ASSESSING PROBLEMS OF CONSTRUCTION MATERIAL MANAGEMENT IN RESIDENTIAL PROJECT: CASE STUDY

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Abstract: ***Material management is a very important and vital aspect for every company since construction materials usually constitute a major portion of the total cost in construction project. Poor management on construction projects can lead to significant negative effects with low productivity, cost and time overrun. Late delivery of materials was the major problem of poor material management The aim of this study has been to assess the current construction material management system and identify problems for Residential building construction projects. The objective of the study is to explore current practice in material managements, to identify the problem in construction material management and to apply ABC (always better control) analysis and s-curve analysis. Construction materials management related literature has been generally reviewed tracking technologies such as wireless, bar-coding and radio frequency identification to solve problems of construction material management. The information communication technology tools which can be one-off the tools for improving material management were not adequately used due lack of awareness in the construction industry. The methodology used for this study is classifying the materials by ABC analysis and to measure the differences by S-Curve analysis.***

Keywords: ***Material Management, Radio Frequency Identification, ABC (Always Better Control) Classification, S-Curve analysis, Information Communication Technology tools***

I. INTRODUCTION

Materials management plays an important role for the development of every construction sector in the world. It is a process where planning, scheduling, coordination, supervision and execution of the tasks are associated with the flow of materials in and out of organization. Material management deals with values and practices which effectively enhance cost of materials recycled in the project. The ABC analysis is a basic analytical management tool. It is commonly known as Always Better Control. The ABC analysis is a tool for classifying material items that has major influences on overall inventory cost. ABC analysis helps in justifying the number of orders and reduces the overall inventory even though overall purchase orders are the S-Curves are an important project management tool. The progress of work against time is very well indicated by S Curve. S-Curve model indicates progress of quantities of work against time that throws a lot of light on the state of the project. Increasingly, selective techniques are being applied to all the functions within the materials management to achieve an efficient method to reduce the inventory cost. Commonly, developing technologies (such as wireless system, RFID), and bar coding are not being sufficiently used to overcome human error and are not well integrated with project management systems to make the tracking and management of materials easier and faster. Moreover, developing a new ICT-based approach to managing materials on construction projects is very necessary.

A. General Objective

Assess the current construction material management system and identify problems for Residential building construction projects.

B. Specific Objectives.

1) To explore current practice in material managements.
2) To identify the problem in construction material management
3) To apply ABC (always better control) analysis and s-curve analysis

II. LITERATURE REVIEW

Construction project is an assignment, undertaken to produce a unique facility, product or service within the stated scope, quality, time, and cost. Cost overrun, poor quality workmanship and suspension of construction projects need in-depth study to improve the outputs of the construction industry (Chitkara, 2003) [1].

Improper materials management can results in increased costs during construction project. Efficient and effective management of materials can result in considerable savings in project costs. Materials may deteriorate in store or get stolen if special attention is not taken. Delays and supplementary costs may be sustained if materials required for particular works are not available. (Hemishkumar Patel, Dr. Jayeshkumar Pitroda)[2]. Currently a more sophisticated solution of (ICT) Information Communication Technology tools are emerging such as wireless communication, bar coding, radio frequency identification. Thus, an appropriate implementation of ICT could benefit in facilitating a more effective and productive materials management process (Kasim, 2005b) [7]. Productive and well-organized material management trainings are important in construction industry. The study indicates that construction materials constitute about 70% of the entire cost for a typical construction project. Proper management ethics and practices are required for this component which will improvise the productivity and cost effectiveness of the project and thus helping on time accomplishment of the project. (Khyomesh V. et. 2011) [4].

Materials management functions are regularly performed on fragmented sources with minimal communication and no obviously recognized tasks assigned to the clients, engineer or contractor. Better material management practices could enhances productivity in operations and decreases overall cost. Top management must be giving more attention to material management because of material deficiencies, high interest charges, escalation values of materials, and competition. There is a developing awareness in the construction project that material management essential to be addressed as a inclusive combined management activity (Eyad Abed El- Qader Al Haddad, 2006) [3]. According

to Ms. Priyadarshani .et.al (2017)[6] specially most of constricting companies are faced the main difficulties in using computer in material management are lack of user-friendly computer program and no understanding for advantage of computer database. Poor documentation of material, in appropriate and inadequate storage cause reimbursements in labor productivity and overall suspensions that can incidentally escalate total job cost (Ashwini R. Patil, et.al 2013) [5].

