 5th month
Formwork	\$12/feet ²	12 000 feet ²	\$144 000	End of the 6th month
Concrete	\$250/yard ³	650 yard ³	\$162 500	End of the 7th month
Asphalt	\$13/feet ²	10 000 feet ²	\$122 000	End of the 8th month
Sum (bid price)			\$472 830	

Table 2.2: Bid submitted by the second lowest bidder

Where PW1 and PW2 denote the present worth of the offers of the lowest bidder and the second lowest bidder respectively. The monthly payments are multiplied by the appropriate present worth factor (P/F, i, n) where 'i' is the discount rate and 'n' the number of months between the start of the contract and the time of payment.

The present value of the offer quoted by the second lowest bidder (\$442 700.55) appears to be lower than the present value of the lowest bidder's offer (\$444009.24). It can be concluded from this calculation that the lowest offer is not the best choice as far as the time value of money is concerned because the bidder who made the lowest offer appears to have frontloaded the bid, the result of which is a materially unbalanced bid.

According to Green (1989) and Cattell et al. (2007) (cited in (David and Chotibhongs, 2009), back-end loading is also used by some bidders in inflationary environments to take advantage of escalation clauses in contracts. This method of unbalancing is not common in relatively short projects undertaken in countries like the US where the rate of inflation is low.

B. Quantities unbalanced bid

Quantities unbalanced bid can be realized through the way to analysis the geological data, measuring principle and drawing, plus the historical experience, the actual quantity and quantity change. If there is a change, the item of the project's comprehensive unit price can be adjusted according to actual quantities which would be increased or decreased (Yi-Lin et al., 2010).

Unbalanced bids may also occur if a bidder discovers a line item whose quantity is underestimated by the owner's engineer. A high unit price on that item and a commensurate decrease of the unit price of another line item may keep the bottom line



competitive but will increase the contractor's profits. Cattell et al. (2007) call this procedure 'quantity error exploitation' or 'individual rate loading'.

David and Chotibhongs, (2009) illustrated this case by the following numerical example: Consider a setting where two contractors compete for a road investment contract that requires only two inputs, e.g. paving and provision of gravel. A bill of quantities including estimations for gravel and pavement is announced by the client, 100 m3 and 150 m2. The contractors differ in the first being more efficient (i.e. having a lower marginal cost) but being less informed about the quantities actually required, i.e., the ex post quantities. Contractor 1 bids her marginal cost at prices 10. Assume that contractor 2 has a higher marginal cost than contractor 1 on both inputs but she has private information about the project and predicts that the gravel is underestimated and the pavement is overestimated by the client. Given this expectation, contractor 2 raises her price on gravel and reduces the price pavement as seen in table 2.3. As depicted in table 2.3, contractor 2 submits the lowest total bid and wins the contract.

The project starts and contractor 2's prediction, that the quantities of gravel will be increased and pavement decreased, turns out to be correct. As seen in table 2.4, contractor 2's skewing of prices based on her expectation of changing quantities made him win the contract and earn higher revenue.

Hence, due to unbalanced bidding the most efficient contractor did not win the contract. The client ended up paying an information rent to contractor 2 i.e. a higher cost than if the most efficient contractor 1 would have won.

Tuble 201 Contractor 5 offers bused on original quantities					
Item	Quantities	Contractor 1	Contractor 2		
	as in BOQ	Unit price \$	Unit price \$		
Provision of gravel	100 M3	10	12		
Pavement (paving)	150 M2	10	8.5		
Total cost		2500	2475		

 Table 2.3: Contractor's offers based on original quantities

Table 2.	4: Co	ontracto	or's offers	based (on modified	quantities
		-				-

Item	Actual	Contractor 1	Contractor 2
	Quantities	Revenue \$	Revenue \$
Provision of gravel	110 M3	1100	1320
Pavement (paving)	145 M2	1450	1232.5
Total cost		2550	2553



C: Inaccurate design drawing

The comprehensive unit price of item that design drawings, project characteristics, content and methods are not very clear or have loopholes can be reduced, in order to reduce the total price of the bid and be claimed through project construction. If contractor find the drawings is not according with the request of project, can he reduce comprehensive unit price of the part, then increase its price after changes.

(Yi- Lin et al., 2010).

Cattell et al. (2007) classify the unbalanced bid into three types namely as, front-end loading, individual rate loading, and back-end loading. "Front-end loading" refers to the loading up of the prices of items that will arise early in the construction schedule, which will obviously improve a contractor's cash flow. "Back-end loading," on the other hand, is designed to take advantage of the contractual mechanism by which contractors may be compensated for inflationary increases in their expenses by way of escalation. Back-end loading is the process of loading the prices of items that will arise late in the schedule. It can also entail loading those items that fall within workgroups that are expected to have a comparatively high rate of escalation.

The third style of loading is called "quantity error exploitation" or otherwise as "individual rate loading." This process entails loading the price of items whose final quantities are expected to exceed the initial quantities contained in the tender documentation.

2.5 Unbalanced bid analysis

In analyzing bids, FHWA recommends that the following process presented in Figure 2.2 will be considered (FHWA, 2004):

• The owner should find out if the bid is mathematically unbalanced, whether the units bid prices are unreasonable agreement with the engineer's estimate and/or the unit prices in other bids. A mathematically unbalanced bid occurs either because the bidder frontloaded the proposal or because the bidder adjusted the unit prices in response to a potentially larger quantity in a line item.

• The owner should find out if the bid is materially unbalanced, whether the bid increases the total project cost if it is awarded. The owner should consider the



detrimental effect of unbalanced bidding upon the competitive process or upon contract administration after award.



Figure 2.2: Detection of unbalanced bid

Heinz (1988) stated that the final analysis of the unbalanced bid should not preclude the use of engineering judgment and the following should be considered:

- Is the bid mathematically unbalanced? Are the unit bid prices in reasonable conformance with the engineer's estimate and other bids?
- If awarded, what effect will unbalanced bid items have on the total contact amount?
- If quantities are incorrect, will the contract cost be increased when the quantities are corrected?
- On items where the quantities may vary, will the lower bidder remain as low bidder?
- If the bid is unbalanced, will the unbalanced have potential detrimental effects upon the competitive process or cause contract administration problems after the award?

According to Wisconsin DOT's Construction and Material Manual (2007), the unbalanced bid analysis consists of the following steps:



(a) Reviewing the line items whose estimated unit prices are identified as being significantly unbalanced.

(b) Checking and verifying the quantities of all items that are found to be significant to the contract.

(c) Calculating a gross sum for each bidder by correcting the quantities of items known to be incorrect and multiplying the corrected quantities by the unit prices offered by each contractor.

(d) Comparing the calculated gross sum totals of all bidders.

(e) Considering the proposal of the lowest bidder to be materially unbalanced if the calculated gross sum of the contract offered by the lowest bidder is found to be higher than the calculated gross sum offered by the second lowest bidder. If the initial proposal of the lowest bidder is found to be materially unbalanced and rejected.

2.6 Detection and prevention

The detection of unbalanced bid depends on the policy of the procurement agency and it is understanding to the nature of balanced or unbalanced bid, and if the procurement entity insert items in the contacts documents such as (general & particular conditions) related to unbalanced bid definitions and limits, how to detect it and how to deal with the case of unbalanced bid is founded.

The main question that should be answered by the procurement entity related to the detection of unbalanced bid is:

- 1- The feasibility of including in tender documents a specific clause which prohibits the submission of bids which are clearly unbalanced.
- 2- The establishment of specific criteria to be used in the determination of unbalanced bids (Griffiths, 2007).

However related to this topic, the American Association of State Highway and Transportation Officials (AASHTO) initiated a survey of unbalanced bids (AASHTO, 2004). Twenty seven state departments of transportation (DOT) responded to this survey. Many state DOTs (such as Illinois, Kansas, Massachusetts and Connecticut) discovered unbalanced bids without having in place any formal procedure to detect such occurrences.



- Seven state DOTs, including California, Florida, North Carolina, Nevada, Tennessee, Texas and Wisconsin provided formal procedures for evaluating bids to detect unbalanced bids.
- Florida DOT's procedure includes the use of an 'Unbalanced Bid Item' program that utilizes a bell curve distribution to develop a statistical average unit price for comparison purposes. The program then establishes a range of acceptable unit prices of the line items to compare to the unit prices submitted by bidders. If the unit prices of any line items of the bidders are out of a defined range, they are flagged by the program. The quantities of the flagged line items are rechecked by engineers to make sure they are not materially unbalanced by the bidder.
- Texas DOT detects unbalanced bids by identifying line item prices that are significantly different from the engineer's estimate. Texas DOT defines a range of 100% above or 50% below the engineer's estimate for major items, and 200% above or 75% below the engineer's estimate for minor items. Major items are defined as items that cost more than 5% of the contract value.
- North Carolina DOT has a contractual provision that singles out unit prices that are in excess of a reasonable unit price. The reasonable unit price is the average of the engineer's estimate and the individual prices received from the other bidders.
- Wisconsin DOT's Construction and Material Manual (2007) recommends using unbalanced bid analysis procedures if the department becomes aware of an error in a quantity of an item shown in the bidding documents, and if an item is found to be both significant to the contract and significantly unbalanced. An item is considered to be significantly unbalanced if the difference between the low bidder's unit price and the estimate, expressed as a percentage of the estimate, is greater than 50% or is less than75%.
- According to FHWA guidelines (FHWA, 2004), the detection of unbalanced bids may be facilitated by the use of computer software named Bid Analysis and Management System/Decision Support System (BAMS/DSS). Among other things, BAMS maintains historical data relating to construction contracts, generates bid-based prices for estimation systems, and analyses price and quantity of bid items by using regression and average values. If the low bid is



materially unbalanced, the owner must take the appropriate action to protect the owner's interest. The law allows for the disqualification of such bids.

 On April 30, 2004 the AASHTO Subcommittee on Construction Contracts Administration Section initiated a survey concerning the evaluation of unbalanced bids.

The survey asked the following questions about evaluating of materially unbalanced bid:

1) Does your state have written procedures for determining when a bid is materially unbalanced? (If yes, please forward a copy to me at the above address.)

2) In the past three years, how many times has a bid been declared to be materially unbalanced?

3) What was the disposition of these circumstances? (Reject all bids and readvertise; award to second low, etc.)

Summary of Responses

- 27 State DOT responses were received by the FHWA Office of Program Administration.
- Several states cited their standard specification language for unbalanced bids, irregular proposals, or consideration of proposals.
- Five State DOTs provided their procedures for evaluating unbalanced bids. See the summary below.
- Regards to equation No.1 of the study , in the past three years, twelve states did not declare a bid to be materially unbalanced, eleven states had between 1- 4 materially unbalanced bids, two states had 5 –10 materially unbalanced bids and two states provided a not applicable response. Considering the approximate 20,000 construction contracts let annually by the states, the issue of materially unbalanced bids is an issue that occurs relatively infrequently.
- The disposition of an apparent irregular bid varies with each state and in some cases, may depend on the unique circumstances for each contract. Several State DOT specifications provide options for: a) award to the apparent low bidder, b) award to the apparent second low bidder (or next responsive bid that is not materially unbalanced), or c) reject all bids and re-advertise.



• In the past three years, states responded to irregular bids in the following manner: eleven states rejected all bids and readvertised, four states indicated that they declared the irregular bid non-responsive and awarded to the lowest responsive bidder, and ten states responded with not applicable reply.

2.7 Avoiding and prevention of unbalanced bid

Yi-Lin et al., (2010) put prevention strategies of unbalanced bid for owners related to the three types of unbalanced bid (Time unbalanced bid, quantities unbalanced bid and unbalanced bid caused by inaccurate designed drawings). The main points of these strategies were as follow:

A. Seriously review the depth and quality of drawing design, and tender with construction drawing in order to reduce construction change from source and avoid "inconsistent between drawing and bill of quantities ."

B. Owner should allocate main price of the project and provide temporary price reasonably to bulk and special materials.

C. Owner should set method of adjusting the temporary price of project items in tender documents.

D. When investigating the credit of contractors, owner should pay attention to contractors' economic dispute state.

E. Pay attention to the quality of Bill of Quantities and eliminate the idea that Bill of Quantities is just use as a reference and final settlement will relay on actual quantities. Arrange cost engineers with full experience and strictly enforce the construction of valuation standard in order to avoid loss and leakage.

F. Perfect construction contract, if quantity change is too big in certain items, the change will bring risk to owners on capital plan and investment control. Owners should use contract to avoid risk. The way is to make rules to restrict and control unbalanced bid in contract.

Phernmbucq, (1996) stated number of actions may be taken to mitigate the practices of unbalanced bid and front loading as follow:

• Ensuring that the estimated quantities estimated are precisely determined.



- Placing a provision in the contract general conditions that allows for renegotiating the unit price for line items if the actual quantity of work varies by 25% (increase or decrease) from the estimated quantity of work.
- Indicating in the contract document that payment for certain lump sum line items will be spread out over a period as opposed to being paid in one lump sum amount.
- Limiting the lump sum price for some items to a specific percent of the total bid price (e.g. mobilization 5% of the total bid price).
- Predetermining a reasonable cost for particular line items and "plugging in" the number in the IFB (e.g., General Requirements, Travel).
- Obtaining a bid price or using a predetermined reasonable cost for certain line items.

2.8 Mathematical modeling

A mathematical model is a description of a system using mathematical concepts and language. The process of developing a mathematical model is termed mathematical modeling. Mathematical models are used not only in the natural sciences (such as physics, biology, earth science, meteorology) and engineering disciplines (e.g. computer science, artificial intelligence), but also in the social sciences (such as economics, psychology, sociology and politicalscience); physicists, engineers, statisticia ns, operations research analysts and economists use mathematical models most extensively.

Mathematical models can take many forms, including but not limited to dynamical systems, statistical models, differential equations, or game theoretic models. These and other types of models can overlap, with a given model involving a variety of abstract structures. In general, mathematical models may include logical models, as far as logic is taken as a part of mathematics. In many cases, the quality of a scientific field depends on how well the mathematical models developed on the theoretical side agree with results of repeatable experiments. Lack of agreement between theoretical mathematical models and experimental measurements often leads to important advances as better theories are developed. (Kalu and Agwu,2012)



Models are used to represent how something will function under certain conditions. Models are simulations of the real world. Researchers have been using mathematical models since the early 1900s to try to explain non-artificial events in a physical sense. It is important to keep models as simple as possible for better understanding. Cited in (Kalu and Agwu, 2012).

Cattell et al., (2010) defined unbalanced bidding models as mathematical tools by which to determine the optimum distribution of prices to be applied to a project's component items when engaging in competitive bidding.

Cattell et al., (2008) defined unbalanced bidding models as mathematical techniques for use by vendors for the purposes of benefiting from the uneven distribution of markup among a project's component items. They are typically designed for use by building or engineering contractors and are also often intended for use in the oil and forestry industries.

2.9 Unbalanced bid strategies and cost baseline

2.9.1 Unbalanced bid strategies

It is usually advantageous for a contractor to use unbalanced bidding strategies in order to benefit from the uneven distribution of markup among the project's component items. The contractor has to decide on the unit prices of all the project's activities so that the summation of the project's component items equals to the tender price. This strategy leads contractor to price some items with a high markup and others with a low one in order to compensate. (Afshar and Amiri , 2008)

Tendering relatively high unit prices on items scheduled for early completion and proportionately lower prices for other items is a type of unbalanced bidding. Well managed unbalanced bidding can help to obtain monies earlier for financing the later stages to improve cash flow of the project. Contractors may provide their own estimate of the quantities for each items of the contract. If their estimations differ from those in proposals, another type of unbalanced bidding could be formulated by overpricing items expected to exceed the proposal estimates while underpricing the ones which appear to be overestimated. This strategy can help the contractor to submit a lower bid or improve the profitability of his tender. However, there can be substantial risk. (Afshar and Amiri, 2008)



Wang (2004) and (David and Chotibhongs, 2009) have attempted to "automate the process" involved in detecting unbalanced bids. Wang's procedure is aligned to the Taiwan system, termed the owner-based approach, where the baseline unit rates are provided by the owner – adjusted by the lowest bid/owner total ratio (discounting ratio). "Employed under the belief that the owner's cost estimate is more reasonable than the bidder because his cost estimate is more thoroughly prepared by the architect" (Wang 2004). This is then embodied in a spreadsheet to identify unit prices exceeding a $\pm 30\%$ cut-off of the owner's rates. (David and Chotibhongs , 2009) procedure is also based on a spreadsheet and follows the USA approach by identifying unit prices exceeding a similar percentage cut-off difference to the engineer's estimate/average bid baseline value. Although they claim the model to be "fully automated", it does still require some input in order to operate in addition to the bidders' data. That is, an approximate payments schedule, the engineer's baseline estimates of the unit prices (if applicable), cut-off values and discount rate.

Cattell et al., (2007) in reviewing the various models, have been particularly critical of the arbitrary nature of the cut-off values as, "despite their significance, it is commonly recommended that they should be decided upon without any scientific or mathematical aid". Of course, the real problem here is that there is no data available to enable such a scientific aid to be developed for, as noted earlier, the risks involved in unbalancing are such that it is not in the interests of anyone to admit to the practice. In fact, the lack of any real data on the nature and extent of unbalancing practice in the industry raises fundamental questions concerning the efficacy or otherwise of any method aimed at detecting unbalanced bids that relies on existing price data. If, as is believed by many, the practice of unbalancing is indeed "virtually universal", the baseline values themselves will be more representative of unbalanced bids than balanced bids. Where the baseline values comprise the simple average unit price of the bids, and the majority of bids are unbalanced, the Baseline figure itself will be equally unbalanced. Likewise, even in the situation where the engineer's estimate provides the baseline figure, an engineer continually and unknowingly exposed to unbalanced bids is unlikely to realize that they are indeed unbalanced and treat them as balanced instead. In such a situation, therefore, it is likely that the unbalanced bids will appear to be balanced and the balanced bids appear to be unbalanced – outcomes termed type I and type II errors in



statistical hypothesis testing, where a type I error is defined as the situation in which a correct hypothesis is inappropriately rejected while a type II error occurs when a false hypothesis is inappropriately retained.

2.9.2 Line items comparison base line

To detect unbalanced bid, the specific parameters and the acceptable difference between the line item's cost and suitable baseline such as the engineer's estimate or average cost of the line item as produced by the other bidders will be specified .

