



MATERIAL MANAGEMENT USING HYPERTEXT PREPROCESSOR

SOFTWARE VERSION: 8.0.26

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ABSTRACT Materials management is a vital function for improving productivity in construction projects. The cost of materials makes up about 60% of most construction projects. Effective material management contributes to lower project costs and more sustainable use of available resources in the long run. The management of materials should be considered at all the phases of the construction process and throughout the construction and production periods. A properly implemented materials management program can achieve the timely flow of materials and equipment to the jobsite, and thus facilitate improved work face planning, increased labour productivity, better schedules, and lower project costs. The basic aim of the project lies in revising the existing material management practices in construction sites which require manual efforts and paper works, by incorporating real time monitoring as well as controlling of materials and developing a web application using PHP (hypertext preprocessor) version 8.0.26. Questionnaire survey was carried out to determine the problems which may lead to the necessity of an automated system for material management. The reliability check was assessed using Cronbach's alpha and determine the most important factor which leads to the automated management system using relative importance index method. By using automation technology, better outcomes are expected as of easing out the storage and retrieval of data related to materials and other operations.

INTRODUCTION

Materials management is a process for planning, executing and controlling field and office activities in construction. The goal of materials management is to insure that construction materials are available at their point of use when needed. The materials management system attempts to insure that the right quality and quantity of materials are appropriately selected, purchased, delivered and handled on site in a timely manner and at a reasonable cost. Materials management is the system for planning and controlling all of the efforts necessary to ensure that the correct quality and quantity of materials are properly specified in a timely manner, are obtained at a reasonable cost and most importantly are available at the point of use when required. Materials management can result in increased costs during construction. Efficient management of materials can result in substantial savings in project costs. If materials are purchased too early, capital may be held up and interest charges incurred on the excess inventory of materials. Materials may deteriorate during storage or get stolen unless special care is taken. Delays and extras expenses may be incurred if materials required for particular activities are unavailable. Ensuring a timely flow of materials is an important concern of material management. For effectively managing and controlling materials, the performance of materials management should be measured. A performance measure calculates the effective working of

a function. These performance measures may differ from system to system. The measures divide the materials management system in parts and make the working of the system more efficient. When joined, the measures make the complete materials management system.

MATERIAL AND SUPPLY CHAIN MANAGEMENT

Material management is a scientific technique, concerned with planning, organizing and control of flow of materials, from their initial purchase to destination. Material management consists of mainly 4 processes i.e. planning, procurement, logistic and inventory. Materials planning, which is the key function of materials management, is closely related to project planning and control set-up. Both these work together to develop a plan for procurement and stocking of construction materials so as to provide the right quantity of materials of right quality at the right prices from the right sources to the sites at the right time. Thus, this research aims to develop a platform for the same. Today, material management has gained acceptance in all developing economies. The materials department accounts for over 60% of the cash outflow and 90% of working capital of most of the organisations. A properly implemented materials management program can achieve the timely flow of materials and equipment to the jobsite, and thus facilitate improved work face planning, increased labour



productivity, better schedules, and lower project costs. Materials management is an important function in order to improve productivity in construction projects. As one of the goals of material management is to provide an unbroken chain of components for production of goods on time for the customer side, Supply Chain Management (SCM) becomes a vital sub part of material management. Supply Chain Management is defined as the management of a network of relationships, within an organisation and between interdependent companies and business units consisting of materials, suppliers, purchasing, operations, finance, logistics, marketing related systems that facilitate the forward and reverse flow of materials, services, financing and information from the original product to final customer with the benefits of adding value, maximising profitability through efficiencies and customers satisfaction. The objective of managing the supply chain is to synchronize the requirements of the customer with the flow of material.

PROBLEMS OF MATERIAL MANAGEMENT

a) Organization Structure:

The coordination and communication between estimating department, research and development department, purchasing department and plant, equipment and machineries department should be maintained at highest level. Main issues in organization structure are as follows.

