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Study on Risk Factors Related With Material Procurement in Construction Industry

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Abstract-This report demonstrate the study concerning with an objective to understand the causes of the difference between actual quantities and estimated quantity worked in the site before starting the construction work. A questionnaire survey was carried out to collect information on the potential causes of divergence. In this paper the most critical factors which affect the smoothness of efficient procurement system are identified and suggestions are to be given to avoid the consequences related with poor material handling system.
Key words: procurement, material handling, productivity, critical factors, benefits.

I. INTRODUCTION

Procurement is the act of obtaining or buying goods and services. The process includes preparation and handing out of a demand as well as the end receipt and sanction of payment. Material procurement in construction companies has been developing as the industry replies to developments in technology and the global economy. Construction companies agreement with suppliers sourced around the world, and this presents benefits for both the investor and the consumer. We need an experienced supply chain procurement specialist who understands regulatory issues, commodities and how the company operates to obtain the maximum benefit.

Materials constitute a major cost component for any Industry. The total cost of installed materials may be 60% or more of the total cost even though the factory cost may be a minor part of the total, possibly less than 20-30%. This is because the manufactured item must be stored, transported, and restored before it is put in place or "used up" at the site. The total cost of materials will include, in addition to the builder selling cost, the cost of earning (cost of placing handing out and disbursing the material, physical distribution, the distributor's cost, and the transportation of materials),and the site-handling costs (cost of receiving, storage, issuing, and disposal).

The efficient procurement and handling of material represent a key role in the successful completion of the work. It is important for the contractor to consider that there may be significant difference in the date that the material was demanded or date when the purchase command was made and the time at which the material will be transported. These delays can happen if the supplier needs a large quantity of material that the supplier is not able to produce at that time or by any other factors out of his control. The contractor should always contemplate procurement of materials is a possible cause for delay.

The tenacity of material procurement is to guarantee that the right materials are in the right place, in the right quantities when required. The obligation of one department (i.e. material management department) for the flow of materials from the time the materials are well-organized, received, and warehoused until they are used is the source of material managing.

Companies must also apply ethical considerations when sourcing raw materials, meaning that they must include considerations about the environment and sources of procurement.

1.1. Procurement Process

Procurement process involves the following steps:

- Classify the goods and services to procure
- Complete Purchase Orders and dispute to suppliers
- Agree on delivery timeframes and methods

- Receive goods and services from suppliers
- Assessment and accept the items obtained
- Approve supplier disbursements

1.2. Procurement Planning

Effective Procurement Planning is vital for all attaining entities in the application of the purchasing objectives for the following reasons:

- An effective strategy saves time and money.
- An operative plan serves as a channel to achieving entity's objectives.
- An effective plan guarantees acquiescence with regulatory policies.
- An effective plan provides a framework to guide procurement officers in the accomplishment of their tasks and duties.

Procurement Planning is important because:

- It helps to decide what to buy, when and from what sources.
- It allows developers to govern if expectations are truthful; particularly the potentials of the requesting entities, which usually expect their necessities met on short notice and over a shorter period than the application of the conforming procurement method allows.
- It is a chance for all shareholders involved in the processes to meet in order to argue on procurement requirements. These stakeholders could be the requesting entity, end users, procurement department, technical specialists, and even sellers to give relevant inputs on detailed requirements.
- It permits the establishment of a procurement strategy for procuring each requirement that will be included in the procurement plan. Such strategy includes a market survey and determining the applicable procurement method given the requirement and the circumstances.

1.3. Procurement life cycle

Procurement life cycle involves the following process

- Identification of Need
- Supplier Identification
- Supplier Communication
- Negotiation
- Supplier Connection
- Logistics Management
- Tender Notification

II. LITERATURE STUDY

Krishna Mochtar, (2015) estimated to attain the objectives in the field of infrastructure growth in construction, national preparedness is required in the field of building materials and equipment. Often the construction project is susceptible due to problems of inaccessibility of construction materials and equipment. The need of this paper is to plot the problems of construction materials and equipment procurement so that construction activities can be held more successfully. Policies on development of construction materials and equipment database should be established to overcome contractors problems in materials and equipment procurement.