Mostly, tracking technologies such as wireless, bar-coding and radio frequency identification (RFID) are not sufficiently employed in improving materials tracking training on construction projects (Kasim et al., 2005b)[7]. There is also inadequate support for the tracking and management of materials for working efficiency in inventory management on site. Consequently, there is possibility for significant advantages if automated tracking technologies are deployed to overcome problems in manual practices, which is labour intensive and error prone (Navon and Berkovich, 2006)[8]. RFID has the potential to facilitate materials management processes for large scale projects, particularly with regard to the capability to store a large amount of data compared to bar-coding (Jaselskis and El-Misalami, 2003)[9]. It is expected that RFID can be useful in reducing paper-based requirements and can also be integrated with various applications such as project management systems to make tracking and management of materials easier and faster. Therefore, this study based on the positioning of RFID to improve on-site materials tracking and inventory management etc...

A. "Current Practice and Challenges in Construction Material Managements

On the table below, the analysis show that at public projects, the main grounds given for unsuccessful material management was the relationship between organizations and clients are linked to the following top most factors

Table 1: major factors affecting material management

Top most factors for unsuccessful material management between organization and client
Rework due to errors occurred during construction
Cash flow problems due to late and reduced payments
Late delivery of construction material
Improper handling during construction
Design/engineering interface - incorrect documents, design changes, extended delay for architect's approval or design changes
Material price escalation
Poor planning, controlling and monitoring of material
Difficulties in finding out client's desires, changes of client's requirements, long procedures to discuss changes
change orders due to enhancement required by clients
Inaccurate data, engineering drawings not fitting the use
excessive quantity during construction
Deliveries not in conformance with planning, wrong and defective deliveries, long storage period, awkward packing, large shipments

III. RESEARCH METHODOLOGY

Research methodology represents an approach involved in collecting and Analyzing data. It is the way that used to achieve our objectives and to give direction for the research work. This includes method of data, analysis by ABC analysis and S-Curve analysis. This study is based on desk study and case study by referring published and different journals. This is because there is many problems and challenges of construction projects in construction industry. This helps to find out the rout causes of problems repeatedly occurred in material management.

A. ABC Analysis

ABC analysis is most commonly used inventory control technique. This technique is very well-matched for the construction industry and is also being used very widely. Most organization was not following any of the control methods for the specific project. The classification of all materials used in production into materials which need highest attention, materials which require medium attention and materials which require the least attention such that the control mechanism be based on selective class of materials is called selective inventory control.

B. *S-Curve Analysis*

S-Curve analysis was used know the variations present between observed planned value and actual value in material management. The deviations of the quantity are created by the cumulative expenditure of some parameters i.e. Material cost against time and it is the illustration of project path. This analysis is performed for comparison between planned and actual cost for Class A material items.

The Class A material items used in the project plan time is viewed from the material classification of items (ABC analysis). The cost variance is computed for these material items which are given by (Chitkara, K.K 2009) [10]

Cost Variance = (BCWP – ACWP) …… [1]

Where, BCWP – Budgeted Cost of Work Performed and ACWP – Actual Cost of Work Performed.

Cost Performance Index is calculated using the formula (Chitkara, K.K 2009) [10]

Cost Performance Index = BCWP/ACWP …….. [2]

These variations for the Class A material items used in the project plan period is considered along with planned and actual consumption of material items as a function of cost. The graph displaying S-Curve for Class A material items are plotted. The class A materials taken for this study are steel, cement and brick. These materials items are taken up for further study

IV. RESULTS AND DISCUSSIONS

From the ABC analysis following conclusions can be made,

Table 2: ABC analysis

Types	Items	Annual usage value
Class A materials	3 items	70%
Class B materials	8items	25%
Class C materials	22 items	5%