Bidders in some American states do have access to these parameters and the acceptable ranges were as follow:

- Texas's procedure analyzes unbalanced prices that vary from the estimate outside a specific range. The range is 100% above or 50% below the estimate for major items and 200% above or 75% below the estimate for minor items. Major items are defined as 5% of the contract or \$100,000 whichever is less.
- North Carolina defines a reasonable unit or lump sum price to be the average of the Engineer's Estimate and the individual balanced bid prices received from the other bidders for the item in question.
- Florida DOT's procedure includes the use of an 'Unbalanced Bid Item' program that utilizes a bell curve distribution to develop a statistical average unit price for comparison purposes (Review of the FDOT Construction Bid and Contract Administration Process, 1997). The program then establishes a range of acceptable unit prices of the line items to compare to the unit prices submitted by bidders. If the unit prices of any line items of the bidders are out of a defined range, they are flagged by the program. The quantities of the flagged line items are rechecked by engineers to make sure they are not materially unbalanced by the bidder.
- Wisconsin DOT's Construction and Material Manual (2007) recommends that An individual item is considered to be significant to the contract if the difference between the total cost of the item and the estimate, expressed as a percentage of the estimated total contract cost, is greater than or less than 0.50% for contracts of less than \$2 million and greater than or less than 0.25% for contracts of \$2 million and larger. An item is considered to be significantly unbalanced if the


difference between the low bidder's unit price and the estimate, expressed as a percentage of the estimate, is greater than 50% or is less than 75%.

• David and Chotibhongs, (2009) use the engineer's cost estimates and bidder average unit prices in his model for detection of unbalanced bid. The proposed model can be improved by further research into developing guidelines for the acceptable difference between the engineer's estimate and the estimate proposed by the bidder for any line item, and the acceptable difference between the average of the line item prices and the prices proposed by a bidder. It is also recommended that the owner keep bid price and final cost data in a database for future reference in tracking over-run and under-run trends in every bid item.

2.10 Theoretical models of unbalanced bidding

There is a lack of exact definition of unbalanced bidding. Models are one way of making concepts more concrete. Two types of models have been developed regarding unbalanced bidding.

A first type focuses on assisting practitioners to detect possibilities for unbalanced bidding in the tendering stage and how to exploit these. The detection models supports clients' interests (see e.g. (David and Chotibhongs, 2009) and exploitations models assist contractors in optimizing the skew (see e.g. Yizhe and Youjie (1992); Cattell et al (2008); Cattell et al (2010).

The second types of models are not designed to provide direct practical guidance to unbalanced bidding. Rather, they focus on predicting and measuring the extent of the Phenomena in order to determine efficiency effects. (Mandell and Nystrom, 2011).

Bidding models can be significantly simplified by having the objective of maximizing a project's top-line revenue rather than maximizing bottom-line profit.

Cattle et al., (2008) put a new model, incorporating all three standard effects of item price loading: namely, front-end loading, individual rate loading, and back-end loading, is proposed that gives effect to determining the optimum pricing for a project's component items.

Front-end loading model

The purpose of pursuing front-end loading, a contractor could determine the present value PV for any item j) by way of the following equation: Cattle et al., (2008)



$$PV_{j} = \sum_{n=1}^{N} \left(\frac{1}{1+r_{j}} \right)^{n} \left[\lambda_{nj} Q_{j} \left(P_{j} - C_{j} \right) \right]$$

where j = item number

$$n = \text{month number}$$

- N =duration of project in months
- r_i = monthly discount rate appropriate to the risk of item j

$$\lambda_{nj}$$
 = proportion of Q_j to be built in month n

$$\sum_{n=1}^{N} \lambda_{nj} = 1.0 \text{ for any item } j$$

Qj = bill quantity of item j

Pj = bill price per unit of item j

Cj = unit cost of item j

Individual rate loading model

The loading of the rates of individual items is a practice otherwise referred to as quantity error exploitation .This practice amounts to allocating high prices to items whose initially-measured quantities are thought likely to be increased, while allocating low prices to items whose initially-measured quantities are thought likely to decrease. A contractor could quantify the present value PV for any item j (that shall later Form the basis by which to determine the PRI for that same item) by way of the following equation: Cattle et al., (2008)

$$PV_{j} = \sum_{n=1}^{N} \left(\frac{1}{1+r_{j}}\right)^{n} \lambda_{nj} \left(Q_{j} + Q_{j}'\right) \left(P_{j} - C_{j}\right)$$

Where Q'j = additional quantity of item j due to variation.



Back-end loading model

The opportunity for back-end loading stems from the fact that the values of escalation is in such instances, determined from estimates based on the contractor's gross item prices rather than being based on his actual costs. For instance, in South Africa the escalation calculation is done in terms of the "Haylett" contract price adjustment provisions (JBCC 2005) (cited in Cattle et all., 2008) with a non-adjustable element of 15% i.e. the adjustment factor is 0.85. This implies that it is being assumed that a contractor's cost is 85% of any item's price. Thus if a contractor's price is high, the assumed cost is also high, regardless of the actual cost. One simple way for a contractor to practice back-end loading is therefore to apply high prices to items that are scheduled to occur late in the contract. These high prices will give the impression that these items have high costs and therefore they will enjoy high levels of escalation adjustment.

The following formulation describes the basis by which an item's present value PVj can be quantified: Cattle et al., (2008)

$$PV_{j} = \sum_{n=1}^{N} \left(\frac{1}{1+r_{j}} \right) \left[\left(\lambda_{nj} \left(Q_{j} + Q_{j}^{\prime} \right) \right) \left[\Upsilon_{nj} f P_{j} - C_{nj}^{\prime} \right] \right]$$

Where:

$$\Upsilon_{nj}$$
 = adjustment for escalation = $\frac{index_n - index_0}{index_0}$

f = adjustable factor (e.g. 0.85 for "Haylett" contracts)

 C'_{nj} = actual increase in the unit cost of item *j* in month *n*

Cattle et all., (2008) damage the three models in one taking in consideration all the price loading: front-end loading, individual rate loading, and back-end loading as follow:-



$$PV_{j} = \sum_{n=1}^{N} \left(\frac{1}{1+r_{j}}\right)^{n} \lambda_{nj} \left(Q_{j} + Q_{j}'\right) \left(P_{j} - C_{j}\right) + \sum_{n=1}^{N} \left(\frac{1}{1+r_{j}}\right)^{n} \left[\left(\lambda_{nj} \left(Q_{j} + Q_{j}'\right)\right) \left[\Upsilon_{nj} f P_{j} - C_{nj}'\right]\right]$$

Thus:

$$PV_{j} = \sum_{n=1}^{N} \left(\frac{1}{1+r_{j}}\right)^{n} \left[\lambda_{nj} \left(Q_{j} + Q_{j}'\right) \left(\left(1+\Upsilon_{nj}f\right)P_{j} - C_{nj}''\right)\right]$$

Where

$$C_{nj}'' = C_{j} + C_{nj}'$$

$$PV_{j} = \sum_{n=1}^{N} \left(\frac{1}{1+r_{j}}\right)^{n} \left[\lambda_{nj} \left(Q_{j} + Q_{j}'\right) \left(\left(1+\Upsilon_{nj}f\right)\left(1-R_{n}\right)P_{j} - C_{nj}''\right) + R_{n}'\right]$$

Where Rn = proportion retained in month n R'n = the amount (if any) released from the retention fund in month n Including any interest earned (if applicable)

2.11 practical models for unbalanced bid

Xingzi et al., (2009) attempted to solve the unbalanced bidding problem with stochastic bidding engineering quantities, which is to maximize the present value of contractor's bidding price for the total project under unbalanced bidding limits and has not been studied ever before. Two types of stochastic models, including the expected value model and the chance-constrained programming model were built to meet different requirements. Then stochastic simulation, neural network and genetic algorithm were integrated to produce a hybrid intelligent algorithm to solve the numerical example. From the numerical result, we could clearly see that the hybrid intelligent algorithm could effectively solve the unbalanced bidding problem. Furthermore, this paper provided a good applied case for the practice of uncertain programming, and it also put forward a new approach for the promotion of uncertainty theory chance constrained model:-

For example, the contractor decides to bid the project, in which the starting times and the duration times of activities are given in Table.



Activity	si	t (month)
1	Jan. 2009	13
2	Oct.2009	6
3	Nov.2009	5
4	Mar.2010	9
5	Sep.2010	4

Table 2.5: Starting times and the duration times of activities

With the idea of maximizing the present value of contractor's bidding price for the total project at the predetermined confidence level subject to some chance constraints, we consider the following chance-constrained model: Xingzi et al., (2009)

$$\begin{array}{ll} \max \overline{f} \\ subject & to: \\ \Pr\{\sum_{i=1}^{5} k_{i} \, \overline{P_{i}} \geq \overline{f}\} \geq 0.95 \\ \Pr\{\sum_{i=1}^{5} \overline{P_{i}} \leq \sum_{i=1}^{5} P_{i}\} \geq 0.95 \\ P_{i} = \sum_{j=1}^{6} q_{ij} \, p_{ij}, & i = 1,2,3,4,5 \\ \overline{P_{i}} = \sum_{j=1}^{6} \xi_{jj} \, x_{ij}, & i = 1,2,3,4,5 \\ \Pr\{\sum_{i=1}^{5} \int_{j=1}^{Model \ solution \ \neg} q_{ij}\} \geq 0.95 \\ 0.9 \, p_{ij} \leq x_{ij} \leq 1.1 \, p_{ij}, & i = 1,2,3,4,5; \ j = 1,2,3,4,5,6. \end{array}$$

Following parameters: the pop _ size is 30, the p _ crossover is 0.2, the p _ mutation is 0.2. After a run of the hybrid intelligent algorithm (5000 cycles in simulation, 1000 training data in neural network, 1000 generations genetic algorithm), we obtain the optimal solution which is given in Table 5, whose objective value f = 2738500.3.

The result shows that the present value of bidding price for the total project is 2738500.3 Yuan when the contractor uses the unbalanced bidding strategy with stochastic bidding engineering quantities. But the budget price for the total project is 3168000 Yuan when the owner adopts the method of linear programming. Then the



present value of the budget price is 2706506.77 Yuan via conversion. In this way, the contractor can obtain surplus profit 31993.53 Yuan. The proof-test proves that this bidding strategy tallies with the actual situation completely. Therefore, the numerical Result is persuasive and successful.

Afshar et al. (2010) consider the uncertainties in biding phase. Uncertainties in quantities of work play an important role for unit price determination in an unbalanced biding model.

Applying Minimize Maximum Regret (MMR) and Minimize Total Regret (MTR) approach in a discrete area where each scenario represents a set of possible quantities of works. Allocating interval scenario case for quantities of works seems to be more appropriate than discrete one. Thus, the unbalanced bidding model with interval quantities of works using MMR is proposed. To define manageable number of scenarios resulting from possible combinations of different unit prices in formulating the Min Max Regret (MMR) model as interval scenario case, a relaxation procedure is employed. In this approach, instead of considering all possible objective functions, a model which is called "Candidate Maximum Regret (CMR)" is applied to determine worst case scenarios. Models are applied to a hypothetical case example and the results are compared.

David and Chotibhongs, (2009) proposed two separated models to deal with the frontloading unbalanced bid or quantities variation unbalanced bid, both models are completely autonomed using MS Excel.

The proposed methodology is presented in Figure 2.3 and 2.4.





Figure 2.3: Detection and analysis of unbalanced bids using the engineer's estimates (David and Chotibhongs, 2009)





Figure 2.4: Detection and analysis of unbalanced bids using average unit price (David and Chotibhongs, 2009)

Once all the bids are received from the bidders, the bottom-line offers are compared with each other. The lowest offer is a candidate for contract award. Figure 2

Detection and analysis of unbalanced bids using the engineer's estimates average unit prices starting from the first line item, the prices of each line item in the lowest offer are compared with the engineer's estimates (Figure 2.3) or the average prices of the respective items in all bids (Figure 2.4).

The process was automated by using an Excel spreadsheet in table's format to show the line items, the engineer's quantities, an approximate payment schedule, the engineer's estimate of cost, the acceptable limits and each bidder's offers relative to each line item. The program orders the bids from the lowest to the highest offer, Bidder 1 being the lowest offer, and highlights the line items in Bidder 1's offer whose prices are beyond the acceptable limits. The analyst checks the quantities involved in these line items and replaces them with the correct quantities if any were understated. The program recalculates the bids of all bidders using the new quantities and orders them again from



the lowest to the highest offer. If the original lowest bidder is no longer the lowest offer, it is rejected on the grounds that the bid was materially unbalanced. If the original lowest bidder is still the lowest bidder, the program checks for frontloading. It then calculates the present worth of all payments given the approximate schedule) and an appropriate discount rate input by the analyst. The present worth of the scheduled payments to all the bidders is, and the bidders will be ordered again from the lowest to the highest offer according to the present value. (David and Chotibhongs, 2009)

2.12 Chapter Summary

The studies in literature review illustrated the concept of unbalanced bid, reasons of unbalanced bid, factors generate unbalanced bid, analysis of unbalanced bid, detection & preventing strategies of unbalanced bid and also how to formulate software model to evaluate and solve the unbalanced bid problems.

After studying many researches and papers in this chapter, the main points were how to detect and deal with unbalanced bid in construction industry using mathematical models depending on guide lines for the acceptable difference between the engineer's estimate and the estimate proposed by the bidder for any line item, and the difference between the average of the line item price and the prices proposed by a bidder .

It was founded that the main challenges faced the detection of unbalanced bid is the absence of clear guide lines related to the value of the four model parameters named as:

- 1- The accepted difference from engineer's estimate.
- 2- The accepted difference from the average line items.
- 3- The proportion of the project that describes as (Early) schedule.
- 4- The Discount Rate.



CHAPTER THREE: METHODOLOGY

3.1 Introduction

This chapter describes the methodology of this thesis, the main topics included in this chapter are research strategy, research design, population, sample size determination, research location, case study, structured interview design, structured interview content, developing and evaluating unbalanced bid model and case study.

3.2 Research strategy

Naoum (2007) defined the research strategy as the way in which the research objectives can be questioned. Two types of research strategies are used at studies, quantitative and qualitative research. Quantitative approach is used to gather factual data and to study relationships between facts and how such facts and relationships accord with theories and the findings of any research executed previously, but the qualitative approach seek to gain insights and to understand people's perception of "the world" whether as individuals or groups (Fellows and Liu, 2007). In this thesis, a quantitative and qualitative approach is used to understand the perception of procurement professional experts in Gaza Strip towards the definition, reasons, types and detection of unbalanced bid in construction projects in Gaza Strip. Quantitative model was extracted for the quantitative collected data obtained from structured interviews with professional experts that will provide mathematical model to improve the process of evaluation, analysis and detection of unbalanced bid in local construction projects, case study for construction projects will be conducted to verify and validate of the model. In this research structured interview with professional experts was used to collecting the suitable data to complete the research.

In order to collect data, the researcher should be able to access the data that needs to be collected for the study. Data can be gathered from a number of sources including written documents, records, workplaces, the Internet, surveys or interviews.



Kvale (1996) regarded interviews as "an interchange of views between two or more people on a topic of mutual interest, sees the centrality of human interaction for knowledge production, and emphasizes the social situatedness of research data."

Nachmias et al., (1996)" cited in Naoum (2007)" defined the personal interview as another major technique for collecting factual information as well as opinions. It is face to face interpersonal role situation in which an interviewer asks respondents questions designed to elicit answers pertinent to the research hypothesis.

Naoum (2007) stated where the interview technique suitable to be used as follows:

- 1- When the people being interviewed are homogenous and share the same characteristics
- 2- When you know enough about your interviewee, so you are only ask what is important and know to ask it.
- 3- When interpersonal contact is essential to explain and describe the questions.
- 4- When a case study needs to be investigated in details, questions were asked such as how and why things had happened.
- 5- When the research requires an explanation as why the respondents are answering or feeling the way do or the answers required more than yes or no, agree or disagree

Gray (2004) has given the following reasons to use interviews for collecting data and use it:

- There is a need to attain highly personalized data,
- There are opportunities required for probing,
- A good return rate is important,
- Respondents are not fluent in the native language of the country, or where they have difficulties with written language.

Interview can take three forms, unstructured, structured and semi structured, some research may be used one form while other may be required combination between two forms.

Kvale et al., (2008) defined a structured interview as a technique to collect information from respondents through an interactive, verbal, real time contact. It is often used as a first step in collecting information for a needs analysis, is a qualitative research method



commonly employed in survey research. The aim of this approach is to ensure that each interview is presented with exactly the same questions in the same order. This ensures that answers can be reliably aggregated and that comparisons can be made with confidence between sample subgroups or between different surveys.

Corbetta (2003) states structured interviews are "interviews in which all respondents are asked the same questions with the same wording and in the same sequence."

Bryman (2001) explains structured interview entails: the administration of an interview schedule by an interviewer. The aim is for all interviewees to be given exactly the same context of questioning. This means that each respondent receives exactly the same interview stimulus as any other. The goal of this style of interview is to ensure that interviewees' replies can be aggregated. Questions are usually very specific and very often the interviewee a fixed range of answers (this type of question is often called closed, closed ended, pre-coded, or fixed choice).

McClelland, (1995) said that Structured interviews are similar to written questionnaires in that they utilize a set of fixed questions with fixed response categories covering a specific area or topic. They work well when the goals of the needs analysis are clear. The questions can only be constructed after the needs analyst knows something about the performance problem or business opportunity. Structured interview questions are concise and singularly address the issue at hand. Depending upon the desired depth and degree of information being sought, structured interviews normally last no longer than fifteen to twenty minutes

3.3 Research design

"Research design" refers to the plan or organization of scientific investigation, designing of a research study involves the development of a plan or strategy that will guide the collection and analyses of data (Poilt, 1985). This research consists of five phases; the first one is the proposal for identifying and defining the problems and establishment of the objectives of the study and development of research plan. The second phase of the research includes literature review of unbalanced bid definition, types, reasons, detection and mathematical models.



The third phase of the research included a field survey which included conducting of structured interviews with local procurement and contracts mangers experts working in almost all the national and international institutions worked in the construction industry sector. Also some actual projects were collected as causes during the field survey. In the fourth phase of the research simple MS Excel model was developed to be used by interested parties in construction industry to evaluate analyses and detection of unbalanced bid.

The fifth phase of the research includes practical case study of number of construction projects implemented in Gaza Strip, which was analyzed and discussed by using MS Excel model. The last phase of the research includes the conclusions and recommendations. Figure 3.1 illustrated the methodology flow chart which includes the objectives of the thesis.





Figure 3.1: Methodology flowchart

3.4 Research population

The population of this research included owners, clients and implemented agencies of the construction projects in Gaza Strip, it contains almost all the national and international agencies working in construction industry such as Municipalities, PA ministries, local consultants, national implementing agencies (Palestinian Economic Council for Development and Reconstruction (PECDAR), Municipal Development and Lending Fund (MDLF), Palestinian Water Authority (PWA),Costal Municipal Water Utility (CMWU))



and international implementing agencies(United Nations Development Program (UNDP), the United Nations Relief and Working Agency (UNRWA), Japan international Cooperation Agency (JAICA), The International Committee of the Red Cross (ICRC)).

