STUDY OF PERFORMANCE AND IMPLICATIONS OF LOWEST BIDDING BID AWARDING SYSTEM IN PAKISTAN

A thesis submitted in partial fulfillment of

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This is to certify that the

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STUDY OF PERFORMANCE AND IMPLICATIONS OF LOWEST BIDDING BID AWARDING SYSTEM IN PAKISTAN

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Has been accepted towards the partial fulfillment

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DEDICATED

TO

MY PARENTS

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ABSTRACT

Construction industry participants have started recognizing that accepting the least price bid does not guarantee maximum value. Achieving a value-based procurement approach is a challenge, particularly for the Pakistani public sector clients, who are limited in their ability to evaluate the competitive bids based solely on the lowest-bid award system. In the current economic climate, it is increasingly likely that construction organizations will submit abnormally low tenders to win new work. Persisting problems of inferior quality of constructed facilities, high incidence of claims and litigation, and frequent cost and schedule overruns have become the main features of Pakistan's public construction works contracts.

This research was undertaken to assess the performance of public owned construction projects awarded on a lowest bidder bid awarding system. Also, the objective was to seek construction professionals' opinions about the traditional bidding procedure and other alternative systems for evaluation of bids and awarding contracts. An extensive literature search was carried out to identify different practices and a questionnaire survey was conducted among the different groups that make up the construction industry in Pakistan. Five alternate bid evaluation and contract award methods are discussed and presented in this research. Few of these methods are in use in some countries and others are emerging. Related regulations of Federal Government of Pakistan are reviewed to develop understanding for the current research.

A questionnaire survey was conducted to investigate weaknesses, performance, opportunities and implications of the public owned construction projects awarded on the basis of lowest bid system in Pakistan. Additionally, the questionnaire was meant to investigate existing bid selection and awarding system and to provide a comparative study of different alternative bidding systems in construction. Initially, a draft questionnaire was prepared and a pilot survey was conducted. In pilot study, 12 questionnaires were completed and 5 construction professionals were interviewed. The items included in the questionnaire were finalized on the basis of these interviews and surveyed questionnaires. In first part of the questionnaire, it was supposed to measure the performance of the lowest bidder and gather opinion of the construction experts about the lowest bid system. In second part, five alternate methods of bidding namely, (1) competitive average bidding, (2) multi parameter bidding, (3) competitive negotiated bidding, (4) non competitive negotiated bidding, and (5) A+B i.e. Time + Cost methods were selected for comparison with the lowest bidding method. For this

comparison study, 10 parameters including time, cost, quality, claims, disputes, relations among stakeholders, repair and maintenance cost, life cycle cost, collusion/bid shopping and associated risks were incorporated into the questionnaire.. The final questionnaire was distributed online as well as through visits to contractors, clients and consultants. Additionally, 12 interviews were conducted with clients, consultants and contractors. In total 200 questionnaires were distributed. The data were collected and 112 valid questionnaires were analyzed by using MS Excel, PH stat, SPSS-20 and Sigma XL.

The results indicate that lowest bidder contract award procedure is the main method when 83% of public contracts fall in this category. Only in rare situations other methods of bidding are followed in Pakistan. Results further indicate that competitive lowest bid method was criticized by the respondents for its negative impact on disputes, claims, coordination, quality control, delays, escalated cost and safety issues. Over 90% of construction professionals perceived that contracts should not be given to the lowest bidder when awarding contracts to non-lowest bidder may improve quality and reduce construction time. Additionally, other alternative bidding procedures included in the study were appreciated by respondents for their positive effects on attributes such as quality, time, better relations between stakeholders, and lower maintenance costs. The study concludes that 70% of the respondents consider the multi-parameter bidding method is to be more effective than lowest bidding method and ranked this method as best amongst all six selected methods. Insights and discussions are given in the analysis. Finally, this work will provide valuable information to clients, consultants and contractors and other stakeholders who desire to improve bidding methods in construction in Pakistan.

LIST OF ABBREVIATIONS

GoP	Government of Pakistan
SBP	State Bank of Pakistan
PEC	Pakistan Engineering Council
USA	United States of America
UK	United Kingdom
ILO	International labour organization
OSHA	Occupational Safety and Health Administration
OHS	Occupational Health and Safety
SH&E	Safety, Health and Environmental
CIWCE	Centre for Improvement of working Conditions and Environment
SPSS	Statistical Package for Social Sciences
ANOVA	Analysis of Variance
RII	Relative Importance Index
SPI	Safety Performance Index
CI	Construction Industry
PPRA	Public Procurement Regulatory Authority

CHAPTER 1

INTRODUCTION

1.1 Back Ground of the Thesis

The construction industry is one of the major sectors which involve substantial financial and human resources. Design and construction play a vital role in the national economy, including the development of residential housing, office, commercial and retail buildings, as well as industrial plants, and the replacement, maintenance, and restoration of the nation's infrastructure and other public facilities. Bid and Procurement issues are widely related to the construction industry and its participants so that striving to improve the procurement of construction by the public sector in particular is in the best interest of both the community and the construction industry.

Currently, the public sector procurement of construction is largely based on the lowest bid award system. The customary practice of awarding contracts to a lowest bidder was established to ensure the least cost for completing a project. In public construction works, this practice is almost universally accepted since it not only ensures a low price but also provides a way to avoid fraud and corruption (Irtishad., 1993). While the low-bid procurement system has a long-standing legal precedence and has promoted open competition and a fair playing field, a long-standing concern expressed by owners and some of their industry partners is that a system based strictly on the lowest price provides contractors with an incentive to concentrate on cutting bid prices to the maximum extent possible (instead of concentrating on quality enhancing measures), even when a higher cost product would be in the owner's best interest, which makes it less likely that contracts will be awarded to the best performing contractors who will deliver the highest quality projects. As a result, the low-bid system may not result in the best value for money expended or the best performance during and after construction. Moreover, the traditional low-bid approach tends to promote more adversarial relationships rather than cooperation or coordination among the contractor, the designer and the owner, and the owner generally faces increased exposure to contractor claims over design and constructability issues (Rizwan, 2008).

The study aims at analyzing the current status of Bid and Procurement Strategies in the construction industry of Pakistan. In Pakistan, the most common method of awarding the contract is the Least Responsive Bidder or Price Based method, which has inherent flaws of high competition and minimum performance. These incompetent practices pose a serious risk and problems like:

- Schedule over runs.
- Increase in total cost of the project, resulting in bankruptcy of companies.
- Merely acceptable construction quality.
- Environmental issues.
- Lack of safety rules and procedures within the construction organization.
- Inconvenience to general community during construction.
- Public safety issues.
- Overall project failure (in few cases).

The Pakistan Federal Government allows different types of procurement and bidding methods. But, it also declares that public bodies should use open competitive bidding as the principal method of procurement except only where conditions for use of such other method stipulated under the rules are satisfied [*rule 20,* S.R.O. 432(I)/2004, *PPRA*].

Although the examination and evaluation of bids require the pre qualification of bidders [*rule 15,* S.R.O. 432(I)/2004, *PPRA)*], the successful bid will be the bid that is found to be responsive to the technical requirements and with the least evaluated price.

In today's construction environment, public sector owners are finding themselves under increasing pressure to improve project performance, complete projects faster, and reduce the cost of administering their construction programs. In response to such pressures, the Pakistan construction industry should come up with alternative procurement and contracting methods which incorporate factors other than just price into the selection process to improve project quality and enhance performance.

The aim of the research presented in this thesis is to assess the impact of competitive low-bid awarding system on performance of major public work projects (in terms of schedule, cost, quality and safety) in Pakistan construction industry. The study will forward recommendations and suggestions for developing a proposal for implementing alternative bid-evaluation and contract award procedures for the construction industry of Pakistan.

1.2 Research Scope

Mainly, the scope of the study is to analyze the performance of public owned construction projects which are awarded by the lowest bidder bid awarding system in Pakistan. A limited study of alternate bidding procedures followed in different parts of the world is also covered in this study. A comparison of these alternate methods is analyzed and it will also forward suggestions and recommendations that are capable of improving the bidding and procurement practices. The results of the literature search and compiled data from the questionnaire surveys are presented in this report. Legal aspects and government regulations pertaining to the issue of public construction contract-award procedures are covered in this study.

However, this research mainly covers public construction projects under the government of Pakistan. Private sector and other practices are given very little attention in this research and they may have slightly different results.

1.3 Research Objectives

Objectives of this thesis are mainly:

- To highlight the weaknesses, performance, opportunities and implications of the public owned construction projects that are awarded on the basis of lowest bidder bid system in Pakistan.
- To analyze the existing bid selection and awarding system and to provide a comparative study of different alternative bidding systems.
- To present conclusions and recommendations on lowest bidding system performance based on analysis and results of this study.

This research concentrates on construction works for public departments under the government of Pakistan. Therefore, emphasis is given for the evaluation and examination of bids in the open competitive bidding system and to analyze the performance of contractors who execute projects in this system.

1.4 Summary

This chapter gave a brief introduction of the existing bidding system in Pakistan and the research objectives were listed. An overview of the bidding system based on the lowest bidder, its implications, performance, research scope and objectives of the research were given. An extensive literature review (chapter 2) became the theoretical base for this study. This further helped in analyzing the results and making conclusions and recommendations.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

The latest developments and desires in different aspects of human life, has directed the professionals in construction industry to use alternative methods of project delivery systems. However, the bidding and project awarding systems are still largely in their basic form. The insufficient and inappropriate no of the capable contractors has led to inferior quality work, cost over runs, schedule delays, poor response to changes, claims, or even abandoning the project. If a client wishes to muddle through these new trends and invite acceptable bidders, it is necessary to clarify and develop pre-determined selection criteria and the objective of the prequalification and bid evaluation processes (Hatush et al., 1997). In Pakistan, major client of construction industry is Government of Pakistan (GOP). And the most common procurement method is the lowest-bidder system in which contracts are awarded to a responsive contractor who offers the least price. The only factor for awarding the contract is price for prequalified and responsive bidders. The prequalification and bid evaluation processes require the development of necessary and sufficient criteria. In last twenty to thirty years, a huge development in project complexity and clients need has led to an increasing use of alternatives for project delivery. The examples are BOT, PPP etc. In contrast, the prequalification criteria and bidding processes have not seen much advancement and are still in their old form.

The client is provided by prequalification, with a list of contractors that are invited to tender on a regular basis. This approach is mostly used by many countries and in which many and different types of criteria are considered to evaluate the overall suitability of contractors. There are unambiguous benefits and distinct pitfalls to the lowest-bidder bid awarding system. In the process, promoting competition amongst the contractors is an obvious advantage. It compels the contractors to lower their costs, usually through innovation and modernization, to ensure they win bids and maintain their profit margins. In addition, the process is beneficial specifically to the public sector because of the transparency and

simplicity, an important criterion of public policy (Photios., 1993). However, allowing projects to be awarded based on the least price has inherent flaws. Delays in meeting the contract duration, increment of the final project cost due to high variations, tendency to compromise quality, and adversarial relationship among contracting parties are the major pitfalls associated with responsive low bid award procedure (Thomas., 2009). Moreover, the low-bid award system encourages unqualified bidders in the competition and in contrary it discourages qualified contractors to participate.

In a survey conducted in the Oromiya regional state, non-existence of real competition during contractors selection; excessive time overruns; compromising quality; and escalation of the final project cost from the estimated cost were the major problems associated with the existing approach of delivering projects (Lemma., 2006). Poor initial funding of the project by the contractor and lack of timely resources of materials, machineries and workforces are also the major factors identified as causes of delays during the construction phase in Pakistan construction industry.

The construction process involves multi-organizational activity. Conflict and disputes can therefore exist at all levels in the contractual chain: between client and consultant, client and contractor, client and sub-contractor, and so on. Among many causes of disagreements in the construction project, the project delivery system selected is one of the significant elements (Abera., 2005).

2.2 Time to Abandon the Low-Bid System

What's needed is American Innovation. The problem with design-bid-build is it stifles innovation. I was at a conference where an owner was asked why he went with the design-build delivery method. His answer was, "Because we got a better design from the contractor than our engineers."

The reality is that in all industries, innovation is what separates the competition. Design-bid-build eliminates most of the opportunities a contractor has to innovate. Of course, the contractor can find better ways to install the bricks and mortar based on the plans and specifications, but the real opportunities occur at the beginning of the design process.

Oregon State University Associate Professor stated in a New Construction Strategies radio interview that innovation thrives much better in an integrated project-delivery environment because it's more collaborative, and innovation thrives in such an environment. However, the key is that the collaboration must begin at the beginning of the design process, where it has the greatest impact.

Some would suggest the contractor can always make suggestions after the bid is awarded. The problem with this approach is the contractor with the best ideas might not be at the table. Also, once the plans are completed and construction is ready to start, the cost of making the changes often wipes out any construction savings because of delays and other costs outside of the contractor's control. A major advantage of the design-build process is its speed, which can translate into huge cost savings.

After the St. Anthony Falls Bridge collapsed in Minneapolis in 2007, they replaced it using the design-build approach. During an interview with Jay Hietpas of the Minnesota Dept. of Transportation, I asked, why did you use design-build? He responded, because the day we opened the new bridge we would have gone out for bids if we had used the design-bid-build approach. Time was of the essence; since it was costing the tax payers $400,000 a day in extra transportation costs alone. In fact, design-build's rapid schedule saved more travel expenses than the cost of the bridge construction, so in essence the bridge was free. Despite this fact, there are still those that focus only on the contractor's cost. Maybe they would have received a lower bid, but it would not have generated a lower cost when all factors were considered.

Looking at the process from purely a project management perspective, we obtain similar results. The best way to reduce construction costs is through project planning. However, to get the best results from planning, it must start at the beginning, not halfway through the process.

Professor Barbara Jackson at Cal Poly at San Luis Obispo states that the construction team is the master builder of today. Projects are too complicated for a single person or even a single discipline to attempt to make all the decisions.

One of the problems implementing an integrated project-delivery approach is the false belief that the process works best on simple projects. In reality, it's the opposite. Simple projects are conducive to design-bid-build because everyone agrees on how to do it. The

more complex a project is, the greater is the need for collaboration between all the team players.

Of course, we need some controls. But contractors should be rewarded based upon performance, and construction costs are part of that evaluation. A low bid at the expense of higher total project costs is a false savings. Even so, some people believe that the low-bid approach is necessary to create competition. But that's not true, because unless you reward what you want, you aren't likely to get it. If you want peak performance, you must reward it, not the low bidder. Imagine what would happen to Olympic times if the gold medal was awarded to the runner who practiced the least, instead of who ran the fastest?

Ted Garrison is a construction industry expert and civil engineer with more than 25 years of construction experience. During the last 12 years, he has authored Strategic Planning for Contractors and co-authored five other books on marketing, sales, customer service and leadership. Garrison also is the host of the Internet radio program, New Construction Strategies, www.NCS30.com, where he conducts weekly interviews of experts within the construction industry. He can be reached at Ted@TedGarrison.com or you can follow him Twitter @TedGarrison

2.3 Legal Framework (Bidding Procedures and Laws)

Government of Pakistan has statutes requiring submission of competitive bids for construction projects. As per Pakistan Engineering Council (PEC) and Public Procurement Regulatory Authority (PPRA), it requires public organizations to award such contracts to the "lowest responsive bidder." Public works procurement as defined by PPRA is "Save as otherwise provided hereinafter, the procuring agencies shall use open competitive bidding as the principal method of procurement for the procurement of goods, services and works" (Rule 20, S.R.O. 432(I)/2004). Few definitions and outline of bidding procedure followed in public sector of Pakistan is discussed in this section.

2.4 Definitions

2.4.1 Bid.

"Bid" means a tender, or an offer, in response to an invitation, by a person, consultant, firm, company or an organization expressing his or its willingness to undertake a specified task at a price.

2.4.2 Bidder.

"Bidder" means a person who submits a bid.

2.4.3 Competitive Bidding.

"Competitive bidding" means a procedure leading to the award of a contract whereby all the interested persons, firms, companies or organizations may bid for the contract and includes both national competitive bidding and international competitive bidding.