- Undefined scope
- Lack of communication between parties involved
- Incomplete drawings Plans are not completed and details are missing
- Lack of conformance to requirements
- Nonstandard specifications that are not commonly used
- Incomplete / ineffective meetings
- Difference between plans and specifications
- Don't communicate exactly.

b) Procurement problem: • Late deliveries- Materials are not delivered as per schedule • Late or incorrect submittals • Poor communication between parties • Lack of conformance to requirements • Unrealistic delivery dates • Re handling of materials • Storage areas are limited or are far from working area. Theft or damaging during handling or other condition.

c) Storage Space: Large number of materials is required depending on the magnitude of the project. And the term

storage space implies both enclosed and open space that can be used to keep materials of work safe until the need for it arise. All materials need protection against many threats such as pilferage, theft, damage or loss. Material such as aggregates, bricks/blocks may not require enclosed storage protection than proper outdoor positioning and stacking. However, other materials such as reinforcement bars, steel columns, timber and galvanized steel for trusses must be protected against contact with water in order to avoid rust/corrosion. The size of proposed building may occupy 60% of the total project site, enabling the remaining 40% to be used for temporary access and site facilities.

d) Security Problem: Security of materials onsite is of paramount importance. Gradual pilferage and theft are issues of concern to the project managers. Loss of materials through pilferage and theft represent financial lost to the project as a whole and in the end it increases the cost of the project. Materials are prone to be stolen despite being in store. And some materials as earlier mentioned may not require indoor storage. Therefore, a well designated vigilante must be maintained 24 hours onsite.

e) Availability of Materials on Market: Steady flow of materials throughout project duration is among the primary function of material management. However, this can be affected by market availability of the material of work. Occasionally manufacturers can run out of raw material or be affected by government policy to the extent that production may have to be slow or suspended. Unavailability of materials of work on market can affect material management by either increasing competition in material purchaser delay the general work progress

AIM

The basic aim of the project lies in revising the existing material management practices in construction sites which require manual efforts and paper works, by incorporating automation for real time monitoring as well as controlling of materials and developing a web application. As a result, better outcomes are expected as of easing out the storage and retrieval of data related to materials and other operations.

OBJECTIVES

The project is carried out in order to satisfy the following objectives:

- To find out the problems which may lead to the necessity of automated system for material management
- To find out the relevance of automation in construction project management, especially in the control and management of materials, through literature reviews and questionnaire survey.
- To develop a sample web application model based on automation in material management and control, which would be simple and cost effective, incorporating material management concepts and other features with the help of field studies.
- Overall by the introduction of this web model, reduce the cost and efficient handling of material at all stages effectively.

SCOPE

Material Management is very vital in any construction project. Having the potential of being one of the core areas in the entire course of construction management, it was chosen to be the field of study for this particular project, keeping the aim of introducing some innovative add-ons to the same. Surveying the literature depicted many instances and case studies of the drawbacks in the current practices of material management in the construction industries. As a result, incorporating automation into the field of managing materials became the primary objective.

Automation obviously results in reduced manual labour and the possible errors likely to occur thereof. The scope of incorporating automation in material management is very large. In general, it can basically start with the real-time development of a software using any coding languages, incorporating all relevant features required for a proper and effective material management.

A properly implemented material management system can lead to better control over material flow, more predictable project outcomes, reduced costs, improved productivity and quality to the whole of construction. A simple, user friendly and cost effective software thus developed can be made use by the construction companies, basically the small scale ones, for their managerial purposes. And the study on the relevance of automation is carried out upon construction companies within Kerala.