The studied population concentrated on the procurement experts and contract mangers who are working in owner agencies consist includes all government agencies, ministries, municipalities, international agencies, and also procurement experts who are working as local consultants.

3.5 Sample size determination

Wood and Haber (1998) defined the sampling as the process of selecting representative units of a population for the study in research investigation. A sample is a small proportion of a population selected for observation and analysis. Structured interview approach will be used for data collection, the selected sample contained almost all the procurement and projects mangers that are working clients or implementing agencies in Gaza Strip. The interviewed experts were wide, comprehensive and representative to the most of client's agencies worked in construction industry in Gaza Strip.

3.6 Research location

Gaza Strip is the location of this study, the participated experts of structured interview was as following:

- 5 experts from national implementing agencies.
- 4 experts from international implementing agencies.
- 3 experts from local consultant consulting companies.
- 3 experts from PA Ministries.

3.7 Structured interview design

In the early stages of designing the questions used in structured interview, a draft was prepared and reviewed with the supervisor.



In the structured interview, the questions were designed to investigate and discuss all the issues related to define, analysis and detection of unbalanced bid in the construction industry in Gaza Strip. This structured interview includes four sections. The first section was designed to obtain general information about unbalanced bid includes definition, types and reasons of unbalanced bid, the second section investigates the analyses of unbalanced bid includes the procedures and methods used in unbalanced bid analysis in Gaza Strip while the third section asked the experts how to detect unbalanced in construction projects in Gaza Strip. Section four was design to investigate the main criteria and bases that used to determine if the unit rate prices are balanced or unbalanced.

The questions used were extracted from actual cases from the literature review and the cases studied locally in Gaza Strip. The researcher relies on many papers, researches and reports such as; Yi-lin et al., (2010), Christodoulou (2008), David and Chotibhongs, (2009), FHWA (2004) and others.

Structured interview were developed and conducted with experts in Arabic and English languages. The researcher believes that, this is much effective and easier to be understood to get more realistic results.

The choice to address the names of experts they were asked to give a frank and honest account of their opinions.

3.8 Structured interview content

The structured interview was conducted face to face with the selected experts in their offices in Gaza strip. At the beginning of the interview the questions in the interview were covered with a letter of explanation for the purpose of the study, were provided to the experts.

The researcher gave brief description about the study purpose and objectives then the research start to ask the questions and record the answers. The interview questions were concentrated on text open - end questions which are used widely in the interviews.

The aims of the interview questions were to meet the research objectives, and collect all the necessary data that can support the discussion, results and recommendation of the research.



Respondents were divided on their views to answer separate groups according to the question directed to them, through the answers was to clarify the vision and attitude of the experts according to questions.

The interview included the following questions:

Part 1 General information

Q1: In your opinion what is the accurate definition of unbalanced bid?

Q2: How you can classify the unbalanced bid (state the types and classification of unbalanced bid)?

Q: In your opinion what is the main reasons of unbalanced bid generation?

Part2 Analysis of unbalanced bid

Q1: In your institution, is there any written procedure for analyses of unbalanced bid to show if the bid is unbalanced.

Q2: If there is written procedure to analyze the bids what are these procedures?

Q3: What is the cost base line that you used to compare it with the submitted lowest bidder line item?

Q4: What is the best cost base line you consider to compare with it?

- 1- Engineers cost estimate.
- 2- Average of bidders line item prices

3- Historical bid prices from procurement entity data bases updated annually or semiannually.

Part 3 Unbalanced bid detection

Q1: Are there specific items in procurement documents used in your institution related to definition and determination of unbalanced bid?

Q2: If there are items in the procurement documents related to the identification of the unbalanced bids, what are the allowed limits of the followings?

- Front load.
- Back load.
- Individual rate loading.



Q3: Are your institution ever declared about a bid to be materially unbalanced bid. If yes, what was the disposition of these circumstances?

Q4: Are there specific precautions taken in the preliminary stages of the project to prevent future unbalanced bids. (Preparation phase - assessment stage - preparation of and drawings – procurement stage)?

Part 4: The criteria and bases that used to determine if the unit rate price is balanced or unbalanced.

Q1: What is the allowable upper and lower difference- as ratio- between the lowest bidder line item and the average bidder's prices for the mentioned line item?

Q2: What is the allowable upper and lower difference- as ratio- between the lowest bidder line item and the engineering cost estimate for the mentioned line item?

Q3: what are the allowable limits to increase or decrease any item without price adjustment?

Q4: What is the allowable upper and lower difference- as ratio- between the lowest bidder line item and the historical bid cost estimate for the mentioned line item?

Q5: In your opinion what is the definition of early schedule activity?

Q6: In your opinion what is the suitable discount ratio to be used in net present value NPV or present worth PW calculation?

3.9 Developing and evaluating software

The researcher developed simple software based on MS Excel approach that can be used in the

analysis and detection of unbalanced bid in Gaza Strip.

Ahuja et al. (1994) summarize the criteria for selection a software system as follows:

1. The software must be relatively easy to install and operate. The input data must be easy to prepare, and the output reports must be understandable.

2. Data sorting is one of the basic uses of computers.

3. The program should be flexible and have the capacity for handling many types of application.



4. The database must contain all the necessary elements so it can be managed to generate the desired information reports.

5. The program should be compatible with other programs and systems in use in the company.

This software is flexible and the user can use it simply because most of the engineers are familiar with MS excel program.

The process was automated by using an Excel spreadsheet shows the line items, the engineer's quantities, an approximate payment schedule, the engineer's estimate of cost, the acceptable limits and each bidder's offers relative to each line item. The program orders the bids from the lowest to the highest offer, Bidder 1 being the lowest offer, and highlights the line items in Bidder 1's offer whose prices are beyond the acceptable limits. The analyst checks the quantities involved in these line items and replaces them with the correct quantities if any were understated. The program recalculates the bids of all bidders using the new quantities and orders them again from the lowest to the highest offer. If the original lowest bidder is no longer the lowest offer, it is rejected on the grounds that the bid was materially unbalanced. Figure 3.2 explain the idea of software formulation.





Figure 3.2: Software formulation flowchart



3.10 Case studies

Four case studies were carefully selected and investigated to represent almost all the clients of construction projects in Gaza strip. These cases discussed in-depth information regarding all issues related to unbalanced bid, all of the case will be studied in two phases: the first phase will be concentrated on the bidding document to check these documents regarding the items of these documents if any related to definition, analyses, detection and dealing with unbalanced bid; the second phase of the case study will be using the MS excel model to analyses of the bidders prices and check if there any unbalanced bid case.

3.11 Chapter Summary

This chapter summarizes the research methodology, which will include literature review and interviews with experts and specialists then use their replies in the formulation of a mathematical model for the analysis and evaluation of bids in order to discover the unbalanced bid.



CHAPTER FOUR: RESULTS AND DISCUSSION

This chapter introduces the survey results and the discussion of the structured interview output for procurement expert's perspectives and attitudes. The structured interview includes four sections. The first section was designed to obtain general information about the unbalanced bids including unbalanced bids definitions, types and classification and the reasons of unbalanced bids case, the second section was to see how the procurement experts in local construction industry deal with bid analysis and if any written procedure for bid analysis in order to discover the unbalanced bids case, the third section was designed to know from the experts if any written method to detect the unbalanced bid case, for example if are there any clause founded in the tender documents related to definition and identification of unbalanced bids fourth section was designed to know from the experts about the criteria and bases that may be used to determine if the unit rate price is balanced or unbalanced. The results obtained were compared with the relevant literatures and the researcher comments were added.

4.1 Structured interview results

Ten procurement experts out of fifteen one were participated in this research. Four main parts of questions were prepared to obtain detailed information about unbalanced bids case such as definition, identification, reasons, analysis, valuation and detection in the construction industry in the Gaza Strip.

Table 4.1 shows that all the experts participated in this interview were procurement experts worked in local and international agencies related to the construction industries in Gaza Strip. This was done to obtain high level of accuracy to these results. The experts are occupying main positions in the implemented agencies with high level of qualifications in procurement issues.



Name of the experts	Name of the organization	Nature of works done by the organization	Position of the expert in the in the organization	Years of experience
Mr. Ziad Korraz	Palestinian water authority (PWA)	Implementing water and wastewater infrastructure projects	Financial and procurement manager.	More than 15 years
Mrs. Safaa Al rabeii	Costal municipalities water utility (CMWU)	Implementing water and wastewater infrastructure projects	Procurement and contracts manager	More than 10 years
Eng. Ahmed Zaid	Municipal development and lending fund (MDLF)	Implementing infrastructure projects and also capacity building package for municipal sector	Procurement and contracts manager	More than 15 years
Eng. Wael Salah	Palestinian economic council for development and reconstruction (PECDAR)	Implementing infrastructure, roads and building	Procurement and contracts manager	More than 15 years
Eng. Ahmed mokbel	United nation development program (UNDP).	Implementing infrastructure, roads and building	Procurement analyst	More than 15 years
Eng. Mohamed Al Amien	Engineering & management consultant center (EMCC)	Engineering consulting firm	Procurement specialist	More than 15 years

Table 4.1: Names and information about the interviewed experts participated in the research



Name of the experts	Name of the organization	Nature of works done by the organization	Position of the expert in the in the organization	Years of experience
Eng. Zhair Mdoekh	Universal group (UG)	Engineering consulting firm	Procurement specialist	More than 15 years
Eng. Mahmoud El halbi	Solid waste management unit (MDLF)	Implementing solid waste infrastructure projects	Procurement specialist	More than 10 years
Eng. Adel Al Qazaz	Ministry of local government	Implementing infrastructure, roads and building	Projects director manager with procurement experience	More than 15 years
Eng. Salem El Whadie	United nation development program (UNDP).	Implementing infrastructure, roads and building	Project Manager with procurement experience	More than 15 years

4.2 Analysis results of structured interview

Part one: General information about unbalanced bids

Q1: In your point of view what is the definition of unbalanced bids?

- Six of the experts who have been interviewed defined the unbalanced bids as the case in which the contractor download items on the other items and raise the unit prices of items that expected to be implemented in the beginning of the project in order to get the financial liquidity in the start of the project implementation which is known as frontloading.
- One of the experts defined the unbalanced as bids are not compatible with municipal law and agreements as well as to raise the prices of some items and reducing the prices of some other items.
- One of the experts defined unbalanced bids as the case of bids which the contractor is aware of or are expected the increase or decrease the amount of certain items and benefit of this situation in pricing process, in addition to raising the prices of items that will be executed in the first to take advantage of liquidity at the beginning of the project.
- One of the experts defined unbalanced bids as, the contractor to develop unbalanced prices for cretin items in hidden reasons in order to obtain liquidity in the first of the project and to increase profit and avoid price inflation.
- One of the experts defined unbalanced bids as, the contractor pricing items with unbalanced prices and not proportionate with the size of the effort that done in these items.

From the previous results it can be concluded that the expert's definition of unbalanced bidding is (The contractor raise the unit rate prices of some items and lower it in another items in order to obtain liquidity in the first of the project or to increase profit, or both).

This definition matches with the other research definition as well like Phernambucq, (1996) who defined the unbalanced bid as the bid based on prices



significantly less than the cost for some works and prices which are significantly overstated for other works.

Christodoulou,(2008) defined unbalanced bids as process by which the overall project actual cost and the project profits are intelligently distributed among the project activities.

Q2: What are the types and classifications unbalanced bidding?

- Six of the interview experts mentioned the most three common types of unbalanced bids in Gaza Strip , namely as follow:
 - Unit rate frontloading
 - Unit rate back loading
 - Raising the unit prices of some items expected to increase during the project implementation and vice versa.
- One of the experts mention only one common type of unbalanced bids in Gaza Strip , which is download the prices of some items on the prices of other items.
- Three of the experts mentioned two common types of unbalanced bids in Gaza Strip as follow:
 - Unit frontloading
 - Raising the unit prices of some items expected to increase during the project implementation and vice versa.
- **Two of the ten Experts** also pointed to another classification of unbalanced bids. Namely, (Mathematical unbalanced bids- and materially unbalanced bids)

The results show that experts concluded the types of unbalanced bids in three main types:

- 1. Unit frontloading.
- 2. Raising the unit prices of some items expected to increase during the project implementation and vice versa.
- 3. Unit back loading which the experts considered it happened rarely in Gaza Strip.

Except two experts, the other experts didn't mention to the classification of unbalanced bids in terms of being a mathematical unbalanced bid or material



unbalanced bids, which shows a certain problem in the understanding the concept of unbalanced bids .

Q3: What are the reasons of unbalanced bids case?

- **Eight of the experts** stated three main reasons for unbalanced bids as follows:
 - Contractor's desire to obtain liquidity at the beginning of the project.
 - Contractor's desire to increase its profit margins.
 - Erroneous and inaccuracies in the preparation of tender documents.
- **One expert** mention one single cause for unbalanced bidding case, (a contractor's desire to get liquidity at the beginning of the project).
- **One expert** attributed the occurrence of unbalanced bid case to reasons related to the contractor only.

From the expert's opinions, it concluded that there are three main reasons for the occurrence of unbalanced bids case as follows:

• Two reasons are related to contractors behavior:

A. Contractor's desire to increase his profit margins.

- B. Contractor's desire to obtain liquidity at the beginning of the project.
- One reason related to the owner is erroneous in the preparation of tender documents that allowing the contractor to exploit the conflict between various tender documents and the project actually needs to provide unbalanced bids.

These reasons for unbalanced bid matches with those stated in other researches as well like Griffiths, (2007) who stated that there are a number of reasons why a bidder may unbalance it is prices in a bid including the likelihood of receiving large payments at the beginning of the contract (front – end loading). Secondly, a bidder may submit an unbalanced bid in order to maximize his profit. The bidder is able to do this by overpricing bid items he believes will be used in greater quantities than estimated in the tender bid documents and underpricing items he believes will be used in significantly lesser quantities.



Part two: Analysis of unbalanced bids

Q1: Is there any written procedure for balanced / unbalanced bids analysis?

Q2: If there was a method or a written procedure for the analysis of unbalanced bids, what is this method or procedure used?

- Nine of the experts who were interviewed clarified that there is no written method or procedure to analyze the bids to explore if the bid is balanced or not, but in usual the evaluation committee asked the contractors to provide prices breakdown for items unit rates, especially in the case of being doubt that these prices are unreasonable or unbalanced.
- A single expert explained that in general there is a method to analyze the bids which is (the bid evaluation mechanism that stated in bidding documents) according to this mechanism the contractors will be asked to provide the evaluation committee with prices breakdown analysis.

The study shows that there was no method or written procedure for bids analysis in order to evaluate the balanced or unbalanced bid, but the usual procedure is to ask the contractors to provide the tender evaluation committee with unit prices breakdown analysis for evaluation purposes and to be compared with nominated prices reference in order to know if the prices are reasonable and balanced or not.

This shows that there is a need to insert a clause in the tender documents to identify the unbalanced bids as well as to develop a method or written procedure in the tender documents for the analysis and evaluation of unbalanced bids.

Q3: What is the unit prices reference that is used in bidder's prices comparison during the bids evaluation and analysis stage?

- One of the interviewed experts said that the prices reference are the prices estimates costs prepared by the owner's engineers, but if the project budget is more than a million dollars, the institution will appoint consultant to prepare the prices estimated costs.
- Six of the interviewed experts said that the prices reference are the prices estimates costs prepared by the owner's engineers.



- **Two of the interviewed** experts said that the reference prices are the prices estimates costs depending on the previous bids prices and updated periodically which called prices monitoring sheet.
- One of the interviewed experts said that the prices reference are the prices estimates costs prepared by the owner's engineers, supported by the bidder average prices after omitting the upper and lower prices.

The study shows that most of the local institutions are using price estimates prepared by the owner's engineers to compare unit prices at the bias evaluation and analysis stage.

This results matches with the results of previous survey prepared by the American association of state highway and transportation officials (AASHTO, 2004) which showed that most of the American states use engineer's estimate as a reference for unit price comparison in the evaluation stage.

Q4: Which of the following prices reference you preferred to use in unit price comparison?

- Price estimates prepared by the owner's engineers
- The average prices of bidders
- Predict prices during the previous tenders occur periodically(price monitoring sheets)
- Other.
- Three of the interviewed experts said that they preferred to ues prices estimated costs prepared by owner's engineers as a reference for prices comparison during bids evaluation stage.
- Four of the interviewed experts explained that they preferred to use price monitoring sheets (prepared according to previous similar bids and updated periodically) as a reference for prices comparison during bids evaluation stage.
- One of the interviewed experts said that he preferred to use the average bidder's prices after omitting the upper and lower prices as a reference for prices comparison during bids evaluation stage.



- One of the interviewed experts said that he preferred to use the average prices of the three bidders next to the lowest bidders as a reference for prices comparison during bids evaluation stage.
- One of the interviewed experts said that he preferred to use prices estimated costs prepared by owner's engineers supported by the average of all bidders prices as a reference for prices comparison during bids evaluation stage.

It is cleared from the experts replay that most of them prefer to use the prices estimated cost prepared by owner's engineers and supported by the average of all bidders prices after omitting the upper and lower prices as reference for prices comparison during the bids evaluation stage.

This matches with North Carolina DOT that consider the average of the engineer's estimate and the individual prices received from the others bidders as reference for price comparison cited in (AASHTO, 2004).

Part Three: Detection of unbalanced bids:

Q1: Are there any specific clause in tender documents regarding the definition and identification of unbalanced bids?

- Three of the experts explained that, it is just only to warn the bidders in prebid meeting from download items on other items and stress that this behavior may be a reason to disqualify the contractor.
- Three of the interviewed experts said that there are no clauses in tender documents regard the definition and identification of unbalanced bids.
- **One expert** pointed out that there is a clause in the Islamic Development bank's tender documents related to the rejection of unbalanced, although he did not explain what the definition and identification of unbalanced bids.
- **One expert** pointed out that in the World Bank tender documents there is a clause related to the definition and identification of unbalanced bids.
- One expert pointed out that there were no clear clauses related to the definition and identification of unbalanced bids, but the following statement is written in tender documents "prices subject to study and evaluation under the tender conditions".



• **One expert** pointed out that particularly there are no special clauses in tender documents related to definition and identification of unbalanced bids but this generally understood through the evaluation process.

From a survey it be concluded that there are no particular clause in the tender documents regards the definition and identification of unbalanced bids.

This shows the need to insert a clause in the tender documents to identify and define the unbalanced bids as well as to develop a method or written procedure in the tender documents for unbalanced bids evaluation.

Q2: If there are clauses in the tender documents regarding the definition and identification of unbalanced bids, what are the allowable upper and lower limits compared with nominated prices reference in the following cases?

