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Research Paper

MANAGING THE RISKS IN CONSTRUCTION PROJECT BY COMPARING MOSPI AND FIDIC

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The construction industry is subjected to greater risks and uncertainties than other industries. To avoid risks and manage the projects smoothly, there are lots of tools and techniques are being adopted. Among those, most of the civil engineering professionals believe that the contract document is the best tool to manage most of the construction risks. The contract document will allow the contracting parties to manage the risks properly and allocate the balanced risks between them during the initial stage of the project itself. This research project is aimed to compare the risk management clauses from the developed country construction contracts with the Indian construction contracts. Finally this research will recommend the changes required in the Indian construction contracts for better risk management to meet the current requirements in the Indian Construction Industry. And in this project it is decided to identify the popular form of procurement method and construction contract adopted from the developed country construction industry and in the Indian construction industry. Then the risk factors associated with the popular form of procurement method will be identified and the risk mitigation clause associated with those risks will be compared with the popular form of construction contract adopted in developed country construction contracts and in the India.

Keywords: Contract, Risk, Design/build method, Procurement route, MOSPI, FIDIC

INTRODUCTION

A construction project is composed of various construction works. The work may involve design and construction or demolition. Each project will have a specific scope, program and budget. There are projects which failed to meet these scope, delayed and run over the budget. A project could be failed due to various reasons. These reasons lead to risks in the projects. Construction projects are normally labor intensive with long period of work and high financial intensity. Risks in a construction projects are avoidable by better risk allocation and management. By avoiding the risks in a project, a project can be made successful. Contract conditions are generally used in a project to manage these risks. Different forms of standard contract condition are used in the construction industry to manage the construction projects smoothly.

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Purpose and Objectives of the Research

1. To understand the risks observed by the construction professionals in their contract decision making process. It will help to ensure whether the construction risks are generated due to the type of procurement method and contract condition adopted in a project.
2. To identify the popular form of construction contract and procurement method adopted from developed countries and Indian construction projects (Comparing all forms of procurement method and contract condition available from developed country and India is not possible).
3. To identify the risks involved with the standard form of procurement method and prioritize those risks (Managing all the risks in a construction project will be more expensive and time consuming, so the significant risk factors associate with the popular form of procurement route will be identified and prioritized for further data analysis process).
4. Compare the popular form of contract conditions used in India and developed countries for better risk mitigation and recommend the suitable contract condition clauses to the Indian construction industry.

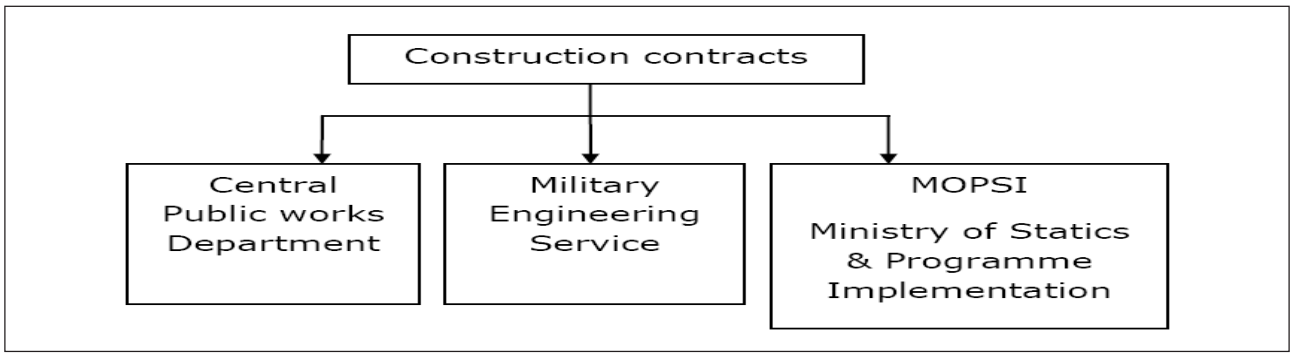
This research output will help to improve the Indian construction industry's contractual risk management practice. There are many different forms of procurement methods and contract types are adopted in the developed countries and the Indian construction industry. Hence, it is not possible to do such an extensive comparative study; so it is decided to identify the popular form of construction contract and procurement method adopted from developed countries and Indian construction industry. The risk mitigation mechanisms/risk allocation clauses from the identified popular form of contracts from India and developed countries will be compared.

EXISTING METHODOLOGY

Construction Contracts

A construction contract may be negotiated for the construction of a single asset such as a bridge, building, dam, pipeline, road, ship or tunnel. A construction contract may also deal with the construction of a number of assets which are closely interrelated or interdependent in terms of their design, technology and function or their ultimate purpose or use; examples of such contracts include those for the construction of refineries and other complex pieces of plant or equipment.

The flow chart below shows the Construction Contracts in India.



About Indian Construction and Construction Contracts

In India construction industry is the second largest industry next to the agriculture. Most of the government projects in India are executed under the Central Public Works Department (CPWD) and Military Engineering Services (MES) contract conditions. The language in the most of the standard form of contracts available in India is considered difficult to comprehend. Disputes in a construction project are mostly aroused due to this reason.

Government of India along with the Indian construction industry has set up the Construction Industry Development Council (CIDC) to solve the problems in Indian construction industry and to standardize the Indian construction contract. This council is started functioning from 1996. On October 4, 2001; the government has released the approved document of unified construction contract condition, which was drafted by Ministry of Statistics and Program Implementation (MOSPI). For the wider adoption this MOSPI contract condition has been circulated to various central and state government departments and they were encouraged to adopt this contract.

About Ministry of Statistics and Programme Implementation

Projects are the cutting edge of development. Projects not only provide industrial and social infrastructure but also create capital base for employment, services, generation of resources for further development with a chain of linked activities. Successful implementation depends largely on carrying out the constituent tasks in a proper sequence, deploying the resources to the best advantage. In the last 20 years, the Project Management Division of the MOSPI has monitored a few thousand infrastructure and industrial projects of the Central/Public Sector enterprises and Government agencies.