METHODOLOGY

A detailed methodology regarding the workflow of the project is drawn out prior to the commencement of the work. Tentative schedules were prepared for the same. The project, having fixed the goals, planned to start with a detailed literature review, referring to various International as well as National journals with regards to Material Management in the construction field. The workflow is as shown below in fig 1.1

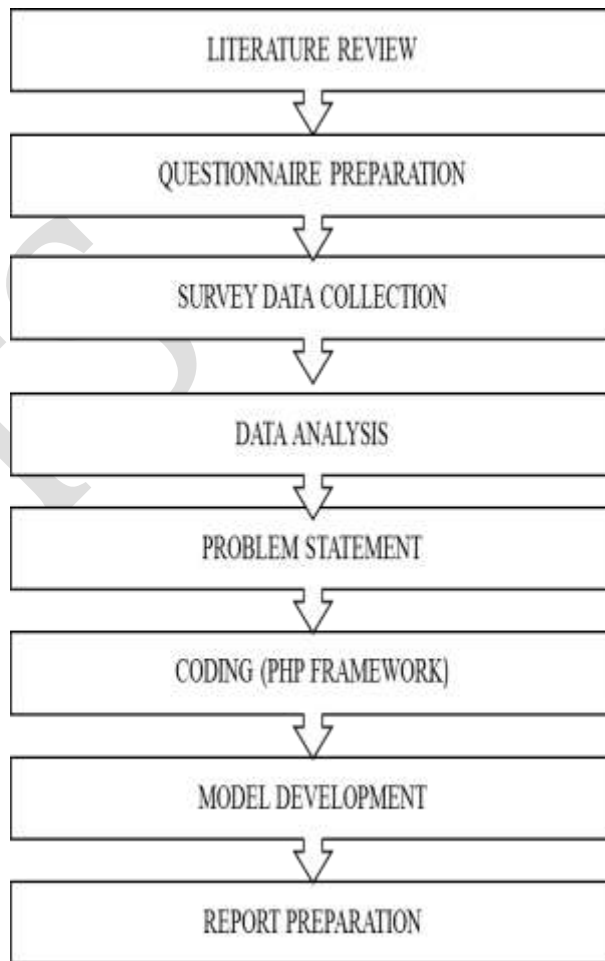


Fig 1.1 Flow chart of detailed methodology

The workflow of the model web application to be developed was formed as the start of model development. As the logic is formulated, the application was planned to be developed by using any of the coding packages. Meanwhile, questionnaires were prepared for intensive field studies, deriving out the factors from the literatures. Detailed analyses also were carried out thereafter. From the field studies and comparisons with



the field requirements, suitable changes were made to the model.

SUMMARY OF PROPOSAL

The analysis was done to understand what are all the problems occurring in the construction field because of improper application of material management. According to the problems that generally occur in the site due to the improper material management, was categorised each problem. For this questionnaires was prepared accordingly and determine the problems which may lead to the necessity of an automated system for material management. Questions were prepared accordingly and those prepared questions were given as a challenge to the site managers, quality control inspector, project manager, purchase manager. From the questionnaires prepared and the answers thus obtained from them were categorized into each class of problems. Thus the problems were pointed out to them and they agreed to each above mentioned problems that were occurring in their site and thus corrections would be implemented. As a solution, develop a sample web application model based on automation in material management and control, which would be simple and cost effective, incorporating material management concepts and other features.

LITERATURE REVIEW

Javad Majrouhi Sardroud, (2012) This research presented a new approach for integrating the latest innovations in ADC technologies, which address a clear path to automate the tracking and monitoring of construction resources (e.g. materials and components), using minimal or no human effort. They found problems concerning construction material management as: Materials required but not purchased ; Materials purchased but not received; Materials arriving at the site at the wrong time; Materials arriving at the site in the wrong quantity; Materials whose specifications do not match those in the purchase order; Unavailability of information regarding the status of orders; Lack of complete and up-to-date information regarding arrival of materials on the site; Lack of up-to-date information regarding site stocks; Extensive multiple-handling of improperly sorted materials in search of required pieces; Missing or surplus materials; Lack of storage space for materials on site; Waste of man hours searching for materials and tracking them. The selected technologies involve the use of combined GPS and GSM technologies equipped with RFID technology to obtain real-time and accurate information about construction resources.