- Unit rate Frontload:
- Four of the experts pointed out that there were no specific ratios.
- One of the interviewed experts identified the allowable limits as ± 10% of the nominated prices reference.
- **Two of the interviewed experts** identified the allowable limits as ± 15% of the nominated prices reference.
- One of the interviewed experts identified the allowable limits as ± 25% of the nominated prices reference.
- One of the interviewed experts identified the allowable limits as ± 20% of the nominated prices reference.

• One of the interviewed experts identified the allowable front loading limit as not less than the total price of materials and workmanship and not more than 15% of the nominated prices reference.

- Vnit rate Back loading:
 - Four of the interviewed experts pointed out that there were no specific allowable limits for back loading case.
 - One of the interviewed experts identified the allowable limits as ± 10% of the nominated prices reference.



- Two of the interviewed experts identified the allowable limits as ± 15% of the nominated prices reference.
- One of the interviewed experts identified the allowable limits as ± 25% of the nominated prices reference.
- Two of the experts pointed out that back loading case is not relevant in Gaza Strip.
- > Change in the amount of items quantities through the implementation of the project:
- **Two of the experts** pointed out that there are no specific ratios in their institution tender documents.
- **Eight of the experts** identified the allowable limits are ± 25% of the original item quantity.

Q3: Have you ever been declared that one bid is materially unbalanced, and what is the procedure in this case, the rejection of the bid or rebalancing it?

- Three of the experts pointed out that three bids were declared materially unbalanced and the contractor was asked to fix the total price of the offer and rebalance the bid which was called (prices normalization), now this procedure is considered illegal and the used procedure is to reject the unbalanced bid.
- Three of the experts pointed out that three bids were rejected because the prices considered as unbalanced (the contractor downloaded items on other items).
- **Two of the experts** pointed out that they had never been rejected a bid because it was unbalanced.
- **Two of the experts** pointed out that number of bids had previously been rejected because the prices were unreasonable and inconsistent with prepared cost estimate.

It was indicated from the experts replies that no bids were rejected because it were considered as unbalanced bids according to defined procedure and methodology,



but number of bids were rejected because of the existing of items prices download or unreasonable prices compares with prices estimates .

This shows the important to develop a clause in biding documents to show specifically how to deal with unbalanced bid case.

Q4: Are there any specific precautions taken in the preliminary stages of the project to prevent the existence of unbalanced bidding in the future?

- **Two of the experts** pointed out that accurate study and preparation of procurement documents of the mentioned project before tendering process will reduce the occurrence of unbalanced bids.
- **Eight of the experts** made it clear that the following precautions should be taken to ensure that no future unbalanced bids will occur:
 - Consistency of the tender documents quantities, drawings and specifications with each other and with the project needs.
 - Accurate reviews of the procurement documents before it were distributed to bidders.
 - Insert a clause in the tender documents to worn the bidders from price downloading during pricing process.

We can concluded that there is no systematic method or a specific action taken in the initial stages of the project in order to prevent the occurrence of unbalanced bids but individual interpretations found is.

This means that we need to do some action and precautions during the early preparation phase in order to prevent the occurrence of unbalanced bid case.

<u>Part four / the criteria of unbalanced bid evaluation (unit prices</u> <u>comparison to show if the prices is unbalanced / balanced)</u>

Q1: in your opinion, what are the suitable minimum and maximum allowable difference between bidder's unit prices and the average of all bidders' prices of the same unit?

- One of the interviewed experts said that the suitable difference will be plus or minus 25% from the bidder's average for the same item.
- One of the interviewed experts said that the suitable difference will be plus or minus 20% from the bidder's average for the same item.



- One of the interviewed experts said that he didn't prefer limited ratio.
- One of the interviewed experts said that the difference will be not less than the price of materials and workmanship, and not more than 15% of the average prices of all bidders for the same line item.
- One of the interviewed experts said that the suitable difference will be plus or minus (10 15%) from the bidder's average for the same item.
- One of the interviewed experts said that the suitable difference will be plus or minus 10% from the bidder's average for the same item.
- Four of the interviewed experts said that the suitable difference will be plus or minus 15 % from the bidder's average for the same item.

Expert's opinion poll showed that the preferable and reasonable allowable difference percentage between the contractor bid prices and the average prices of all bidders for the same line item will be $\pm 15\%$.

This matches with the concept found in AASHTO study in 2004 related to limits of unbalanced line items, but different in the allowable limits, for example Wisconsin DOT's state that an item is considered to be significantly unbalanced if the difference between the low bidder's unit price and the estimate, expressed as a percentage of the estimate, is greater than 50% or is less than 75%..

Q2: In your opinion, what are the suitable minimum and maximum allowable difference between contractor's unit prices and the cost estimate prepared by the owners' engineers for the same unit line?

- One of the interviewed experts said that the suitable difference will be plus or minus 25% from the cost estimate prepared by owner's engineers for the same line item.
- One of the interviewed experts said that the suitable difference will be plus or minus 20% from the cost estimate prepared by owner's engineers for the same line item.
- One of the interviewed experts said that the difference will not be less than the price of materials and workmanship, and not more than 15% of from the cost estimate prepared by owner's engineers for the same line item.



- One of the interviewed experts said that the suitable difference will be plus or minus (10 15%) from the cost estimate prepared by owner's engineers for the same line item
- One of the interviewed experts said that the suitable difference will be plus or minus 10% from the cost estimate prepared by owner's engineers for the same line item.
- Five of the interviewed experts said that the suitable difference will be plus or minus 15 % from the cost estimate prepared by owner's engineers for the same line item.

Expert's opinion poll showed that the preferable and reasonable allowable difference percentage between the contractor bid prices and the cost estimate prepared by owner's engineers for the same line item will be $\pm 15\%$.

This matches with the concept found in AASHTO study in 2004 related to limits of unbalanced line items, but different in the allowable limits, for example Wisconsin DOT's state that an item is considered to be significantly unbalanced if the difference between the low bidder's unit price and the estimate, expressed as a percentage of the estimate, is greater than 50% or is less than 75%.

Q3: In your opinion, what are the suitable minimum and maximum allowable difference between contractor's unit prices and the price monitoring sheets (prices based on previous prices from similar projects and updated periodically)?

- One of the interviewed experts said that the suitable difference will be plus or minus 25% from price monitoring sheets.
- **One of the interviewed experts** said that the suitable difference will be plus or minus 20% from price monitoring sheets.
- **One of the interviewed experts** said that he didn't prefer any limit ratio.
- One of the interviewed experts said that the difference will be not less than the price of materials and workmanship, and not more than 15% of from price monitoring sheets for the same line item.
- One of the interviewed experts said that the suitable difference will be plus or minus (10 15%) from price monitoring sheets.



- **One of the interviewed experts** said that the suitable difference will be plus or minus 10% from price monitoring sheets.
- Four of the interviewed experts said that the suitable difference will be plus or minus 15 % from price monitoring sheets.

Expert's opinion poll showed that the preferable and reasonable allowable difference percentage between the contractor bid prices and from price monitoring sheets for the same line item will be $\pm 15\%$.

Q4: In your opinion what is the allowable percentage to decrease or increase the amount of one of the items during the implementation of the project without adjusting the unit price?

- Two of the interviewed experts didn't mention any percentages.
- One of the interviewed experts said that the reasonable percentage is +/- 15 %.
- One of the interviewed experts said that the reasonable percentage is +/- 20 %.
- Six of the interviewed experts said that the reasonable percentage is +/- 25 %

There is consensus between the experts regarding the increase or decrease of the quantity of any item by 25% without adjusting the unit price.

This matches with almost all the tender documents used in the world such as International Federation of Consulting Engineers (FIDIC) and World Bank procurement guide lines.

Q5: In your opinion what is the suitable definition of early schedule Activity?

The experts agreed that the definition of early schedule activity is the activity that will be implemented at the beginning of the project and be located on the critical path.

Q6: What is the appropriate interest rate to be used in present worth (PW) calculations?

The experts agreed that this is financial issues and the Palestinian monitory authority in cooperation with banks will definite this ratio, any way they mentioned that the interest rate various from 5-8 %.


4.3 Chapter Summary

During the study structured interview were done with ten local procurement experts, the questions were prepared in advanced and from their replies the following notes were founded:

There is no common definition or identification of unbalanced bid terms.

There is no clause in used tender documents related to unbalanced bid in terms of

definition, identification, evaluation and analysis.

There isn't any written method or procedure for bid evaluation and analysis in order to discover the unbalanced bid.

There isn't any legal framework to deal with unbalanced bid.

The experts mentioned only two type of unbalanced bid in the Gaza Strip (front load and individual rate loading).

The experts mentioned three type of unit price reference used in the Gaza strip (estimated cost prepared by owner's engineers, price monitoring sheets and average of bidder's prices)

The expert's replies regards to the criteria used to determine if the unit rate price are balanced or unbalanced were are shown in table 4.2.

#	Reference price	Lower limit	Upper limit
1	Cost estimated prepared by owner	15%	15%
2	Cost estimate monitoring sheet	15%	15%
3	Average of the bidder after omitting the upper and lower prices	15%	15%
4	Variation of specific item from original quantity during implementation.	25%	25%
5	Interest rate	5% per year	8% per year.
6	Early scheduled activity	The activity that will the beginning of the critical Path.	be implemented in project and laid in

 Table 4.2: Allowable Recommended limits between reference unit price and lowest

 bidder and other evaluation criteria.



CHAPTER FIVE: Mathematical Model

5.1 Introduction

This chapter presents the MS Excel program developed to help the implementing agencies in improving their bidder's selection process in Gaza Strip especially regarding the unbalanced bids cases. In addition, it describes the program components, and the method used. The program implementation and evaluation are also discussed.

5.2 Concepts

It was found that the evaluation and analysis process of the bids needs improvements to be more relative to deal with the detection and preventing of unbalanced bids.

A written method and procedure has been found for the evaluation and analysis of bids in order to know if it is balanced or unbalanced bids.

The researcher autonomies the process using MS Excel program to help the owners and the procurement experts in detection the unbalanced bids during the evaluation process, and then selecting the suitable contactor.

The researcher named this program as unbalanced bid detection model (UBDM).

The model was developed by using "MS Excel Macro" programming language. MS Excel environment was originally used to make easy to the experts and the mangers who work with bids analysis and evaluation. Moreover, MS Excel as component of MS Office is the most widely used computer application program.

The program was designed to be flexible and easy to use. This chapter presents concepts, description, implementation, and evaluation of the model.

Figure 3.2 explain the idea of software formulation and show the program flow chart and how the data will be proceed.



5.3 Program description

Unbalanced bids evaluation and detection model (UBDM) was prepared to work under MS Excel environment, as it was programmed under excel program using Macro language, because Excel program as part of Microsoft Office is easy to be used by all the experts and mangers involved in construction industry.

The model will start to work directly after clicking on the program icon or by opening the model file through the MS Excel program.

Just after the program start to work the cover page and the main spared sheet appears and enables the user to input the required data as Figure 5.1 & 5.2.



Figure 5.1: UBDM cover page



5.4 Data entry

The required input data will be entered directly in specific location in the spread sheet (columns and rows colored with specific color) as shown in Figure 5.2 and the input data will be:

Company Name:							Calculation Me	Reset Model	
Date:							C Engineer Est	imates	
Annual Interest Rate								Calculat	e
# of Bidders:							Custom Ave	rage	
# of Items:					1			Cover Page	
Bid Item No	orginal quantity	Modified quantity	Unit	Payment duration	eng estimate	% of price range	Bidder <mark>1</mark> unit price	Bidder1unit price Discount	Bidder1unit price Totals
			_						-
			-	1					
			+						
	-							-	-
3			-				-		-
	1							-	
	-		+	1	-			-	
				1					
			1						
	-								

Figure 5.2: UBDM input data sheet

- Number of participated bidders in the tender.
- Number of the line items.
- The bank interest rate per year (will be used in present value calculations)
- The dimension unit for every line item as mentioned in the related columns titles.
- The original quantities as stated in tender bill of quantities for every line item.
- The modified quantities based on further studies when needed during the evaluation process.
- The payment schedule duration in months for every line item.
- The engineer cost estimate or any other proposed prices reference for every line item.



- The allowable percentage difference ratio between the reference proposed prices and the bidder's prices.
- The unit prices for every line item for all the participant bidders as shown in the appropriate columns.

5.5 Program procedures and calculation

The program will automate the data just after the user click on the calculate icon as shown in Figure 5.3, 5.4, 5.5.

3							-		- Cala
Company Name:	Arab U	Inited Compar	ny						Calcu
Date:	4/15/2	013							
Annual Interest Ra	it 12.00%	6							
# of Bidders:	4								00
# of Items:	17								
Bid Item No	Qty			Payment	<i>2</i> - 11				-
100	20	Woothed Qty	Unit	duration	eng estimate	% of price range	te ooo oo	Lower Limit	Average
100	2.9	49		24	15,000.00	20.00%	42,000.00	12,000.00	22,002,00
101.	19	1.4		19.	33,000.00	20.00%	42,000.00	26,000.00	35,265.00
102	12	12	-	18	20,000.00	20.00%	24,000.00	16,000.00	19,156.50
105	30	30		3	80,000:00	20.00%	96,000.00	64,000.00	70,981.50
104	6	8	_	. 1	300,000.00	20.00%	360,000.00	240,000.00	387,482.00
105	12	12		24	1,200.00	20.00%	1,440.00	960.00	1,032.50
106	30	30		25	89,000.00	20.00%	106,800.00	71,200.00	68,884.50
107	14	14		22	4,500.00	20.00%	5,400.00	3,600.00	4,524.00
108	25	25		13	62,000.00	20.00%	74,400.00	49,600.00	68,860.00
109	25	25		3	10,000.00	20.00%	12,000.00	8,000.00	112,160.00
110	7	7		9	5,000.00	20.00%	6,000.00	4,000.00	4,690.50
111	30	30		17	3,400.00	20.00%	4,080.00	2,720.00	3,589.50
112	2	2		16	150,000.00	25.00%	187,500.00	112,500.00	167,500.00
113	16	16		9	2,800.00	25.00%	3,500.00	2,100.00	3,059.50
114	18	18		9	7,200.00	25.00%	9,000.00	5,400.00	8,344.00
115	5	5		8	3,600.00	25.00%	4,500.00	2,700.00	3,215.50
116	32	32		25	9,800.00	25.00%	12,250.00	7,350.00	9,895.00

Figure 5.5: UBDM procedure & calculations

Through the model the following procedure will be done:

• The program will automatically calculate the upper and lower acceptable difference of the bidder's unit price depending on the given data (engineer's cost estimate or other proposed cost reference and the allowable ratio for



acceptable range difference between the bidder' prices and the engineer's cost estimate for the same line item).

- The total of every line item will be calculated for all the participated bidders and also the grand total for every bidder will be calculated.
- The program will arrange the bidders according to their prices grand totals ascending from the lowest to the highest prices.
- The program will detect the unbalanced bid according to the following procedure:
 - 1. The program will start to highlight the unbalanced line item from the lowest bidder prices, depending on the following rule (the bidder's unit price will be considered as balanced if it laid within the acceptable prices limits, greater than the lower limit and less than the upper limits) and the line item will be considered as unbalanced if it laid outside the acceptable limits.
 - 2. If the lowest bidder include at least one or more line item that are considered unbalanced, this mean that the mentioned bid is considered as mathematically unbalanced bid.
 - 3. The program will start to cheek if the lowest bidder is also materially unbalanced bid, that by calculation of the present value for all the bidder prices using the following equation :

 $PW = C/(1+R)^{T}$ where :

C= the prices submitted by the contractors

PW= present worth of the money

R= interest rate monthly

T= number of months (calculated from the time schedule)

The program will rearrange the bidders ranking according to the money present value, if the ranking changed, the previous lowest bidder will be considered as materially unbalanced bid and may be rejected, but if the ranking didn't change the unbalanced unit item will be subjected to



quantity check and the process will be repeated using the new modified quantities if it was founded.

- 4. The program will rearrange the ranking of the bidders according to the modified quantities and if the ranking didn't change, the bidder will be accepted but if the ranking changed the bidder will also considered as materially unbalanced bid and the process will continue.
- 5. The process will continue as the above procedure until balanced bid is founded, else all the bids will be rejected.

5.6 Program results, outputs and verification

David and Chotibhongs, (2009) give numerical sample for the unbalanced bid front loading case, the following data of the example was stated below:

Number of bidders=2 bidders

Number of line item = 6 line items

Interest rate = 1% per month

The offers of the two bidders were stated in Table 5.1.

Item	Unit	Quantity	Payment Schedule	Engineers Cost Estimate	Bidder1 Unit Price	Bidder2Unit Price
Site cleaning	Day	60	3 Month	1500 \$	2000 \$	500\$
Mobilization	Day	10	4 Month	1100\$	1200\$	800\$
Fencing	L.M	422	5 Month	35\$	30\$	15\$
Framework	M2	12000	6 Month	8.5\$	9\$	12\$
Concrete	M3	650	7 Month	200 \$	150\$	250\$
Asphalt	M2	10000	8 Month	11.5\$	12\$	12.2\$

Table 5.1:	Two	bidder's	offers	example #1

The total price of bidder 1 is 470160 \$.

The total price of bidder 2 is 472830 \$.



It was cleared that bidder 1 offer included frontloading and after present value calculation it will not still the lowest prices (see paragraph 2-6 in literature review chapter).

This result was verified by the MS Excel as shown in the Figure 5.7 & 5-8.