2.4.4 Contractor.

"Contractor" means a person, consultant, firm, company or an organization who undertakes to supply goods, services or works.

2.4.5 Contract.

"Contract" means an agreement enforceable by law.

2.4.6 Lowest Evaluated Bid.

(i) A bid most closely conforming to evaluation criteria and other conditions specified in the bidding document; and

(ii) Having lowest evaluated cost.

2.4.7 Responsive Bidder.

The word "responsive" is inserted to require that a successful bid must also adequately fulfill the requirements of the project as specified. While it is not too difficult to determine whether a bid is responsive because responsiveness is evaluated based on the documents submitted by contractors, it takes considerable amount of time and effort to ascertain whether a bid is responsible.

2.4.8 Responsible Bidder.

"Responsible" generally refers to the apparent low bidder's quality, fitness, and capacity to perform the proposed work satisfactorily. "Responsible" means more than simply financially responsible. The bidder must also have the requisite judgment, skill, ability, and integrity to perform the contract according to its terms (Irtishad., 1993). For two reasons application of this requirement becomes difficult. First, there is generally a narrow window of time available between a bid opening and the award of the bid. Second, although the law allows public organizations to reject any or all the bids, the rejection cannot be done arbitrarily or in bad faith. When it is the low bid which is rejected, particularly close scrutiny of the reasons given for the rejection is warranted. For these reasons, the decision to reject a low bid on the ground that the bidder was not responsible enough is dependent on the discretion of the organization. In most cases some degree of subjectivity gets absurd in the process of determining whether a particular bidder is responsible. As a consequence, these kinds of rejections frequently give rise to resentment and may end up in court. To avoid these problems, many public organizations take only responsiveness of the bid in consideration before making award decisions. Some public organs use a stringent and specific set of prequalification procedures.

2.4.9 Invitation for Bids

The "Invitation for Bids" is meant for publication in the national/ international newspapers, as well as on PEC Website & PPRA Website in case of Federal Govt. procuring agencies and for other additional distribution to be decided by the Employer as notice for calling of Bids. The eligible bidders are defined in Clause IB.3 of Instructions to Bidders.

2.4.10 Eligible Bidders

This Invitation for Bids is open to all bidders meeting the following requirements:

a) Duly licensed by the Pakistan Engineering Council (PEC) in the category relevant to the value of the Works.
b) Duly prequalified / enlisted with the Employer.

2.4.11 Instructions to bidders (ITB)

The eligible bidders who are interested to participate in the bidding process are issued the bidding documents for the specific contract for procurement of Works. The most relevant section of Bidding Documents for the bidders at bidding stage is the Instruction to Bidders (ITB). The clarity, conciseness and completeness of the Section i.e. ITB is most important because the bidders are required to seek guidance from the Employer and abide by these instructions for finalization of a real, meaningful, rational and complete bid conforming to the requirements of the Bidding Documents.

2.4.12 Bid Opening

One of the most important activities in procurement is the bid opening in the presence of the representatives of bidders at the designated place, on the fixed date and time. This is a vital step towards making the process transparent. The bid opening committee has to publicly announce, the following most important information about each bid and sign the tabulated sheet simultaneously:-

(i) Name of bidder.

(ii) The bid price.

(iii) Discounts, if any.

(iv) Modifications to the Bid, if any.

(v) Withdrawal of bids(s), if any.

(vi) Presence/Absence of bid security and its amount.

(vii) Similar information on alternate bids, if any.

2.4.13 The Bidding Period.

The notice should be published so as to give the prospective bidders' sufficient time for preparation and submission of bids which may be 42 to 154 days depending on the size of the Works.

2.4.14 Bid Security

Each bidder shall furnish, as part of his bid, a Bid Security in the amount stipulated in the Bidding Data in Pak Rupees or an equivalent amount in a freely convertible currency.

2.4.15 Evaluation of Bids.

Procuring agencies shall formulate an appropriate evaluation criterion listing all the relevant information against which a bid is to be evaluated. Such evaluation criteria shall form an integral part of the bidding documents.All bids shall be evaluated in accordance with the evaluation criteria and other terms and conditions set forth in the prescribed bidding documents.

2.4.16 Procedures for Competitive Bidding.

(a) Single Stage – One Envelope Procedure.

Each bid shall comprise one single envelope containing, separately, financial proposal and technical proposal (if any). All bids received shall be opened and evaluated in the manner prescribed in the bidding document.

(b) Single Stage – Two Envelope Procedure.

The bid shall comprise a single package containing two separate envelopes. Each envelope shall contain separately the financial proposal and the technical proposal. Initially, only the envelope marked "TECHNICAL PROPOSAL" shall be opened. After the evaluation and approval of the technical proposal the procuring agency, shall at a time within the bid validity period, publicly open the financial proposals of the technically accepted bids only. The financial proposal of bids found technically nonresponsive shall be returned un-opened to the respective bidders. The bid found to be the lowest evaluated bid shall be accepted.

(c) Two Stage Bidding Procedure.

First Stage.

The bidders shall first submit, according to the required specifications, a technical proposal without price. The technical proposal shall be evaluated in

accordance with the specified evaluation criteria and may be discussed with the bidders regarding any deficiencies and unsatisfactory technical features. After such discussions, all the bidders shall be permitted to revise their respective technical proposals to meet the requirements of the procuring agency.

Second Stage.

The bidders, whose technical proposals or bids have not been rejected and who are willing to conform their bids to the revised technical requirements of the procuring agency, shall be invited to submit a revised technical proposal along with the financial proposal. The revised technical proposal and the financial proposal shall be opened at a time, date and venue announced and communicated to the bidders in advance; and the revised technical proposal and the financial proposal shall be evaluated in the manner prescribed above.

(d) Two Stage - Two Envelope Bidding Procedure.

First Stage.

The bid shall comprise a single package containing two separate envelopes. Each envelope shall contain separately the financial proposal and the technical proposal. Initially, only the envelope marked "TECHNICAL PROPOSAL" shall be opened. The envelope marked as "FINANCIAL PROPOSAL" shall be retained in the custody of the procuring agency without being opened. The technical proposal shall be discussed with the bidders with reference to the procuring agency's technical requirements. Those bidders willing to meet the requirements of the procuring agency shall be allowed to revise their technical proposals following these discussions.

Second Stage.

After agreement between the procuring agency and the bidders on the technical requirements, bidders who are willing to conform to the revised technical specifications and whose bids have not already been rejected shall submit a revised technical proposal and supplementary financial proposal, according to the technical requirement. The revised technical proposal along with the original financial proposal

and supplementary financial proposal shall be opened at a date, time and venue announced in advance by the procuring agency.

2.4.17 Award of the contract.

Subject to Clauses IB.30 and IB.34, the Employer will award the Contract to the bidder whose bid has been determined to be substantially responsive to the Bidding Documents and who has offered the least evaluated Bid Price**,** provided that such bidder has been determined to be eligible in accordance with the provisions of Clause IB.3 and qualify pursuant to Sub-Clause IB 29.2.

2.5 Alternative Methods of Procurement.

PPRA also allows the owners and clients to use other methods of procurement in special circumstances. These special circumstances are well defined and spelled out in PPRA rules. A procuring agency may utilize the following alternative methods of procurement of goods, services and works, namely:-

2.5.1 **Petty Purchases**.

Procuring agencies may provide for petty purchases where the object of the procurement is below the financial limit of *twenty five thousand rupees. Such procurement shall be exempt from the requirements of bidding or quotation of prices. Provided that the procuring agencies shall ensure that procurement of petty purchases is in conformity with the principles of procurement prescribed in rule 4.

2.5.2 **Request for Quotations**.

A procuring agency shall engage in this method of procurement only if the following conditions exist, namely:-

(i) The cost of object of procurement is below the prescribed limit of one hundred thousand rupees:

(ii) The object of the procurement has standard specifications.

(iii) Minimum of three quotations have been obtained.

(iv) The object of the procurement is purchased from the supplier offering the least price.

2.5.3 Direct Contracting.

A procuring agency shall only engage in direct contracting if the following conditions exist, namely:-

(i) The procurement concerns the acquisition of spare parts or supplementary services from original manufacturer or supplier.

(ii) Only one manufacturer or supplier exists for the required Procurement.

(iii) Where a change of supplier would oblige the procuring agency to acquire material having different technical specifications or characteristics and would result in incompatibility or disproportionate technical difficulties in operation and maintenance.

(iv) In case of an emergency.

2.5.4 Negotiated Tendering.

A procuring agency may engage in negotiated tendering with one or more suppliers or contractors with or without prior publication of a procurement notification.

2.6 Contract-Award Procedures in Construction

Bidding procedures are mainly negotiated and competitive. Mostly, the other methods are either variant of, or somewhat between these two significant types. In competitive method, the work is awarded to the least-bidder, if he/she is proved to be a responsive one. In negotiated method of procurement the cost is discussed and negotiated with selected constructor. Some modifications have been proposed for minimizing the concerns and implications of these two extreme types, and tried in many countries. In this research, following contract-award methods are studied and considered:

(i) Competitive Lowest Bidding Method (Price-basis)

(ii) Competitive Average Bidding Method (Price-basis)

(iii) Multi Parameter Bid Method (Basing on quality, time, price and "other" factors)

(iv) Negotiated Bid Method (Competitive)

(v) Negotiated Bid method (Non-Competitive)

(vi) A+B Method

2.6.1 Lowest Bidding Method (on Price basis)

This is the most commonly used procedure to obtain and select contractors/construction firms for execution of construction projects. In broad-spectrum, the aim of competitive bidding (price-based) is to obtain the least possible price for a particular project, service or facility. Competitive bidding method tries to ensure that everyone gets an equal chance to bid, minimizes collusion, and saves the public money. It focuses on honest competition to obtain the finest work and supplies at the lowest possible cost. It also necessitates protecting against nepotism, favoritism, extravagance, corruption and fraud (Sweet., 1989).

For the procedure to be fair and workable, it is required to have a clearly defined criterion to help the bid evaluating officials determine whether bids are responsive and the bidders seem to be responsible. In the competitive lowest-bidding method, the prequalified and responsive bidder who submits the least bid, meeting the specifications must be winner of the contract.

2.6.1.1 Implications and Concerns

It is generally accepted that competitive lowest bidding method saves public money and protects public interest; this conventional method has been criticized in last two decades or so mainly because of low/inferior quality, incorporation of many changes/change orders, establishment of negative relationships, schedule overruns, and increasing cost of the overall project.

The tendering process for award of construction projects in Pakistan is normally based on the lowest-bidding method. In this method, the firm which is responsive and submits the lowest bid, gets the right for the construction project. The main advantage is that contractors continuously try to reduce costs by adopting technological and managerial innovations which

can save costs (Photois., 1993). This saving is then transferred to the owner through this competitive bidding process.

If a bid submitted by a contractor is drastically lower than the engineer estimate or client's expectation and the other bidders, it is hard to comprehend that how the contractor would complete the project profitably. Such bids are defined as *Abnormally Low Tenders* by (Thomas., 2009). An Abnormally low tender is a bid whose price seems significantly low than all of or the average of total bids in the same tendering procedure. The European Union made a legislation to permit government sector clients with the choices of awarding a project either by adopting traditional lowest bidding or the Economically Most Advantageous Tender (EMAT). The legislation permitted public clients to minimize the risks of some of the unpleasant results of abnormally low tenders (ALT). It includes:-

(a) Undesired quality because of the need of construction costs reduction (Winch).

(b) Predatory pricing and unjust competition which distorts the construction industry, affecting other bidders negatively (Alexanderson et al, 2006).

A report on "Prevention, Detection and Elimination of ALT in the European CI" by European Commission's Europe states that a bid is considered abnormally low if by comparing it with the client's Engineer estimate and all the bids submitted, it seems to be abnormally low by not keeping a margin for normal level of profits. Also the ALT cannot be justified by economy of the selected method, the chosen technical solution, extremely favorable conditions on hand to the tender, or the originality of the proposed work (Thomas., 2009).

2.6.1.2 Assumptions Vs Implications

The assumptions upon which competitive lowest bid method is based and their implications are discussed as following:-

(a) Competitive lowest bid assumes that the projects or services can be independently evaluated or compared before the award decision. This is not a simple task. To avoid these inherent problems, it is usually stated in ITB that for consideration, bids should be responsive and the bidders must be responsible.

(b) It assumes that the submitted bids are free and there is a true competition, whereas, often there is collusion among the bidders for the purpose of taking turns and

fictitious bids are submitted. By collusion, objective of obtaining the lowest price cannot be accomplished.

(c) The success of competitive lowest bid method depends on the integrity and capability of the bidder, which is normally difficult to gauge since the tendency is to take into account the price only.

(d) Another concern of competitive tendering is the complexity of involving the contractor during the design phase. Inflexible specifications also make competitive bidding method less effective because it doesn't provide the contractors a chance to come up with multiple options. If specifications do not allow for alternative products and a feasible method for substitutes, competitive cost may be restricted.

(e) Another problem associated with this competitive method is that when the bidders are as large in number as is the case in a slow economy, a client accepts a significant risk of choosing a contractor that might have accidentally or deliberately submitted an unrealistic lower price (Photois., 1993). A contractor may not stick to such a low price where, at the same time, it is expected to complete the project as per schedule and specifications, and also make a rational profit. The usual result is excessive claims and disputes that lead to time over runs, compromises in product quality, and ultimately shooting costs.

(f) Although lowest bidding method is supposed to promote innovations by forcing contractors for continuous effort to reduce costs by adopting managerial and technological innovations which are cost-saving yet it is criticized for discouraged innovation (Irtishad., 1993). Nicolson asserts, lower bids provide lesser margin for a builder to implement latest techniques or improve the quality of his new product.

(g) It has also been criticized for not offering any incentive for the high quality construction of a completed project at a reasonable cost.

(h) Another concerning practice of a contractor is that they intentionally submit an artificially low bid in expectation of making the profit through changes and construction claims (Thomas., 2009). Some bidders carefully review the bid documents to search for mistakes and doubts in those areas that may provide chances of change orders and claims at some stage in the project (Dowle et al., 1990). These contractors can use this knowledge to submit a low bid with the anticipation of retrieval of the money later. In such cases the ALT is not true reflection of the final

contract cost or the unanticipated costs incurred by the client when dealing with number of change orders and claims.

(i) Low bidding method has also been criticized for causing abuse of the change order procedure. An allegation that number of change orders is too high and very expensive under this system. Therefore, according to its critics, the lowest bid method doesn't guarantee the lowest cost because of delays and cost over runs during the procedure.

Despite all these pitfalls, strong arguments in favor of using the traditional lowest bidder system are present. The public sector seems at ease with this process because the bid evaluation is comparatively easier. Its impartiality is ensured since price is the sole criterion for evaluation of bids. Its susceptibility to different types of political and social pressures is lesser than other methods that are based on some measure of subjectivity.

2.6.2 Competitive Average Bidding (Price-based)

One of the variations of the competitive lowest bidding method of awarding construction works is based on the principle that the bid closest to average of all the bids is considered to be the best bid, and not the one which is minimum or maximum. Tenders which are bid far lower than the average are considered unrealistically underbid. The bids which are greatly higher than the mean are considered unrealistically overbid. On the basis of this principal some methods are evolved and these are generally known as European Methods (Irtishad., 1993).

Generally, the best contractor based on the average-bidding method is the bidder whose bid satisfies a particular correlation with mean of all the bids. For average-bidding method, different measures are used for calculation of the average, or use different criterion for evaluating the best bid. But point to remember is that this method takes into account the price only.

For example, some countries use typical arithmetic average while few use weighted average. This method is mostly used in Taiwan. Another approach of obtaining the average includes the elimination of all the bids which differ largely (more than a specified percentage) or the outliers and then the mean of the remaining bids is calculated. The winner could be the one whose price is nearest to the mean, or the other whose bid price is closest but less than the average. This method is widely used for construction projects in Italy (Photios., 1993).

In Europe, a formula to calculate a realistic offer from a number of competitive bidders was developed which is known as "Danish" system. This system right away rejects the highest and the lowest offers and rest of the bids are considered only (Irtishad., 1993).