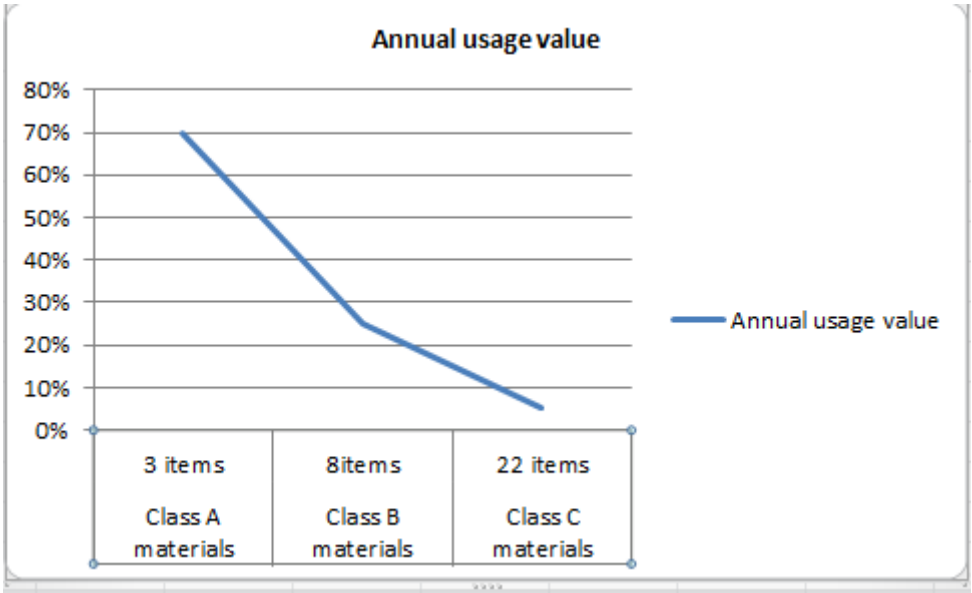

Fig. 1: ABC analysis

Table 2: Cost variance and Cost Performance Index for Steel

No	Period	Planned cost (BCWP)	Actual cost (ACWP)	Cost variance (BCWP-ACWP)	Cost performance index (BCWP/ACWP)
1	Sept. 2017	2689561	2412562	276999	1.12
2	Oct. 2017	3698742	2988446	710296	1.24
3	Nov. 2017	3729654	2879546	850108	1.30
4	Dec. 2017/18	4178955	3698583	480272	1.13
5	Jan. 2018	5697856	4715896	981960	1.21
6	Feb. 2018	8796512	6684598	1511914	1.32

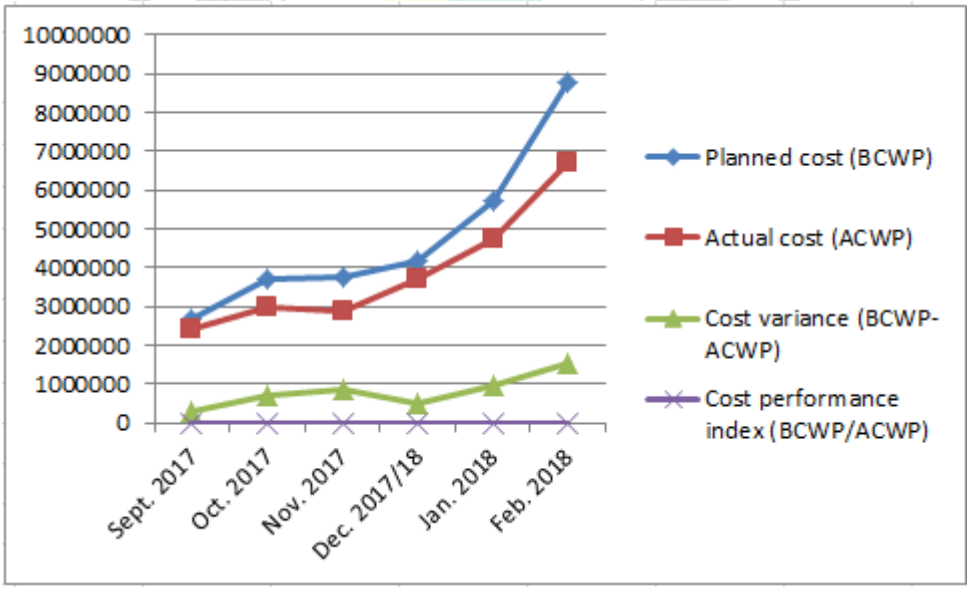

Fig. 2: S-Curve analysis for Steel

Table 3: Cost variance and Cost Performance Index for Cement

No	Period	Planned cost (BCWP)	Actual cost (ACWP)	Cost variance (BCWP-ACWP)	Cost performance index (BCWP/ACWP)
1	Sept. 2017	2189000	2004500	184500	1.1
2	Oct. 2017	3580990	3114255	466735	1.5
3	Nov. 2017	4358960	3667445	691515	1.9
4	Dec. 2017/18	3850456	3442322	408134	1.12