Hisham. S.M, et al., (2011)observed the grants progress of a new optimization model for construction logistics preparation that is capable of simultaneously integrating and improving the critical planning decisions of material procurement and material storing on construction sites. Material procurement and storage on construction sites need to be correctly planned and executed to avoid the negative influences of material shortage or excessive material inventory on-site. Shortages in the supply and flow of construction material were often quoted as major causes of productivity degradation and economic losses.

Ola Laedre, KjellAusteng, et al., (2006) reported the procurement routes in public building and construction projects. The paper objective is to find out if public owners select a

procurement route according to recommended practice. The credentials study suggests that public owners carry onto select the same procurement route as they are in the habit of. They do not consider what procurement route outfits each single project, and therefore they do not select the route conferring to recommended practice. The paper calls for modernization and better supported collection of the procurement route in public building and construction projects.

B.H.W.Hadikusumo, et al., (2005) ascertained a dispersed database system equipped with electronic agents for material procurement is anticipated. Results showed that this system can be used to assist human purchasers to carry out solicitation in identifying suppliers, searching materials, and preparing acquisition orders. Inefficient procurement practices can result in costly delays, loss of profit, and possible litigation. The electronic agent is used for establishing a communication between the electronic contractor agent and the electronic supplier agent. This electronic agent is also considered as a means of safeguarding the system from outsiders.

III. METHODOLOGY

Methodology is the attention given to the nature and kinds of processes to be followed in a given procedure or in attaining an objective. Fig .1 represents the methodology adopted for successful completion of the project.

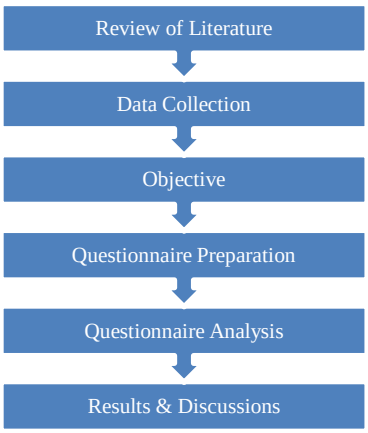

Fig.1. Methodology flow chart

IV. OBJECTIVE OF THE STUDY

The main objective of the study is to know the importance of procurement in construction and to achieve the following

- To buy at the lowest price, consistent with desired quality and service.
- To minimize the overall cost of acquisition by improving the efficiency of operations and procedures.
- To achieve a high degree of cooperation and coordination with user departments.

V. DATA COLLECTION

This section presents the method for data collection, and also the tool for analyzing the data

5.1. Data Collection

Data is collected by distributing questionnaire to the contractors, engineers, client by visiting the site office and company directly. The data are collected through meetings and interviews by explaining the content of questionnaire. The collected data are analyzed using SPSS software.

The questionnaire consists of about 30 questions which are framed using the factors identified from the literatures. The questionnaire form was designed in a likert scales running from very often, often, sometimes, seldom, and never. These five positions were given weights of 1,2,3,4 and 5 for scoring purposes. It requires the respondents to indicate the degree of agreement with each of a serious of statement related to the stimulus objects. This type of question is easy to construct and administer. Respondents readily understand how to use the scale. Questionnaire development is an efficient data collection technique to measure the variable of interest. After the collection of responses the results are taken for analysis.

The mean value is used to classify the answer given by the respondent.

1. Very often $0.00 \leq$ mean index < 1.50
2. Often $1.50 \leq$ mean index < 2.50
3. Sometimes $2.50 \leq$ mean index < 3.50
4. Seldom $3.50 \leq$ mean index < 4.50
5. Never $4.50 \leq$ mean index < 5.00

5.2. Factor Identification

Material procurement and storage on construction sites need to be appropriately scheduled and executed to elude the negative influences of material shortage or excessive material inventory on-site. Shortages in the supply and flow of construction material were often cited as major causes of productivity deprivation and economic losses. Ordering smaller quantities of material more frequently reduces the locked-up capital in material inventories; however, it increases the probability of material shortages and project delays. On the other hand, ordering larger quantities of material less frequently minimizes the probability of material shortage and project delays; however, it increases the cost of locked-up capital in large inventory buffers on-site. Construction planners need to consider this critical trade off during the planning of material procurement and storage on-site. The procurement decision variables in the developed model are designed to identify the fixed-ordering periods of each material in every construction stage to consider the changing demand rates of materials over the project duration.