The formula is similar to the PERT and stands as following:-

$$NA = (NH + 4A + NL) / 6 \qquad \textbf{[Eq. 2.1]}$$

Where,

NA = New average;

NH = New high;

A = Average of all offers;

NL = New low

The first bid which is above this NA is then treated as rational, reasonable and acceptable. The method is not effective unless the minimum number of bidders is eight and this is the key limitation of Danish system.

The fundamental idea of the average bidding method is that the best bid is the one closest to a defined average, neither the minimum nor the maximum. These competitive cost-based average bidding methods are mainly used to make sure that the selected contractor is responsible, to minimize project failure, and to avoid disputes and construction claims.

The basic principle is that the bidders should get a reasonable and practical cost of their work. It is assumed that with a fair price, the contractor would ensure quality needs of the project, would finish on schedule, and will not have any adverse relationship with the client, consultant and engineer.

2.6.2.1 Implications and Concerns

In average bidding methods, as described above, all the features of open bidding system are retained. The only variation is that the selected contractor is the one whose bid is close to the average of all the submitted bids.

The major risk of the lowest-bidding method is the likelihood of awarding a contract to a person or firm that submits, accidentally or deliberately, an unrealistic low bid. Such an occurrence may lead to the owner's disadvantage by promoting disputes, increase in costs,

and delays in schedule. To tackle this problem, some countries have adopted the average-bidding method and the contract is awarded to the contractor whose price is near the average-bid price. Average bidding method finds its relative merits over lowest-bid method (Photois., 1993).

The major advantage of this method is that it safeguards a client from signing a contract at an unrealistic low bid price that will certainly lead to adversarial relationships during construction (Ioannou et al., 1993). This method also provides shelter to contractors for not honoring a bid containing an oversight or a gross mistake.

The basic disadvantage of the average-bidding method is that it doesn't promote competition that leads to lesser costs for the client. A breakthrough (technological or managerial) resulting in major money savings will not necessarily be passed on to the client in the form of lower costs, unless all participating bidders are known to have this breakthrough. It has been criticized that average bid method results in considerably higher profits in construction projects (Irtishad., 1993).When such high profits are earned throughout the industry, bid prices are expected to fall gradually and the savings will eventually be passed to the client. It has been claimed that the average bid method would increase contractor profitability and it has the potential to improve relationships between the owner and the contractor.

From the above discussion, it is obvious that most of the apparent benefits of the average method may only be applicable in the long run. Some of these benefits are intangible in nature. The success of this method is also dependent on the need that subcontractors of prime contractor are also selected on the same average-bidding method. It would be very difficult to ensure in the way bidding is practiced when sub-bids are accepted till last minute. Additionally, current laws don't restrict main contractors to retain a preselected group of subcontractors.

Some pitfalls of the competitive lowest bidding method can also prevail with the average bid system. As in case of the lowest bid method, collusion among the bidders and the absence of prequalification may negate its intent and undesirable results will be produced (Ioannou et al., 1993).

Higher profitability of contractor and better relationships between the client and the contractor cannot be ascertained in the countries which are practicing average bid method.

Evidence is not enough to conclude that incidence of construction claims is less in European countries (that practice average bid method) as compared to those countries that are not following this method (Irtishad., 1993).

2.6.3 Multi-Parameter Bidding Method (Based on price and "other" factors)

This is a model based competitive bidding which not only on caters for cost but also considers other parameters as proposed by Herbs man and Ellis; they named it the multi-parameter bidding procedure (Herbsman et al., 1992). They suggest that the major parameters should be cost, time and quality with minor parameters on the discretion of the client. The amount of time proposed in the bid to complete the project can have an impact on cost. For example, a construction company which can complete a building project three months earlier than its closest bidder may save the owner some additional rent cost. By factoring this cost saving in the bidding process, a better reflection of the total costs can be estimated. Similarly, the impact of better quality may also be included in the contract award decision. The costs of repair and maintenance are directly associated with the quality of the built facility being constructed. In Multi-Parameter Bidding Method, estimation of quality may be calculated by the kind of materials and type of equipment proposed to be used, the past performance of the main contractor and the subcontractors which are proposed in the bid.

In Multi-Parameter Bidding Method, time and quality parameters are assigned a maximum number of attainable points. The bids are then evaluated and ranking is made basing upon these points, as well as the bid cost.

Some other parameters may also be included in the model as desired by the owner. Other factors may include safety records, past working experience with client, history of disputes and claims, defect rectification history etc. In this method a "total combined cost" will come up after applying all these factors (Tarricon., 1993). The total combined costs of all the bids are then compared to pick the best bidder.

2.6.3.1 Implications and Concerns

In this method factors other than cost are considered before contract award decision is made. This is done in a more meticulous fashion than the traditional practice of prequalification procedure. Technical merit, time and quality factors are given more emphasis in a bid evaluation.

Some people stress that the innovation is needed for the sake of time and high quality, to get better value for the public money, to minimize life-cycle costs of a product for the public department, while maintaining a reasonable profit for the contractor.

For many years, the element of time was not the most important factor of construction projects in many countries. The element of cost was the most important one. In the last two to three decades, the CI of Pakistan has involved in both building of new roads and construction of new facilities. These construction projects are mainly in urban areas and cause substantial problems to the public. Also, high volumes of traffic cause delays in completion of the projects. For instance, in U.S.A, a few innovative procurement systems for "buying time" were introduced in order to minimize such delays (Zohar et al.). The common denominator of all those procurement system is the ability of the contractor to procure the time for completion of the project.

2.6.4 Competitive Negotiated Bidding

At times it becomes necessary to obtain bids from a selected group of builders who possess known technical, managerial and financial capacity to complete a multi dimensional complex project. Some classified projects may also require only those contractors who can perform work at some specific place. In such circumstances, competitive price-based open bidding may not be suitable.

On the other hand, single-source negotiation method is very hard to put into practice in public sector as this may lead to allegations of corruption and favoritism. To stay away from these problems with single-source negotiated bidding many organizations and clients are using variations that include features of both competitive and negotiated methods.

To modify pure negotiated method, increase in the number of construction companies/contractors to negotiate with, provides multiple options for selecting amongst the contractors. In few cases, based on previous experience or reference, some companies which are well known to be professional and competent to complete a construction project, are contacted by the owner or client (Irtishad., 1993). The owner may negotiate a tender with the most qualified company for professional services at compensation which the organization determines are fair, competitive, and reasonable. In making such decision, the public body

must conduct an analysis of the price of the professional services needed in addition to their complexity and scope.

The Pakistan Federal Government laws allow such tendering as already discussed in sections 2.3.3 and 2.3.4 (as per rule 42 of S.R.O. 432(I)/2004).

2.6.4.1 Implications and Concerns

Request for proposals and/or request for qualification for a particular project are typical examples of competitive negotiated method.

Proposals from more than one contractor are scrutinized for factors such as technical capability, project schedule as well as cost. These methods are usually engaged when the project is planned to be built under a design/build contract. Promoters of competitive negotiated bidding method claim that this method saves time, improves quality and reduces number of claims.

The main pitfalls of this method are:-

(a) The cost and time spent by the contractor for preparing a proposal is higher.

(b) The system lends itself to a situation where the contractor is reserved to propose any new or innovative ideas because preconceived ideas of the evaluators may not fit in the particular situation; contractors are required to disclose confidential commercial and financial information that should not be released outside the company.

(c) The owner may try to get cost-saving ideas from the competing contractors during the interviews and yet may choose not to award the project to the contractor whose ideas would later be utilized; and the processes of evaluation turn out to be subjective rather than objective (Kelley., 1991).

2.6.5 Non-Competitive Negotiated Bidding

The non-competitive negotiated procedure is essentially the process of negotiating a bid with a single source, usually a preselected contractor. For this reason it is also known as sole-source negotiation. The cost to be paid, and the product or goods to be procured by the owner are normally the items of negotiation. The firm, that is known to be prequalified and having expertise, can be chosen without any notification or tendering advertisement. This

saves additional effort, time and money but chances of favoritism and corruption are increased.

Different countries have different rules and regulations regarding direct procurement, but mostly these rules are similar in nature. In most of the cases, when there are no competitors available for technical reasons or if the required product can only be provided or constructed by one contractor/organization, non-competitive negotiated bidding method is adopted. Also, when there is a need of similar service or repetition of works from a firm, this method may be adopted. In Pakistan, for some classified projects or for projects which have security concerns due to geographical location of the project site, this method is adopted. Direct procurement is usually common in the form of variations or change orders in the construction industry. This method is very common in new construction projects in the private sector like housing, commercial buildings, private schools, hospitals and industries etc. However, in government construction projects, it is almost nonexistent.

2.6.6 A+B bidding method

In this method contractors bid on the cost (part A) and on the time (part B), and the lowest combined bidder (A+B) is awarded the project. In the last decade or so, many departments of transportation around the United States have experimented with using the A+B bidding method. A survey of 101 projects was conducted and it was analyzed by comparing the projects which were awarded using A+B bidding method with similar projects that were bid using conventional methods (cost only). The conclusion from the research shows that substantial savings in construction time have been achieved when using the A+B method with almost no addition in cost. This was achieved by better planning and management skills of the contractors that were using the time factor as part of their bid strategy.

{http://dx.doi.org/10.1061/(ASCE)0733-9364(1995)121:4(430)}

2.7 Summary of Literature Review

Professionals in the construction industry have agreed the importance of the method of bid evaluation and contract award procedure chosen for the successful accomplishment of construction contracts. Many countries have also revised their construction procurement of construction contracts based on their own experiences and research findings.

Least bidder bid awarding procedure has been widely accepted in many countries for decades. The customary practice of awarding contracts to a least bidder was established to ensure the least cost for completing a project. In public construction works, this practice is almost universally accepted since it not only ensures a low price but also provides a way to avoid fraud and corruption (Irtishad., 1993). However, allowing projects to be awarded based on the least price has become one of the major sources of construction projects failures. Delays in meeting the contract duration, increment of the final project cost due to high variations, tendency to compromise quality, and adversarial relationship among contracting parties are the major pitfalls associated with responsive low-bid award procedure (Thomas, 2009). Moreover, the low-bid award system encourages unqualified bidders in the competition and in contrary it discourages qualified contractors to participate.

Consequently, many countries based on their previous experiences and research findings have developed modified procedures to address these problems. Competitive Average Bidding, Multi Parameter Bidding, Competitive Negotiated Bidding and Non-Competitive Negotiated Bidding methods are the most frequently used procedures in many countries. Competitive Average Bidding method has become the most favorite of many European countries. The EU introduced legislation to allow public sector clients the option of awarding a construction project using either the traditional low bid or the Economically Most Advantageous Tender (EMAT). The legislation allowed public sector clients to reduce their exposure to some of the adverse effects of abnormally low tenders (ALT), including: Unsatisfactory quality through the need to reduce construction costs (Winch., 2000); and Predatory pricing and unfair competition that distorts the market, negatively affecting the other bidders (Alexanderson et al., 2006).

Competitive Average Bid procedure has become more popular because all the features of open competitive system are retained on one hand. On the other hand, the possibility of awarding a construction contract to a contractor that submits, either accidentally or deliberately, an unrealistically low bid price will be reduced. The competition provides a way to avoid fraud and corruption, which are the major pitfalls of other negotiation based alternatives. The averaging will safeguard an owner against signing a construction contract for an unrealistically low bid price that almost certainly will lead to adversarial relationships during construction (Ioannou et al., 1993).

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction

Research strategy shows how the researchers are going to carry out their study to achieve and answer research objectives (Saunders *et al.,* 2007). The research was started with extensive literature review in the form of previous studies, research papers, books on the subject and few case studies. The methods for collecting and generating research data are the questionnaire survey and interviews. This research is conducted with an aim to study the performance of the contractors in the construction industry of Pakistan in the public sector, who are awarded the projects on lowest bidding bid award system which is prime method used in Pakistan. The study also aims at exploring the new methods which may fit in our environment and bring some positive changes in the project execution. Schematic layout of the research methodology used in this research is given in Figure 3.1. A total of 35 parameters were identified for study of performance of lowest bidding bid system and then these were shortlisted to 26 keeping in view the Pakistani environment and culture. Basing on these parameters the questionnaire was prepared with 26 parametric questions and 5 opinion of the respondent based questions.

A pilot study was carried out from 12 construction experts with their interviews to finalize the questionnaire. For exploratory study 5 methods other than the lowest bidding bid system were selected and part II of the questionnaire was designed. 10 parameters were selected for comparison of these methods. The questionnaires were further reviewed and finalized after making necessary adjustments. The questionnaires were then distributed in different segments of construction industry as well were floated on line through google Drive.

The response rate was satisfactory. The collected data was analyzed using MS excel and Statistical Package for the Social Sciences (SPSS-20). Tests for normality and consistency of data were applied. All the selected parameters were analyzed individually and a comprehensive rating of performance was measured. Similarly, for comparison of other tendering methods all the parameters were assigned a numbers on likert scale and their

comparison is made. The results obtained are concluded and some recommendations are made basing on these results.

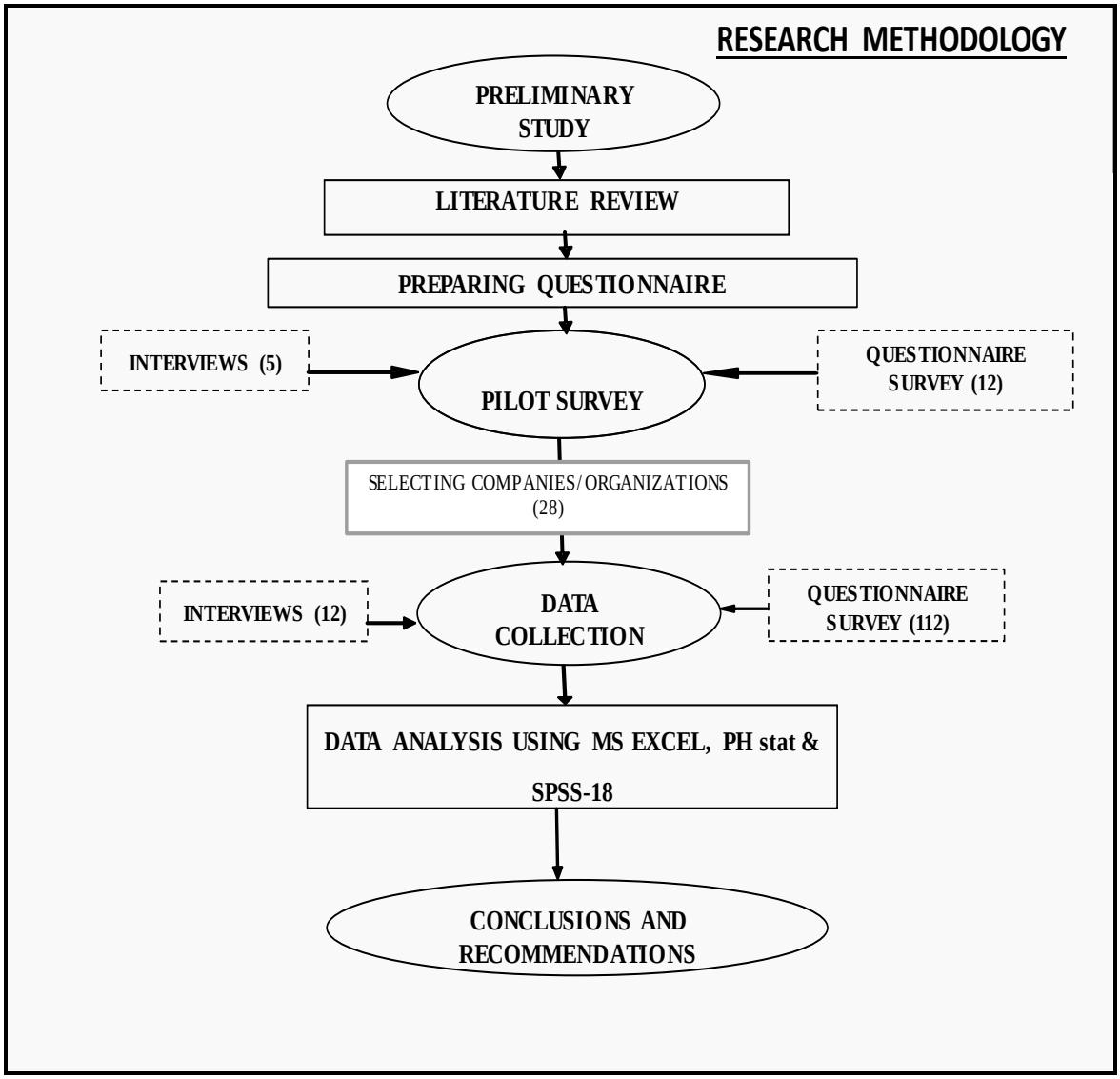

Figure 3.1 Research Methodology

3.2 The Questionnaire

The questionnaire form consisted of two parts. Part I was designed to study the performance of lowest bidder bid system in public sector of Pakistan. It consisted of three sections. First section covered general considerations for "lowest bidder" before the award of the contract and contained 10 questions. Second section, comprised of 10 questions covered the specific parameters regarding performance of lowest bidder after the award and completion of the project. The third section consisting of 6 questions explored about some actions related to the contractor who executed the project being lowest bidder. At the end 5 general questions were asked which were based on the opinion of the respondent along with any additional comments.