5	Jan. 2018	4886670	3546211	1340459	1.4
6	Feb. 2018	5889000	3751245	2137755	1.7

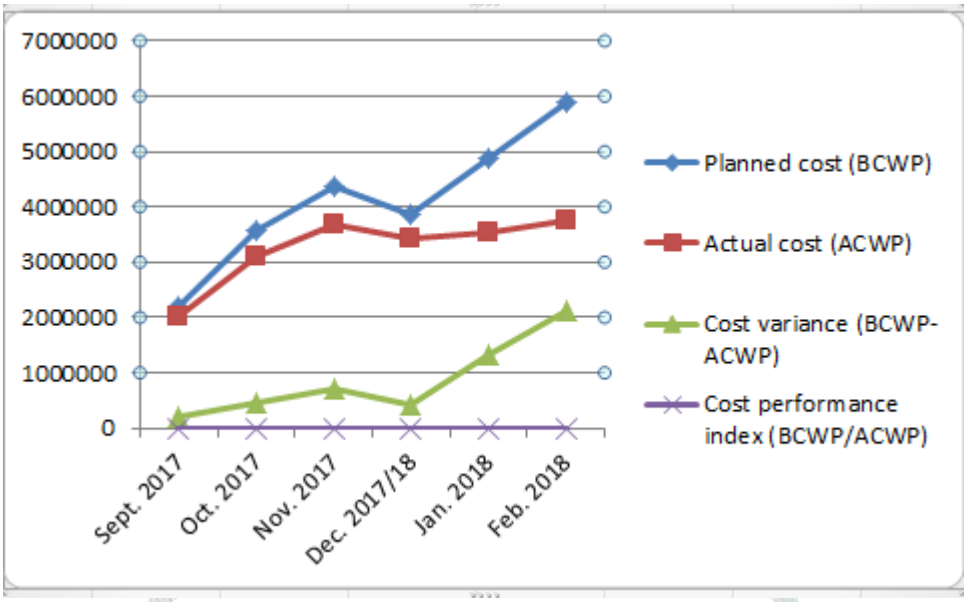

Fig. 3: S-Curve analysis for cement

Table 4: Cost variance and Cost Performance Index for bricks

No	Period	Planned cost (BCWP)	Actual cost (ACWP)	Cost variance (BCWP-ACWP)	Cost performance index (BCWP/ACWP)
1	Sept. 2017	1800966	1145877	655089	1.6
2	Oct. 2017	2112354	1447755	664599	1.5
3	Nov. 2017	1889088	1113322	775766	1.7
4	Dec. 2017/18	3258466	2245454	1013012	1.5
5	Jan. 2018	3886554	2866744	1019810	1.4
6	Feb. 2018	4866443	3558445	1307998	1.4