It emerges from the analysis of the Central Sector Projects by the MOSPI that many of the projects suffer from inadequacies in project formulation and implementation, resulting in large time and cost overruns, affecting the very viability of the projects and acting as drag on the economy. The analysis has also identified several factors responsible for time and cost overruns some within the control of the enterprises and some beyond their control. As an apex institution for monitoring, the MOSI has initiated several measures to improve the system and procedures relating to project formulation, implementation and monitoring.

Time and cost overruns in projects in the environment of uncertainties, inadequate funding, delay in land acquisition, law and order problems, general escalation in costs, and, high cost of capital cannot be eliminated altogether; but these can be controlled by suitable measures. Measures highlighted above have definitely brought about improvement in the project implementation scenario.

Selection of Contract for Risk Mitigation

In this project MOSPI construction contract conditions from the developing country (India) is selected. In developed countries there are lot of selfgoverning organizations are functioning to deal with project management and contract management practices, for example (NEC, JCT, ICE). The developed

countries construction industry has very good reputation on successfully managing the risks through construction contracts. So, from the developed countries the popular form of construction contract condition FIDIC is choosed. By comparing these two contract clauses (i.e., from the developed countries and the developing country (India)) the risks in the procurement method are mitigated properly. So this comparative study will help to improve the contract management system in India.

DATA COLLECTION METHOD

For this research study it is decided to use both primary data and secondary data.

- The primary data were collected through reviewing the literatures of descriptive documents and statistical information from the different authors.
- The secondary data refers to the data obtained from the e-survey research by survey questionnaire method.

Procurement Method

Definition

- A procurement system can be defined as an organizational system that assigns specific responsibilities and authorities to people and organizations, and defines the relationships of the various elements in the construction of a project.
- Procurement describes the merging of activities undertaken by the client to obtain a building.

Types of Procurement

In the British construction industry acquisition or ordering of properties or their elements is defined as “procurement”. It refers to a wide array of strategies, rules, forms of procurement and responsibilities arising from material, services and construction equipment.

There are several forms or methods of property procurement. Each of those involves a different type of contract, contractual relationships, information flow, roles and responsibilities within a planning team. Available procurement forms are:

1. Traditional (lump sum)
2. Design & Build (D&B)
3. Construction Management
4. Management Contracting
5. Private Finance Initiative (PFI)
6. Public-Private Partnership (PPP)
7. Framework Contracting
8. Prime Contracting

A standard form of contract condition from one of the developed countries and one of the developing countries will be considered here for risk management in construction projects (India – The developing country is considered in this project).

Popular Form of Procurement Methods used for Indian Construction Projects

The aim of this research is to compare the risk mitigation clauses from Indian construction contract and developed construction contract for the risk factors which are associated with the popular form of procurement method.

To make this comparative study successful, it is important to identify the most popular form of construction contract and procurement method which is been adopted from the Indian

and developed construction industry.

The data to identify the popular form of procurement method is obtained from the Chartered Institute and Statistical Report published by the government.

- The Survey report (Contracts in use-2007) published by the Royal Institute of Chartered Surveyors (RICS).

The RICS (Contracts in Use) survey report is published by the Royal Institute of Chartered Surveyors at the interval of every three years. The survey is conducted among the civil engineering professionals, who working in different trade, for example contractor's organization, Client's organization, Architectural, Engineering; this makes the report to be more valid. This is a very authoritative report produced from the survey conducted by RICS, to identify the most popular form of procurement method.

The report enclosed the survey result that the design build method is one of the most commonly used procurement method in India.

Risk Identification

The top 20 risk factors associated with design and build method are identified from the various literature reviews are given below:

1. Cost involved with changes in design and scope of work.
2. Delays due to changes in government and statutory regulations/delay due to government action.
3. Estimation errors or design errors.
4. Poor quality of work done by the contractor.
5. Changes in quantity.
6. Exceptionally inclement weather.
7. Owner delays (lack of payment, unable to get approvals, delayed progress payments).
8. Delays in availability of labor, material and equipment.
9. Force majeure.
10. Exchange rate fluctuation.
11. Inflation
12. Unforeseen ground condition.
13. Inadequate specification and requirements.
14. Delay in agreeing variations /Delay caused by settling contractual disputes due to variation.
15. Fossils and antiquities.
16. Time overrun by the contractor.
17. Changes in legislation.
18. Permits and licenses (Environmental agency, etc.).
19. Site access, site security.
20. Contract termination for economic risk.

Risk Categorization

The risk factors identified from the literature review is categorized for simplifying the research process. Different authors have developed various types of categorization approaches for risk analysis process. These 20 risk factors are classified into six groups from the various literature reviews, they are: capability risks, contractual and legal risks, economic risks, physical risks, political and societal risks, third party risks.

a. Contractual and Legal risks (A1) Cost involved with changes in design and scope of work (A2) Estimation errors or design errors (A3) Changes in quantity (A4) Owner delays (lack of payment, unable to get approvals, delayed progress payments (A5) Delay in agreeing variations/Delay caused by settling contractual disputes due to variation

b. Capability risks : (B6) Poor quality of work done by the contractor (B7) Inadequate specification and requirements (B8) Time overrun by the contractor (B9) Site access and Site security.

c. Economic risks (C10) Delays in availability of labor, material and equipments (C11) Exchange rate fluctuation (C12) Inflation (C13) Contract termination for economic risks.

d. Physical risks (D14) Exceptionally inclement weather (D15) Force majeure (D16) Unforeseen ground condition (D17) Fossils and antiquities.

e. Political risks: (E18) Delays due to changes in government and statutory regulations/ delay due to government action (E19) Changes in legislation.

f. Third party risks : (F20) Permits and licences (Environmental agency etc.).