Part II of the questionnaire was designed to make comparison with some other methods of tendering used in different parts of the world. For this purpose 5 methods were chosen and 10 parameters were identified to gauge the comparison.

A five-point likert scale, with 1 being very low and 5 being very high, was utilized to judge the performance parameters. All the stakeholders of CI including clients, consultants and contractors/subcontractors are made part of this survey.

The questionnaire was distributed in hard form as well as it was uploaded through "google Drive" for online filling and submission. Since the online submission through "google drive" is a paper free method, it provides more and speedy responses. A total of 120 questionnaires were invited online and 80 were sent to different firms and organizations. Out of these 200 questionnaires sent out, 117 were received. Five incomplete questionnaires are excluded, so final analysis is carried out basing on 112 questionnaires. Respondents to this survey include 32 clients, 21 consultants and 59 contractors/subcontractors.

3.3 Sample Size

Calculation of accurate sample size during research survey plays very crucial and vital role accurate and reliable data analysis. It also ensures that surveyed data is true representation of target population keeping statistical power of data in mind (James Lani, 2010). For a research study the sample size can be calculated through following empirical formula (Jonathan Wilson, 2010):-

$$n = N / [(1+N (e) 2] \quad (3.1)$$

Where,

n = Sample size

N = Population size

e = Precision level

Sample size that represents the targeted population can also be determined by using equation (3.2) (Shash and Abdul-Hadi, 1993):

$$\mathbf{n = n' / (1 + n' / N)} \quad \mathbf{(3.2)}$$

where;

n: sample size from finite population

N: total population

n′: sample size from infinite population, which can be calculated as $n'=S^2/ V^2$

S^2: standard error variance of population elements = P (1-P); maximum at P=0.5

V: standard error of sample population = 0.05 for confidence level 95%

There were 112 valid replies out of 200 showing an overall response rate of 56%. In the construction enterprises, a good response rate is around 30% (Black *et al.*, 2000). Therefore, the response rate in this research is acceptable. To know whether or not this sample size truly represents the population, Table 3.1 is used which exhibits sample sizes required for various population sizes and characteristics at three levels of precision.

Table 3.1 True Sample Size

Completed sample sizes needed for various population sizes and characteristics at three levels of precision.

	Sample size for the 95% confidence level					
	±10% Sampling Error		±5% Sampling Error		±3% Sampling Error	
Population Size	50/50 split	80/20 split	50/50 split	80/20 split	50/50 split	80/20 split
100	49	38	80	71	92	87
200	65	47	132	111	169	155
400	78	53	196	153	291	253
600	83	56	234	175	384	320
800	86	57	260	188	458	369
1,000	88	58	278	198	517	406
2,000	92	60	322	219	696	509
4,000	94	61	351	232	843	584
6,000	95	61	361	236	906	613
8,000	95	61	367	239	942	629
10,000	95	61	370	240	965	640
20,000	96	61	377	243	1,013	661
40,000	96	61	381	244	1,040	672
100,000	96	61	383	245	1,056	679
1,000,000	96	61	384	246	1,066	683
1,000,000,000	96	61	384	246	1,067	683

Source: (*Dillman, 2000)*

Until 2012, around 30000 building and civil engineering establishments have been registered with PEC. Practically, all these registered organizations would not be active in the CI; however this number can be used as the population size. Confidence level is selected as 95%. It is also assumed that the answers will be homogeneous and will set the p value to 0.5 (means that probability of occurrence is 50%). Using a fifty-fifty split maximizes the question variance, which requires the largest possible sample to control for the differences among the response options. By applying these values in equations (3.1) and/or (3.2), the sample size comes out to be 96 for a sampling error of ±10%. Analysis of the collected data by SPSS, gave maximum sampling error as ±9.40% which

is less than ±10% so any sample over 96 is quite acceptable for a sampling error of ±10%. Hence, a sample comprising of 112 respondents is quite reliable for further analysis.

3.4 Pilot Study

Before distribution of a questionnaire among respondents or a detailed study, a pilot study was carried out to check the workability, practicality and realism of proposed questionnaire form and also to find out the resources required for the research study. It was also aimed at to check the effectiveness of sampling frame and the level of success which was desired to be achieved through proposed techniques. Five detailed interviews were carried out from renowned professionals in the country belonging to public and academic sectors. The government officials from Ministry of Finance and NHA were interviewed to discuss the proposed research procedures and data analysis techniques. In private sector, FWO, NLC, MES and NESCOM were consulted to check the validity and reliability of the questionnaire form including its arrangement, language and time required to answer the questions. In academic sectors, renowned professors from UET Lahore and NUST were interviewed to find out any weaknesses in research plan or in data analysis techniques.

3.5 Data Collection

The main part of the research study was collection of required data, which was obtained through filling of questionnaire forms and carrying out of personnel interviews from targeted population. Out of 200 identified respondents, 117 were received back. On scrutiny, five were rejected due to different reasons and 112 were kept for analysis. Detail of respondents is given in Table 3.2 and Figure 3.2 shows the distribution of the respondents on histogram.

Table 3.2 Detail of Respondents Feed Back

Mode	Clients		Consultants		Contractors/ subcontractors		Total Sent	Total Received	Total Valid
	Sent	Received	Sent	Received	Sent	Received			
Online	40	23	28	18	52	33	120	74	72
Hard copy	19	09	12	03	49	31	80	43	40
Total	59	32	40	21	101	64	200	117	112
Response Rate	54%		52%		64%		58.5%		56%

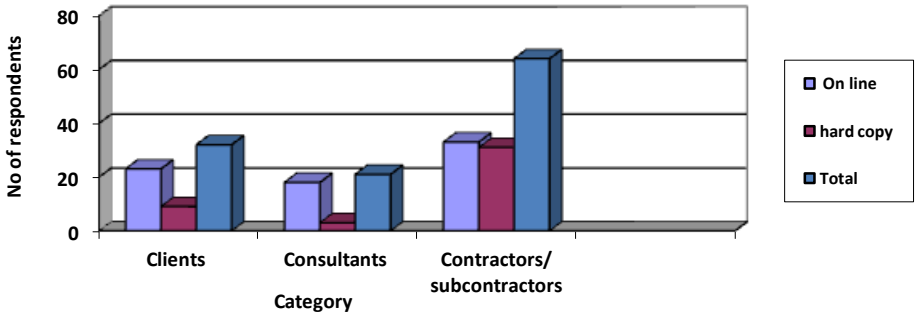

Figure 3.2 Detail of Respondents Feed Back

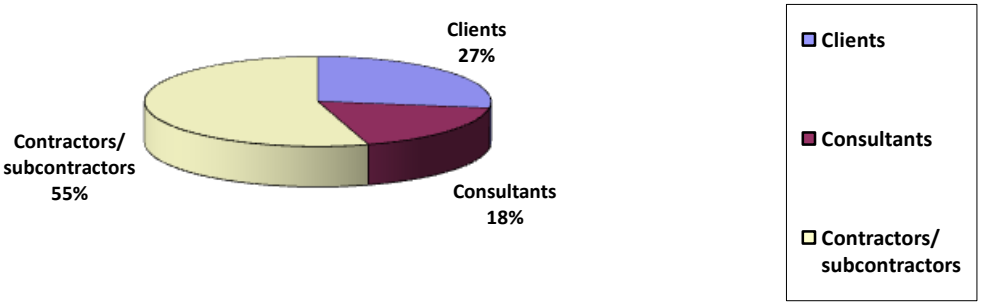

Figure 3.3 Detail of Respondents Feed Back

3.6 Comparison study of alternative methods

For comparison study, of lowest bidder bid system with different methods used in some countries of the world, Part II of the questionnaire was developed. 5 alternate methods were selected after extensive literature review on the subject. To assess these methods, 10 parameters were selected pertaining to the performance of contractors for execution of a project. Instead of using "Yes/No" answers, a five point likert scale was used, to explore the complete range of possible replies between "Yes" and "No" (Fellow and Liu, 2003). In this study, questionnaire survey was administered as it is the most appropriate method for this kind of study (Naoum, 2007). For questionnaire survey same methodology was adopted as explained above in this chapter.

The main consideration for using likert scale is to establish the extent to which respondents agree or deviate with a particular parameter (Cormack, 2000). The responses to each statement/question are then used to calculate RII ranging from 0 to 1. RII method has the limitation that it may capitalize on skewed data thus inflating the relative weight for a certain factor. In this research, the RII is renamed as parameter index (PI) and is used to rank each parameter in CI of Pakistan.

$$\textbf{Parameter Index} = \sum p / (A * N)$$

$$\textbf{PI} = [0\,n1 + 1\,n2 + 2\,n3 + 3\,n4 + 4\,n5] / [A * N]$$

where;

p : weighting given to each parameter by the respondents ranging from 0 to 4

n1 : number of respondents for impossible

n2 : number of respondents for less likely

n3 : number of respondents for likely

n4 : number of respondents for very likely

n5 : number of respondents for almost always

A: highest weight i.e. 4

N: sample size or number of samples

All 10 parameters were assigned a weight and then their weighted average was calculated to establish the best ranking of these five methods. Weights assigned to different parameters are shown in Table 3.2.

Table 3.3 Weights assigned to different parameters

Weights assigned to different parameters		
Parameter		**Weight**
01	Time of completion will be reduced.	2
02	Quality of finished product will be improved	3
03	Number of claims will be reduced	1
04	Number of disputes will be minimized	1
05	Better relations between client and contractor will be established	1
06	Overall cost of the project will be reduced	2
07	Repair and maintenance costs will be reduced	2
08	Life cycle cost of the project will be reduced	1

Weights assigned to different parameters		
Parameter		**Weight**
09	Collusion/bid shopping will be minimized	1
10	Number of "Risks" associated with the project will be reduced	1

After calculating the parameter index of all parameters, weighted value for each method was calculated to rank the five methods as under:-

$$\text{Ranking Index} = (2PI1+3PI2+PI3+PI4+PI5+2PI6+2PI7+PI8+PI9+PI10)/15 \quad (3.3)$$

Where,

PI1, PI2, PI3 …….. PI10

are parameter Indices of parameters 1 to 10 respectively.

3.7 Data Analysis Strategy

To get the reliable and practical outcomes out of received data from respondents across the country, data was segregated. It was distributed in different groups. Data analysis strategy is divided into following steps:

a. Distribution of received questionnaires into respondent category i.e. clients, consultants and contractors/subcontractors.
b. Acceptance/ rejection of questionnaire forms for final data analysis.
c. Entering of complete data into MS Excel and SPSS for its analysis.
d. Checking the normality and reliability of complete data.
e. Analyzing the data with kruskal-wallis and Mann-Whitney tests.
f. Assessment of lowest bidder bid system for different execution parameters of construction projects.
g. Calculation of performance index (PI) for all parameters of 5 selected bidding systems.

h. Calculation of ranking index (RI) for all the methods and determination of ranking for each method.
i. Writing of data reflective notes for conclusions and future recommendations.

3.8 Summary

This Chapter discusses the detail of formulation of survey questionnaire form and methodology for data analysis. Chapter also briefs in detail regarding the sample size and data collection procedures for data analysis. Other methods, such as interviews are chosen to complement and validate the survey questionnaire. Finally the chapter tells about the adoption of various steps towards the data analysis strategy. Data is analyzed using MS excel PH stat and SPSS-20, to have frequency analysis, reliability analysis and parameter analysis.

CHAPTER 4

RESULT ANALYSIS AND DISCUSSIONS

4.1 Introduction

To check the quality, normality, reliability and authenticity of questionnaire surveyed data which was received from various categories of respondents across the country pertaining to performance of lowest bidder, the following basic data analysis tests were performed on the received data.

4.2 Measurement of Normality of Data

The type of data used for the research study was on ordinal scale and more precisely it was based on the Likert scale measurement involving various categories of respondents across the country therefore. The Shapiro-Wilk test for normality of the surveyed data showed no normal distribution like parametric data behavior so it was treated as *non parametric* for its further analysis and statistics study.

Table 4.1 Shapiro Wilk test for Normality

Ser	Parameter	Statistic	df	Sig
01	Lowest bidder is selected amongst the selected contractors	.825	112	.000
02	Bid shopping (settlement amongst the contractors before bid submission) is carried out in construction contracts.	.834	112	.000
03	Related experience (same nature of construction work done previously) is considered along with lowest bid.	.854	112	.000
04	Financial position of the lowest bidder is considered before award of the contract.	.802	112	.000
05	History / reputation of the lowest bidder is also considered before final award of the contract.	.792	112	.000
06	Past working relationship / confidence of owner on the contractor is also considered besides being lowest bidder.	.864	112	.000

Ser	Parameter	Statistic	df	Sig
07	Quantum of work / commitments (in other projects) of the lowest bidder is also considered before awarding the contract.	.851	112	.000
08	Prequalification requirements for the contractors as per PEC are considered.	.645	112	.000
09	Availability of sufficient related manpower and Tools & Plants is also considered before award of contract to the lowest bidder.	.832	112	.000
10	Safety rules/procedures, safety equipment and presence of safety organization of the lowest bidder's company is also checked.	.871	112	.000
11	What was the degree of satisfaction with overall quality of work completed?	.803	112	.000
12	Completion of the work activities as per schedule submitted by the contractor.	.806	112	.000
13	Completion of the project within stipulated time.	.824	112	.000
14	Overall cost management of the project.	.814	112	.000
15	Adherence to instructions and specifications.	.735	112	.000
16	Submission of timely reports and returns.	.693	112	.000
17	Establishment of effective communication with client and consultant.	.865	112	.000
18	Cooperation with the owner and consultant.	.901	112	.000
19	Application of latest trends in construction.	.834	112	.000
20	Response to changes	.812	112	.000
21	Written warnings issued to the contractor.	.812	112	.000
22	Defects in completed work were experienced within warranty period.	.824	112	.000

Ser	Parameter	Statistic	df	Sig
23	The contractor was called upon to attend the warranty calls.	.802	112	.000
24	The contractor responded well to the warranty calls and rectified the defects.	.816	112	.000
25	Major defects were observed after expiry of warranty period.	.834	112	.000
26	Awarding the contract to the "lowest bidder" affected the smooth project execution?	.833	112	.000

4.3 Measurement of Reliability of Data (Non-Parametric)

To estimate the internal consistency of scale data given by respondents as per Likert scale, Cronbach's Alpha (α) was used to measure its reliability or viability or correlation before its interpretation. The value of "α" ranges from negative infinity to one, where a score closer to one would indicate a higher degree of reliability (Cronbach, 1951). By using SPSS, the value of Cronbach Alpha was calculated as 0.968, it can be interpreted that there was high level of uniformity or strong internal consistent reliability between the scores submitted by respondents in ranking of various bidding methods.