The best way to procure equipment and materials is through a competitive bidding process that culminates in a negotiated price to meet all specified requirements. The price might not be the low bid, but would be the best price that included the cost of such factors as maintenance and operating costs. Competition is best achieved through performance specifications that define the requirements for the equipment in a generic manner so that all qualified manufacturers in the market have an equal chance of getting the order. This is facilitated by obtaining vendor input during preliminary design to ensure that the design does not favor any particular manufacturer.

The following factors are identified

- Planning and scheduling
- Organizational and personnel
- Time consumption
- Communication problems
- Storage facility
- Change order
- Quality assistance and control
- Re-defining of work task
- Lack of co-ordination among sub-contractor
- Accuracy and cost
- Difficulty in managing material
- External factors

5.3. Analysis report

SPSS (statistical package for social sciences) is the software employed in statistical analysis of the questionnaire. The analysis yields weighted frequency of response, mean, Standard deviation, Cronbach alpha value and Kaiser-Meyer-Olkin measure of sampling adequacy.

5.4. Reliability Test

For internal reliability, Cronbach's alpha was calculated for each scale. Cronbach's alpha for 160 samples was collected as 0.861. Thus the results indicate internal construct consistency and reliability of the data. Cronbach'salpha value range from 0 to 1 with 0.75 being considered the most sensible value. It indicates the project is reliable.

Table I Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.861	0.937	30

5.5. Factor Analysis

The Bartlett's sphericity test and the KMO index enable to detect if we can or cannot summarize the information provided by the initial variables in a few number of factors.

A principal component factor analysis with varimax rotation was performed on 30 variables that assessed the material procurement practices in construction industries. The statistical test result (KMO=0.694, Bartlett's test of sphericity=435.00, significance=0.000) revealed that the factor analysis method was appropriate. The seven dimensions and the percentage of variance explained are listed in table.

Table II KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.694
Bartlett's Test of Sphericity	Approx. Chi-Square	6754.353
	Df	435
	Sig.	.000

5.6. Descriptive statistics

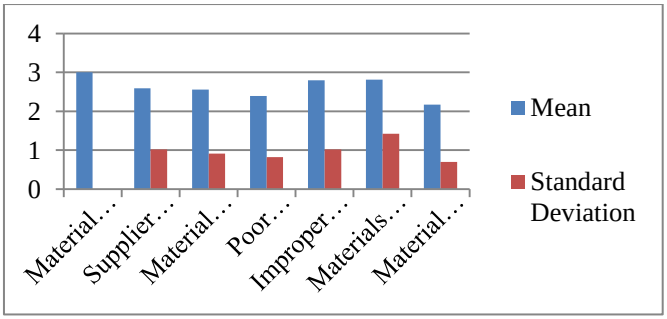

Fig.2.Factor Interpretation Chart

The factor clarification is useful in summarizing the information provided by the initial variables in a few number of factors. In these charts the factors with their mean and standard deviation are shown.

VI. RESULTSAND DISCUSSIONS

This study was carried out based on literature review and data collected relating to the topic.

The performance of160 respondents have identified seven important factors namely material storage, supplier selection, material planning, poor co-ordination, improper storage, material delays and material handling from the frequency responses using SPSS software.

Among these seven factors, the factors with highest means which are obtained from the statistical analysis are considered as the most critical factors of the study.

- Material storage with mean=3
- Material delay with mean=2.81
- Supplier selection with mean=2.58

VII. CONCLUSION

This chapter summarizes the research and its most important findings and also presents some implications for further research. Using interviews this research aimed to identify reasons, why more companies have not adopted procurement for purchases.

While the benefits of procurement have been widely described in the literature, there are still major issues companies need to beat before the profit of procurement can be enjoyed. Based on the interviews, seven factors that were preventing companies in adopting procurement for purchasing of indirect materials were found. They are,

- Material storage
- Supplier selection
- Material planning
- Poor coordination
- Improper storage
- Material delays
- Material handling

For procurement process to be successful, the Purchase manager and the Planning engineer have to find ways of easing the problems and making the procurement process smoother for companies.

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