Risk Significance in the Popular Procurement Route

The identified risks which are associated to design and build procurement method were evaluated by working out a risk level by categorizing the likelihood of the risks and the impact severity. These risk factors can be further evaluated by plotting them in the risk exposure matrix. Plotting the risk level in a risk exposure matrix decides which risk factors are worthy to further attention. A typical example of risk matrix adopted for the calculation of the risk significance level is shown in the Table 1. Five point Likert scale for severity and seven point Likert scale for likelihood is converted into numerical. The model risk matrix table showed in the Table 1 shows the calculation of risk significance index. The risk factors will be ranked by using this index score.

Table 1: Risk Exposure Matrix Model- Calculation of Risk Significance Index

Likelihood (β)	Severity (α)				
	Very Low (1)	Low (2)	Medium (3)	High (4)	Very High (5)
Very Very Low (1)	1	2	3	4	5
Very Low (2)	2	4	6	8	10
Low (3)	3	6	9	12	15
Medium (4)	4	8	12	16	20
High (5)	5	10	15	20	25
Very High (6)	6	12	18	24	30
Very Very High (7)	7	14	21	28	35

Risk significance score is calculated by multiplying the likelihood of occurrence with the impact severity. The significance score will be calculated for all the twenty risks which are associated to the design and build procurement method, by using the Equation (1).

$$S_{ij} = \alpha_{ij} \times \beta_{ij} \quad ...(1)$$

S_{ij} Significance score assessed by the survey respondent *i* for the risk *j*

α_{ij} Likelihood of the risks *i* assessed by the survey respondent *j*

β_{ij} Severity of the risk *i* assessed by the survey respondent *j*

Risk significance index score for each risk factor is calculated by averaging the scores from all the responses. These results can be used for ranking the risks. The equation for risk significance index (RS) score is given by the Equation (2).

$$RS_i = \Sigma S_{ij} / N \quad ...(2)$$

RS_i Risk significance index score for risk *i*

N Total number of responses

SECONDARY DATA COLLECTION

Empirical Web Based Survey Questionnaire

In this project research an e-survey is conducted among the civil engineering industry professionals from Tamil Nadu. The list of members were scrutinized from the directory of civil engineering association.

Data relevant to the background of the respondents and their organizations, impact severity, likelihood of occurrence the risks and party best capable to manage the risks associated to the design and build procurement method were gathered through a comprehensive questionnaire. To accomplish this purpose, internet based survey questionnaire was found very essential to collect the data. The survey data collection method was preferred over other data collection method because of the following reasons,

- Mail surveys have special value if the target is to address a widely spread sample.
- Mail surveys have the advantage of a possible large sample size giving more authoritative ground for generalization.
- The main advantage is, the respondents can complete this survey at their leisure time.
- Another advantage is the relatively low cost to collect data through this method.

Sample Size and Composition of the Survey Respondent

The survey questions were distributed to the construction industry professionals from the directory of Coimbatore civil engineering association through e-mail. The survey questionnaire was sent to 42 construction professionals in random. In the closed ended questions section, the survey respondents were asked to rate the risk factors according to their perception over the identified risks factors which are associated to design and build procurement method and in the open ended question the respondents were asked to write the practical risk mitigation mechanism for the give risk factors. Since these open ended questions were not mentioned as compulsory questions, the

survey participants were not showed their interest to fill this part of questions. To increase the response rate the participants were been communicated by sending remainder mails and calls. Finally a total 19 survey responses were gathered for the survey questionnaire. The response rate was 45.23% for the survey.

Results of the Survey Questionnaire

Characteristics of the Survey Respondents

In this part of the questionnaire, the respondents were requested to tell the type of organization they are working for. This information gathered in the section A of the questionnaire is to understand the background of the respondent. Table 2 shows the background of the survey respondents by type of organization they are working.

Size of the Organization

Table 3 shows the survey response count No's based on the size of the survey respondent's organization. From Table 3 it is clear that, around 53% of the respondents in survey are working for the organizations with staffs strength of more than 300. Despite the some other respondents are working for the organization with less than 300 staffs the majority of the respondents are working with more than 300 staffs. This states that the majority of the respondents were from the organization who are doing multi and large projects.

Experience of the Survey Respondents

Table 4 shows the professional experience of the respondents who took part in this survey. This table shows that the survey participants have the working experience ranges from below five years to above 20 years. In the survey around 47% of the respondents were from the group of people who have experience range between 5 and 10 years.

Table 2: Characteristics of the Survey Respondents – Type of Organisation

Type of Organization	Response Count (No's)	Response Percent (%)
Client organization	0	0%
Main Contractor	1	5.3%
Sub-Contractor	0	0%
Site Engineer	1	5.3%
Executive engineer	4	21%
Architectural Consultant	0	0%
Engineering Consultant/ General engineer	8	42.1%
QS Consultant	0	0%
Project Management Consultant	4	21%
Planning Engineer	1	5.3%

Table 3: Characteristics of the Survey Respondents – Size of the Organisation		
No of People Working in a Organization	**Response count gh, 88u eh (No's)**	**Response Percent (%)**
Below 50	1	5
50-100	2	11
100-200	4	21
200-300	3	16
Above 300	10	47

Table 4: Characteristics of the Survey Respondents- Professional Experience		
Work experience in construction industry	**Response count (No's)**	**Response percent (%)**
Below 5 years	3	16
5 - 10 yrs	9	47
10-15yrs	4	21
15-20yrs	0	0
20-25yrs	1	5
Above 25yrs	2	11

PRIORITIZING THE RISK FACTORS

A total of 20 risk factors associated to the design and build procurement method were identified from the literature review. In the survey questionnaire, the participants were asked to rank the risk factors according to their level of agreement against the (Impact severity, Likelihood of occurrence of risks and party best capable to manage the risks). From that risk significant score index the top 10 risks associated with design and build method were identified and shown in the Table 5.

These prioritized top 10 risk factors will be analyzed in the contractual mechanism and it will be qualitatively analyzed by comparing the risk mitigation mechanisms stated in the popular form of contract condition from India-MOSPI and FIDIC.