Table 4.2 Cronbach's Coefficient Alpha Test

Test	Value	No of items
Cronbach's Alpha	0.968	38
Cronbach's Coefficient half split method		
Ist half	0.945	19 items
2nd half	0.943	19 items

4.4 Kruskal-Wallis Test for Reliability.

It is a non parametric test, used to determine whether three or more independent groups e.g. client, consultant, and contractor are identical or diverse on some variable of interest. If asymptotic significance < 0.05, it means there is significant difference between ratings or perceptions. If asymptotic significance > 0.05, it means no significant difference between ratings or perceptions. The test was conducted for two sets of group. Firstly, it was done to check between client, consultant, and contractor. The results showed less than .05 for only one parameter i.e. lowest bidder is selected among the qualified bidders. It shows that perception of three groups was not same. To identify the group whose perception is different from others, Mann-Whitney test was conducted. Result of this test is as under:

Table 4.3 krskal-Wallis test client, consultant and contractor

Ser	Null Hypothesis	Significance	Decision
01	Lowest bidder is selected amongst the selected contractors	.005	Reject
02	Bid shopping (settlement amongst the contractors before bid submission) is carried out in construction contracts.	.429	Retain
03	Related experience (same nature of construction work done previously) is considered along with lowest bid.	.328	Retain
04	Financial position of the lowest bidder is considered before award of the contract.	.841	Retain
05	History / reputation of the lowest bidder is also considered before final award of the contract.	.374	Retain
06	Past working relationship / confidence of owner on the contractor is also considered besides being lowest bidder.	.245	Retain
07	Quantum of work / commitments (in other projects) of the lowest bidder is also considered before awarding the contract.	.197	Retain

Ser	Null Hypothesis	Significance	Decision
08	Prequalification requirements for the contractors as per PEC are considered.	.760	Retain
09	Availability of sufficient related manpower and Tools & Plants is also considered before award of contract to the lowest bidder.	.811	Retain
10	Safety rules/procedures, safety equipment and presence of safety organization of the lowest bidder's company is also checked.	.997	Retain
11	What was the degree of satisfaction with overall quality of work completed?	.791	Retain
12	Completion of the work activities as per schedule submitted by the contractor.	.956	Retain
13	Completion of the project within stipulated time.	.860	Retain
14	Overall cost management of the project.	.657	Retain
15	Adherence to instructions and specifications.	.774	Retain
16	Submission of timely reports and returns.	.340	Retain
17	Establishment of effective communication with client and consultant.	.975	Retain
18	Cooperation with the owner and consultant.	.959	Retain
19	Application of latest trends in construction.	.910	Retain
20	Response to changes	.631	Retain
21	Written warnings issued to the contractor.	.271	Retain
22	Defects in completed work were experienced within warranty period.	.705	Retain
23	The contractor was called upon to attend the warranty calls.	.828	Retain

Ser	Null Hypothesis	Significance	Decision
24	The contractor responded well to the warranty calls and rectified the defects.	.593	Retain
25	Major defects were observed after expiry of warranty period.	.051	Retain
26	Awarding the contract to the "lowest bidder" affected the smooth project execution?	.287	Retain

The same test is applied for experience of the respondents. Five groups of experience are made i.e. 0-5 years, 6-10 years, 11-15 years, 16-20 years and 20+ years. The difference in perception of the respondents was observed in two parameters which is shown in the Table 4.4.

Table 4.4 krskal-Wallis test based on experience of the respondents

Ser	Null Hypothesis	Significance	Decision
01	Lowest bidder is selected amongst the selected contractors	.065	Retain
02	Bid shopping (settlement amongst the contractors before bid submission) is carried out in construction contracts.	.742	Retain
03	Related experience (same nature of construction work done previously) is considered along with lowest bid.	.328	Retain
04	Financial position of the lowest bidder is considered before award of the contract.	.794	Retain
05	History / reputation of the lowest bidder is also considered before final award of the contract.	.059	Retain
06	Past working relationship / confidence of owner on the contractor is also considered besides being lowest bidder.	.166	Retain
07	Quantum of work / commitments (in other projects) of	.275	Retain

Ser	Null Hypothesis	Significance	Decision
	the lowest bidder is also considered before awarding the contract.		
08	Prequalification requirements for the contractors as per PEC are considered.	.087	Retain
09	Availability of sufficient related manpower and Tools & Plants is also considered before award of contract to the lowest bidder.	.137	Retain
10	Safety rules/procedures, safety equipment and presence of safety organization of the lowest bidder's company is also checked.	.253	Retain
11	What was the degree of satisfaction with overall quality of work completed?	.869	Retain
12	Completion of the work activities as per schedule submitted by the contractor.	.993	Retain
13	Completion of the project within stipulated time.	.351	Retain
14	Overall cost management of the project.	.909	Retain
15	Adherence to instructions and specifications.	.383	Retain
16	Submission of timely reports and returns.	.589	Retain
17	Establishment of effective communication with client and consultant.	.487	Retain
18	Cooperation with the owner and consultant.	.683	Retain
19	Application of latest trends in construction.	.530	Retain
20	Response to changes	.029	Reject
21	Written warnings issued to the contractor.	.188	Retain
22	Defects in completed work were experienced within warranty period.	.541	Retain

Ser	Null Hypothesis	Significance	Decision
23	The contractor was called upon to attend the warranty calls.	.955	Retain
24	The contractor responded well to the warranty calls and rectified the defects.	.593	Retain
25	Major defects were observed after expiry of warranty period.	.301	Retain
26	Awarding the contract to the "lowest bidder" affected the smooth project execution?	.264	Retain

The result shows that the parameter at serial 20 i.e. "response to changes by the lowest bidder" was perceived differently by the different experience level respondents. Further to check this difference, Mann-Whitney test is conducted.

4.5 Mann-Whitney test for Rejected null hypotheses.

This test is conducted to check for a certain parameter for which the Null hypothesis is rejected by kruskal-wallis test. The results show that which groups differ in perception from other groups. The results are tabulated below:

Table 4.5 Results of Mann-Whitney Test

Null hypothesis	Kruskal-wallis test sig value	Mann-Whitney Asymptotic significance value Sig level .05		
		Consultant-client	Client-contractor	Consultant-contractor
Lowest bidder is selected amongst the selected contractors	.005	.858	.005	.001

Null Hypothesis	Kruskal-wallis test sig value	Mann-Whitney Asymptotic significance value Sig level .05									
		0-5 & 6-10	0-5 & 11-15	0-5 & 16-20	0-5 & 20+	6-10 & 11-15	6-10 & 16-20	6-10 & 20+	11-15 & 16-20	11-15 & 20+	16-20 & 20+
Response to changes	.029	.138	.497	.001	.006	.892	.062	.049	.382	.675	.434

The result shows that the perception of contractors is different from clients and consultants as regards to the parameter of selection of lowest bidder. Similarly, the perception of low experience professionals is different from those having more experience in the CI as regarding response to changes.

4.6 Analysis of lowest bidder bid system

In public sector, the lowest bidder bid system is widely used in construction projects of Pakistan. The detailed survey was carried out to ascertain different conditions associated with this system followed in different parts of the country. The questionnaire survey (part I) consisted of three main sections followed by few opinion based questions. Analysis of the different parameters and conditions selected after thorough literature review is given in this section. A parameter Index for each selected parameter was calculated as shown under:

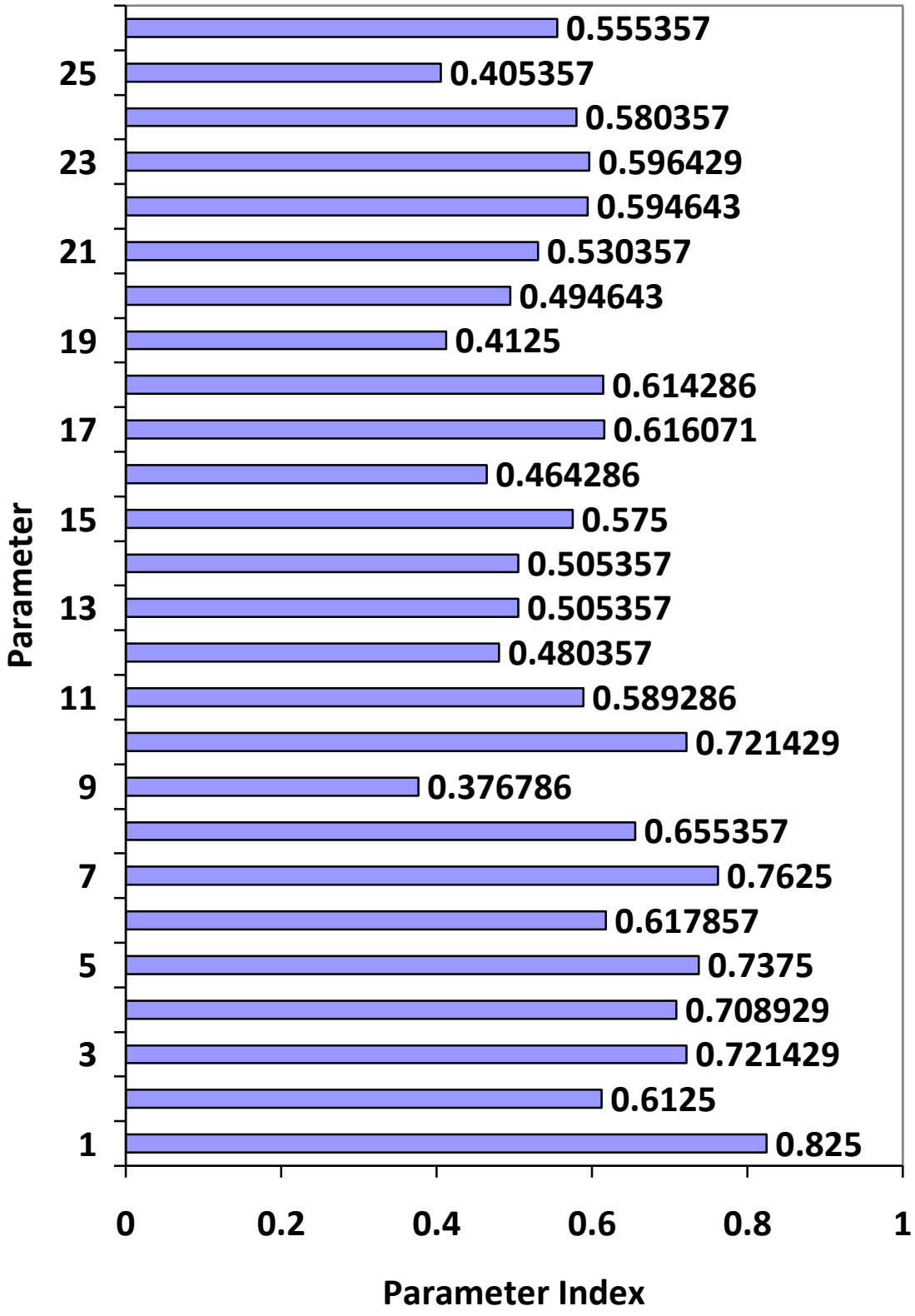

Figure 4.1 Parameter Index Chart

4.6.1 Specific to lowest bidder bid system before the award of the contract.

a) Question 1 was designed to ascertain the frequency of awarding the contract to the lowest bidder in our CI. The results were as per expectations as shown in Table 4.6. the histogram is shown in Figure 4.2.

Table 4.6 Frequency of award of project to lowest bidder

Lowest bidder is selected amongst the selected contractors			
Likert scale	*Frequency*	*Percentage*	*Cumulative %*
1	0	0.00%	0.00%
2	9	8.04%	8.04%
3	12	10.71%	18.75%
4	47	41.96%	60.71%
5	44	39.29%	100.00%
	weighted %		82.5

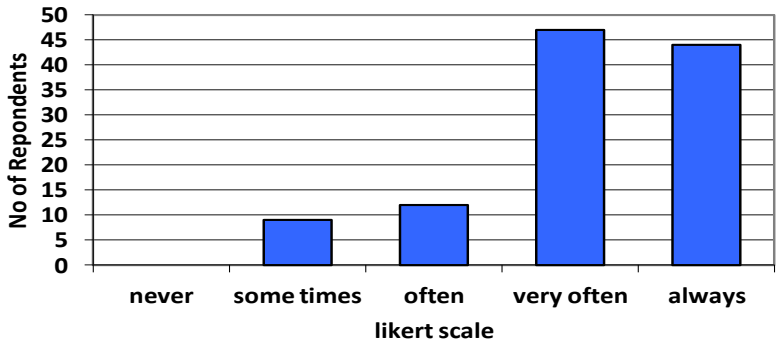

Figure 4.2 Frequency of award of project to lowest bidder

The results of weighted average on likert scale ranging from 1 to 5 shows that 92.4 % contracts are awarded to lowest bidder in CI of Pakistan.

b) Collusion/Bid shopping is a malpractice in almost all the construction industries of the world. The phenomenon is also prevailing in Pakistani CI. Another question was framed to ascertain whether the lowest bidder is really a lowest one or he is made the lowest by the cooperation of other bidders. By this practice a group of contractors make a lobby and then "TAKE TURNS". This not only affects the spirit of the competitive bidding process but also escalates the bid price because of the unrealistic Bid price quoted by the bidders for the project.

Table 4.7 Bid shopping

Bid shopping (settlement amongst the contractors before bid submission) is carried out in construction contracts			
Likert scale	*Frequency*	*Percentage*	*Cumulative %*
1	6	5.36%	5.36%
2	26	23.21%	28.57%
3	38	33.93%	62.50%
4	39	34.82%	97.32%
5	3	2.68%	100.00%
	weighted %		61.25

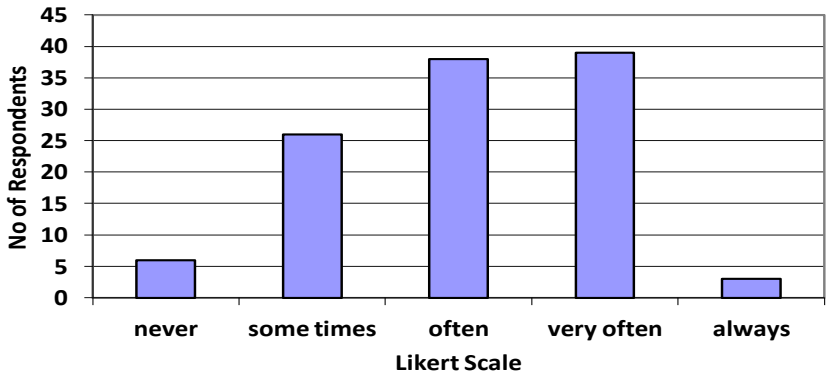

Figure 4.3 Bid shopping

The weighted average shows that 64.2 % times this malpractice is there in CI of Pakistan. This trend also shows that the true spirit of least bid is buried somewhere far behind. The contractors take turns by adopting this practice.

c) Three questions of similar nature were framed to assess the considerations of the owners for Related experience (same nature of construction work done previously), history / reputation of the lowest bidder before final award of the contract and Past working relationship / confidence of the owner on the contractor is also considered besides being lowest bidder. The related response of the respondents is tabulated in Table 4.8

Table 4.8 Related experience

Before award of contract, Consideration for:-			
Likert scale	Related experience	History / reputation	Past working relationship
1	0	0	0
2	9	20	15
3	40	29	25
4	49	38	52
5	14	25	20

d) Financial position of the lowest bidder is another aspect which is needs to be checked before the award of the contract. If the bidder doesn't have sufficient funds available with his firm, he cannot take the project long way. The Table 4.9 shows the result of projects on which this aspect is given due consideration.