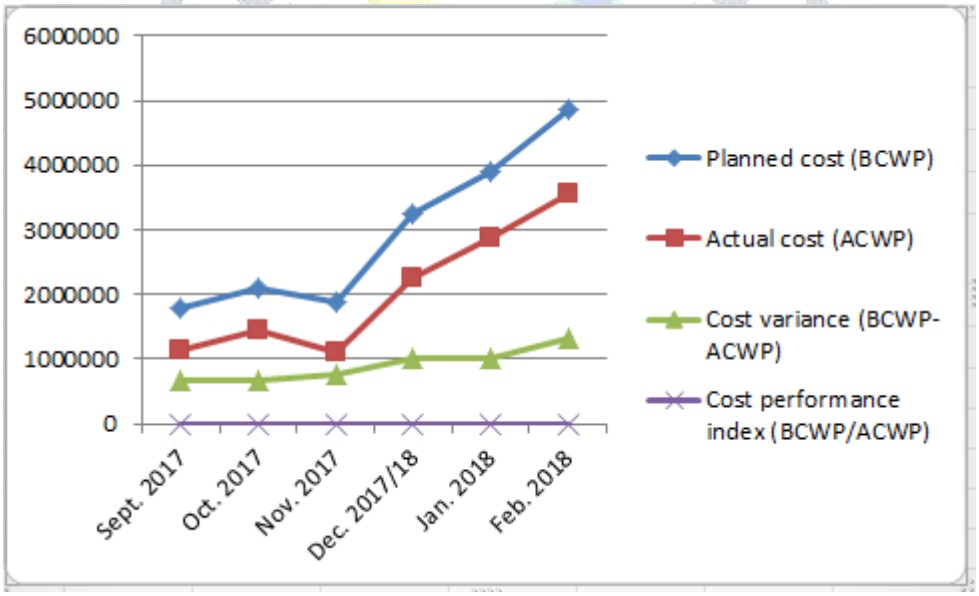

Fig 4: S-Curve analysis for bricks

V. CONCLUSIONS

In any situation material management plays a vital role in building construction projects. From this study we conclude that materials for the project, which is a vital resource if properly managed and handled can vary the cost of the project to a large extent, especially Class A material items. If strictly followed the measures to handle the materials properly and efficiently for a construction project, it can reduce the total material cost of the project. Generally, we will recommend that to improve effective material management in building construction sites

- The Cost Performance Index values for Class A materials are greater than one indicating a favorable performance of the material items in the project.
- The Cost Variance values for the Class A materials is a tool to measure the profit and it has a positive value. It indicates the project has a cost under run i.e. the cost incurred is less than the planned or budgeted cost
- Proper control, monitoring and tracking of the system is required.

- ❖ Use Radio Frequency Identification (RFID), bar coding and Information Communication Technology(ICT) for improving material management in construction industry
- ❖ Attentiveness and liability should be generated inside the organization
- ❖ There is a necessity of an efficient MIS integrating all aspects of material management.
- ❖ Firms employing suitable material management mandate to increase their overall efficiency
- ❖ There should be an integrated material management group co-ordination among the site and the organization.

Computerization can be greatly recommended to meet the following points of construction materials management.

- ➢ Accurate and speedy transfer of information to customers and suppliers, bills, statements, reminders, etc
- ➢ Improvement of customer relations, vendor and employee relations, by timely accurate and relevant information and thro vendor analysis
- ➢ Information for management for control purposes e.g. stock levels, inventory position, customers' acceptance etc., etc.
- ➢ To increase profits at the same time giving better service by optimum scheduling, forecasting and optimizing utilization of traffic facilities, warehouses, machines, etc.
- ➢ Reduction of inventories to free the working capital
- ➢ To increase the productivity of materials and facilities

VI. FUTURE WORKS

A research has done on different basis on ABC analysis and S-Curve analysis but there is a problem of introducing new technologies such RFID, ICT and bar coding for material tracking and management. Therefore, the researcher recommends further study in this area.

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REFERENCES

[1] Chitkara Construction Project Management, Planning, Scheduling & Controlling, Tata McGraw- Hill Publishing Company Ltd, 2003.

[2] Hemishkumar Patel, Dr. Jayeshkumar Pitroda, Prof. J. J. Bhavsar, "Analysis of Factor Affecting Material Management and Inventory Management: Survey of Construction Firms in Gujarat Region of India" Volume 1, Issue 10 May2015

[3] Eyad Abed El- Qader Al Haddad, A Construction Materials Management System for Gaza Strip Building Contractors, 2006

[4] Khyomesh V. Patel," Construction Materials Management On Project Sites" National Conference on Recent Trends in Engineering & Technology, 13-14 May 2011

[5] Ashwini R. Patil, Smita V. Pataskar'', Analyzing Material Management Techniques on Construction Project, International Journal of Engineering and Innovative Technology (IJEIT) Volume 3, Issue 4, October 2013

[6] Ms. Priyadarshani N. Mane , Dr. A. K. Gupta & Prof. D. B. Desai, A Review Paper on Onsite Material Management for Construction Projects , Imperial Journal of Interdisciplinary Research (IJIR) Vol-3, Issue-2, 2017. .

[7] Kasim, N.B., Anumba, C.J. and Dainty, A.R.J. (2005b) "Materials Management in Complex Projects: Case Studies" Proceeding s, International Conference on Construction & Real Estate Management, Penang, F Malaysia, 12~- 13 'December, pp. 232-238.

[8] Navon, R. and Berkovich, 0. (2006) "An Automated Model for Materials Management and Control "Construction Management and Economics, Vol. 24, No. 6, pp. 635-646.

[9] Jaselskis, E. J. and El-Misalami, T. (2003) Implementing Radio Frequency Identification in the Construction Process. Journal of Construction Engineering and Management, Vo1.129, No.6, pp. 680-688.

[10] Chitkara, K.K. "Construction Project Management: Planning, Scheduling andControlling", Tata McGraw Hill education Private Limited, New Delhi, pub-2009.