CONTRACTUAL MECHANISMS

Risk 1 – Delays in availability of labor, material and equipment

a) FIDIC

If the Contractor fails to comply with Sub-Clause 8.2 [Time for Completion], the Contractor shall subject to Sub-Clause 2.5 [Employer's Claims] pay delay damages to the Employer for this default. These delay damages shall be the sum stated in the Contract Data, which shall be paid for every day which shall elapse between the relevant Time for Completion and the date stated in the

Table 5: Top Ten Risk Factors Associated with Design and Build Procurement Method			
Rank of Risk Factor	**Risk Factor No.**	**Risk Factor**	**Risk Sig. Score Index (Rs.)**
R1	C10	Delays in availability of labour, material and equipment	28.4
R2	B8	Time overrun by the contractor	21.1
R3	B6	Poor quality of work done by the contractor	17.7
R4	D16	Unforeseen ground condition	16.6
R5	F20	Permits and licenses (Environmental agency etc.)	14.1
R6	A1	Cost involved with changes in design and scope of work	8.7
R7	A3	Changes in quantity	7.7
R8	A4	Owner delays (lack of payment, unable to get approvals, delayed progress payments)	3.7
R9	D14	Exceptionally inclement weather	3.4
R10	A2	Estimation errors or design errors	3.3

Taking-Over Certificate. However, the total amount due under this Sub-Clause shall not exceed the maximum amount of delay damages (if any) stated in the Contract Data.

These delay damages shall be the only damages due to the Contractor for such default. Other than in the event of termination under Sub-Clause 15.2 [Termination by Employer] prior to completion of the works. These damages shall not relieve the Contractor from his obligation to complete the works, or from any other duties, obligations or responsibilities which he may have under the Contract.

b) MOSPI

Early Warning

Clause 32.1 says that, the contractor is to warn the employer at the earliest opportunity of specific likely futures or circumstance that may delay the execution of work. The employer shall ask the contractor to provide an estimate of the expected completion date.

Liquidated Damages

In the case of a delay in completion of the contract, according to Clause 9A of MOSPI, the contractor may need to pay the Liquidated Damages (LD) at the rate of (0.5%) of the contract price per week of delay. And the same clause says that the LD rate may be increased up to 10% of the contract price upon the decision of the employer. Clause 9A (i) say that if the owner is satisfied with the works can be completed by the contractor within a reasonable time after the specified time for completion; the owner may allow further

extension of time at its discretion with or without the levy of liquidated damages. Clause 9A (ii) says that the owner if not satisfied that the works can be completed by the contractor, and in the event of failure on the part of the contractor to complete work within further extension of time allowed as aforesaid, shall be entitled, without prejudice to any other right, or remedy available in that behalf, to withdraw the contract. Clause 9A(iii) says that the owner, if not satisfied with the progress of the contract and in the event of failure of the contractor to recoup the delays in the mutually agreed time frame, shall be entitled to terminate the contract.

Risk 2 – Time overrun by the contractor

a) FIDIC

According to the Clause 8.7 If the Contractor fails to comply with Sub-Clause 8.2 [Time for Completion], the Contractor shall subject to Sub-Clause 2.5 [Employer's Claims] pay delay damages to the Employer for this default. These delay damages shall be the sum stated in the Contract Data, which shall be paid for every day which shall elapse between the relevant Time for Completion and the date stated in the Taking-Over Certificate. However, the total amount due under this Sub-Clause shall not exceed the maximum amount of delay damages (if any) stated in the Contract Data. These delay damages shall be the only damages due from the Contractor for such default, other than in the event of termination under Sub-Clause 15.2 [Termination by Employer] prior to completion of the Works. These damages shall not relieve the Contractor from his obligation to complete the Works, or from any other duties, obligations or responsibilities which he may have under the Contract.

Employers Claim: Sub-Clause 2.5

If the Employer considers himself to be entitled to any payment under any Clause of these Conditions or otherwise in connection with the Contract, and/or to any extension of the Defects Notification Period, the Employer or the Engineer shall give notice and particulars to the Contractor The notice shall be given as soon as practicable after the Employer became aware, or should have become aware, of the event or circumstances giving rise to the claim. A notice relating to any extension of the Defects Notification Period shall be given before the expiry of such period. The particulars shall specify the Clause or other basis of the claim, and shall include substantiation of the amount and/or extension to which the Employer considers himself to be entitled in connection with the Contract. The Engineer shall then proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine (i) the amount (if any) which the Employer is entitled to be paid by the Contractor; and/or (ii) the extension (if any) of the Defects Notification Period. This amount may be included as a deduction in the Contract Price and Payment Certificates.

The Employer shall only be entitled to set off against or make any deduction from an amount certified in a Payment Certificate, or to otherwise claim against the Contractor in accordance with this Sub-Clause.

b) MOSPI

Early Warning

Clause 32.1 says that, the contractor is to warn

the employer at the earliest opportunity of specific likely futures or circumstance that may delay the execution of work. The employer shall ask the contractor to provide an estimate of the expected completion date.

Liquidated Damages

In the case of a delay in completion of the contract, according to clause 9A of MOPSI, the contractor may need to pay the LD at the rate of (0.5%) of the contract price per week of delay. And the same clause says that the LD rate may be increased up to 10% of the contract price upon the decision of the employer. Clause 9A (i) say that if the owner is satisfied with the works can be completed by the contractor within a reasonable time after the specified time for completion; the owner may allow further extension of time at its discretion with or without the levy of liquidated damages. Clause 9A (ii) says that the owner if not satisfied that the works can be completed by the contractor, and in the event of failure on the part of the contractor to complete work within further extension of time allowed as aforesaid, shall be entitled, without prejudice to any other right, or remedy available in that behalf, to withdraw the contract. Clause 9A (iii) says that the owner, if not satisfied with the progress of the contract and in the event of failure of the contractor to recoup the delays in the mutually agreed time frame, shall be entitled to terminate the contract.

Incentives: Clause 50.9.B (Option Clause) Clause 50-9(B) articulates that, for early completion of the contract before the stipulated date of completion, the contractor may get an incentive amount at the rate of half per cent (0.5%) of the contract price per week of early completion or it may be subject to maximum of five percent (5%) of the contract price.

