A Decision Support System for Contract Bidding and Selection in Construction Projects

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ABSTRACT
Contractor selection methods currently in existence are criticized as incomplete, biased and lacking consideration in terms of the contractor’s ability to achieve simultaneously time, cost, quality and safety standards. A large percentage of all construction work is awarded on the basis of competitive bidding. Under this system, the owner of a project invites a number of prospective contractors to compete for a project by tendering bids or proposed bid prices. The award is made on the basis of the proposed bid prices, the project generally being awarded to the lowest responsible bidder. In making transparent decision and healthy competition tendering, there exists a need for flexible guidance tool for decision support.

Keywords—selection; competitive; bid price; decision support

INTRODUCTION
Preparation of an agreement has a great influence on economic success of both parties and on their behavior in order to increase their profits and to protect themselves against possible loss. It is important to use technological innovations in construction contracting. Even when the construction contractor is selected and the price and work terms are negotiated; it’s possible to choose at least several variants of agreements. The aim is to develop a hierarchical model of criteria of a construction contract agreement based on their functions. Construction contract agreements can be concluded, evaluated and compared on the basis of this model. This model forms the basis of decision support system for analysis of construction contracts. Decision support system created on the basis of presented model can be very useful and helpful in construction contract agreement and can be widely implemented in construction sectors.

The successful execution of a construction project is heavily impacted by making the right decision during tendering processes. Managing tender procedures is very complex and uncertain involving coordination of many tasks and individuals with different priorities and objectives. In making transparent decision and healthy competition tendering, there exists a need for flexible guidance tool for decision support. Contractor selection is one of the most important processes and causes a lot of problems encountered during construction. Therefore, selection of a contractor is a very important stage in the implementation of an investment project.

Scope of the article are to improve current tendering procedures and contractor selection, to select most eligible contractor, to increase probability of avoiding project failure related to cost overrun, poor quality and lack of functionality, to ensure confidentiality, greater transparency and healthy competition in tender evaluation process.

Research objectives are to analyze and consider risk opportunity when proposing a project, to improve the success rate of construction projects, to improve the success rate of construction projects.

Research methodology are based on works of factors influencing the different types of contract system in construction industry was carried out. Many authors have expressed their concerns about existing contract system. The paper related to type of contract bidding and selection in construction projects. Evaluation of construction contracts is related to legal regulation of a construction contracts application of principles intended for construction and law.

Research results – presented a model of criteria system which can form the basis of construction contracts and also factors to be considered while preparing bid and making contract. Development of theoretical model for tendering process and preparing contract document.
II. LITERATURE REVIEW

Tejas C. Patil [13] the author explained the importance of successful tendering and bidding process. Decision to bid is a major financial decision because of following factors. First, the contractor assumes substantial costs for the preparations of the estimates and the tender at the risk of not recovering them if he is not awarded the job. Second, and most importantly, the contractor commits himself to investment in the construction of the project if he wins the bid. Sigitas Mitkus[6] the author clearly explained the importance to use technological innovations in construction contracts and hierarchal model of criteria of construction contract agreements. The author describes the selection of contractor is a very important stage in the implementation of a construction project. The author uses two research methods for the study, Analytical hierarchy process and Multi criteria methods. Dwarika Puri [3] the author reviewing the various criteria used for contractor prequalification and bid evaluation. The first contractor prequalification decision problem is to collect a set of criteria and express them as a hierarchy. The major problem solution of the decision lies at the top of the hierarchy. The criteria and sub-criteria are found on each descending level of the hierarchy Construction contractors have big influences upon projects and their successes. Therefore, it is quite critical to select a qualified contractor in the process of construction management. Partick Sik Wah Fong [11] the author identified there should be tradeoff between cost, time and quality in the final selection of contractor and also explained in public projects; tender price still dominates over other factors. Steps carried out in AHP process: Hierarchic structure, Prioritization procedure and Calculation of results. Zedan Hatush [5] the paper discussed about current tendering procedures and contractor selection. The author describes the selection of contractor with the best overall potential to perform and complete the job satisfactorily. There is a need for a contractor selection technique that is capable of considering multiple criteria.

III. TENDERING PROCESS

A. Advertisement

The purpose of advertising for tenders is to create interest for the proposed work amongst a considerable number of builders so as to secure the benefits of keen competition. The advertisements are given under a heading “Tender Notice”. The advertisement should appear well in advance in order to afford bidders a reasonable time to make necessary inquiries. A period of less than two or three weeks is sufficient and for big projects four to six months is required. Information to be given in tender notice,

- Mode of submitting tender
- Form in which tender has to be submitted
- Name of the inviting authority
- Nature of the work and its location
- Estimated cost of the work
- Time limit
- Pre tender conference
- Earnest money deposit
- Security deposit
- The last date, the place and the time of receipt of sealed bids
- The date, time, place and procedure of opening of tenders
- Whom to contact for further information

B. Bidding Stage

Bidding is an offer of setting a price one is willing to pay for something or a demand that something be done. A price offer is called a bid. The goal of the bidding process is to maximize value for money by creating appropriate incentives through a competitive process. When a bid is open to all suppliers, it is called ‘open unrestricted bidding’. Generally, these bids are invited through advertisements to fulfil the buyers’ main aim to have competitive bids. The general theory is that unless there is publicity of the requirements of the buyer, good response from suppliers may not come. Without good response, the chances of obtaining a competitive price are low. The option of limited bids is also there. Sometimes, buyers prefer to invite bids from some selected suppliers, say 15 in number, to reduce the expenditure on publicity. This is called limited bids or limited tenders.