Table 4.9 Financial position of the lowest bidder

Frequencies (Financial position of the lowest bidder is considered before award of the contract. [choice])			
Likert scale	*Frequency*	*Percentage*	*Cumulative %*
1	0	0.00%	0.00%
2	19	16.96%	16.96%
3	29	25.89%	42.86%
4	48	42.86%	85.71%
5	16	14.29%	100.00%
	weighted %		70.8

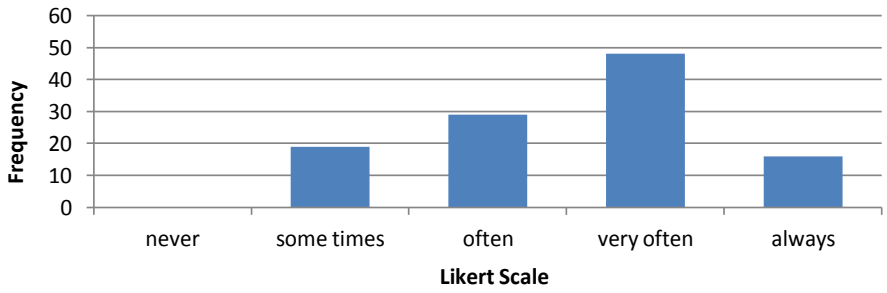

Figure 4.4 Financial position of the lowest bidder

e) The number of projects already under progress by the same bidder may affect the execution of new assignment because of the multidirectional attention. Number of resources and employees of the firm can be a guide to ascertain that how many projects can be undertaken by that firm at a time. To judge that how many clients and owners are aware of this aspect of project management, a question was framed to see that how many people take this consideration into account before award of the contract.

Table 4.10 Commitments in other projects

Quantum of work / commitments (in other projects) of the lowest bidder is also considered before awarding the contract			
Likert scale	*Frequency*	*Percentage*	*Cumulative %*
1	28	20.00%	0.00%
2	34	24.29%	30.36%
3	34	24.29%	69.64%
4	14	10.00%	91.07%
5	2	1.43%	100.00%
	weighted %		76.2

The data analysis shows that only 38 % people keep this consideration in their minds before award of the contract to the lowest bidder.

f) As per PPRA and PEC rules, all public owned construction projects must be executed by those contractors only who fulfill the requirements of PEC and they are registered within the prescribed category of contractors. Not much of violations were observed in this regard, but still at some projects, it was observed

that contractors not fulfilling the prescribed requirements were awarded the contract due to different reasons. The analysis shows that 85% of the projects follow this basic requirement, whereas 15% do not. This is an acceptable percentage, but still public owned bodies must try to ensure the selection of contractor as per PEC framework besides being lowest bidder.

Table 4.11 Prequalification requirements

Prequalification requirements for the contractors as per PEC are considered.			
Likert scale	*Frequency*	*Percentage*	*Cumulative %*
1	6	5.08%	5.36%
2	9	7.63%	13.39%
3	18	15.25%	29.46%
4	46	38.98%	70.54%
5	33	27.97%	100.00%
	weighted %		65.5

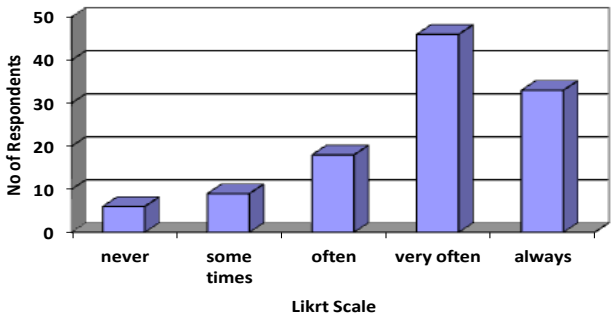

Figure 4.5 Prequalification requirements

g) Safety is one of the most neglected aspects in CI of Pakistan. Internationally, safety has been given due consideration and solid rules and regulations have been made to implement the safety practices. OSHA is one of the examples which describe the rules for safety in depth and its implementation. A question was asked from the respondents that besides being lowest bidder, is there any consideration for safety rules/procedures, safety equipment and presence of safety organization of the lowest bidder's company. The analysis in Table 4.12 shows that in Pakistani CI very less emphasis is given to safety of workers.

Table 4.12 Safety rules/procedures

Safety rules/procedures, safety equipment and presence of safety organization of the lowest bidder's company is also checked			
Likert scale	*Frequency*	*Percentage*	*Cumulative %*
1	45	40.18%	40.18%
2	44	39.29%	79.46%
3	17	15.18%	94.64%
4	3	2.68%	97.32%
5	3	2.68%	100.00%
	weighted %		72.12

4.6.2 Specific to Lowest bidder during and after the execution of the project

The section 2 of the questionnaire survey form (Part I) was purely designed to analyze the performance of the lowest bidder who later becomes contractor after the bidding process is over and the selected contractor is awarded the construction contract. In this section there were ten questions which were designed in a way that performance evaluation of the executing agency is clearly visible and implications of awarding the contract to the lowest bidder could be highlighted. The survey was very interesting and useful in compiling the

results for lowest bidders' performance. The analysis of the different aspects of this section is explained as under:-

a) One of the most important parameters of any construction project is the quality of the finished product. Quality of the finished facility not only improves the standards of living but it also minimizes the repair and maintenance costs and thus having a lower life cycle cost of the project. The better quality also brings peace of mind for the end user and saves extra time and effort in frequent repairs and maintenance. A better quality gives job satisfaction to the contractor, consultant and the owner. Moreover, a better reputation of the construction firm is achieved and it gets more opportunities for future works. Once a project is completed with high quality standards, then other concerning factors like cost, time etc are shadowed. But, this is only achievable with compatible rates and overall price of project. A reasonable profit is the need of the executing agency. Both, better quality and reasonable profit can be achieved at the same time, only if, the rates offered are compatible with the desired quality. During interviews on many project sites, this was the main reason given by the contractors for not finishing the job with optimum quality. The results of the questionnaire survey are tabulated in Table 4.13.

Table 4.13 Satisfaction with overall quality of work

What was the degree of satisfaction with overall quality of work completed			
Likert scale	*Frequency*	*Percentage*	*Cumulative %*
1	0	0.00%	0.00%
2	18	16.07%	16.07%
3	82	73.21%	89.29%
4	12	10.71%	100.00%
5	0	0.00%	100.00%
	weighted average		58.9%

Figure 4.6 shows that the data obtained was normally distributed and around 73% of the respondents showed their satisfaction level of quality as good. None of the respondents were either totally satisfied or unsatisfied with the quality of the finished product. The quality produced by the lowest bidder was assessed to be 59% on weighted average. On probing the contractors about quality, it can be deduced that an even better quality can be achieved if price is increased.

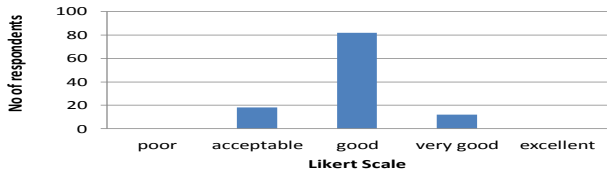

Figure 4.6 Satisfaction with overall quality of work

b) Time is money. Time value of money is emphasized by many authors and plenty of literature is available on the subject. Time management on any project is of essence due to many factors including the major factor of cost. Experts say that any saving in time will contribute to the overall saving of the project for the contractor as well the owner. For example, if a project of building construction is completed and handed over to the owner three months prior to its completion date; the contractor will save a reasonable sum of amount in shape of overheads etc. Other advantages to the contractor can be good reputation, better relations with the client, improvement in management skills, and availability of sufficient time for defect rectification and above all greater sense of achievement. At the same time, this early completion may reward the owner with savings in cost of the project or an extra advantage given may be in shape of rents, hiring, returning of bank loans, insurances etc. To check this very important aspect of time management by the lowest bidder, two questions were included in the survey questionnaire. One question was pertaining to the completion of work activities as per schedule and the other was regarding overall time management of the project. The results of these can be seen in figure below:

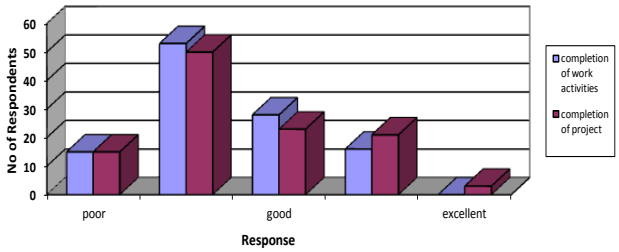

Figure 4.7 Time management

From the above result, it can be seen that there is very little variation between completion of work activities and overall completion of the project within the stipulated time. The majority of the projects have an acceptable trend of time management. The analysis shows that only 51% of the public projects are completed within or before time where as 49% of the projects performed by the lowest bidder get delayed due to one or the other reason. For construction projects, this is a big ratio of getting the projects' completion delayed and obviously all the advantages of early completion as discussed above are converted into disadvantages.

c) Cost is the major factor around which the whole process of bidding and construction revolves internationally in general and in Pakistani CI in particular. Except for few exceptions in the world, mostly the lowest bidder bid system is followed mainly because of saving the cost. But, the question here is that whether this saving is worth or not. If planned on life cycle costs of the projects, the lowest bidder bid system purely based on cost may not seem to be a viable option. In many parts of the world, this fact has been realized that lowest bidder in not a better option for the construction projects. To assess this aspect of lowest bidder bid system in Pakistan a question was framed as cost management of the lowest bidder on construction projects. The maximum number of respondents rated this aspect as below average. The results are shown in Table 4.14.

Table 4.14 Cost management

Overall cost management of the project			
Likert scale	*Respondents*	*Percentage*	*Cumulative %*
1	21	15.79%	18.75%
2	37	27.82%	51.79%
3	31	23.31%	79.46%
4	20	15.04%	97.32%
5	3	2.26%	100.00%
	weighted %		50.5

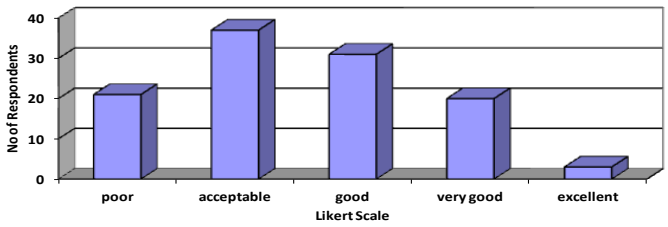

Figure 4.8 Cost Management

The weighted average of the respondents shows that 50.5% of the industry is satisfied with the cost management of the projects whereas 49.5% are not. Like quality, this is again not a good percentage for a construction industry.

d) Adherence to instructions and specifications and submission of any reports and returns (if required) remain weak areas on the part of contractors. Most of the

contractors in CI are under educated thus weak in theoretical parts of the project. The analysis shows that

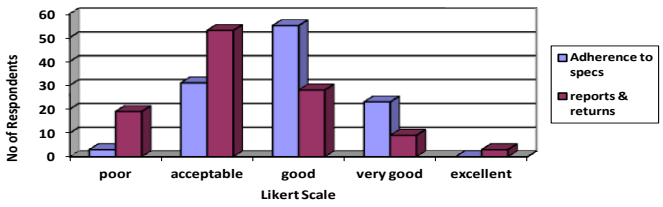

Figure 4.9 Adherence to specifications and reports and returns

e) Effective communication is the life line of any construction project. Under communicated projects normally lead to confusions, misunderstandings disputes and claims. Cooperation and establishments of better relations between client and contractor are also inter-related with effective communication. These two aspects, if taken care well during the life of a project, may bring many positive results on the health of a project. The results of the analysis in this regard show that contractors are generally good in these aspects of a project and keep in touch with the clients' reps, consultants or the engineers. The distribution of the results is shown in Table 4.15.

Table 4.15 Establishment of communication

Measure of Relationships			
Likert scale	Establishment of effective communication with client and consultant	*Cooperation with the owner and consultant*	*Remarks*
1	7	12	

Measure of Relationships			
Likert scale	Establishment of effective communication with client and consultant	*Cooperation with the owner and consultant*	*Remarks*
2	24	13	
3	50	45	Maximum
4	15	39	
5	16	3	

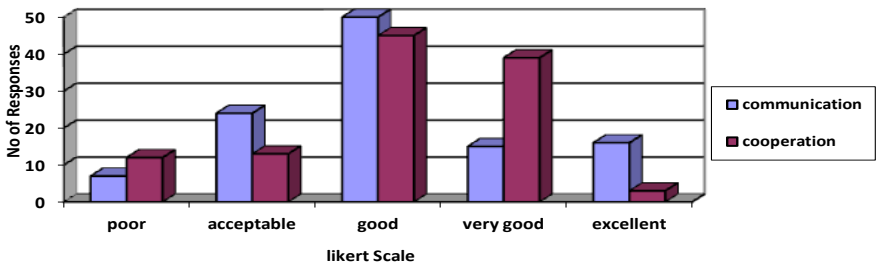

Figure 4.10 Communication and cooperation

f) Use of modern equipment and machinery in any project increases the efficiency manifolds. Most of the manual methods of construction have been replaced with mechanized or electronic systems worldwide. The trend is also growing in Pakistani CI and many modern techniques have been adopted. E.g. the concrete mixing with conventional methods has been replaced with batching plants. This not only improves the quality and strength but pouring time is also reduced. Man power employment requirements are reduced too thus minimizing many areas of concern like safety, insurance, health etc. analysis shows that still a need of modernizing is felt because many contractors are still following the old conventional methods. The weighted average shows that 46% of the lowest

bidders in construction industry are applying the latest trends in construction. This is very obvious that adoption of the latest trends cost more initially, but with the passage of time these trends produces better quality and become less costly when repeated. The Table 4.16 shows the application of latest trends by lowest bidders in Pakistani CI.

Table 4.16 Latest trends in construction

Application of latest trends in construction			
Likert scale	*Respondents*	*Percentage*	*Cumulative %*
1	28	20.00%	25.00%
2	59	42.14%	77.68%
3	15	10.71%	91.07%
4	10	7.14%	100.00%
5	0	0.00%	100.00%
	weighted %		41.25

g) In construction projects, no design can be perfect and changes do occur. There is no known project in the world which has completed without any change. Project change management, after realization of its importance, has become a major subject of construction management. The changes made during the execution phase of a construction project are made by the owner, designer, consultant, contractor or the Engineer. The more number of changes made by any one of the above mentioned, is irritating for the contractor who is the lowest bidder until or unless this change is giving some financial or other benefits. Since this aspect plays a vital role in successful completion of the construction project therefore a

question regarding response to changes by the lowest bidder was asked from the professionals of the construction Industry and its results are shown in Table 4.17.

Table 4.17 Response to changes

Frequencies (Response to changes			
Likert scale	*Frequency*	*Percentage*	*Cumulative %*
1	21	15.79%	18.75%
2	39	29.32%	53.57%
3	30	22.56%	80.36%
4	22	16.54%	100.00%
5	0	0.00%	100.00%
	weighted %		55.4

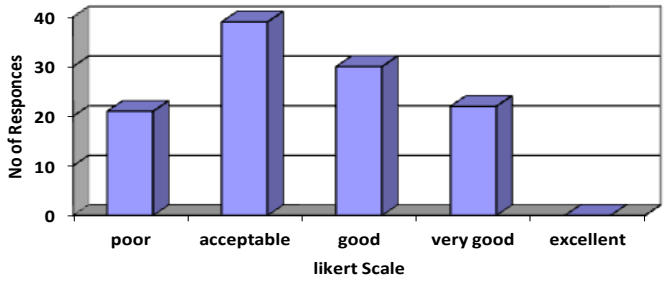

Figure 4.11 Response to changes

4.6.3 Actions related to the contractor who executed the project being "lowest bidder".

An evaluation of the lowest bidder was also carried out through questionnaire survey regarding some actions by owner or consultant during and after the completion of the project. These included written warnings, defect observation in warranty period, defects after the warranty period, contractors' response for defect rectification etc. The results show that the response of the contractor who executed the project being lowest bidder was generally good.

a) A legal aspect of project under clauses of FIDIC also states that written correspondence should be carried out with all the primary stakeholders of the construction project. In such cases, where some negligence is observed regarding specifications, quality, schedule or cost, the contractor should be served with written warnings and a record must be kept for future reference and claim/dispute resolution. A question regarding issuance of written warnings issued to the contractor showed the results as per Table 4.18.