Risk 3 – Poor quality of work done by the contractor

a) FIDIC

According to the clause 4.9 Quality of Assurance, The Contractor shall institute a quality assurance system to demonstrate compliance with the requirements of the Contract. The system shall be in accordance with the details stated in the Contract. The Engineer shall be entitled to audit any aspect of the system. Details of all procedures and compliance documents shall be submitted to the Engineer for information before each design and execution stage is commenced. When any document of a technical nature is issued to the Engineer, evidence of the prior approval by the Contractor himself shall be apparent on the document itself.

Compliance with the quality assurance system shall not relieve the Contractor of any of his duties, obligations or responsibilities under the Contract.

b) MOSPI

Under clause 33.1 the employer may check the contractor's work and notify the contractor if defects are identified. The employer has the rights to ask the contractor to search for defects and to uncover and test any work that the employer considers may have defects. Under Clause 34.1 the employer may instruct the contractor to carry out the tests which are not mentioned in the contract specification, if there are no defects identified during this test, it will be considered as compensation event. The employer shall notify the contractor about the

any defects, before the defects liability period (Clause 35.1).

According to the Clause 3B, the contractor should submit 5% of the contract amount as performance guarantee and under Clause 48.1 the employer shall retain money from the each payment (the % of the retention money will be mentioned in contract data). This retention money will be released to the contractor upon the completion of total work. 5% Performance Guarantee should be refunded within 14 days of the issue of the defect liability Certificate (taking over Certificate with a list of defects). Retention money should be refunded after issue of no defect certificate. Under Clause 32.1 the contractor is to warn the employer at the earliest opportunity to specific unlikely future events may affect the quality of the work. Under Clause 12 (g) the contractor is eligible to get compensation for any loss or damage due to the use or occupation by the Employer of any Section or part of the Permanent Works except as may be provided for in the contract.

Risk 4 – Unforeseen ground condition

a) FIDIC

Clause 4.12 unforeseeable physical conditions, In this Sub-Clause, physical conditions means natural physical conditions and manmade and other physical obstructions and pollutants, which the Contractor encounters at the Site when executing the Works, including sub-surface and hydrological conditions but excluding climatic conditions.

If the Contractor encounters adverse physical conditions which he considers to have been Unforeseeable, the Contractor shall give notice to the Engineer as soon as practicable.

This notice shall describe the physical conditions, so that they can be inspected by the Engineer, and shall set out the reasons why the Contractor considers them to be Unforeseeable. The Contractor shall continue executing the Works, using such proper and reasonable measures as are appropriate for the physical conditions, and shall comply with any instructions which the Engineer may give. If an instruction constitutes a Variation, Clause 13 [Variations and Adjustments] shall apply.

If and to the extent that the Contractor encounters physical conditions which are Unforeseeable, gives such a notice, and suffers delay and/or incurs Cost due to these conditions, the Contractor shall be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to:

a. An extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [Extension of Time for Completion], and

b. Payment of any such Cost, which shall be included in the Contract Price.

After receiving such notice and inspecting and/or investigating these physical conditions, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine (i) whether and (if so) to what extent these physical conditions were Unforeseeable, and (ii) the matters described in subparagraphs (a) and (b) above related to this extent.

However, before additional Cost is finally agreed or determined under sub-paragraph (ii), the Engineer may also review whether other physical conditions in similar parts of the

Works (if any) were more favorable than could reasonably have been foreseen when the Contractor submitted the Tender. If and to the extent that these more favorable conditions were encountered, the Engineer may proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine the reductions in Cost which were due to these conditions, which may be included (as deductions) in the Contract Price and Payment Certificates.

However, the net effect of all adjustments under sub-paragraph (b) and all these reductions, for all the physical conditions encountered in similar parts of the Works, shall not result in a net reduction in the Contract Price.

The Engineer may take account of any evidence of the physical conditions foreseen by the Contractor when submitting the Tender, which may be made available by the Contractor, but shall not be bound, by any such evidence.

b) MOSPI

Clause 7.1 encourages the bidders to visit the before entering into bidding. The same clause says that it is bidder's responsibility to examine the site of works and its surrounding to obtain information for preparing the bid. Clause 44.1 (f) says that the following situation may be considered for the compensation event. Ground conditions are substantially more adverse than could reasonably have been assumed with the ground investigation report. Under Clause 11.1 (c) the contractor is responsible for any loss or damage to the extent that it is due to the design of the Works.

Risk 5 – Permits and licences (Environmental agency etc.)

a) FIDIC

Clause 2.2 Permits, Licenses or Approvals - The Employer shall (where he is in a position to do so) provide reasonable assistance to the Contractor at the request of the Contractor:

a. By obtaining copies of the Laws of the Country which are relevant to the Contract but are not readily available, and

b. For the Contractor's applications for any permits, licenses or approvals required by the Laws of the Country:

   i. Which the Contractor is required to obtain under Sub-Clause 1.13 [Compliance with Laws];

   ii. For the delivery of Goods, including clearance through customs; and

   iii. For the export of Contractor's Equipment when it is removed from the Site.

b) MOSPI

Under Clause 32.1 the contractor is to warn the employer at the earliest opportunity to specific unlikely future events may delay the scheduled completion date. Under Clause 9A-i, if the owner is satisfied, that the works can be completed by the contractor within a reasonable time after the specified time for completion, may allow further extension of time at its discretion with or without the levy of liquidated damages.

Risk 6 – Cost involved with changes in design and scope of work (Changes made by client)

a) FIDIC

Under the Clause 13.1 Right to Vary, Variations

may be initiated by the Engineer at any time prior to issuing the Taking-Over Certificate for the Works, either by an instruction or by a request for the Contractor to submit a proposal.

The Contractor shall execute and be bound by each Variation, unless the Contractor promptly gives notice to the Engineer stating (with supporting particulars) that the Contractor cannot readily obtain the Goods required for the Variation. Upon receiving this notice, the Engineer shall cancel, confirm or vary the instruction.