Company Name: Date: Annual Interest R Fof Bidders: Fof Items: Bid Item No Site cleaning Mobilization Fencing Framwork Concrete Asphalet							Cover	Page			
Company Name:	Arab U	nited Compar	ny				- Calculation Met	thod			
Date:	mpany Name: Arab United Company te: 4/15/2013 nual Interest Rat 12.00% if Bidders: 2 of Items: 6 Bid Item No Qty Modified Qty Unit payment duration site cleaning 60 Mobilization 10 10 10 day 4 1,100.00 15 Fencing 422 422 12000 M2 6 8.50 15							mates			
Annual Interest Ra	Impany Name: Arab United Company te: 4/15/2013 nual Interest Rate 12.00%										
t of Bidders:	2						Custom Aver	age —			
f of Items:	Arab United Company Arab United Company										
							Re	set Model			
							-				
Bid Item No	Qty	Modified Qty	Unit	payment duration	eng estimate	% of price range	Bidder1 unit price	Bidder2 unit price			
site cleaning	60	60	day	3	1,500.00	15.00%	2,000.00	500.00			
Mobilization	10	10	day	4	1,100.00	15.00%	1,200.00	800.00			
Fencing	422	422	LM	5	35.00	15.00%	30.00	15.00			
Framwork	12000	12000	M2	6	8.50	15.00%	9:00	12.00			
Concrete	650	650	MЗ	7	200.00	15.00%	150:00	250.00			
Asphalet	10000	10086	MO	8	11.50	15 00%	12:00	12.20			

Figure 5.6: Input data of front-loading example 1

		– Calcu	ulation Method	Deset Model						
		٥	Engineer Estimates	Calculat						
			Custom Average	Cover Page						
								Round1	Round2	
Upper Limit	Lower Limit	Average	Bidder1 unit price	Bidder1unit price Totals	Bidder2 unit price	Bidder2unit price	Totals	Bidder1	Bidder2	
1,725.00	1,275.00	1,250.00	2,000.00	120,000.00	500.00	30,000.00		Unbalaned	Unbalaned	
1,265.00	935.00	1,000.00	1,200.00	12,000.00	800.00	8,000.00		Balanced	Unbalaned	
40.25	29.75	22.50	30.00	12,660.00	15.00	6,330.00		Balanced	Unbalaned	
9.78	7.23	10.50	9.00	108,000.00	12.00	144,000.00		Balanced	Unbalaned	
230.00	170.00	200.00	150.00	97,500.00	250.00	162,500.00		Unbalaned	Unbalaned	
13.23	9.78	12.10	12.00	120,000.00	12.20	122,000.00		Balanced	Balanced	
			GT	470,160.00		472,830.00		Unbalaned	The Winner	r is Bidder2
			Rank GT	1		2				
			PW	443,547.02		442,714.48				
			Rank By PW	2-Rejected		1-Winner				

Figure 5.7: Results of front-loading example 1



• Griffiths, (2007) gave hypothetical example represented bids submitted by two contractors for the same work as shown in Table 5.2.

Work Required	Quantity	Payment Schedule	Engineers Cost Estimate	Bidder1 Unit Price	Bidder1 Total Price	Bidder2 Unit Price	Bidder2 Total Price
A stage 1	50	3 Month	2450 \$	5000 \$	250000 \$	2500\$	125000\$
B stage 1	15	3 Month	2100\$	4000\$	600000\$	2000\$	300000\$
C stage 1	200	3 Month	1950\$	4000\$	800000\$	2000\$	400000\$
D stage 2	100	4 Month	260\$	1000\$	100000\$	250\$	25000\$
E stage 2	250	4 Month	950 \$	150\$	37500\$	1000\$	250000\$
F F- stage	100	5 Month	4000\$	1\$	100\$	4000\$	400000\$
G F-stage	300	5 Month	550	1\$	300\$	500\$	150000\$
H F-stage	100	5 Month	1600	1\$	100\$	1500\$	150000\$
	Total b	id prices			1788000\$		1800000\$

 Table 5.2: Input data for example #2

The above example was discussed in Griffiths, (2007) as follow:

1- Issues and Concerns – Front Loaded Payments

In the case of Contractor 1, it is cleared that the bid is unbalanced as unit bid prices are front loaded in Stage 1 of the contract with minimal unrealistic costs attributed to work required towards the final stages of a contract.

Contractor 2 represents a balanced bid with unit bid prices representative of actual costs to conduct the work involved.

- In the case of Contractor 1 at the end of Sage 1 of the contract (phases A, B and C), the contractor will be paid an amount of \$1,650,000 or 92 per cent of the total contract price.
- At the end of Stage 1 of the contract (phases A, B and C), contractor
 2 would have been paid an amount of \$825,000 or 46 per cent of the total contract price.



• The difference in payments at this stage of the contract to the two contractors would be \$825,000. The "prepayment" to contractor 1 invariably has an interest cost to the owner. If this interest cost is factored into the bid price of the contract, it could result in a situation where contractor 1's original tender bid is higher than contractor 2.

The same example were done by the MS Excel model, the same conclusion regards the unbalanced bid front loading case were achieved as shown in Figure 5.8 & 5.9

Company Name:	Examp	le 2					Calculation Met	Reset Mode
Date:	4/15/2	013					Engineer Esti	mates
Annual Interest Ra	t 12.00%							
# of Bidders:	2						Custom Aver	age
Company Name: Example 2 Date: 4/15/2013 Annual Interest Rate 12.00% # of Bidders: 2 # of Bidders: 2 # of Items: 8 Bid Item No Qty Asatge 1 50 50 8 Stage 1 150 150 C Stage 1 200 200 Date: 100 4 month E Stage 2 250 250 4 month Final Stage 100 100 5 month G Final Stage 300 300 5 month								Cover Page
Bid Item No	Qty	Modified Qty	Unit	Payment duration	eng estimate	% of price range	Bidder1 unit price\$	Bidder2 unit price \$
A satge 1	50	50		3 months	2,450.00	15.00%	5,000.00	2,500.00
B Stage 1	150	150		3 months	2,100.00	15.00%	4,000.00	2,000.00
C Stage1	200	200		3 months	1,950.00	15.00%	4,000.00	2,000.00
D Stage 2	100	100		4 months	260.00	15.00%	1,000.00	250.00
E Stage 2	250	250		4 months	950.00	15.00%	150.00	1,000.00
F Final Stage	100	100		5 months	4,000.00	15.00%	1.00	4,000.00
G Final Stage	300	300		5 months	550.00	15.00%	-1.00	500.00
H Final Stage	100	100		5 months	1,600.00	15.00%	1.00	1,500.00

Figure 5.8: Input data of unbalanced bid example 2.



		Calc	ulation Method	Reset	t Model							
		•	Engineer Estimates	Calcu	ilate							
			Custom Average	Cove	r Page							
			Bidder1			Bidder2				Round1	Round2	
Jpper Limit	Lower Limit	Average	unit price\$	Bidder1unit price	\$ Bidder1unit pric	unit price \$	Bidder2unit pric	e § Bidder2unit price	\$ Totals	Bidder1	Bidder2	
2,817.50	2,082.50	3,750.00	5,000.00	0.00%	250,000.00	2,500.00	0.00%	125,000.00		Unbalane	c Balanced	
2,415.00	1,785.00	3,000.00	4,000.00	0.00%	600,000.00	2,000.00	0.00%	300,000.00		Unbalane	c Balanced	
2,242.50	1,657.50	3,000.00	4,000.00	0.00%	800,000.00	2,000.00	0.00%	400,000.00		Unbalane	c Balanced	
299.00	221.00	625.00	1,000.00	0.00%	100,000.00		0.00%	25,000.00		Unbalane	c Balanced	
1,092.50	807.50	575.00	150.00	0.00%	37,500.00		0.00%	250,000.00		Unbalane	c Balanced	
4,600.00	3,400.00	2,000.50	1.00	0.00%	100.00	4,000.00	0.00%	400,000.00		Unbalane	c Balanced	
632.50	467.50	250.50	1.00	0.00%	300.00		0.00%	150,000.00		Unbalane	c Balanced	
1,840.00	1,360.00	750.50	1.00	0.00%	100.00	1,500.00	0.00%	150,000.00		Unbalane	c Balanced	
			GT		1,788,000.00			1,800,000.00		Unbalane	c The Winne	r is Bidder2
			Rank GT		1			2				
			PW		1,734,084.27			1,731,032.45				
			Rank By PW		2-Rejected			1-Winner				

Figure 5.9: Results of unbalanced bid example 2.

2- Issues and Concerns –Quantities Changes

If the quantities of the work required under item "D" were to increase by an amount not exceeds 25 per cent of the tender quantity, say for example 20%, the modified quantity of the item "D" will be 120% of the original quantity which equal (120 units). If the grand total of the two contractors recalculated according to the modified quantity the result will be as shown in Table 5.3

	Total according	Rank according	Total according	Rank according
	to original	to original	to modified	to modified
	quantity	quantity	quantity	quantity
Bidder 1	1,788,000\$	1	1,808,000\$.	2
Bidder2	1,800,000\$	2	1,805,000\$.	1

 Table 5.3: Effect of quantities changes in example #2

It was shown from the result that the grand total of bidder # 1 was more than the grand total of bidder# 2. This is because the unit price of item "D" is considered unbalanced in offer of bidder 1.

This result has been verified using the MS Excel model as shown in Figures 5.10, 5.11, 5.12



Company Name:	Examp	le 2					Calculation Met	Reset Model	
Date:	4/15/2	013					Engineer Esti	mates	
Annual Interest Ra	at 0.00%								
# of Bidders:	2						Custom Aver	age	
# of Items:	8							Cover Page	
									5
Bid Item No	Qty	Modified Qty	Unit	Payment Duration	eng estimate	% of price range	Bidder1 unit price	Bidder2 unit price	
A stage 1	50	50		3	2,450.00	15.00%	5,000.00	2,500.00	
B stage 1	150	150		3	2,100.00	15.00%	4,000.00	2,000.00	
C Stage 1	200	200		3	1,950.00	15.00%	4,000.00	2,000.00	
D Stage 2	100	100		4	260.00	15.00%	1,000.00	250.00	
E Stage2	250	250		4	950.00	15.00%	150.00	1,000.00	
F Final Stage	100	100		5	4,000.00	15.00%	1000	4,000.00	
G Final Stage	300	300		5	550.00	15.00%	1.00	500.00	
H Final Stage	100	100		5	1,600.00	15.00%	1000	1,500.00	

Figure 5.10: Input data of unbalanced bid example 2 (Quantities changes).



Figure 5.11: Results of unbalanced bid example 2 (based on original quantities)



				5.95	VINC 9537070 - 10		1.2		
Company Name:	Example 2			Calc	ulation Method	Reset Model			
Date:	4/15/2013			6	Engineer Estimates	2			
Annual Interest Rate:	0.00%				Engineer Estimates	Calculat			
# of Bidders:	2			0	Custom Average				
# of Items:	8					Cover Page			
									Round1
Bid Item No	Modified Qty	Upper Limit	Lower Limit	Average	Bidder1 unit price	Bidder1unit price Totals	Bidder2 unit price	Bidder2unit price Totals	Bidder2 unit price
A stage 1	50	2,817.50	2,082.50	3,750.00	5,000.00	250,000.00	2,500.00	125,000.00	Balanced
B stage 1	150	2,415.00	1,785.00	3,000.00	4,000.00	600,000.00	2,000.00	300,000.00	Balanced
C Stage 1	200	2,242.50	1,657.50	3,000:00	4,000.00	800,000.00	2,000.00	400,000.00	Balanced
D Stage 2	120	299.00	221.00	625.00	1,000.00	120,000.00	250.00	30,000.00	Balanced
E Stage2	250	1,092.50	807.50	575.00	150.00	37,500.00	1,000.00	250,000.00	Balanced
F Final Stage	100	4,600.00	3,400.00	2,000.50	1.00	100.00	4,000.00	400,000.00	Balanced
G Final Stage	300	632.50	467.50	250.50	1.00	300.00	500.00	150,000.00	Balanced
H Final Stage	100	1,840.00	1,360.00	750.50	1.00	100.00	1,500.00	150,000.00	Balanced
					GT	1,808,000.00		1,805,000.00	The Winner is Bidder2 unit price
					Rank GT	2		1	
					PW	1,808,000.00		1,805,000.00	
					Rank By PW	2		1-Winner	

Figure 5.12: Results of unbalanced bid example 2 (based on modified quantities)

5.7 Chapter Summary

To check the validity and verification of the model a number of cases concerning unbalanced bids in previous researches have been studied related to analysis, evaluation and detection of unbalanced bid, the same cases were studied using the proposed mathematical model and the result obtained from the model matched with the results that found in the previous researches which approved the validity and verification of the proposed mathematical model.



CHAPTER SIX: CASE STUDIES

This chapter presents number of case studies collected from actual project implemented in the Gaza Strip. The data was collected via interviews with the project's owners, and implemented agencies. Reviewing project documents are the core of data for all case studies summarized data of the collected information was presented by concentrating on procurement stage of these projects. The procurement documents for each case were reviewed; the bids evaluation process took more attentions. Each of the case studies was reevaluated using Unbalanced Bids Detection Model (UBDM).

Discussion and recommendation has been concluded for each case.

6.1 Case study No 1: development of Al Shanty area in Jabalia

6.1.1 Project background

This case illustrates one of projects which executed at Gaza Strip in the 2012-2013 through Municipal Development Program (MDP) the main program of Municipal Lending and Development Fund (MDLF). The project concentrates in development of Al Shanty area in the west of Jabalia city. The project consists of earth works, concrete for retaining walls, road base works and interlock tiles works.

Bidding was conducted through the National Competitive Bidding (NCB) procedure specified in the World Bank procurement guidelines and was opened to all local bidders.

Post qualification method was used in contractor selection. Qualifications requirements were presented in the biding documents including technical, financial and legal requirements as detailed in the bidding documents.

The project was advertised in local newspaper on 30/6/2012 and the bid opening date was on 31/7/2012. The evaluation process continues until 27/8/2012 where the winner bidder was selected. (Table 6.1 shows the characteristics of project).



	of Development of the Shaney theat in Busana
Project Name	Development of Al Shanty Area in Jabalia
Description of Project	The project concentrate in development of Al Shanty Area in west jabalia, the project consists of earth work, road base works, concrete works and interlock tiles works
Project Location	Al Shanty Area, west of Jabalia
Target Population	In total, the project would serve 20000 people
District	Jabalia, North Gaza Strip
Allocated Budget (\$)	600,000.00 Euro
Planned Project Duration	12 months
Implemented Agency	MDLF
Owner	Municipality of Jabalia
Consultant	Engineering Management Consultant Center (EMCC)
Used Tender Documents	NCB procurement documents used in World Bank for small works.

Table 6.1: Characteristics of Development of Al Shanty Area in Jabalia

6.1.2 Project history

Bidding stage

In this project seven contractors have submitted tenders. Complete bidding documents were provided including general and private condition, technical specification, bill of quantity and drawings. Bidding process was continued for 30 days, passing through all steps; advertising, bid sell, site visit, per–bid meeting, tender submitting and tender opening meeting. The tenders were opened and financial offers were announced through open meeting attending by concerned parties' representative including the contractors.

Evaluation stage

The evaluation process consists of the following steps:



- 1. Preliminary examination process. The step included checking, by yes or no, the legibility, submitting bid security, bid completeness and substantial responsiveness of the contractor.
- 2. Prices corrections
- 3. Price review (check of summations for BOQ items).

Based on evaluation result, Table 6.2 summarizes the final bid prices for contractors.

S.N	Bidder Name	Read out bid prices (Euro).	Unconditional discount %	Corrected bid prices (Euro)
1	А	505,650	0.0%	505,650
2	В	566,400	0.0%	566,400
3	С	408,600	0.0%	408,600
4	D	497,700	0.0%	497,700
5	Е	448,950	0.0%	448,950
6	F	477,900	0.0%	477,900
7	G	510,900	4.0%	490,464

Table 6.2: Characteristics of the participated bidders of case study No. 1

Awarding stage

The evaluation committee reviewed the submitted bidder's offers and concentrated on the lowest bidder C, the committee found that some of unit price item are considered as unreasonable especially for items related to leveling, retaining walls concrete, road base coarse layer and interlock tiles. The committee asked the lowest bidder to provide the municipality with breakdown analysis for unit rate prices. The company provided the committee with price breakdown analysis for the mentioned unit rate that considered being unreasonable with an appropriate justification. The evaluation committee accepted the company analysis and justification and considered the bidder (C) as the lowest evaluated responsive bidder.

6.1.3 Assessment

6.1.3.1 Used tender documents

The used procurement documents in the project were World Bank standard bidding documents for national competitive bidding (NCB). The documents were inspected



related to unbalanced bid documents. The following paragraph was included in evaluation clause in the documents " If the bid for an admeasurement contract, which results in the lowest Evaluated Bid Price, is seriously unbalanced, front loaded or substantially below updated estimates in the opinion of the Employer, the Employer may require the Bidder to produce detailed price analyses for any or all items of the Bill of Quantities, to demonstrate the internal consistency of those prices with the construction methods and schedule proposed. After evaluation of the price analyses, taking into consideration the schedule of estimated contract payments. The Employer may require that the amount of the performance security be increased at the expense of the Bidder to a level sufficient to protect the Employer against financial loss in the event of default of the successful Bidder under the Contract."(SBD, Instruction to Bidder, Clause 34.5)

The following points were shown from the above paragraph:

- There is no specific definition or identification of unbalanced bid in the tender documents.
- There is no appointed reference of unit price estimate to be used in prices comparison; also there are no acceptable limits for the definition of unbalanced unit price.
- There is no method or procedure in the tender documents to determine if the bid is balanced or not.
- The documents deal only with the case of front loading by asking the bidder to increase the amount of performance security without checking the effect of front loading in the ranking of the bidders.
- There is no legal framework in the tender documents to deal with unbalanced bids.



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6.1.3.2 Bids evaluation by MS Excel model

The following entry data were entered into MS Excel model:

- Line items,
- Contract quantities for every line item,
- Payment duration for every line item,
- Engineering cost estimate for every line item,
- Acceptable range for unite rate difference from the cost reference,
- Bidder's offers for every line item,
- Interest rate.

The program was run and the collected results were shown in the Figure 6.1 &6.2.

Agancy Name:	Jabalia	Al Nazla Mu	nicip	ality- develo	oping Al Shanty	street			Calc	ulation Method	Res	et Mode	1
Date:	4/15/20	013								Engineer Estimat	ac.		
Annual Interest Rate	0.00%								•	Custom Average	alculat		
# of Bidders:	7										-		
# of Items:	8										Co	ver Page	•
													Ji.
Bid Item No	Qty	Modified Oty	Unit	Paymnet duration	eng estimate Euro	% of price range	Upper Limit	Lower Limit	Average	A	A Totals	в	B Totals
1	24000	2,4000	M2	2	1.00	15.00%	1.43	1.05	1.24	0.70	16,800.00	1.00	24,000.00
2.	750	750	LM	4	10.00	15.00%	15.18	11.22	13.20	14.00	10,500.00	14.00	10,500.00
3	2.40	240	MB	5	270.00	15.00%	259.44	191.76	225.60	250.00	60,000.00	280.00	67,200.00
4	90	90	NO	12	100.00	15.00%	92.00	68.00	80.00	55.00	4,950.00	100.00	9,000.00
5	150	150	NO	12	50:00	15.00%	50.60	37.40	44.00	30.00	4,500.00	80.00	12,000.00
6	24000	24000	M2	7	7.00	15.00%	5.52	4.08	4.80	5.70	136,800.00	7.00	168,000.00
7	24000	24000	M2	12	13.00	15.00%	12.37	9.15	10.76	11.00	264,000.00	11.00	264,000.00
8	9	9	NO	12	600.00	15.00%	844.10	623.90	734.00	900.00	8,100.00	1,300.00	11,700.00
										GT	505,650.00		566,400.00
										Rank GT	5		7
										PW	505,650.00		566,400.00
										Rank By PW	5		7

Figure 6.1: MS Excel results for case study #1



										Round1
с	C Totals	D	D Totals	E	E Totals	F	F Totals	G	G Totals	c
2.00	48,000.00	2.00	48,000.00	0.40	9,600.00	1.00	24,000.00	1.50	35,985.60	Unbalaned
12.00	9,000.00	12.00	9,000.00	13.00	9,750.00	14.00	10,500.00	13.00	9,746.10	Balanced
120.00	28,800.00	200.00	48,000.00	218.00	52,320.00	200.00	48,000.00	260.00	62,375.04	Unbalaned
50.00	4,500.00	100.00	9,000.00	85.00	7,650.00	100.00	9,000.00	60.00	5,397.84	Unbalaned
30.00	4,500.00	50.00	7,500.00	50.00	7,500.00	60.00	9,000.00	25.00	3,748.50	Unbalaned
4.00	96,000.00	4.50	108,000.00	4.30	103,200.00	5.00	120,000.00	4.50	107,956.80	Unbalaned
9.00	216,000.00	10.80	259,200.00	10.50	252,000.00	10.50	252,000.00	11.75	281,887.20	Unbalaned
200.00	1,800.00	1,000.00	9,000.00	770.00	6,930.00	600.00	5,400.00	400.00	3,598.56	Unbalaned
	408,600.00		497,700.00		448,950.00		477,900.00		510,695.64	The Winner is
	1		4		2		3		6	
	408,600.00		497,700.00		448,950.00		477,900.00		510,695.64	
	1-Winner		4		2		3		6	

Figure 6.2: MS Excel results for case study #1

The program orders the bids from the lowest to the highest offer. Bidder C being the lowest offer, and the program highlighted the line items in Bidder C's offer whose prices are beyond the acceptable limits or substantially higher than the engineer's cost estimate (named as unbalanced in Figure 6.2).