Table 4.18 Written warnings issued to the contractor

Written warnings issued to the contractor			
Likert scale	*Frequency*	*Percentage*	*Cumulative %*
1	0	0.00%	0.00%
2	60	53.57%	53.57%
3	34	30.36%	83.93%
4	15	13.39%	97.32%
5	3	2.68%	100.00%
	weighted %		53

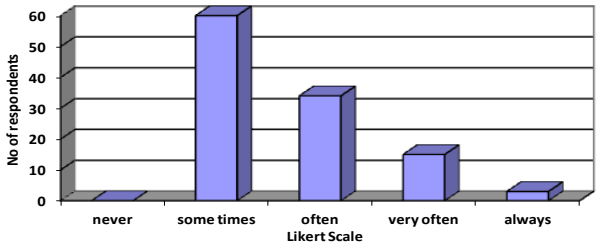

Figure 4.12 Written warnings issued to the contractor

The histogram shows that mostly the written warnings are avoided and sometimes when the conditions are unavoidable the owners and consultants resort to this for keeping a pressure on the contractor. During interviews it was assessed that there can be multiple reasons for not issuing the written warning frequently and they may include:-

i. Avoidance of bitter relationships amongst the stakeholders on a construction project.

ii. Trying to resolve the issues by verbal conversations.

iii. Due to strong and influential contractors.

iv. Lesser knowledge about contract clauses and specifications.

b. Defects are always observed in construction projects immediately after the completion or after some time. These defects can be of minor or major nature. Minor defects normally do not bother much to the owner or the contractor. But major defects observed in the project are of serious concern to the owner. The contract agreement always covers this aspect and reasonable time period is kept as a warranty period for any construction project. It normally ranges from 1 to 3 years depending upon the nature of the component being constructed or installed. After the contractor has demobilized from the construction site it is very difficult and troublesome to come back and rectify the major defect. This critical aspect

was covered in four questions of the questionnaire survey. The results are tabulated in Table 4.19.

Table 4.19 Defect occurrence and rectification

Frequency Chart				
Likert scale	Defects in completed work within warranty period	*The contractor was called upon to attend the warranty calls*	*The contractor responded well to the warranty calls and rectified the defects*	*Major defects were observed after expiry of warranty period*
1	4	4	13	31
2	46	39	16	50
3	24	37	55	28
4	25	19	25	3
5	13	13	3	0

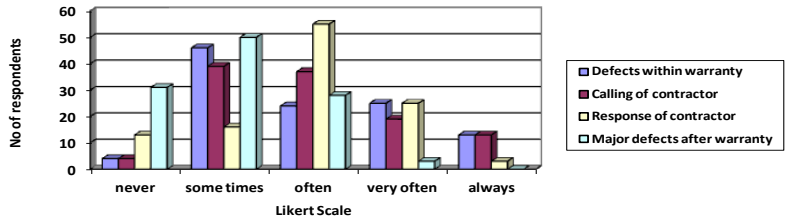

Figure 4.13 Defect occurrence and rectification

4.6.4 Opinion of the construction Experts regarding lowest bid awarding system

There is general perception in the CI of Pakistan that if the contracts are not awarded to the lowest bidder, the overall performance on any construction project can be improved. The opinion of the experts from the construction Industry of the Pakistan was also sought through 3 questions in this regard and it was seen that almost every responder was against the system of lowest bidding in their opinion.

The first question in this regard, "in your opinion should the contract be always awarded to the lowest bidder", was answered as "NOT ALWAYS" by 83% of the respondents as shown in Figure 4.14.

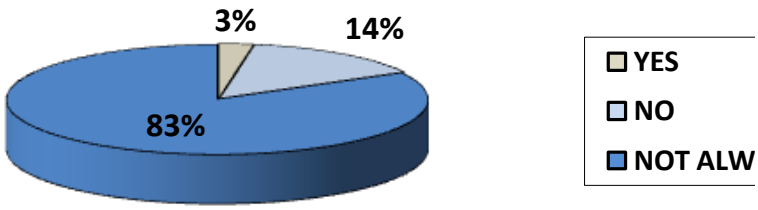

Figure 4.14 Award of contract to lowest bidder (opinion)

In second question, the opinion of the respondents was sought regarding improvement in quality if the project is executed by the "Non Lowest Bidder". The response shown in Figure 4.15 tells that almost 91% people think that quality will be improved.

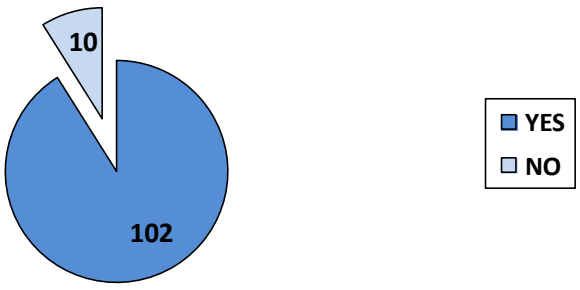

Figure 4.15 Improvement in quality (opinion)

In third question, the opinion of the respondents was sought regarding completion of the project before the schedule time if it is executed by the "Non Lowest Bidder". The response shows that almost 92% people think that project can be completed before stipulated time as shown in Figure 4.16.

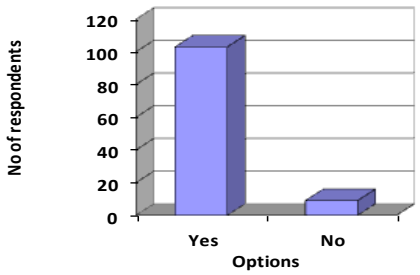

Figure 4.16 Reduction in completion time (opinion)

4.6.5 Comparison and ranking of other bidding method with lowest bid awarding system

In phase II of research**,** a comparison study, of lowest bidder bid system with different methods used in some countries of the world, was carried out. 5 alternate methods were selected after extensive literature review on the subject as under:-

(i) Competitive Average Bidding Method (Price-basis)

(ii) Multi Parameter Bid Method (Basing on quality, time, price and "other" factors)

(iii) Negotiated Bid Method (Competitive)

(iv) Negotiated Bid method (Non-Competitive)

(v) A+B Method (cost + time)

To assess these methods, 10 parameters were selected pertaining to the performance of contractors for execution of a project. By using the PI formula as already explained, the parameter index is calculated.

Parameter Index = $\sum p / (A * N)$

PI = [0 n1 + 1 n2 + 2 n3 + 3 n4 + 4 n5] / [A * N]

where;

p : weighting given to each parameter by the respondents ranging from 0 to 4

n1 : number of respondents for impossible

n2 : number of respondents for less likely

n3 : number of respondents for likely

n4 : number of respondents for very likely

n5 : number of respondents for almost always

A: highest weight i.e. 4

N: sample size or number of samples

All 10 parameters were assigned a weight and then their weighted average was calculated to establish the best ranking of these five methods.

4.4.5.1 Competitive average bidding method

The responses of the questionnaires were tabulated and values were assigned from 0 to 4 for impossible, less likely, likely, very likely and almost always respectively. After feeding the data in the equation 3.3 the performance index of all ten parameters is given in Table 4.20.

Table 4.20 Competitive average bidding

ser	Parameter	Parameter Index (PI)
01	Time of completion will be reduced.	0.3720238
02	Quality of finished product will be improved	0.4910714
03	Number of claims will be reduced	0.4285714
04	Number of disputes will be minimized	0.4047619
05	Better relations between the client and the contractor will be established	0.4940476
06	Overall cost of the project will be reduced	0.3125
07	Repair and maintenance costs will be reduced	0.4553571
08	Life cycle cost of the project will be reduced	0.4464286
09	Collusion/bid shopping will be minimized	0.5744048
10	Number of "Risks" associated with the project will be reduced	0.452381

4.4.5.2 Multi Parameter Bidding Method

In this method the highest performance index is given to collusion and Quality parameters by the respondents. The PI is shown in Table 4.21.

Table 4.21 Multi-parameter bidding

ser	Parameter	Parameter Index (PI)
01	Time of completion will be reduced.	0.6547619
02	Quality of finished product will be improved	0.7589286
03	Number of claims will be reduced	0.702381
04	Number of disputes will be minimized	0.6964286
05	Better relations between the client and the contractor will be established	0.6577381
06	Overall cost of the project will be reduced	0.6220238
07	Repair and maintenance costs will be reduced	0.7142857
08	Life cycle cost of the project will be reduced	0.6577381
09	Collusion/bid shopping will be minimized	0.7946429
10	Number of “Risks” associated with the project will be reduced	0.7470238

4.4.5.3 Competitive negotiated bidding method

In this method competition as well as the negotiation is used. The PI of different parameters is shown in Table 4.22.

Table 4.22 Competitive negotiated bidding

ser	Parameter	Parameter Index (PI)
01	Time of completion will be reduced.	0.5744048
02	Quality of finished product will be improved	0.5625
03	Number of claims will be reduced	0.5327381
04	Number of disputes will be minimized	0.5357143
05	Better relations between the client and the contractor will be established	0.6041667
06	Overall cost of the project will be reduced	0.5952381
07	Repair and maintenance costs will be reduced	0.5744048
08	Life cycle cost of the project will be reduced	0.4910714
09	Collusion/bid shopping will be minimized	0.672619
10	Number of “Risks” associated with the project will be reduced	0.6309524

4.4.5.4 Non competitive negotiated bidding method

This method is used for special type of contracts like dams or some classified projects. The PI of all the parameters is shown in Table 4.23.

Table 4.23 Non-competitive negotiated bidding

ser	Parameter	Parameter Index (PI)
01	Time of completion will be reduced.	0.297619
02	Quality of finished product will be improved	0.3482143
03	Number of claims will be reduced	0.4553571
04	Number of disputes will be minimized	0.3571429
05	Better relations between the client and the contractor will be established	0.5714286
06	Overall cost of the project will be reduced	0.2916667
07	Repair and maintenance costs will be reduced	0.3779762
08	Life cycle cost of the project will be reduced	0.3571429
09	Collusion/bid shopping will be minimized	0.8184524
10	Number of “Risks” associated with the project will be reduced	0.3214286

4.4.5.5 A+B bidding method (Time+cost)

This is mostly used in highway department of USA. It is a very successful method as regards the completion time. The results in Table 4.24 also show that substantial time is saved by using this method with almost no addition in cost.

Table 4.24 A+B bidding

ser	Parameter	Parameter Index (PI)
01	Time of completion will be reduced.	0.5625
02	Quality of finished product will be improved	0.2291667
03	Number of claims will be reduced	0.2172619
04	Number of disputes will be minimized	0.2380952
05	Better relations between the client and the contractor will be established	0.3541667
06	Overall cost of the project will be reduced	0.422619
07	Repair and maintenance costs will be reduced	0.2559524
08	Life cycle cost of the project will be reduced	0.2291667
09	Collusion/bid shopping will be minimized	0.2708333
10	Number of "Risks" associated with the project will be reduced	0.2946429

4.4.5.6 Ranking index and Ranks of the different methods

All 10 parameters were assigned a weight and then their weighted average was calculated to establish the best ranking of these five methods. Weights assigned to different parameters are shown in table 3.2.

After calculating the parameter index (PI) of all parameters, weighted index for each method was calculated to rank the five methods as under :-

Ranking Index = (2PI1+3PI2+PI3+PI4+PI5+2PI6+2PI7+PI8+PI9+PI10)/15

Where,

PI1, PI2, PI3 …….. PI10

are parameter Indices of parameters 1 to 10 respectively. Ranking index of the all the methods is shown in Table 4.25. The best method in this study is Multi parameter bidding method.

Table 4.25 Ranking index of different bidding methods

Ser no	Method	Ranking Index	Rank	remarks
1.	Competitive average bidding method	0.436905	3	
2.	Multi parameter bidding method	0.700992	1	First
3.	Competitive negotiated bidding method	0.57619	2	
4.	Non competitive negotiated bidding method	0.390675	4	
5.	A+B bidding method (cost + time)	0.318254	5	Last

This result shows that 70 % of the respondents of the construction industry in Pakistan have appreciated the idea of Multi-parameter bidding the most. Six parameters were ranked highest out of ten including disputes, claims, repair and maintenance cost, life cycle cost, overall cost of the project and no of risks associated with the project. This

result shows that lowest bidding method if replaced with multi parameter bidding method can fetch fruitful results and improvement in the construction industry.

4.7 Summary

This chapter includes analysis of performance parameters for the projects executed by the lowest bidder. Data obtained through questionnaires was not normally distributed but it was reliable. The analysis shows the medium level of performance by lowest bidder regarding cost, time, quality and other parameters. The perception of contractors is found to be different from clients and consultants regarding award of contract to the lowest bidder. Similarly less experience professionals have a different perception than experienced professionals. Five alternative methods of bidding were selected for comparison with traditional lowest bidding method. Around 70% of the respondents appreciated and supported the idea of multi parameter bidding.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

5.1 Review of Research Objectives

The objectives of this study as a result of research were:

- To highlight the weaknesses, performance, opportunities and implications of the public owned construction projects which are awarded on the basis of lowest bidder bid system in Pakistan.
- To analyze the existing bid selection and awarding system and to provide a comparative study of different alternative bidding systems.
- To present conclusions and recommendations on lowest bidding system performance based on analysis and results of this study.

The first objective of the research was to study and analyze the performance of the lowest bidder in public sector of Pakistani CI. This was achieved through identifying 26 performance parameters and transforming them into a questionnaire along with some opinion based questions. To improve the project performance, 5 new methods were identified which are already in use in different parts of the world. 10 performance parameters were identified and performance index (PI) for each parameter of the five methods was calculated. After doing this through survey questionnaire, RI of all the methods was calculated on the basis of weighted parameters. This concluded to the best possible option against the lowest bidder. This study of comparison of different methods has provided the basis to undertake more elaborate studies for actual comparison between different alternatives. The obtained results, conclusions or recommendations may be sent to PEC or PPRA for further evaluation and consideration.

5.2 Conclusions

The method of procurement of public construction works has a major role in the successful end of the project. In this research, the performance of public owned construction projects awarded on the least bidder bid evaluation and contract award system were assessed.