Each Variation may include:

a. Changes to the quantities of any item of work included in the Contract (however, such changes do not necessarily constitute a Variation);

b. Changes to the quality and other characteristics of any item of work;

c. Changes to the levels, positions and/or dimensions of any part of the Works;

d. Omission of any work unless it is to be carried out by others;

e. Any additional work, plant, materials or services necessary for the permanent Works, including any associated Tests on completion, boreholes and other testing and exploratory work; or

f. Changes to the sequence or timing of the execution of the Works.

The Contractor shall not make any alteration and/or modification of the Permanent Works, unless and until the Engineer instructs or approves a Variation.

b) MOSPI

According to Clause 4 A the owner can propose the variation up to ±25% in quantity of each individual item, and ±10% of the total contract.

Under Clause 4 A (b) the contractor can claim the rate of material and labor, plus 10% for overheads and profit for the items/work included extra. If there is delay in the owner and the contractor coming to an agreement on the rate, under Clause 4C the employer will propose the provisional rate and this rate will be paid until the rates are finally determined. Under Clause 44.1 (c) the contractor is entitled for compensation event if any variation in the design is proposed by the employer.

Risk 7 – Changes in quantity

a) FIDIC

Under the Clause 13.1 Right to Vary**,** Variations may be initiated by the Engineer at any time prior to issuing the Taking-Over Certificate for the Works, either by an instruction or by a request for the Contractor to submit a proposal.

b) MOSPI

The following are the clauses under the changes in the quantities, Clause 38 Changes in the Quantities

38.1 If the final quantity of the work done differs from the quantity in the Bill of Quantities for the particular item by more than +25% provided the change exceeds + 10% of initial Contract Price, the Nodal Officer or his nominee shall adjust the rate(s), to allow for the change.

38.2 The Nodal Officer or his nominee shall not adjust rates from changes in quantities if thereby the Initial Contract Price is exceeded by more than 15% except with the Prior approval of the Employer.

38.3 If requested by the Nodal Officer or his nominee where the quoted rate (s) of any item(s) is abnormally high, the Contractor shall provide the Nodal Officer or his nominee with a detailed cost breakdown of such rate in the Bill of Quantities.

Risk 8 – Owner delays (lack of payment, unable to get approvals, delayed progress payments)

a) FIDIC

According to the clause 14.8 Delayed payment, If the Contractor does not receive payment in accordance with Sub-Clause 14.7 [Payment], the Contractor shall be entitled to receive financing charges compounded monthly on the amount unpaid during the period of delay. This period shall be deemed to commence on the date for payment specified in Sub-Clause 14.7 [Payment], irrespective (in the case of its sub-paragraph (b)) of the date on which any Interim Payment Certificate is issued. Unless otherwise stated in the Particular Conditions, these financing charges shall be calculated at the annual rate of three percentage points above the discount rate of the central bank in the country of the currency of payment, and shall be paid in such currency. The Contractor shall be entitled to this payment without formal notice or certification, and without prejudice to any other right or remedy.

b) MOSPI

The general contract conditions state that,

a. Bills should be prepared and submitted by the Contractor. Joint measurements should be taken continuously and need not be connected with billing stage. System of 4 copies of measurements, one each for Contractor, Client and Engineer, and signed by both Contractor and Client can be tried.
b. 75% of bill amount should be paid within 14 days of submission of the bill. Balance amount of the verified bill should be paid within 28 days of the submission of the bill.
c. For delay in payment beyond these periods specified in B) above, interest at a prespecified Rate (suggested rate 12% p. a.) should be paid.

Risk 9 – Exceptional Inclement Weather

a) FIDIC

Clause 4.12 unforeseeable Physical conditions, in this Sub-Clause, physical conditions means natural physical conditions and manmade and other physical obstructions and pollutants, which the Contractor encounters at the Site when executing the Works, including sub-surface and hydrological conditions but excluding climatic conditions.

If the Contractor encounters adverse physical conditions which he considers to have been Unforeseeable, the Contractor shall give notice to the Engineer as soon as practicable.

This notice shall describe the physical conditions, so that they can be inspected by the Engineer, and shall set out the reasons why the Contractor considers them to be Unforeseeable. The Contractor shall continue executing the Works, using such proper and reasonable measures as are appropriate for the physical conditions, and shall comply with

any instructions which the Engineer may give. If an instruction constitutes a Variation, Clause 13 [Variations and Adjustments] shall apply.

a. If and to the extent that the Contractor encounters physical conditions which are Unforeseeable, gives such a notice, and suffers delay and/or incurs Cost due to these conditions, the Contractor shall be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to:

b. An extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [Extension of Time for Completion], and

c. Payment of any such Cost, which shall be included in the Contract Price.

After receiving such notice and inspecting and/or investigating these physical conditions, the Engineer shall proceed in accordance with Sub-Clause 3.5 [*Determinations*] to agree or determine (i) whether and (if so) to what extent these physical conditions were Unforeseeable, and (ii) the matters described in sub-paragraphs (a) and (b) above related to this extent.

However, before additional Cost is finally agreed or determined under sub-paragraph (ii), the Engineer may also review whether other physical conditions in similar parts of the Works (if any) were more favourable than could reasonably have been foreseen when the Contractor submitted the Tender. If and to the extent that these more favorable conditions were encountered, the Engineer may proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine the reductions in Cost which were due to these conditions, which may be included (as deductions) in the Contract Price and Payment Certificates.

However, the net effect of all adjustments under sub-paragraph (b) and all these reductions, for all the physical conditions encountered in similar parts of the Works, shall not result in a net reduction in the Contract Price.

The Engineer may take account of any evidence of the physical conditions foreseen by the Contractor when submitting the Tender, which may be made available by the Contractor, but shall not be bound, by any such evidence.

b) MOSPI

According to Clause 11.1 (d) the employer is responsible for the unforeseen event occurred due to the nature of force. Under Clause 12 A (f) the contractor is entitled to have compensation for the event of flood, tornadoes, earthquakes and landslides and under Clause 28.1 the intended completion date shall be extended by the employer. Clause 13.1 says that the contractor has to provide the insurance cover for the following events; loss or damage to the works, plants and machineries, loss or damages to the equipment, loss of or damage to the property in connection with the contract, personal injury or death.