The researcher checked the quantities involved in these line items and replaces the understated quantities with the actual quantities after further study of the project needs. The program recalculates the bids of all bidders using the new quantities and orders them again from the lowest to the highest offer as shown in Figure 6.3 & 6.4.



Agangu Mamau	Jabalia	ALNozla Mu	nicir	ality dayol	pring Al Shantu	stroot			Ca	culation Method -	Res	et Mode	L I
Agancy Name:	1/15/2	AI Nazia IViu	muh	Janty- Geven	oping Ar Snanty	sueer	-				1105	, or mouto	
Date:	4/15/2	013								Engineer Estimation	es		
Annual Interest										Version and an and a second second	Calculat		
Rate	0.00%									v costom Average			
# of Bidders:	7											le Maria de la composición de la composici	
# of Items:	8										Co	ver Page	8
Bid Item No	Qty	Modified Qty	Unit	Paymnet duration	eng estimate Euro	% of price range	Upper Limit	Lower Limit	Average	A	A Totals	в	B Totals
1	24000	31293	N12	2	1.00	15.00%	1.43	1.05	1.24	0.70	21,905.10	1.00	31,293.00
2	750	1494	LM	4	10:00	15.00%	15.18	11.22	13.20	14.00	20,916.00	14.00	20,916.00
3	2:40	129	MB	5	270.00	15.00%	259.44	191.76	225.60	250.00	32,250.00	280:00	36,120.00
4	90	141	NO	12	100.00	15.00%	92.00	68.00	80.00	55.00	7,755.00	100.00	14,100.00
5	150	60	NO	12	50.00	15.00%	50.60	37.40	44.00	30.00	1,800.00	80.00	4,800.00
6	24000	31298	M2	7	7.00	15.00%	5.52	4.08	4.80	5.70	178,370.10	7.00	219,051.00
7	24000	31293	M2	12	13.00	15.00%	12.37	9.15	10.76	11.00	344,223.00	11.00	344,223.00
8	9	6	NO	12	600.00	15.00%	844.10	623.90	734.00	900.00	5,400.00	1,300.00	7,800.00
										GT	612,619.20		678,303.00
										Rank GT	5		7
										PW	612,619.20		678,303.00
										Rank By PW	5		7

Figure 6.3: MS Excel results for case study #1(quantities check)

Round	1
Round	1
C CTotals D DTotals E ETOtals F FTOtals G GTotals C	
2.00 62,586.00 2.00 62,586.00 0.40 12,517.20 1.00 31,293.00 1.50 46,920.72 Unbal	ined
12.00 17,928.00 12.00 17,928.00 13.00 19,422.00 14.00 20,916.00 13.00 19,414.23 Baland	ed
120.00 15,480.00 200.00 25,800.00 218.00 28,122.00 200.00 25,800.00 260.00 33,526.58 Unbal	ined
50.00 7,050.00 100.00 14,100.00 85.00 11,985.00 100.00 14,100.00 60.00 8,456.62 Unbal	ined
30.00 1,800.00 50.00 3,000.00 50.00 3,000.00 60.00 3,600.00 25.00 1,499.40 Unbal	ined
4.00 125,172.00 4.50 140,818.50 4.30 134,559.90 5.00 156,465.00 4.50 140,762.17 Unbal	ined
200 281,637.00 10.80 337,964.40 10.50 328,576.50 10.50 328,576.50 11.75 367,545.67 Unbal	ined
200.00 1,200.00 1,000.00 6,000.00 770.00 4,620.00 600.00 3,600.00 400.00 2,399.04 Unbal	ned
512,853.00 608,196.90 542,802.60 584,350.50 620,524.44 The W	inner is C
1 4 2 3 6	
512,853.00 608,196.90 542,802.60 584,350.50 620,524.44	
1-Winner 4 2 3 6	

Figure 6.4: MS Excel results for case study #1(quantities check).

It was shown from the result that the original lowest bidder is still the lowest bidder, so the program checks for frontloading.



It is clear that line item #1 price is substantially higher than the engineer's estimate (and the average price of all bidders) and whose performance is scheduled early in the project.

The program then calculates the present worth (PW) of all payments given the approximate schedule and an appropriate discount rate input by the analyst and orders the bids again based on the present worth of the offers as shown in Figures 6.5 & 6.6.

						2. 20	1						
Agancy Name:	Jabalia	Al Nazla Mu	nicip	ality- devel	oping Al Shanty	street	1		Calc	ulation Method	Res	et Mode	9
Date:	4/15/20	013								Engineer Ectimate			
Annual Interest Rate	12.00%	8					5			Custom Average	Calculat		
# of Bidders:	7											1	1
# of Items:	8										Cor	ver Page	
Bid Item No	Qty	Modified Qty	Unit	Paymnet duration	eng estimate Euro	% of price range	Upper Limit	Lower Limit	Average	A	A Totals	в	B Totals
1	24000	31293	M12	2	1.00	15.00%	1.43	1.05	1.24	0.70	21,905.10	1.00	31,293.00
2	750	1494	LIM	4	10.00	15:00%	15.18	11.22	13.20	14.00	20,916.00	14.00	20,916.00
	2.40	129	M3	5	270.00	15.00%	259.44	191.76	225.60	250.00	32,250.00	280.00	36,120.00
4	90	141	NO	12	100.00	15.00%	92.00	68.00	80.00	55.00	7,755.00	100.00	14,100.00
5	150	60	NO	12	50.00	15.00%	50.60	37.40	44.00	30.00	1,800.00	80:00	4,800.00
6	24000	31293	M2	7	7.00	15.00%	5.52	4.08	4.80	5.70	178,370.10	7.00	219,051.00
Ż	24000	31293	M12	12	13.00	15.00%	12.37	9.15	10.76	11.00	344,223.00	11.00	344,223.00
8	9	6	NO	12	600.00	15.00%	844.10	623.90	734.00	900.00	5,400.00	1,300.00	7,800.00
										GT	612,619.20		678,303.00
										Rank GT	5		7
										PW	557,379.37		618,631.36
										Rank By PW	5		7

Figure 6.5: MS Excel results for case study #1(present worth calculations).



										Round1
с	C Totals	D	D Totals	E	E Totals	F	F Totals	G	G Totals	c
2.00	62,586.00	2.00	62,586.00	0.40	12,517.20	1.00	31,293.00	1.50	46,920.72	Unbalaned
12.00	17,928.00	12.00	17,928.00	13.00	19,422.00	14.00	20,916.00	13.00	19,414.23	Balanced
120.00	15,480.00	200.00	25,800.00	218.00	28,122.00	200.00	25,800.00	260.00	33,526.58	Unbalaned
50.00	7,050.00	100.00	14,100.00	85.00	11,985.00	100.00	14,100.00	60.00	8,456.62	Unbalaned
30.00	1,800.00	50.00	3,000.00	50.00	3,000.00	60.00	3,600.00	25.00	1,499.40	Unbalaned
4.00	125,172.00	4.50	140,818.50	4.30	134,559.90	5.00	156,465.00	4.50	140,762.17	Unbalaned
9.00	281,637.00	10.80	337,964.40	10.50	328,576.50	10.50	328,576.50	11.75	367,545.67	Unbalaned
200.00	1,200.00	1,000.00	6,000.00	770:00	4,620.00	600.00	3,600.00	400.00	2,399.04	Unbalaned
	512,853.00		608,196.90		542,802.60		584,350.50		620,524.44	The Winner is
	1		4		2		3		6	
	468,917.54		554,899.36		492,191.69		531,759.44		564,986.32	
	1-Winner		4		2		3		6	

Figure 6.6: MS Excel results for case study #1(present worth calculations).

It is shown from the above figures that the original lowest bidder is still the lowest bidder and that means this is mathematical unbalanced bid case; the owner can award the contact to the lowest bidder tacking in consideration the necessary precautions regarding front loading of line item #1.

6.2 Case study No 2: development of Street #B1 in Al Fokhary Municipality

6.2.1 Project background

This case illustrates one of projects which executed at Gaza Strip in the 2012 through Municipal Development Program (MDP) the main Program of Municipal Lending and Development Fund (MDLF). The project concentrates in development of opening and expansion of street # B in Al Fokhary area. The project consists of earth works, sub base works, and land fencing works.

Bidding was conducted through the local shopping (NS) procedure specified in the World Bank Procurement Guidelines and was open to all local bidders.

Post qualification method was used in contractor selection, qualifications requirements were presented in the Biding Documents including technical, financial and legal requirements as details in the bidding documents.

The project quotation was distributed to number of local construction companies and the bid opening date was on 22/7/2012, the evaluation process continues until



22/8/2012 where the winner bidder was selected. (Table 6.3 shows the characteristics of project).

Project Name	Development of Street #B1
Description of Project	The project concentrate in opening and expansion of street #B1 in Al Fkhary area, the project consists of earth work, sub base works (Kurkar), and land fencing works.
Project Location	Al Fkhary Municipality
Target Population	In total, the project would serve 5000 people
District	Al Fkhary, South Gaza Strip
Allocated Budget (\$)	56,600.00 Euro
Planned Project Duration	60 days
Implemented Agency	MDLF
Owner	Municipality of Al Fkhary
Consultant	EMCC
Used Tender Documents	National shopping documents used in world bank for small works.

Table 6.3: Characteristics of Development of Street # B1 in Al Fkhary

6.2.2 Project history

Bidding stage

In this project five contractors have submitted tenders. Complete bidding documents were provided including general and private condition, technical specification, bill of quantity and drawings. Bidding process was continued for 14 days, passing through all steps; quotation distribution, site visit, per–bid meeting, tender submitting and tender opening meeting. The tenders were opened and financial offers were announced through open meeting attending by concerned parties' representative including the contractors.

Evaluation stage

The evaluation process consists of the following steps:

- 1. Preliminary examination process. The step included checking, by yes or No, the legibility, bid completeness and substantial responsiveness of the contractor.
- 2. Prices corrections.



3. Price review (check of summations for BOQ items).

Based on evaluation result, table 6.4 summarizes the final bid prices for contractor.

S.N	Bidder Name	Read out bid	Unconditional discount %	Corrected bid
1	А	33,200	0.0%	33,200
2	В	39,700	2.0%	38,906
3	С	55,700	11%	49,573
4	Е	53,800	0.0%	53,800
5	F	69,400	0.0%	69,400

Table 6.4: Characteristics of the participated bidders of case study No. 2

Awarding stage

The evaluation committee reviewed the submitted bidder's offers and concentrated on the lowest bidder A, the committee found that some of unit price item are considered as unreasonable especially for items related to earth works , leveling, and Kurkar works . The committee asked the lowest bidder to provide the municipality with breakdown analysis for unit rate prices. The company provided the committee with price breakdown analysis for the mentioned unit rate that considered being unreasonable with an appropriate justification. The evaluation committee accepted the company analysis and justification and considered the bidder (A) as the lowest evaluated responsive bidder.

6.2.3 Assessment

6.2.3.1 Used tender documents

The used procurement documents in the project were World Bank national shopping documents, the documents were inspected related to unbalanced bid documents, the bids evaluation clause wasn't include any statement or even word related to unbalanced bid.

6.2.3.2 Bids evaluation by MS Excel model

The following entry data were entered into MS Excel model:

• Line items,



- Contract quantities for every line item,
- Payment duration for every line item,
- Engineering cost estimate for every line item,
- Acceptable range for unite rate difference from the cost reference,
- Bidder's offers for every line item,
- Interest rate.

The program was run and the collected results were shown in the figure 6.7 & 6.8.

Company Name:	Al Fkha	ary Muincipal	ity						Calc	ulation Method	Rese	et Model	
Date:	29/4/2	013								Engineer Estimates			
Annual Interest R	ate0.00%										Calc	rulate	
# of Bidders:	5						1		0	Custom Average			
# of Items:	3								-	-	Cov	er Page	
											18 0		
Bid Item No	Qty	Modified Ob	lloit	Payment duration (month	eng estimate	% of price range	Lloper Limit	Lower Limit	Averana		A Discount	A Totals	
1	1	1	LS	1	7.900.00	15.00%	9.085.00	6.715.00	17.500.00	1.000.00	0.00%	1.000.00	
2	7000	7000	M2	2	1.60	15.00%	1.84	1.36	1.32	1.20	0.00%	8,400.00	
3	3400	3400	LIM	2	10.50	15.00%	12.08	8.93	6.92	7.00	0.00%	23,800.00	
										GT		33,200.0	
										Rank GT			
										PW		33,200.0	
										Rank By PW		1-Winner	

Figure 6.7: MS Excel results for case study #2

		U									
				5	-	1				Round1	
3	B Discount	B Totals	c	C Discount	CTotals	E	E Totals	F	F Totals	A	
11,500.00	2.00%	11,270.00	25,000.00	11.00%	22,250.00	16,000.00	16,000.00	298,000.00	298,000.00	Unbalaned	
	2.00%	5,145.00	0.50	11.00%	3,115.00	2:00	14,000.00	2.50	17,500.00	Unbalaned	
6.75	2.00%	22,491.00	8.00	11.00%	24,208.00	7.00	23,800.00	6.50	22,100.00	Unbalaned	
		38,906.	00		49,573.		53,800.00		337,600.00	The Winner is A	
			2			3		4	5		
		38,906.	00		49,573.	00	53,800.00		337,600.00		
			2			2		4	(E		

Figure 6.8: MS Excel results for case study #2

The program orders the bids from the lowest to the highest offer, Bidder A being the lowest offer, and highlighted the line items in Bidder A's offer whose prices are beyond the acceptable limits or substantially higher the cost estimate (named as unbalanced in Figure 6.8).The researcher checked the quantities involved in these line items and replaces the understated quantities with the modified quantities after further study to the project needs. The program recalculates the



bids of all bidders using the new quantities and orders them again from the lowest to the highest offer as shown in figure 6.9&6.10

]		- 6-1	. de Ven Medlend					
Company Name:	Al Fkha	ary Muincipal	ity					Calculation Method			Res	et Model			
Date:	29/4/2	013							۲	Engineer Estimates	ngineer Estimates				
Annual Interest R	nt 0.00%										Calc	rulate			12
# of Bidders:	5								0	Custom Average					
# of Items:	3										Cov	er Page			
Bid Item No	Qty	Modified Qty	Unit	Payment duration /month	eng estimate Euro	% of price range	Upper Limit	Lower Limit	Average	A	ADiscount	ATotals	в	B Discount	B Totals
1	1	1	LS	1	7,900.00	15.00%	9,085.00	6,715.00	17,500.00	1,000.00	0.00%	1,000.00	11,500.00	2.00%	11,270.00
	7000	26150	M2	2	1.60	15.00%	1.84	1.36	1.32	1.20	0.00%	31,380.00	0.75	2.00%	19,220.25
3	3400	3400	LM	2	10.50	15.00%	12.08	8.93	6.92	7.00	0.00%	23,800.00	6.75	2.00%	22,491.00
										GT		56,180.0	D		52,981.2
										Rank GT			2		1
										PW		56,180.00	D		52,981.2
										Rank By PW			2		1-Winner

Figure 1 Figure 6.9: MS Excel results for case study #2(quantities check)

									Round1	
c	C Discount	C Totals	E	E Discount	E Totals	F	F Discount	F Totals	в	
25,000.00	11.00%	22,250.00	16,000:00	0.00%	16,000.00	298,000.00	0.00%	298,000.00	Unbalaned	
0.50	11.00%	11,636.75	2.00	0.00%	52,300.00	.2.50	0.00%	65,375.00	Unbalaned	
8.00	11.00%	24,208.00	7.00	0.00%	23,800.00	6.50	0.00%	22,100.00	Unbalaned	
		58,094.75			92,100.00			385,475.00	The Winner is B	
		3			4			5		
		58,094.75			92,100.00			385,475.00		
		3			4			5		

Figure 6.10: MS Excel results for case study #2(quantities check)

It is shown from the above figures that the original lowest bidder is no longer the lowest bidder and that means this is materially unbalanced bid case; the owner can reject the offer of the original lowest bidder and award the contact to the second lowest bidder whose bidder became the lowest bidder based on the total of modified quantities.

6.3 Case study No 3: development of Al Rashid Street near Jabalia

6.3.1 Project background

This case illustrates one of projects which expected to be executing at Gaza Strip in the 2013.

The project will be funded by Islamic development Bank (IDB) through the Palestinian economic council for development and reconstruction (PECDAR). The project



concentrates in development of Al Rashid Road which regional road is connecting the north of Gaza strip to the Gaza city through the costal side the work will be near Jabalia municipality in length equal 1500 liner meter with width equal 42 m. The project activities include Tunnel works, road works, sewage works, storm water works, water supply works, traffic works and street lighting works.

Bidding was conducted through the local shopping procedure used in Palestinian Economic Council for Development and Reconstruction (PECDAR) and was open to all local bidders.

Post qualification method was used in contractor selection, Qualifications requirements were presented in the Biding Documents including technical, financial and legal requirements as details in the bidding documents.

The project was advertised in local newspaper on 13/3/2013 and the bid opening date was on 25/3/2013, the evaluation process continues until 25/4/2013 where the winner bidder was selected. (Table 6.5 shows the characteristics of project).

