Comparison analysis of parameters affecting material Procurement in construction industry by RII and IMPI methods

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***Abstract* - This paper is written to show the critical factors that are affecting in material procurement management system in construction projects. The methodology was applied to study factors affecting materials procurement process in the four stages plan, conduct, administration and close projects. The information gathered the literature, structural interview and pilot study. The analysis is carried out comparing all factors by two methods and identifies most critical factors by all four respondents' architects, engineers, contractors and developers. The outcome of this paper may provide a platform for all construction industry stakeholders to appreciate the most critical factors in material procurement management in construction industry.**

***Keywords:* material procurement, RII and IMPI, construction industry, comparison analysis.**

1. INTRODUCTION

In the construction industry to manage a productive and cost effective site, efficient material management is very essential. An important factor that affects the performance of construction projects is the improper handling of materials during site activities. This an effort to analyze the Process analysis of material Procurement management by generating strategies to improve the procurement process in commercial projects. Materials management is considered as a means to achieve better productivity, which should be translated into cost reduction. Procurement is the acquisition of goods or services at the best ownership cost, in the right quantity and quality, at the right time and place for the organization. Various problems are present in the material procurement during every stage of the project life and the reasons of these problems are presented material procurement management system of the contracting organizations. Materials represent a major expense in construction, so minimizing procurement costs improves opportunities for reducing the overall project costs.

2. OBJECTIVES OF MATERIALS PROCUREMENT MANAGEMENT

- Identify the most common factors that are influencing the materials procurement management in construction projects.
- To maintain continuity to ensure that scheduled activities are not interrupted.
- To create goodwill for the organization through healthy buyer-supplier relationship.

3. METHODOLOGY

The methodology was based on the literature review, casual interviews, surveys, and the analysis of information sources. From the information gathered from structural interviews, pilot study, and questionnaire survey and from a literature, improved strategies were obtained and a proper strategic approach to the material Procurement management process was proposed for the commercial building projects. Analysis is carried out comparing two methods RII and IMPI.

4. QUESTIONNAIRE SURVEY

(1) Importance Index (IMPI.) Method

Importance Index Method helps to determine the relative importance of the various factors as a function of severity & frequency of their occurrence.

Frequency Index (F.I.):

A formula is used to rank risk event based on frequency of occurrence as identified by the participants.

$$Frequency\ Index\ (F.I.)\ (\%) = \Sigma\ an/N \times 1004/4$$

Where,

a = constant expressing weighting given to each response (ranges from 1 for rarely up to 4 for always),
n = frequency of the responses,
N = total number of responses.

Severity Index (S.I.):

A formula is used to rank risk event based on severity as indicated by the participants.

$$Severity\ Index\ (S.I.)\ (\%) = \Sigma\ an/N \times 1004/4$$

Where,

a = constant expressing weighting given to each response (ranges from 1 for little up to 4 for severe),
n = frequency of the responses,
N = total number of responses.

Importance Index (IMP.I.):

The importance index of each event is calculated as a function of both frequency and severity indices, as follows:

$$Importance\ Index\ (IMP.I.)\ (\%) = [F.I.\ (\%) \times S.I.\ (\%)]/100$$

(2) Relative importance Index (RII) method

RII = ΣW÷A×N

W= the weight assigned to each strategy by the respondents A = Highest weight N = the total number of respondents Factors affecting Material Management are rated as Strongly Agree (4), Agree (3), Disagree (2) and Strongly Disagree(1).

5. RESULT AND CONCLUTION

After structural interviews, pilot study and literature review analysis is carried out comparing all factors by two methods and identifies most critical factors by all four respondents' architects, engineers, contractors and developers.
The various factors affecting the Material procurement management are:

Table 1:- Factors affecting the Material procurement management

Sr. No.	FACTORS
Factors related to Plan Procurement	
A1	Material procured without planning
A2	Schedule is not planned before starting the project
A3	Undefined Scope/ Clarity of Scope
A4	Improper specification
A5	Degree of project complexity
A6	Quality level of project
A7	Time constrains
A8	Financial risk
A9	Resource availability/lack of resource
A10	Type of procurement system
A11	Project type & nature
A12	Forecasting of materials price in market
Factors related to Conduct Procurement	
B1	Delay in approval
B2	Delivery time schedule
B3	Price competition
B4	Uncontrollable bid list
B5	Non competent vendor selected
B6	Vendor satisfaction
B7	Socio cultural suitability
B8	Incompetent material supplier are selected for project
B9	Delay in issue of purchase order
B10	Client reputation
B11	Materials transportation cost
Factors related to Administer Procurement	
C1	Flexibility for changes
C2	Lake of coordination between prime contractor and supplier
C3	Rejection of material due to non compliance to the specification
C4	Over ordering of construction materials
C5	Client's specific requirement
C6	Compliance with safety procedure
C7	Too many variation
C8	Political issue/Transport strike
C9	Material shortage or late delivery
C10	Scarcity of materials in market
Factors related to Close Procurement	
D1	Prompt honoring of payment certificates
D2	Disputes between parties to the contract

D3	Variation between contract sum and final account
D4	Payment method of project
D5	Complaints of other parties to the contract