Risk 10 – Estimation errors or design error

a) FIDIC

The Clause 1.9 Delayed Drawings or Instructions, The Contractor shall give notice to the Engineer whenever the Works are likely to be delayed or disrupted if any necessary

drawing or instruction is not issued to the Contractor within a particular time, which shall be reasonable. The notice shall include details of the necessary drawing or instruction, details of why and by when it should be issued, and details of the nature and amount of the delay or disruption likely to be suffered if it is late. If the Contractor suffers delay and/or incurs Cost as a result of a failure of the Engineer to issue the notified drawing or instruction within a time which is reasonable and is specified in the notice with supporting details, the Contractor shall give a further notice to the Engineer and shall be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to:

a. An extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [Extension of Time for Completion], and

b. Payment of any such Cost plus profit, which shall be included in the Contract Price.

After receiving this further notice, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine these matters.

However, if and to the extent that the Engineer's failure was caused by any error or delay by the Contractor, including an error in, or delay in the submission of, any of the Contractor's Documents, the Contractor shall not be entitled to such extension of time, Cost or profit.

b) MOSPI

Clause 11 (c) says that the contractor is responsible for the damages or loss that is caused due to the design of the work. According to Clause 32.1 the contractor has to inform the employer about the event that may cause adverse effect to the quality of the work and under Clause 32.2 the contractor shall cooperate with the employer to find out the solution to minimize that adverse effect.

RESEARCH DISCUSSION

Key Findings

The risk mitigation measures of FIDIC form of contract derived from the data analysis process were compared and contrasted with the risk mitigation measures of MOSPI form of contract. The findings of the comparative study are detailed below.

In this chapter, the risk mitigation mechanisms derived out for the 10 key risk factors from the data analysis process is used for making a comparative observation. Such observations after making a critical interpretation were presented in this chapter as key research findings.

Risk 1 – Delays in availability of labor, material and equipment

a. To mitigate this risk, both MOSPI and FIDIC says that the contractor is responsible to arrange labor, material and equipment to carry out the work. Under both the contract conditions the contractor is entitled to get compensation if the employer is not provide something which he is to provide by the date for providing it shown on the accepted programme. Both the contract conditions allow the contractor to get compensation event, if there is any delay caused by the employer nominated subcontractors.

b. FIDIC contract clearly mentioned that the contractor shall subject to (Employer's claim) pay delay damages to the Employer

for every day which elapse between the relevant Time for Completion This clause makes the contractor to feel more responsible to get work done from the subcontractors rather than blaming others.

c. From the survey response the participants feel that the contractor is better positioned to manage this risk. (Mean=0.8125; contractor 100%).

Risk 2 – Time overrun by the contractor

The risk mitigation mechanisms adopted by both the contracts have an early warning clause; under this clause the contractor can give early warning about the event that may affect the planned completion date. And both the contracts have the clause to get liquidated damages from the contractor, if he failed to deliver the project within the time mentioned in the contract data. Under MOSPI contract liquidated damages shall be fixed between 0.5% and maximum of 10% of the project value for a week of delay until the completion of the work. But in FIDIC there is a flexibility provided to do negotiation to finalize the percentage of delay damages to be fixed. It allows the contractor and the client to talk and think about the situation to finalize the delay damage to be fixed for that particular project.

a. Incentive clause is provided in the contract MOSPI; it supports to encourage the contractor to complete the project within the time. In MOSPI contract incentive rate is fixed, it can be ½% to 5% of the project value per week of early completion. But in FIDIC the incentive rate for early completion of the project is not mentioned.

b. From the survey response the participants feel that the Contractor is better positioned to manage this risk (mean=0.75; contractor >client).

Risk 3 – Poor quality of work done by the contractor

a. In FIDIC contract it is mentioned that the contractor shall institute a Quality assurance system to demonstrate compliance with the requirements of contract. But in MOSPI, if the contractor fails to correct the defects before end of the defects correction period, the employer may correct that defects and the amount will be collected from the contractor.

b. In MOSPI contract the performance bond is mentioned that the contractor should submit 5% of the contract value as performance guarantee to the employer. But in FIDIC this is in option clause, but in MOSPI performance guarantee is compulsory. It increases the financial burden to the contractor.

c. It is clear that the survey respondents feel that, the contractor is best positioned to manage the risk to the work performance (mean = 0.86; contractor > client).

Risk 4 - Unforeseen Ground Condition

a. MOSPI clearly indicates that it is contractor's responsibility for any inaccuracies in the topographical data provided by the contractor and the contractor is encouraged to ascertain the ground condition at his own risk and cost before entering into the contract. However the contractor is entitled to have compensation, if the ground condition is substantially more adverse than could

reasonably have been assumed with the ground investigation report.

b. FIDIC seems to be more efficient than MOPSI, in allocating this risk fairly. Under FIDIC the contractor can get compensation for the event that may stop the contractor to complete the work at mentioned time. This clause prevents the contractor to avoid paying liquidated damages, in case of any delays caused due to the adverse ground condition.

c. The survey respondents feel that the contractor should involve to manage this risk (mean=0.8; contractor 100%).

Risk 5 – Permits and licenses (Environmental agency, etc.)

a. Both the contract MOSPI and FIDIC says that the contractor can issue an early warning to the employer about the event and process which may affect the estimated project completion date. The full risks related to obtaining permits and license might be transferred to the contractor.

b. The survey respondents feel that the contractor is highly responsible to manage this risk (mean=0.87; contractor > client).