Project Name	Development of Al Rashid street near jabalia.						
Description of Project	The project concentrates in development of Al Rashid Road which regional road is connecting the north of Gaza strip to the Gaza city through the costal side, the work will be near Jabalia municipality in length equal 1500 liner meter and width equal 42 m. The project activities will include Tunnel works, road works, sewage works, storm water works, water supply works, traffic works and street lighting works.						
Project Location	Jabalia Municipality						
Target Population	In total, the project would serve more than 350000 people.						
District	Jabalia, North Gaza Strip.						
Allocated Budget (\$)	2,000.00 0 US\$						
PlannedProjectDuration	365 days.						
Implemented Agency	Palestinian Economic Council for Development and Reconstruction (PECDAR)						
Owner	Municipality of Jabalia						

 Table 6.5: Characteristics of Development Al Rashid Street near Jabalia



Consultant	EMCC
Used tender documents	PECDAR documents.

6.3.2 Project history

Bidding stage

In this project seven contractors have submitted tenders. Complete bidding documents were provided including general and private condition, technical specification, bill of quantity and drawings. Bidding process was continued for 12 days, passing through all steps; advertising, documents sale, site visit, per–bid meeting, tender submitting and tender opening meeting. The tenders were opened and financial offers were announced through open meeting attending by concerned parties' representative including the contractors.

Evaluation stage

The evaluation process consists of the following steps:

- 1. Preliminary examination process. The step included checking, by yes or No, the legibility, bid completeness and substantial responsiveness of the contractor.
- 2. Prices corrections.
- 3. Price review (check of summations for BOQ items).

Based on evaluation result, table 6.6 summarizes the final bid prices for contractor

SN	Ridder Name	Read out bid	Unconditional	Corrected bid		
D •11	Didder Maine	prices (US\$).	discount %	prices (US\$)		
1	А	2,306,467	0.0%	2,306,467		
2	В	2,310,000	0.0%	2,310,000		
3	С	2,344,000	0.0%	2,344,000		
4	D	2,369,815	0.0%	2,369,815		
5	Е	2,404,140	1.0%	2,380,337		
6	F	2,382,932	0.0%	2,382,932		
7	G	2,408,637	0.0%	2,408,637		

 Table 6.6: Characteristics of the participated bidders of case study No. 3



Awarding stage

The evaluation committee reviewed the submitted bidder's offers and it was shown that all the bidders' offers are higher than the allocated budget, the evaluation committee decided to reduce the original quantities after further study to the project needs, so the bidders prices were as shown in table 6.7:

Table 6.7: Characteristics of the participated bidders of case study No. 3 after quantities reduction

S.N	Bidder Name	Read out bid prices (US\$).	Unconditional discount %	Corrected bid prices (US\$)	Corrected bid prices (US\$)after quantities reduction
1	А	2,306,467	0.0%	2,306,467	1,999,994
2	В	2,310,000	0.0%	2,310,000	2,000,054
3	С	2,344,000	0.0%	2,344,000	2,023,390
4	D	2,369,815	0.0%	2,369,815	2,081,670
5	Е	2,404,140	1.0%	2,380,337	2,136,851
6	F	2,382,932	0.0%	2,382,932	2,060,662
7	G	2,408,637	0.0%	2,408,637	2,093,455



The committee asked the lowest bidder to provide it with breakdown analysis for unit rate prices. The company provided the committee with price breakdown analysis. The evaluation committee accepted the company analysis and justification and considered the bidder (A) as the lowest evaluated responsive bidder based on the total amount after quantities reduction.

6.3.3 Assessment

6.3.3.1 Used tender documents

The used procurement documents in the project were PECDAR national shopping documents, the documents were inspected related to unbalanced bid documents, the bids evaluation clause wasn't include any statement or even word related to unbalanced bid.

6.3.3.2 Bids evaluation by MS Excel model

The following entry data were entered into MS Excel model:

- Line items.
- Contract quantities for every line item.
- Modified quantities based on further study regarding the project needs and allocated budget.
- Payment duration for every line item.
- Engineering cost estimate for every line item.
- Acceptable range for unite rate difference from the cost reference.
- Bidder's offers for every line item.
- Interest rate.

The program was run and ordered the bids from the lowest to the highest offer, Bidder A being the lowest offer, the program highlighted the line items in Bidder A's offer whose prices are beyond the acceptable limits .It was cleared from the result that the original lowest bidder is still the lowest bidder, so the program checks for frontloading.



It is clear from the attached excel output file that numbers of line items prices are substantially higher than the engineer's estimate and whose performance is scheduled early in the project.

al Rashed.xlsm الرسالة الماجستير ...

al Rashed PW.xlsm الرسالة الماجستير ...

The program then calculates the present worth (PW) of all payments given the approximate schedule and an appropriate discount rate input by the analyst and orders the bids again based on the present worth of the offers as shown in table 6.8.*It is shown from the table that the original lowest bidder is no longer the lowest bidder and that means this is materially unbalanced bid case; the owner can reject the offer of the original lowest bidder and award the contact to the second lowest bidder whose bidder became the lowest bidder based on the total of modified quantities.*

S.N	Bidder Name	Read out bid prices (US\$). Original quantities	Rank based on Original Quantities	Corrected bid prices (US\$) after quantities reduction	Rank based on modified Quantities	Present worth (PW) Interest rate 8% per year	Rank based on (PW)of modified Quantities
1	А	2,306,467	1^{st}	1,999,994	1^{st}	1,921,583	2^{nd}
2	В	2,310,000	2^{nd}	2,000,054	2 nd	1,920,382	1 st
3	С	2,344,000	3 rd	2,023,390	3 rd	1,947,093	3 rd
4	D	2,369,815	4 th	2,081,670	5 th	2,002,582	5 th
5	Е	2,380,337	5 th	2,115,482	7 th	2,032,794	7 th
6	F	2,382,932	6 th	2,060,662	4 th	1,982,222	4 th
7	G	2,408,637	7 th	2,093,455	6 th	2,012,266	6 th

 Table 6.8: Present worth calculation of bidders prices of case study No3.

Case study No 4: development of Al Karama Street in Jabalia

6.4.1 Project background

This case illustrates one of projects which executed at Gaza Strip in the 2011-2012 through United Nation Development Program (UNDP) funded by German Development Bank (KFW). The project concentrates in development of Al Karama



Street in the west of jabalia city. The project consists of earth works, concrete for retaining walls, Road base works, storm water line works and asphalt works.

Bidding was conducted through the National Shopping (NS) procedure used in UNDP and was open to all local bidders.

Post qualification method was used in contractor selection, Qualifications requirements were presented in the Biding Documents including technical, financial and legal requirements as details in the bidding documents.

The project was advertised in local newspaper on 27/7/2011 and the bid opening date was on 11/8/2011, the evaluation process continues until 27/8/2012 where the winner bidder was selected. (Table 6.9 shows the characteristics of project).

Project Name	Development of Al Karama Street in Jabalia				
Description of Project	The project concentrates in development of Al Karama Street in the west of jabalia city. The project consists of earth works, concrete for retaining walls, Road base works, storm water line works and asphalt works				
Project Location	Al Karama, west of Jabalia				
Target Population	In total, the project would serve 100,000 people				
District Jabalia, North Gaza Strip					
Allocated Budget (\$)	330,000.00 Euro				
Planned Project Duration	8 months.				
Implemented Agency	United Nations Development Program (UNDP)				
Owner	Municipality of Jabalia				
Consultant	NA				
Used tender documents	National Shopping procurement documents used in UNDP				

Table 6.9: Characteristics of Development of Al Karama Street in Jabalia



6.4.2 Project history

Bidding stage

In this project five contractors have submitted tenders. Complete bidding documents were provided including general and private condition, technical specification, bill of quantity and drawings. Bidding process was continued for 14 days, passing through all steps; advertising, bid sell, site visit, per–bid meeting, tender submitting and tender opening meeting. The tenders were opened and financial offers were announced through open meeting attending by concerned parties' representative including the contractors.

Evaluation stage

The evaluation process consists of the following steps:

- 1. Preliminary examination process. The step included checking, by yes or No, the legibility, submitting bid security, bid completeness and substantial responsiveness of the contractor.
- 2. Prices corrections.
- 3. Price review (check of summations for BOQ items).

Based on evaluation result, table 6.10 summarizes the final bid prices for contractor.

101 01	ur ucter istics of the	in here stadels of cube study 1100 1								
S.N	Bidder Name	Read out bid prices (Euro).	Unconditional discount %	Corrected bid prices (Euro)						
1	А	330,110	0.0%	330,110						
2	В	397,405	1.0%	393,430						
4	С	340,240	0.0%	340,240						
5	D	354,340	0.0%	354,340						
6	Е	340,095	0.0%	340,095						

Table 6.10: Characteristics of the participated bidders of case study No. 4

Awarding stage

The evaluation committee reviewed the submitted bidder's offers and concentrated on the lowest bidder A, the committee found that some of unit price item are considered as unreasonable (some of them are under estimated such as items number R2, R4, R7 and



others are higher than the cost estimate such as items numbers R5, SD2, SD3 and SD4. The committee asked the lowest bidder to provide the municipality with breakdown analysis for unit rate prices. The company provided the committee with price breakdown analysis for the mentioned unit rate that considered being unreasonable with an appropriate justification. The evaluation committee accepted the company analysis and justification and considered the bidder (A) as the lowest evaluated responsive bidder.

6.4.3 Assessment

6.4.3.1 Used tender documents.

The used procurement documents in the project were especial national bidding documents used in UNDP ,the documents were inspected related to unbalanced bid documents ,the evaluation clause in bidding documents was included the following paragraphs .

"The Contractor shall not download the price of any item on the price of any other item that contained in the bills of quantities".

"The contractor shall submit the analysis of prices for any or all of the items within 48 hours when form engineer request". (UNDP/PAPP/KFW Projects / phase V/ particular conditions)

The following points were shown from the above paragraph:

- There is no specific definition or identification of unbalanced bid in the tender documents.
- There is no appointed reference of unit price estimate to be used in prices comparison; also there are no acceptable limits for the definition of unbalanced unit price.
- There is no method or procedure in the tender documents to determine if the bid is balanced or not.
- The documents deal only with the case of download the price of any item on the price of any other item which may be include the frontloading Case .
- There is no legal framework in the tender documents to deal with unbalanced bids.



6.4.3.2 Bids evaluation by MS Excel model.

The following entry data were entered into MS Excel model:

- Line items,
- Contract quantities for every line item,
- Payment duration for every line item,
- Engineering cost estimate for every line item,
- Acceptable range for unite rate difference from the cost reference,
- Bidder's offers for every line item,
- Interest rate.

The program was run and the collected results were shown in the figure 6.11 &6.12.



Figure 6.11: MS Excel results for case study #4



Figure 6.12: MS Excel results for case study #4

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The program orders the bids from the lowest to the highest offer, Bidder A being the lowest offer, and highlighted the line items in Bidder A's offer whose prices are beyond the acceptable limits or higher than the engineer's cost estimate (named as unbalanced in Figure 6.12). The researcher checked the quantities involved in these line items and replaces the understated quantities with the actual quantities according to further study of the project needs. It is clear that line items numbers R5, R6, SD2, and SD3 and SD4 are substantially higher than the engineer's estimate and whose performance is scheduled early in the project. The program then calculates the present worth (PW) of all payments given the approximate schedule and an appropriate discount rate input by the analyst and orders the bids again based on the present worth of the offers as shown in figures 6.13 & 6.14.

Agancy Name:	Jabalia	abalia Al Nazla Municipality- developing of Al K arama Street				Calcu	ation Method 🛛		Reset Model						
Date:	8/5/20	13								nainear Entimator	_				
Annual Interest Rat	e: 8.00%									ngneer Estimates	C	alculate			12
# of Bidders:	5								00	ustom Average					
# of Items:	12											Cover Page			
Bid Item No	Qty	Modified Qty	Unit	Paymnet duration	Eng.estimate US\$	% of price range	Upper Limit	Lower Limit	Average	A	A Discount	A Totals	в	B Discount	B Totals
RI	6000	5313	M2	5	1.00	15.00%	1.15	0.85	1.85	0.85	0.00%	4,516.05	2:50	1.00%	13,149.68
R2	1900	1682	M2	5	12.00	15.00%	13.80	10.20	13.20	10.00	0.00%	16,820.00	16.00	1.00%	26,642.88
R3	4100	3630	M2	5	5.00	15.00%	5.75	4.25	5.63	5.30	0.00%	19,239.00	8.30	1.00%	29,827.71
R4	3000	2656	M2	5	3.00	15.00%	3.45	2.55	1.83	1.50	0.00%	3,984.00	2.50	1.00%	6,573.60
R5	2580	2288	LM	4	13.00	15.00%	14.95	11.05	18.67	18.00	0.00%	41,184.00	20.00	1.00%	45,302.40
R6	10	9	M3	3	150.00	15.00%	172.50	127.50	241.67		0.00%	1,755.00	185.00	1.00%	1,648.35
R7	20	19	M3	3	250.00	15.00%	287.50	212.50	245.67	200.00	0.00%	3,800.00	185.00	1.00%	3,479.85
RS	9000	7950	M2	6	16.00	15.00%	18.40	13.60	17.53	17.80	0.00%	141,510.00	19.60	1.00%	154,261.80
SD1	850	850	LM	2	50	15.00%	57.5	42.5	62.333333	53.00	0.00%	45,050.00	68.00	1.00%	57,222.00
SD2	50	50	LM	2	30	15.00%	34.5	25.5	55	41.00	0.00%	2,050.00	63.00	1.00%	3,118.50
SD3	19	19	NO	2	570	15.00%	655.5	484.5	742.33333	850.00	0.00%	16,150.00	765.00	1.00%	14,389.65
SD4	4	4	NO	6	700	15.00%	805	595	730	985.00	0.00%	3,940.00	360.00	1.00%	1,425.60
										GT		299,998.05			357,042.02
										Rank GT		1			5
										PW		290,832.59			346,191.57
										Rank By PW		1-Winner			5

Figure 6.13: MS Excel results for case study #1(present worth calculations based on modified quantities).


									Round1
с	C Discount	C Totals	D	D Discount	D Totals	E	E Discount	E Totals	A
1.30	0.00%	6,906.90	2.00	0.00%	10,626.00	2.25	0.00%	11,954.25	Balanced
13.40	0.00%	22,538.80	12.00	0.00%	20,184.00	14.20	0.00%	23,884.40	Unbalaned
5.60	0.00%	20,328.00	5.00	0.00%	18,150.00	6.00	0.00%	21,780.00	Balanced
1.00	0.00%	2,656.00	2.00	0.00%	5,312.00	2.00	0.00%	5,312.00	Unbalaned
20.40	0.00%	46,675.20	18.00	0.00%	41,184.00	18.00	0.00%	41,184.00	Unbalaned
328.50	0.00%	2,956.50	250.00	0.00%	2,250.00	280.00	0.00%	2,520.00	Unbalaned
267.00	0.00%	5,073.00	270.00	0.00%	5,130.00	300.00	0.00%	5,700.00	Unbalaned
16.80	0.00%	133,560.00	18.00	0.00%	143,100.00	15.80	0.00%	125,610.00	Balanced
61.00	0.00%	51,850.00	70.00	0.00%	59,500.00	58.00	0.00%	49,300.00	Balanced
49.00	0.00%	2,450.00	60.00	0.00%	3,000.00	56.00	0.00%	2,800.00	Unbalaned
637.00	0.00%	12,103.00	600.00	0.00%	11,400.00	825.00	0.00%	15,675.00	Unbalaned
540.00	0.00%	2,160.00	700.00	0.00%	2,800.00	950.00	0.00%	3,800.00	Unbalaned
		309,257.40			322,636.00			309,519.65	The Winner is A
		2			4			3	
		299,980.54			312,958.95			300,268.42	
		2						2	

Figure 6.13: MS Excel results for case study #1(present worth calculations based on modified quantities).



6.5 Chapter Summary

It is shown from the above figures that the original lowest bidder is still the lowest bidder and that means this is mathematical unbalanced bid case; the owner can award the contact to the lowest bidder without any future financial risk on the owner.

Through this chapter the bidding documents for a number of construction projects implemented in the Gaza Strip have been studied, it was taking into account that these projects will be diverse in terms of the project budget, project donor, and project scope.

Bidding documents for these projects have been studied related to unbalanced bids issues and then the bids of these projects were analyzed and evaluated using the MS Excel Model (UBDM).

Through the study of these cases the following were found:

- The clear weakness in the tender documents for the cases that have been studied related to unbalanced bidding in terms of the definition, analysis, evaluation and legal framework to deal with these cases.
- MS Excel provides a tool for analysis and evaluation of the bid offers in easy and fast way. It enables the procurement experts to use all the necessary information they have about the bids, as well as their knowledge and expertise and incorporate them to evaluate the bids and detection of the unbalanced one.
- The MS Excel Model (UBDM) was used to evaluate and analysis of the submitted bidding in all the mentioned case studies, using the actual data collected from the projects owners. The result was satisfied and the model enables the researcher to evaluate analysis and discover the unbalanced bids in all of the case study.
- The MS Excel Model discover the mathematically and materially unbalanced bid in all case study and this will give the owner the opportunity to reject the materially unbalanced bid and to take the suitable action towards the mathematically unbalanced bid.



CHAPTER SEVEN: CONCLUSION AND RECOMMENDATIONS

7.1 Introduction

This chapter introduces the research conclusion and recommendations for the expertise who are involved in the construction process especially the procurement expertise and contracts mangers to improve the local practices in procurement and contacts management process in construction projects in Gaza Strip especially related to detection and prevention of unbalanced bids. Recommendations for further studies are also included.

7.2 Conclusion

- There is no clear and definite definition of unbalanced bidding but in general the experts defined the unbalanced bid as "The contractor raise the unit prices of some items and lowers it in another items in order to obtain liquidity in the early stage of the project or to increase profit, or both".
- 2. Two types of unbalanced bid are common in Gaza Strip construction industry :
- Unit frontloading
- Raising the unit prices of some items expected to increase during the project implementation and vice versa.
- 3. Three main reasons for the occurrence of unbalanced bids case as follows:
- Two reasons related to contractors behavior:
 Contractor's desire to increase his profit margins.
 Contractor's desire to obtain liquidity at the beginning of the project.