Additionally, it has been tried to investigate opinions of construction professionals from public organizations about the current method of bid award procedure and other alternatives. The following conclusions are drawn based on the assessment made on information gathered through questionnaires from construction professionals.

a) It can be concluded from the research that least responsive bid evaluation and contract award procedure is the main method of awarding public constructions works contract. Almost 83% of all the public projects are awarded to responsible and responsive bidders with the least price offers in CI of Pakistan.
b) Collusion/Bid shopping is a malpractice in almost all the construction industries of the world. The phenomenon is also prevailing in Pakistani CI. Another question was framed to ascertain whether the lowest bidder is really a lowest one or he is made the lowest by the cooperation of other bidders. The result shows that this practice prevails in 62 % of the cases. By this practice a group of contractors make a lobby and then "TAKE TURNS". This not only affects the spirit of the competitive bidding process but also escalates the bid price because of the unrealistic Bid quoted by the Bidders for the project.
c) Related experience (same nature of construction work done previously), history / reputation of the lowest bidder and past working relationship / confidence of the owner on the contractor are considered in more than 60% of the cases.
d) Few violations were observed in prequalification requirements of contractors as per PEC. At some projects, it was observed that contractors not fulfilling the prescribed requirements were awarded the contract due to different reasons.
e) Quality of the completed projects by the lowest bidders was found to be just satisfactory (index rating of 59%) and not the optimum. During interviews on few project sites, lower rates were the main reason given by the contractors for not finishing the job with optimum quality.
f) Almost half of the public owned projects overrun the time stipulated for their completion. Lowest bidder cannot put in extra resources to boost the project as it costs more and profit margin is reduced. Ultimately the project is delayed as a whole and WBS is also not followed in letter and spirit.
g) Cost is the major factor around which the whole process of bidding and construction revolves internationally in general and in Pakistani CI in particular. Except for few exceptions in the world, mostly the lowest bidder bid system is

followed mainly because of saving the cost. But, at the same time, it is concluded that more than 50% of the construction projects overrun the budget and end up with a higher cost.

h) Adherence to instructions and specifications and submission of any reports and returns (if required) is a weak area on the part of contractors. Most of the contractors in CI are under educated thus weak in theoretical parts of the project.

i) Effective communication is the life line of any construction project. Under communicated projects normally lead to confusions, misunderstandings disputes and claims. Cooperation and establishments of better relations between client and contractor are also inter-related with effective communication. This particular aspect was seen to be satisfactory as more than 60% of the respondents rate this as satisfactory in CI of Pakistan.

j) No design can be perfect. Changes during or after the execution phase of the project are almost inevitable. More than half of the lowest bidders are normally reluctant to accept change orders, unless it is more profitable.

k) Written warnings to the contractor are normally avoided by the clients and consultants and these are served occasionally.

l) Defects are generally observed in the more than 60% of the built facilities within the warranty period. Contractors are often called upon to rectify the defect and their response is generally good.

m) Not much of major defects are observed after the expiry of the warranty period of the completed project by the lowest bidder.

n) More than 90% of the construction professionals opine that:

    i. Construction projects should not be always given to the lowest bidder.
    ii. The quality of the finished project will be improved if performed by the non lowest bidder and project can be completed before stipulated time.

o) Study of alternate methods for bidding is supported by the construction professionals. It was appreciated that new methods in the field must be tried to get ultimate results.

p) Competitive average bidding method can serve in a better way with following advantages

    i. Time of completion can be reduced.

ii. A better quality of the finished product can be achieved.
iii. Lesser no of claims.
iv. Although cost of the project will increase but with better quality, repair and maintenance cost may decrease thus reduction in life cycle cost is expected.
v. Collusion / bid shopping will be minimized.

q) Multi parameter bidding method was appreciated by most of the construction professionals as it appears to be more comprehensive and more useful in selection of the best bid. It can contain as many parameters as desired by the client. It may have edge on the traditional lowest bidding method in following aspects:
   i. Better quality.
   ii. Lesser time.
   iii. Lesser disputes and claims.
   iv. Lesser number of project Risks.
   v. Lesser repair and maintenance cost.
   vi. Better relations amongst stakeholders.
   vii. No collusion or bid shopping.

r) Competitive negotiated bidding is also a method which can bring upon positive changes as compared to the lowest bidding. The major advantages may be listed as following:
   i. Comparatively better quality.
   ii. Satisfaction of the owner.
   iii. Better relations with client and consultant.
   iv. Reduced repair and maintenance costs.

s) Non-competitive negotiated bidding may suit in some special circumstances where there are lesser number of contractors willing to work or due to some classified nature of the project or may be because of some security reasons. This method is generally not suitable for public construction projects.

t) A+B method includes only cost and time. The project, in this case, may have only two major advantages i.e. early finish and least cost. If the quality and other aspects of the project can be controlled by the supervision consultant, this method can obtain rich dividends. Substantial savings in construction time can be

achieved when using the A+B method with almost no or very little addition in cost. The little addition in cost may also be compensated by early completion and handing over of the facility to the owner. E.g. an early finished road project can generate more revenues in shape of toll tax or an early finished building can fetch extra rents.

u) The initial cost of the project in all five methods discussed in the study appears to be more than the conventional lowest bidding method. But, in long term comparison these methods have lesser life cycle cost with better quality and standards.

v) It is discovered in the research that the progress as per the schedule of most projects awarded on the responsive least bidder bid award procedure was not satisfactory.

w) Traditional bidding procedure has been criticized that it might guarantees the lowest cost project, but not the best.

x) All respondents believed that bidding procedure should depend on type and complexity of the project.

y) The perception of contractors was analyzed to be different from clients and consultants regarding the award of the project to the lowest bidders.

z) The perception of lesser experienced professionals was different from the experienced ones regarding response to changes by the lowest bidder.

aa) In some projects of particular organizations it is observed that contractors are pre-decided and they are made lowest bidders by adjusting the bid price by the clients just to fulfill the audit requirements.

5.3 Recommendations

Findings of this research show the moderate level of performance of public construction projects executed by the lowest bidders in most of the cases. The researcher of this thesis strongly recommends the Federal Government of Pakistan to look for other alternative bidding methods for evaluation and award.

a) Keeping in view the inherent weaknesses of the lowest bid system it should be improved by taking following measures:-

i. Quality assurance team of the lowest bidder should be a pre requisite during the execution on public construction projects.
ii. System of incentives and penalties should be strictly imposed and implemented for scheduled completion of the projects.
iii. Projects should be planned in a way that changes are minimized. However, changes made during the execution of the construction project should be well worked out and it should be incorporated in a way that contractor accepts it voluntarily and a reasonable profit to the contractor be kept in mind.
iv. Safety infrastructure of the firm should be given adequate importance at the time of bid evaluation.

b) Flexibility in method of awarding the project should lie with client in the best interest of the project keeping in view the life cycle analysis and nature of the project.
c) Multi parameter bidding method was appreciated by most of the respondents. It can be adopted on trial basis and subsequently adopted if the results are better than the lowest bidding method.
d) Bidding procedure should be made more fair and transparent.
e) Percentage of Performance and insurance bonds should be revised for the lowest bidder to cope up the weaknesses.
f) The cost of any project should not be kept in mind as a single factor but life cycle cost should also be evaluated.
g) Government organizations should be authorized to reject the lowest tender even if the bidder is responsive and responsible if the authority considers non lowest bidder to be more beneficial for the execution of the project.
h) It is also recommended that legislators should work along with higher institutions and other stakeholders before they produce/modify/change the bid evaluation and contract award system in the country. Finally, the concerned government body should consult professionals in this area on whether there is a need to modify/change the current legislation for procurement of works. And the modification/change, if any, should be based on type and complexity of the project.

5.4 Recommendations for Future Research

This study was primarily carried out to assess the performance of the contractors executing the public construction projects. Secondly, an effort is made to highlight the

different alternate methods available for procurement of works. Some of these alternatives are successfully followed in different parts of the world. In future, researchers may perform following:

a) A study may be carried out with large sample size to validate the conclusions of this study.
b) Case studies may be conducted on construction projects executed on lowest-bid and lump-sum basis and conclusions be compared for cost and schedule overruns.
c) Alternative methods, other than conventional lowest bidding, discussed in this study may be analyzed by professionals in the industry.

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APPENDICES

Appendix 1

National University of Sciences and Technology, Islamabad

QUESTIONNAIRE

(Part I)

Subject: Performance and implications of lowest bidding bid system in Pakistan

General Information about the Respondent	
Personal Details: *(All the details will be kept confidential)*	
Name: (Optional)	
Name of Company: (Optional)	
Telephone: (Optional)	
Email: (Optional)	
Please encircle appropriate category for each question below.	
Age (years)	1. 18-30 2. 30-40 3. 40-55 4. 55+
You belong to which stakeholder organization?	1. Owner 2. Contractor 3. Academia 4. Consultant 5. Subcontractor
Position/Appointment	1. Manager 2. Field Engineer 3. Inspector 4. Worker 5. Supervisor
Experience in Construction Industry	1. 0-5 2. 6-10 3. 11-15

(years)	4. 16-20 5. 20+
How long have you worked in this company/ organization	1. Less than 1 year 2. 1-5 years 3. 6-10 years 4. 11-15 years 5. More than 15 years
Education	1. Primary 2. Secondary 3. Certificate/Diploma 4. College or Higher

Subject: <u>Performance and implications of lowest bidding bid system in Pakistan</u>

1. **General Considerations for "lowest bidder" before the award of the contract.**

Please encircle one box to indicate the practice in your company/organization		**Never**	**Some times**	**Often**	**Very often**	**Always**
01	Lowest bidder is selected amongst the selected contractors.	1	2	3	4	5
02	Bid shopping (settlement amongst the contractors before bid submission) is carried out in construction contracts.	1	2	3	4	5
03	Related experience (same nature of construction work done previously) is considered along with lowest bid.	1	2	3	4	5
04	Financial position of the lowest bidder is considered before award of the contract.	1	2	3	4	5
05	History / reputation of the lowest bidder is also considered before final	1	2	3	4	5

1. **General Considerations for "lowest bidder" before the award of the contract.**

	Please encircle one box to indicate the practice in your company/organization	**Never**	**Some times**	**Often**	**Very often**	**Always**
	award of the contract.					
06	Past working relationship / confidence of owner on the contractor is also considered besides being lowest bidder.	1	2	3	4	5
07	Quantum of work / commitments (in other projects) of the lowest bidder is also considered before awarding the contract.	1	2	3	4	5
08	Prequalification requirements for the contractors as per PEC are considered.	1	2	3	4	5
09	Availability of sufficient related manpower and Tools & Plants is also considered before award of contract to the lowest bidder.	1	2	3	4	5
10	Safety rules/procedures, safety equipment and presence of safety organization of the lowest bidder's company is also checked.	1	2	3	4	5

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6. Specific to "lowest bidder" after the award of contract/completion of the project.						
Please encircle one box to indicate the level of performance in your company/organization		**Poor**	**Acceptable**	**Good**	**Very good**	**Excellent**
11	What was the degree of satisfaction with overall quality of work completed?	1	2	3	4	5
12	Completion of the work activities as per schedule submitted by the contractor.	1	2	3	4	5
13	Completion of the project within stipulated time.	1	2	3	4	5
14	Overall cost management of the project.	1	2	3	4	5
15	Adherence to instructions and specifications.	1	2	3	4	5
16	Submission of timely reports and returns.	1	2	3	4	5
17	Establishment of effective communication with client and consultant.	1	2	3	4	5
18	Cooperation with the owner and consultant.	1	2	3	4	5

19	Application of latest trends in construction.	1	2	3	4	5
20	Response to changes	1	2	3	4	5

7. Actions related to the contractor who executed the project being "lowest bidder".

		Never	**Some times**	**Often**	**Very often**	**Always**
21	Written warnings issued to the contractor.	1	2	3	4	5
22	Defects in completed work were experienced within warranty period.	1	2	3	4	5
23	The contractor was called upon to attend the warranty calls.	1	2	3	4	5
24	The contractor responded well to the warranty calls and rectified the defects.	1	2	3	4	5
25	Major defects were observed after expiry of warranty period.	1	2	3	4	5
26	Awarding the contract to the "lowest bidder" affected the smooth project execution?	1	2	3	4	5

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(Please tick the most appropriate option)

4. The contract is awarded to the lowest bidder because:-

   a. It is a government practice.

   b. The offer was close to the engineer estimate.

   c. The contractor was prequalified.

   d. The client had good experience with the contractor.

   e. The contractor was classified.

5. The projects of your company/organization are normally supervised by:-

   a. The Client.

   b. The Consultant.

   c. The Engineer.

   d. Any other agency.

6. In your opinion, "should the contract be always awarded to the lowest bidder".

   a. YES b. NO c. Not Always

7. In your opinion, if the contract is awarded to the "Non lowest bidder", can the quality of work be improved?

   a. YES b. NO

8. In your opinion, if the contract is awarded to the "Non lowest bidder", can the project be completed before stipulated time?

   a. YES b. NO

Any additional comments/suggestions:

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National University of Sciences and Technology, Islamabad

QUESTIONNAIRE

(Part II)

(Comparison of other bid awarding systems with lowest bidding method)

Subject: Performance and implications of lowest bidding bid system in Pakistan

General Information about the Respondent	
Personal Details: *(All the details will be kept confidential)*	
Name: (Optional)	
Name of Company: (Optional)	
Telephone: (Optional)	
Email: (Optional)	
Please encircle appropriate category for each question below.	
Age (years)	1. 18-30 2. 30-40 3. 40-55 4. 55+
You belong to which stakeholder organization?	2. Owner 2. Contractor 3. Academia 4. Consultant 5. Subcontractor
Position/Appointment	2. Manager 2. Field Engineer 3. Inspector 4. Worker 5. Supervisor 6. Owner

Experience in Construction Industry (years)	2. 0-5 2. 6-10 3. 11-15 4. 16-20 5. 20+
How long have you worked in this company/ organization	1. Less than 1 year 2. 1-5 years 3. 6-10 years 4. 11-15 years 5. More than 15 years
Education	1. Primary 2. Secondary 3. Certificate/Diploma 4. College or Higher

Subject: <u>Performance and implications of lowest bidding bid system in Pakistan</u>

(Comparison of other bid awarding systems with lowest bidding method)

1. **Competitive Average Bidding Method (Price-basis)** The bid closest to average of all the bids is considered to be the best bid						
Please encircle / tick one box to indicate your experience based opinion		**Impossible**	**Not likely**	**likely**	**Very likely**	**Almost Always**
01	Time of completion will be reduced.	1	2	3	4	5
02	Quality of finished product will be improved	1	2	3	4	5
03	Number of claims will be reduced	1	2	3	4	5

1. **Competitive Average Bidding Method (Price-basis)**

The bid closest to average of all the bids is considered to be the best bid

	Please encircle / tick one box to indicate your experience based opinion	**Impossible**	**Not likely**	**likely**	**Very likely**	**Almost Always**
04	Number of disputes will be minimized	1	2	3	4	5
05	Better relations between the client and the contractor will be established	1	2	3	4	5
06	Overall cost of the project will be reduced	1	2	3	4	5
07	Repair and maintenance costs will be reduced	1	2	3	4	5
08	Life cycle cost of the project will be reduced	1	2	3	4	5
09	Collusion/bid shopping will be minimized	1	2	3	4	5
10	Number of "Risks" associated with the project will be reduced	1	2	3	4	5

2. **Multi-Parameter Bidding Method (Based on price and "other" factors)**

A model based competitive bidding which not only on caters for cost but also considers other parameters including time, quality and any other factor (past experience, financial capability, reputation, size of organization, claims or dispute history etc.) considered appropriate by the client.

Please encircle / tick one box to indicate your experience based opinion		**Impossible**	**Not likely**	**likely**	**Very likely**	**Almost Always**
01	Time of completion will be reduced.	1	2	3	4	5
02	Quality of finished product will be improved	1	2	3	4	5
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07	Repair and maintenance costs will be reduced	1	2	3	4	5
08	Life cycle cost of the project will be reduced	1	2	3	4	5
09	Collusion/bid shopping will be minimized	1	2	3	4	5
10	Number of "Risks" associated with the project will be reduced	1	2	3	4	5

3. **Competitive Negotiated Bidding**

Obtain bids from a selected group of contractors who possess known technical, managerial and financial capacity to complete a multi dimensional complex project

Please encircle / tick one box to indicate your experience based opinion		**Impossible**	**Not likely**	**likely**	**Very likely**	**Almost Always**
01	Time of completion will be reduced.	1	2	3	4	5
02	Quality of finished product will be improved	1	2	3	4	5
03	Number of claims will be reduced	1	2	3	4	5
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09	Collusion/bid shopping will be minimized	1	2	3	4	5
10	Number of "Risks" associated with the project will be reduced	1	2	3	4	5

4. Non-Competitive Negotiated Bidding

The process of negotiating a bid with a single source, usually a preselected contractor. The firm, that is known to be prequalified and having expertise, can be chosen without any notification or tendering advertisement. This saves additional effort, time and money but chances of favoritism and corruption are increased.

Please encircle / tick one box to indicate your experience based opinion		**Impossible**	**Not likely**	**likely**	**Very likely**	**Almost Always**
01	Time of completion will be reduced.	1	2	3	4	5
02	Quality of finished product will be improved	1	2	3	4	5
03	Number of claims will be reduced	1	2	3	4	5
04	Number of disputes will be minimized	1	2	3	4	5
05	Better relations between the client and the contractor will be established	1	2	3	4	5
06	Overall cost of the project will be reduced	1	2	3	4	5
07	. Repair and maintenance costs will be reduced	1	2	3	4	5
08	Life cycle cost of the project will be reduced	1	2	3	4	5
09	Collusion/bid shopping will be minimized	1	2	3	4	5
10	Number of “Risks” associated with the project will be reduced	1	2	3	4	5

5. **A+B bidding method**

In this method contractors bid on the cost (part A) and on the time (part B), and the lowest combined bidder (A+B) is awarded the project

Please encircle / tick one box to indicate your experience based opinion		**Impossible**	**Not likely**	**likely**	**Very likely**	**Almost Always**
01	Time of completion will be reduced.	1	2	3	4	5
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Any additional comments/suggestions:

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Thanks for your co-operation