Risk 6 – Cost involved with changes in design and scope of work (Changes made by client)

a. In MOSPI there is flexibility provided to the employer to make variation up to ±25% in quantity of each individual item, and ±10% of the total contract. For the extra work the contractor can claim the current market rate for material and labor, plus 10% for overheads and profit for that item of work. In MOPSI the profit percentage for the extra work carried out by the contractor is fixed by 10% it may not sufficient to the contractor, since the extra work may require additional effort to complete that work. Such variation limits are not observed in FIDIC and moreover in FIDIC contract variations may be initiated by the Engineer at any time prior to issuing the Taking over Certificate for the works, either by an instruction or by a request for the contractor to submit a proposal.

b. The survey participants feel that the client is best positioned to manage this risk (mean=0.733; client > contractor).

Risk 7 – Changes in Quantity

a. In MOSPI there is flexibility provided to allow for the changes if the Bill of Quantities for the particular item by more than ± 25% provided the change exceeds ± 10% of initial contract price. The changes in quantities cannot be adjusted if the rates changes in quantities are the initial contract price is exceeded by more than 15%. Such variation limits are not observed in FIDIC and moreover in FIDIC contract variations may be initiated by the Engineer at any time prior to issuing the Taking over Certificate for the works, either by an instruction or by a request for the contractor to submit a proposal.

b. The survey respondents feel that both the contractor and the client should involve to manage this risk (mean=0.71; client=contractor).

Risk 8 – Owner delays (lack of payment, unable to get approvals, delayed progress payments)

a. In FIDIC contract, if the Contractor does not

receive payment, he shall be entitled to receive financing charges compounded monthly on the amount unpaid during the period of delay. But in MOSPI, Bills should be prepared and submitted by the Contractor. 75% of bill amount should be paid within 14 days of submission of the bill. Balance amount of the verified bill should be paid within 28 days of the submission of the bill.

b. The survey participants feel that the client is best positioned to manage this risk (mean= 0.83; client 100%).

Risk 9 – Exceptional Inclement Weather

a. Both the contract clearly mentioned that the contractor should make insurance against the loss or damage to the works, plant, materials and also the contractor is liable to do insurance against death or bodily injury to employees of the contractor.

b. Both the contract forms allow the contractor to claim the compensation for the event which damages very extremely.

c. The survey participants feel that the contractor and the client both are equally positioned to manage this risk (mean=1; client= contractor)

Risk 10 – Estimation errors or design errors

a. MOSPI completely transfers this risk to the contractor, making contractor liable for all the risks that arise from any design errors or inaccuracies in the design irrespective of design inputs given by the client. But FIDIC saves the contractor from any of defects in the works due to his design so far he proves that he used reasonable skill and care to ensure his design is compiled with the works information.

b. Both the contract says that the contractor can issue an early warning to the employer about the design error which may affect the quality of the work and timely completion of the work.

c. The survey participants feel that the contractor is best positioned to manage this risk (mean= 0.83; contractor > client).

RECOMMENDATIONS TO THE INDIAN CONSTRUCTION

Industry

In India, MOSPI form of contract is used as a standard document as well as a guiding document for preparing bespoke contract. The other form contract conditions available in India were drafted to deal with the more specific projects. MOSPI is the only standard form of construction contract published by the Ministry of Finance India, for adopt in any general projects in the domestic market. Hence it is important to analyze its risk management capabilities by comparing with the Developed Countries popular form of contract condition (FIDIC). The comparative study conducted in this chapter would assist in making recommendation to the contractual practices adopted in Indian construction industry. The suggestions and observation gathered from the different survey participants and the research findings are presented below as recommendations.

a. MOSPI form of contract is not specially drafted to deal with any specific

procurement method. It is essential to draft specialized contract forms to deal with the specific procurement method to achieve more efficiency in contract management system in India.

b. After a detailed comparison of risk mitigation clauses from FIDIC contract with MOSPI contract it indicates there is a major level of inequity situation in MOSPI. From the comparison it is observed that the contractual clauses in MOSPI are drafted more in favor of the client rather than the contractor. MOSPI contract transfers maximum risks to the contractor. Transferring maximum risks to the contractor is not a good practice, it will increase the burden to the contractor (financial and responsibilities). Ultimately the contractor will consider more contingencies at the time of bidding. It is considered as the financial loss to the employer. So it is wise to share the risks optimally when it happens, rather than paying more premiums to the contractor for the risks which are expected to happen in the future. Hence it is important to modify the contract clauses in the MOSPI form of contract to make more balanced contract.

c. From the detailed study of MOSPI form of contract, it is observed that it is framed to deal with only the domestic projects. For the major international funded projects FIDIC contract conditions are used. Construction industry in India needs to frame an indigenous contract condition to deal with the international projects with more relevant to the socioeconomic conditions of the country.

CONCLUSION

The successful completion of a project depends on many factors of which proper risk allocation is one of the most important. This research undertaken to perform a comparative study of the risk mitigation clauses from popular form of contract conditions adopted from India and Developed Countries construction industry. Such a comparative study has helped to make the critical analyze of the risk mitigation capability of the developing contract management system in India with the developed contract management system.

To make the comparative study more effective, this research has identified the popular form of contract condition and procurement method adopted from Developed Countries and India, i.e., FIDIC contract in Developed Countries and MOSPI contract in India along with design and build procurement method are most popularly adopted. The 20 significant risks associated with design and build procurement method were identified from the literature review and the top 10 risks were prioritized through a comprehensive assessment of their impact severity, likelihood of occurrence established through the research survey. The contractual risk mitigation mechanism for the top 10 risk factors was identified through the data analysis process.

The key findings obtained from this comparative study of FIDIC (Developed Countries) with MOSPI (India) for mitigating the risks associated with the design and build procurement method shall help to improve the condition of the risk allocation mechanism adopted in the Indian construction industry. This comparative study helps to get to know

about the risk mitigation capacity of the Indian construction contract and it enabled to make relevant recommendation to improve the efficiency of the Indian construction projects. However the recommendations made by this research project is not conclusive, but to provide a comparative list of risk mitigation techniques adopted by both the contractual and industry perspective. Hence the readers of this research shall consider these recommendations as a guide note to mitigate risks rather consider as a conclusive solution for mitigate risks.

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