Table 2: Top 10 factors by engineers

AS PER ENGINEERS					
rank	FACTORS	RII	no	FACTORS	IMPI
1	Material procured without planning	0.855	1	Material procured without planning	55.12
2	Forecasting of materials price in market	0.8	2	Lake of coordination between prime contractor and supplier	55.08
3	Price competition	0.795	3	Variation between contract sum and final account	52.12
4	Delay in approval	0.75	4	Type of Procurement system	50.37
5	Lake of coordination between prime contractor and supplier	0.745	5	Political issue/Transport strike	49.88
6	Variation between contract sum and final account	0.73	6	Flexibility for changes	49.73
7	Type of Procurement system	0.71	7	Price competition	49.33
8	Political issue/Transport strike	0.69	8	Schedule is not planned before starting the project	47.9
9	Schedule is not planned before starting the project	0.68	9	Delay in approval	47.6
10	Flexibility for changes	0.68	10	Too many variation	46.91

Table 3: Top 10 factors by contractors

AS PER CONTRACTORS					
RANK	FACTORS	RII	RANK	FACTOR	IMPI
1	Material procured without planning	0.78	1	Flexibility for changes	58.52
2	Flexibility for changes	0.76	2	Material procured without planning	54.75
3	Forecasting of materials price in market	0.75	3	Political issue/Transport strike	54.31
4	Political issue/Transport strike	0.75	4	Degree of project complexity	53.29
5	Price competition	0.73	5	Forecasting of materials price in market	52.2
6	Degree of project complexity	0.725	6	Lake of coordination between prime contractor and supplier	48.96
7	Delay in approval	0.72	7	Delay in issue of purchase order	47.6
8	Lake of coordination between prime contractor and supplier	0.7	8	Schedule is not planned before starting the project	47.25
9	Schedule is not planned before starting the project	0.685	9	Price competition	47.25
10	Delay in issue of purchase order	0.68	10	Delay in approval	45.21

Table 4: Top 10 factors by architects

AS PER ARCHITECTS					
RANK	FACTORS	RII	RANK	FACTORS	IMPI
1	Political issue/Transport strike	0.77	1	Political issue/Transport strike	58.12
2	Flexibility for changes	0.72	2	Flexibility for changes	55.62
3	Schedule is not planned before starting the project	0.71	3	Delay in issue of purchase order	53.16
4	Lake of coordination between prime contractor and supplier	0.69	4	Forecasting of materials price in market	48.41
5	Prompt honoring of payment certificates	0.69	5	Price competition	48.41
6	Material procured without planning	0.68	6	Schedule is not planned before starting the project	48.39
7	Degree of project complexity	0.66	7	Lake of coordination between prime contractor and supplier	48.37
8	Type of Procurement system	0.65	8	Prompt honoring of payment certificates	47.83
9	Delay in issue of purchase order	0.65	9	Degree of project complexity	46.68
10	Too many variation	0.63	10	Material procured without planning	43.33

Table 5: Top 10 factors by developers

AS PER DEVELOPERS					
RANK	FACTORS	RII	RANK	FACTORS	IMPI
1	Forecasting of materials price in market	0.77	1	Flexibility for changes	53.77
2	Material procured without planning	0.75	2	Forecasting of materials price in market	49
3	Price competition	0.74	3	Schedule is not planned before starting the project	48.93
4	Political issue/Transport strike	0.73	4	Political issue/Transport strike	48.88
5	Flexibility for changes	0.72	5	Delay in issue of purchase order	48.41
6	Delay in approval	0.71	6	Material procured without planning	46.1
7	Lake of coordination between prime contractor and supplier	0.7	7	Price competition	46.08
8	Schedule is not planned before starting the project	0.69	8	Lake of coordination between prime contractor and supplier	46.08
9	Degree of project complexity	0.68	9	Degree of project complexity	45.54
10	Type of Procurement system	0.67	10	Type of Procurement system	45.54

Table 6: shows top 10 factors agreed by all four parties by both methods.

	OVERALL RESULT				
RANK	TOTAL	RIII	RANK	FACTORS	IMPI
1	Forecasting of materials price in market	0.77	1	Flexibility for changes	54.38
2	Material procured without planning	0.75	2	Political issue/Transport strike	52.58
3	Price competition	0.74	3	Material procured without planning	50.87

4	Political issue/Transport strike	0.73	4	Lake of coordination between prime contractor and supplier	50.16
5	Flexibility for changes	0.72	5	Forecasting of materials price in market	49.1
6	Delay in approval	0.71	6	Degree of project complexity	48.17
7	Lake of coordination between prime contractor and supplier	0.7	7	Schedule is not planned before starting the project	48.09
8	Schedule is not planned before starting the project	0.69	8	Price competition	48.01
9	Degree of project complexity	0.68	9	Delay in issue of purchase order	47.9
10	Type of Procurement system	0.67	10	Delay in approval	45.65

Table 6.1: Comparison between various groups of risks by both methods

CONSTRUCTION PHASES	RII	RANK	CONSTRUCTION PHASES	IMPI	RANK
Administration phase	0.57	**1**	Plan phase	30.22	**1**
Plan phase	0.54	**2**	Administration phase	29.45	**2**
Close phase	0.53	**3**	Conduct phase	24.27	**3**
Conduct phase	0.48	**4**	Close phase	22.79	**4**

Figure 1: Pyramid showing comparing of Group of Phases by two methods

6. RECOMMENDATION FOR FURTHER RESEARCH

Find out the most important factors that are affecting materials procurement management by other methods and comparing factors by different methods, developing effective framework for affected problems and their mitigating measures.

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