C. Prequalification

Pre-qualification questionnaires are used to shortlist bidders to invite to tender where a certain level of technical ability is required, and form part of the restricted tendering procedure. It gained importance especially with many massive projects being financed by the World Bank. The intending bidders are supplied with prequalification documents. It includes

- Past experience
- Major works on hand
- Technical personnel engaged
D. Tendering Stage
Tender is a written offer submitted by the contractors in pursuance of the notification given, to execute certain work or supply of some specified articles or transport of materials at certain rates with the terms and conditions laid down in the tender documents. An offer, usually in writing, to execute work or supply goods or services at a stated price, and under stated conditions from which a contractor undertake a work in return for a certain sum of money. The work to be undertaken may be
- Construction work of a project
- Supply of requisite materials of specified quality
- Supply of machinery and equipment
- Transport of materials

E. Award of Contract
Before accepting the tender, the engineer makes sure that the successful contractors tender is in order and also ensures that his resources, equipments, experience and sureties are genuine and satisfactory. A formal contract between tenderer and the owner has to be signed at specified date and place. Sometimes the letter of acceptance itself mentions the order to commence the work. The Letter Of Intent (LOI) mentions that till the signing of a formal agreement, the tender and its acceptance would constitute a binding contract.

IV. BID PREPARATION IN A FIRM
A detailed analysis has been done in order to figure out the bid preparation and enclosures during bid preparation. A data and factors considered in bid preparation has discussed.

A. Data to be Considered
1. Notice inviting tender
A call for bids, call for tenders or invitation to tender (ITT), is a special procedure for generating competing offers from different bidders looking to obtain an award of business activity in works, supply or service contracts.
2. Scope of work
Scope of work (SOW) is the area in an agreement where the work to be performed is described. SOW should contain milestones, reports, deliverables, time line for all deliverables and end products that are expected to be provided by the performing party.

3. Completion schedule
The time period stated in the contract within which the contractor is obligated to complete the construction project.

4. Mode of tendering
The following are the widely recognized modes of tendering, both in private and public sectors, i) open tender ii) Limited Tender Enquiry (LTE) iii) single tender iv) rate contract. Based on the above, other dimensions of the modes of tendering is the tendering steps followed while scrutinizing the tenders. The following are popularly used methods, i) single bid ii) two stage bid iii) three stage bid etc.,

5. Tender fees
The total charges associated with the delivery and certification of commodities underlying futures contract. The cost of tender represents the total cost related to taking physical delivery of a commodity.

6. Earnest Money Deposit (EMD)
Deposit paid to demonstrate commitment and to bind a contract, with reminder due at a particular time. If the contract is breached by failure to pay, then the EMD is kept by the client as predetermined or committed damages.

7. Date, time and venue of pre-bid meeting
Pre bid meetings also called conferences, are scheduled during the preparation of socialization documents. Prospective bidders and consultants can become aware of date, time and venue of pre bid meeting

8. Mode of submission of bids
Single – stage: one- envelope bidding: envelope containing both price and technical proposal.
Single – stage: two- envelope bidding: one containing technical proposal and other containing price proposal enclosed together in a single outer envelope.
Two – stage: two- envelope bidding: at the first stage bidders submit two sealed envelopes simultaneously and bidders are allowed to revise the technical proposals to meet the requirements of the purchaser. After the evaluation of technical proposals bidders are invited to second stage

9. Opening of bids
Stage in bidding process where the received bid envelopes are examined by the client or owner of an Invitation to Bid (ITB)
10. Technical specification
A document that defines a set of requirements that a product or assembly must meet or exceed.

11. Location of project
A place where an event or action is going to occur

12. Currency offer
Type of currency: domestic or foreign currency

13. Performance bank guarantee
A performance bond also known as a contract bond is a surety bond issued by an insurance company or a bank to guarantee satisfactory completion of a project by a contractor.

14. Evaluation of bids
After the submission deadline, the process of opening, examining and evaluating bids to determine bidder’s responsibility, responsiveness and other factors associated with selection of a bid for contract award.