- One reason related to the owner is erroneous in the preparation of tender documents that allowing the contractor to exploit the conflict between various tender documents and the project actually needs to provide unbalanced bids.
- 4. The research shows that there was no method or written procedure for bids analysis in order to evaluate the bids if it balanced / unbalanced bid, but the usual procedure is to ask the contractors to provide the evaluation committee with unit prices breakdown analysis for evaluation purposes and to be compared with specific reference prices in order to know if the prices are reasonable or not.
- 5. The majority of local construction institution tend to use the prices estimated cost prepared by owner's engineers as reference for prices comparison during the bids evaluation stage.
- 6. There are no particular clauses in the tender documents regards the definition and identification of unbalanced bids or any clause related to detection and dealing with unbalanced bid.
- 7. There was no systematic way or intense, clear and specific action to be taken in the initial stages of the project in order to prevent the Future occurrence of unbalanced bids but the founded was individual interpretations.
- 8. Method depended on the comparison of lowest bidder unit price with reference unit prices was developed to analysis and evaluate the bids in order to see if it balanced or unbalanced and this method is used in several global previous studies and many construction institutions used similar method in bids analysis and evaluation which enrich and represent strength point of the research.
- 9. The acceptable difference between the lowest bid unit price and the proposed unit price reference was +/-15% for front load and +/-25% for the change of quantity for specific item during the implementation stage. The remaining criteria are shown in table 4.2.



- 10. Ms. excel program was used to develop model for analysis and evaluation of the bids in order to show if it balanced or unbalanced bids, the model are completely automated by MS Excel which is easy operated program and almost all the experts work in the procurement and construction managements are familiar with Excel environment.
- 11. The MS Excel Model (UBDM) was used to evaluate and analysis of the submitted bidding in all the mentioned case studies, using the actual data collected from the projects owners. The result was satisfied and the model enables the researcher to evaluate analysis and discover the unbalanced bids in all of the case study.
- 12. The MS Excel Model discover the mathematically and materially unbalanced bid in all case study and this will give the owner the opportunity to reject the materially unbalanced bid and to take the suitable action towards the mathematically unbalanced bid .

7.3 Recommendations to the parties involved in bids analysis and evaluation

- The institutions working in the field of construction industry in the Gaza Strip which evaluate and analyze the bids should need to define clearly and specifically the unbalanced bid case through special clause in the tender documents.
- The owner to set limitation for unbalanced bid consideration.
- Determine the legal status of unbalanced bids and how to deal with the contractor who submitted unbalanced bid.
- The capacity of project's owner to prepare tender documents integrated and compatible with the needs of the project is the basic guarantee for the inability of companies to submit unbalanced bid.



- Considering the unbalanced bid practice as unethical and take it into consideration during the classification or qualification companies for future projects.
- The owner institution is recommended to keep bid price and final cost data in a database for future reference in tracking over- run and under- run trends in every bid item.

7.4 Recommendation for future researchers

- Developing guidelines for the acceptable difference between the engineer's estimate and any other selected cost reference and the price proposed by the bidder for any line item.
- Developing appropriate relationship between the line item amount and allowable difference from the proposed prices reference.



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Annexes



Annex 1: proposed clauses regards unbalanced bid to be insert in procurement documents

The following paragraph may be inserting in tender documents as part of unbalanced bid clause (definition & identification of unbalanced bid):

"The bid submitted by one of the participants bidders is considered to be unbalanced bid if the bidder has raised the prices of front items in the bill of quantities and reduced the prices the items by specific ratio from the reference prices that are used in prices comparison or increase the prices of the quantities expected to increase during the project implementation , and vice versa."

"يعتبر العطاء المقدم من احد المشاركين غير متوازن اذا قام مقدم العطاء بزيادة اسعار البنود المتقدمة في جدول الكميات وبالمقابل تخفيض اسعار البنود المتاخرة بنسبة محددة عن اسعار المرجعية التي يتم المقارنة من خلالها او زيادة اسعار الكميات المتوقع زيادتها وبالعكس".

The following proposed written procedure can be used in unbalanced bid evaluation and analysis.

• Unit bid price data for specific items of work is first compared against the corresponding engineer's estimate or any other cost estimate reference such as average bidder prices or prices monitoring.

• For projects identified in step one, the unit price bid for each item is compared to the estimated unit price on the engineer's estimate or other proposed cost estimate reference. For those items that vary from the estimate outside a specific range, a further evaluation is made. The proposed accepted range is 15% above or 15% below the estimate (the proposed cost estimate reference) for the evaluated item.



• For items identified in step 2, the estimated quantity is verified. If the quantity is found in error, the unit bid price is extended with the quantity to determine if it changes who is low bidder. If the low bidder is not affected, the contract may be awarded. If the low bidder is affected, we can go to the second lowest bidder.

• If quantities are found to be accurate, the bid may be either mathematically unbalanced or materially unbalanced. To determine whether a bid is mathematically or materially unbalanced, present value depending on payment schedule and bank interest rate will be calculated to all bidders. If the arrangement of the bidders is changed and the lowest bidder didn't still the lowest bidder, this mean that we can consider it as materially unbalanced bid and go toward the second lowest bidder, we will continue in the process until we select suitable bidder or may be reject all bidders.

The following statement can be added in the tender documents as part of unbalanced bid clause (legal framework for unbalanced bid).

"Unbalanced bid offer is considered as legal reason to disqualify technically and exclude the bidder, even if it was the lowest bidder prices)"

"يعتبر قيام المقاول بتقديم عطاء غير متوازن سببا في اعتبارة غير مؤهل فنيا للمشاركة في العطاء ويتم استبعادة حتي لو كان اقل الاسعار المشاركة في العطاء"



Annex 2 the collected answer for each expert related to structured interview questions.





Q #						Experts	s replies				
Q#	Question	Ahmed Mokbel	Salem El whadie	Ziad Korraz	Wael Salah	Safaa Al rabeii	Adel Al Qazaz	Zhair mdoekh	Mohamed Attea	Mahmoud Al halbi	Ahmed Zaid
Part 2	: Analysis of unb	alanced biddin	g.								
1	Is there any written procedure for unbalanced bid analysis to evaluate it as balanced or unbalanced bid?	No any written method or procedure to analyze the bids for conclusion if the bid is balanced or not.	No any written method or procedure to analyze the bids for conclusion if the bid is balanced or not.	No any written method or procedure to analyze the bids for conclusion if the bid is balanced or not.	A method to analyze the bids which is (the bid evaluation mechanism that stated in bidding documents)	No any written method or procedure to analyze the bids for conclusion if the bid is balanced or not.	No any written method or procedure to analyze the bids for conclusion if the bid is balanced or not.	No any written method or procedure to analyze the bids for conclusion if the bid is balanced or not.	No any written method or procedure to analyze the bids for conclusion if the bid is balanced or not.	No any written method or procedure to analyze the bids for conclusion if the bid is balanced or not.	No any written method or procedure to analyze the bids for conclusion if the bid is balanced or not.
2	If there was a way or a written procedure for the analysis of unbalanced bids to know if the bid is balanced or unbalanced, what is this method or procedure?	In usual the evaluation committee asked the lowest bidder to provide them with prices breakdown for items unit rates.	In usual the evaluation committee asked the lowest bidder to provide them with prices breakdown for items unit rates.	In usual the evaluation committee asked the lowest bidder to provide them with prices breakdown for items unit rates.	According to this mechanism the contractors will be asked to provide the evaluation committee with prices breakdown analysis for conclusion if the bids are balanced or not.	In usual the evaluation committee asked the lowest bidder to provide them with prices breakdown for items unit rates.	In usual the evaluation committee asked the lowest bidder to provide them with prices breakdown for items unit rates.	In usual the evaluation committee asked the lowest bidder to provide them with prices breakdown for items unit rates.	In usual the evaluation committee asked the lowest bidder to provide them with prices breakdown for items unit rates.	In usual the evaluation committee asked the lowest bidder to provide them with prices breakdown for items unit rates.	In usual the evaluation committee asked the lowest bidder to provide them with prices breakdown for items unit rates.

						Experts	s replies				
Q #	Question	Ahmed Mokbel	Salem El whadie	Ziad Korraz	Wael Salah	Safaa Al rabeii	Adel Al Qazaz	Zhair mdoekh	Mohamed Attea	Mahmoud Al halbi	Ahmed Zaid
3	what is the reference unit prices that be used to compare it with contractors bids prices during the bid evaluation and analysis phase?	estimates costs prepared by the engineers owner, but in case that the project budget more than a million dollars, the	estimates costs prepared by the engineers owner.	estimates costs prepared by the engineers owner.	estimates costs depending on the previous bids prices and updated periodically which called prices monitoring	estimates costs prepared by the engineers owner.	estimates costs prepared by the engineers owner.	rhe prices estimates costs prepared by the owner's engineers, supported by the bidder average prices after omitting the upper and lower prices	estimates costs prepared by the owner's engineers.	estimates costs prepared by the owner's engineers.	rine prices estimates costs depending on the previous bids prices and updated periodically which called prices
		appoint consultant to prepare the cost estimate.			sheet						sheet



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	Which of the	Average	Price	Prices	Prices	Price	Prices	Price	Prices	The average	Price
	following prices	bidders prices	monitoring	estimated costs	estimated	monitoring	estimated costs	monitoring	estimates	of the three	monitoring
	reference you	after omitting	sheets	prepared by	costs	sheets	prepared by	sheets	costs prepared	bidders	sheets
	prefer to	the upper and	(prepared	owner's	prepared by	(prepared	owner's	(prepared	by the	followed by	(prepared
	compare bidder	lower prices	according to	engineers	owner's	according to	engineers.	according to	owner's	the lowest	according to
	unit prices with		previous	supported by	engineers.	previous		previous	engineers.	bidder	previous
	it?		similar bids	the average of		similar bids		similar bids			similar bids
4			and updated	all bidders		and updated		and updated			and updated
-			periodically)	prices.		periodically)		periodically)			periodically)

0#	Question					Experts	replies				
Q#	Question	Ahmed	Salem El	Ziad Korraz	Wael Salah	Safaa Al	Adel Al	Zhair	Mohamed	Mahmoud	Ahmed
		Mokbel	whadie		Waei Balan	rabeii	Qazaz	mdoekh	Attea	Al halbi	Zaid
Part 3	/ detection of un	balanced bids.									
	Are there any	Only noted in	Only noted	No clauses in	The following	Only noted in	No special	No clauses in	There is a	I think that in	No clauses in
	specific items in	the tender	in the tender	tender	statement is	the tender	clauses, but this	tender	clause in the	the World	tender
	tender	documents and	documents	documents	written (prices	documents and	generally	documents	Islamic	Bank	documents
	documents	records of the	and records	regard the	subject to	records of the	understood	regard the	Development	documents	regard the
	regarding the	preliminary	of the	definition and	study and	preliminary	through the	definition and	bank's tender	may be	definition and
1	definition and	meeting to	preliminary	identification of	evaluation	meeting to	evaluation of	identification	documents	clauses	identification
I	identification of	warn the	meeting to	unbalanced	under the	warn the	the bids.	of unbalanced	related to the	related to the	of unbalanced
	unbalanced	contractor from	warn the	bids	tender	contractor		bids	rejection of	definition and	bids
	bids?	download	contractor		conditions)	from download			unbalanced	identification	
		items on other	from			items on other				of unbalanced	
		items and	download			items and				bids.	
		stress that this	items on			stress that this					



		1 1 .	.1 .			1 1 '		1			
		behavior may	other items			behavior may					
		be a reason to	and stress			be a reason to					
		disqualify the	that this			disqualify the					
		contractor	behavior may			contractor					
			he a reason								
			to disqualify								
			to uisquality								
			the								
			contractor								
	If there are	*No specific	* +/-10	* +/-15	No specific	No specific	FL +-20%	Not less than	* +/-15	*No specific	* +/-25
	clauses in the	ratios in	*+/-10	*+/-15	ratios in	ratio for FL or	BL NA	the total price	*+/-15	ratios in	*+/-25
	tender	institution	*+/-25	*+/-25	institution	BL.	IRL +/-25%	of materials	*+/-25	institution	*+/-25
	documents	Documents.			Documents.	For IRL +/25%		and		Documents.	
	regarding the	Documentor			2000000000			workmanshin		For FL or BL	
	definition and							and not more		TOT TE OF DE	
								and not more $150/$ for		·	
•	identification of							than 15% for		FOR IKL +/-	
2	unbalanced							FL.		25%.	
	bidding, what							BI NA			
	are the							IRL +/-25%			
	allowable upper										
	and lower limits										
	compared with										
	prices reference										
	proposed in the										

0#	Question					Experts	s replies				
Q#	Question	Ahmed Mokbel	Salem El whadie	Ziad Korraz	Wael Salah	Safaa Al rabeii	Adel Al Qazaz	Zhair mdoekh	Mohamed Attea	Mahmoud Al halbi	Ahmed Zaid
	following cases?										
	Front load										
	 Back load 										
	Individual rate										
	load										
	Have you ever	One bid was	One bid	Never been	In one case	In one case	No. of Bids	One bid was	No. of Bids	Never been	No. of Bids
2	been declared	declared	was	declared that	all the bids	all the bids	had	declared	had	declared that	had
3	that one bid is	materially	declared	the bid is	were rejected	were rejected	previously	materially	previously	the bid is	previously
	materially	unbalanced	materially	materially	and the	and the	been rejected	unbalanced	been rejected	materially	been



unbalanced,	and the	unbalanced	unbalanced.	project	project re	be	ecause	the	and the	from	IDB	unbalanced.	rejected
and what is the	contractor	and the		readvertises.	advertises.	pr	rices	were	contractor	because	it		because the
procedure in	was asked to	contractor				ur	nreason	able	was asked to	was			prices were
this case, the	fix the total	was asked				ar	nd		fix the total	unbalanc	ed.		unreasonabl
rejection of the	price of the	to fix the				in	nconsist	ent	price of the				e.
bid or	offer and	total price				W	ith pre	pared	offer and				
rebalancing it?	rebalance the	of the offer				cc	ost estin	nate	rebalance the				
	bid which	and							bid which				
	was called	rebalance							was called				
	(prices	the bid							(prices				
	normalization	which was							normalization				
), now this	called), now this				
	procedure is	(prices							procedure is				
	considered	normalizati							considered				
	illegal and the	on), now							illegal and the				
	used	this							used				
	procedure is	procedure is							procedure is				
	to reject the	considered							to reject the				
	unbalanced	illegal and							unbalanced				
	bid.	the used							bid.				
		procedure is											
		to reject the											
		unbalanced											
		bid.											

0 "						Experts	s replies				
Q#	Question	Ahmed Mokbel	Salem El whadie	Ziad Korraz	Wael Salah	Safaa Al rabeii	Adel Al Qazaz	Zhair mdoekh	Mohamed Attea	Mahmoud Al halbi	Ahmed Zaid
4	Are there any specific precautions taken in the preliminary stages of the project to prevent the existence of unbalanced bidding in the future?	Consistency of the projects quantities, drawings and specifications. Accurate review of the procurement documents. Putting clause in tender documents related to definition and detection of unbalanced bid	Consistency of the projects quantities, drawings and specification s. Accurate review of the procurement documents. Putting clause in tender documents related to definition and detection of unbalanced bid	Consistency of the projects quantities, drawings and specifications. Accurate review of the procurement documents. Putting clause in tender documents related to definition and detection of unbalanced bid	Accurate study and preparation of procurement documents of the mentioned project before the project tendering	Consistency of the projects quantities, drawings and specifications. Accurate review of the procurement documents. Putting clause in tender documents related to definition and detection of unbalanced bid	Accurate study and preparation of procurement documents of the mentioned project before the project tendering	Consistency of the projects quantities, drawings and specifications. Accurate review of the procurement documents. Putting clause in tender documents related to definition and detection of unbalanced bid	Consistency of the projects quantities, drawings and specifications. Accurate review of the procurement documents. Putting clause in tender documents related to definition and detection of unbalanced bid	Consistency of the projects quantities, drawings and specifications Accurate review of the procurement documents. Putting clause in tender documents related to definition and detection of unbalanced bid	Consistency of the projects quantities, drawings and specification s. Accurate review of the procurement documents. Putting clause in tender documents related to definition and detection of unbalanced bid
Part f	our / the criteria	of unbalanced	bid evaluation	n (unit prices co	mparison to sl	now if the price	es is unbalanced	l or balanced).			
1	In your opinion, what are the suitable minimum and maximum allowable difference between contractor's unit	+/-25%	+/-10%	+/-15%	+/- (10-15%)	No specific ratio	+/-20%	Not less than the total price of materials and workmanship and not more than 15%.	+/-15%	+/-15%	+/-15%



prices and the					
average of all					
bidders' prices of					
the same unit?					

Q #	Orregtion					Experts	s replies				
Q#	Question	Ahmed Mokbel	Salem El whadie	Ziad Korraz	Wael Salah	Safaa Al rabeii	Adel Al Qazaz	Zhair mdoekh	Mohamed Attea	Mahmoud Al halbi	Ahmed Zaid
2	In your opinion, what are the suitable minimum and maximum allowable difference between contractor's unit prices and the cost estimate prepared by the owners' engineers for the same unit line?	+/-25%	+/-10%	+/-15%	+/- (10-15%)	+/-15%	-20% to +10%	Not less than the total price of materials and workmanship and not more than 15%.	+/-15%	+/-15%	+/-15%
3	In your opinion, what are the suitable minimum and maximum allowable difference between contractor's unit prices and the price monitoring	+/-25%	+/-10%	+/-15%	+/- (10-15%)	No specific ratio	-20% to +10%	Not less than the total price of materials and workmanship and not more than 15%.	+/-15%	+/-15%	+/-15%

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	sheets(pricesbasedonpreviouspricesfromsimilarprojectsandupdatedperiodically)?										
0,#	Orrestian					Experts	s replies				
Q#	Question	Ahmed Mokbel	Salem El whadie	Ziad Korraz	Wael Salah	Safaa Al rabeii	Adel Al Qazaz	Zhair mdoekh	Mohamed Attea	Mahmoud Al halbi	Ahmed Zaid
4	In your opinion what is the allowable percentage to decrease or increase the amount of one of the items during the implementation of the project without modifying the unit price?	No specific ratio	No specific ratio	+/-25%	+/-20%	+/-25%	+/-25%	+/-25%	+/-15%	+/-25%	+/-25%
5	In your opinion what is the suitable definition of early schedule Activity?	The activity that will be implemented at the beginning of the project and be located on the critical path.	The activity that will be implemente d at the beginning of the project and be located on the critical path.	The activity that will be implemented at the beginning of the project and be located on the critical path.	The activity that will be implemented at the beginning of the project and be located on the critical path.	The activity that will be implemented at the beginning of the project and be located on the critical path.	The activity that will be implemented at the beginning of the project and be located on the critical path.	The activity that will be implemented at the beginning of the project and be located on the critical path.	The activity that will be implemented at the beginning of the project and be located on the critical path.	The activity that will be implemented at the beginning of the project and be located on the critical path.	The activity that will be implemented at the beginning of the project and be located on the critical path.
6	What is the appropriate	3-5%	7-8%	7-8%	NA	NA	NA	6-7%	7-8%	7-8%	7-8%

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interest rate to be used in net present value (NPV) calculations?					



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