B. Enclosures While Submission of Bid
The following are list of enclosures to be attached during submission of bid for any type of project,

- Bidders General Information
- Bid Eligibility Criteria Form
- No Deviation Certificate
- Letter of Authority
- Performa for Contract Security-Cum-Performance Guarantee By Contractor
- Performa for Bank Guarantee for Earnest Money Deposit (EMD)
- Performa for Bank Guarantee for Advance Payment
- List of approved banks for Bank Guarantee

The following samples are collected from XXX Company. The enclosures are submitted by the firm for the project of design, engineering, procurement, supply, erection, testing, commissioning of 2 X 40 MW AC solar PV power projects, on EPC basis including O&M services.

C. Prequalification criteria

- Financial statement
  1. Authorised Capital
  2. Paid-up Capital
  3. Net Worth
  4. Turnover
  5. Net Profit /(Loss) After Tax
  6. Current Assets

- Credit Facilities
  1. Name of Bank
  2. Line of Credit
  3. Maximum amount of Credit line
  4. Amount of Credit available

- Current Major Projects
- Past major projects
- Details of Owned Plant and Equipment

- Details of Personnel
- Details of Sub Contractors
- Details of Joint Ventures

V. CONTRACT DOCUMENTS

A. Data to be Included in Contract Document

1. Definitions and rules of usage
In the agreement, the capitalised words and expressions shall, unless repugnant to the context or meaning thereof, have the meaning hereinafter respectively.

2. Scope of agreement
Defines the services or tasks and the conditions for payment and dispute settlements. A scope of services agreement is the foundation of a service contract.

3. Contractor’s representations and warranties
A term to describe the assertions that a client and contractor makes in a contract agreement.

4. Obligation of the client
Client undertakes following obligations, i) to reasonably cooperate with the contractor in all matters required for the successful completion of the project ii)to pay the price in respect of project to the contractor under the terms and conditions specified in the agreement

5. Health and safety on the site
Prior to the commencement of the services on the site, contractor shall make the required evaluation of risks on health and safety and prepare and send it to the client a health and safety plan to address and mitigate risks. It also includes safety & accident prevention and safe working procedures.

6. Programming and execution of the services
In this chapter they include, i) service program ii) storage at site iii) inspection of the services iv) risk of loss v) installation, commissioning and test operations v) output

7. Price and payment terms
Describes the price and payment terms paid by the client to the contractor in consideration for the completion of works and services by the contractor.
8. Warranties
A written guarantee or promise which provides assurance by one party to other party that specific facts and conditions are true or will happen in specified time.

9. Force majeure
A contract provision that allows a party to suspend or terminate the performance of its obligations when certain circumstances beyond their control arise, making performance inadvisable, commercially impracticable, illegal or impossible.

10. Confidentiality
All information provided by either of the parties to the other for the development and execution of the agreement, as well as terms and conditions of the agreement should be considered as confidential, may not be disclosed to the third parties without the prior written consent of the disclosing party.

11. Intellectual property
Patents, trademarks, industrial designs, geographical indications, trade secrets and other legal interests protected as intellectual property under the law of this state.

12. Performance security
Contract bond issued by an insurance company or a bank to guarantee satisfactory completion of a project by a contractor.

13. Termination
Termination of a agreement occurred in following cases, i) termination for cause ii) clients termination without case iii) termination by the contractor v) termination due to occurrence of force majeure event.

14. Applicable law
The agreement should govern in accordance with the laws of India.

15. Arbitration
Settlement of a dispute between parties to a contract by a third party (arbitrator) without resorting to court action. Arbitration is usually voluntary but, sometimes it is required by law. Type of arbitration i) voluntary arbitration ii) compulsory arbitration

16. Anti bribery compliance
Bribery is a serious criminal offence in jurisdictions in which the company operates. Bribery offences can result in the imposition of severe lines, exclusion from tendering for public contracts and other severe reputational damage. The main purpose is to set out responsibilities, provide information and guidance to the workers.

17. Back charges
An adjustment due to an error or it may be to collect an expense that was not liable until a later period due to timing issues. The client may back charge in following cases, i) contractor failure to comply with any provision ii) contractor fails to take action in a reasonable time iii) completion of incomplete work by client

18. Expediting
Rights that the client has under agreement or at law for any delay in completion of the services, client may appoint an expediting agency or an expeditor at the contractor’s sole expense.

19. Insurance
A financial product that legally binds the insurance company to pay losses when a specific event occurs.

20. Acceleration of the work
In the event of any delay from the schedule set forth in the timetable client may notice to the contractor for any reason attributable to the contractor

VI. CONCLUSION
For this project, collected information’s and data regarding contract bidding, prequalification process, contract selection process and these collected data are studied. Contractor selection for any type of projects mainly based on past experience in relevant projects, major projects in hand, technical personnel engaged and financial statement. And also from the study of contract document came to know that, factors to be considered while preparing contract document are drawings, specification, general conditions of contract, addenda, notifications and agreement between owner and contractor.

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