Collected information can then be shared among all players in construction including upstream parties (e.g. material suppliers) and downstream parties (e.g. contractors). The use of automated advanced tracking and data storage technologies can provide intangible and comprehensive benefits in communication and labour utilisation, and it can also facilitate extremely low-cost, infrastructure-free solutions to form the backbone of a construction resource management system (e.g. materials management system). In this approach, the combination of RFID, GPS, and GSM technologies, as a powerful portable data collection tool, enables the collection, storage, sharing, and reuse of field data accurately, completely, and almost instantaneously.

T. Phani Madhavi, et al., (2010) They have done analysis on the work site was done with the previous knowledge of the material management, and new methodologies were implemented at work site, based on the current construction scenario. Understanding of the problems that occur at the work site due to, inventory, purchasing and on how materials are being handled at the work site were taken into consideration. On how, materials are being procured was done with questionnaires and weight ages were given to each. Analysis was done on purchasing and new concept of purchase requisition slip and tender quotation were introduced. Importance on how materials are properly procured at the site was also taken into consideration and new appropriate technological implications were introduced like RFID, PDA, which helped us in a proper scheduling and financial control for proper scheduling and based on the materials importance, and on how they have to be released, ABC analysis and FIFO analysis were done.

Sruthilaya Dara (2022) The paper discusses how effective material management can contribute to lower project costs and more sustainable use of available resources in the construction sector. In the construction industry, the selection of materials and equipment is critical to the successful completion of a project. Management-related factors influence productivity in the construction industry. Factors like quality supervision, inadequate knowledge for selecting the type of equipment, proper maintenance, and inspection, discontinuous routine checks, inadequate measures for efficient usage, and negotiation with terms of equipment are the factors that are more significant than cause the difficulties in the equipment management. The cost of

equipment and material must be included while estimating the total cost of the project. The organization must be able to identify the efficiency of equipment and the efficiency of the materials. This study focused mostly in identify the significant factors like poor equipment maintenance, improper maintenance of economic life, equipment breakdown, improper inventors management, surplus purchase of material, and excessive wastage of materials discovered to be the major factors in the construction industry. Various factors influence the productivity of the construction industry, it is critical to enhance the productivity of projects. The usage of proper material and heavy equipment, and maintenance are required to achieve the target production.

Shriprasad V. Bankar, et al.,(2023) The paper discusses how to optimize construction processes by utilizing a questionnaire survey and the Statistical Package for the Social Sciences (SPSS) software. The authors aim to address the challenges of reducing construction duration and minimizing costs by identifying the root causes of delays and implementing effective strategies.

Through the comprehensive data collection process and advanced statistical analysis, they have gained valuable insights into the factors impacting construction timelines and expenses, enabling us to develop strategies for improvement. The outcomes of the analysis have led to the development of effective strategies aimed at minimizing construction duration and cost. These strategies encompass various aspects, including optimizing project planning processes, enhancing resource allocation and utilization, streamlining communication channels, improving procurement practices, and implementing cost-saving measures. By implementing these strategies, construction projects can benefit from reduced construction duration, resulting in savings in labour, equipment, and overhead costs.

Khyomesh V.et al., (2014) It's a study about the centralised material management and team co-ordination between the site and the organization. The following are problems in materials management :Materials Identification , Vendor Selection, Procurement Problem, Construction Phase. They point out that proper control, tracking and monitoring of the system is required for proper material management and awareness and accountability should be created within the organization . There is a need of an efficient MIS integrating all aspects of material management. Firms employing proper

material management system are seen to have increased their overall efficiency by 35%.

Neha Dube.et al.,(2022) The paper aims to arrive at effective method of evaluation of subcontracting practices. Evaluation of subcontracting is explored in terms of cost, quality, time and capabilities. A questionnaire survey was administered to subcontractors, general contractors, and construction owners to investigate these issues and to determine the differences in perceptions between the parties. The results confirm the focus of the construction industry primarily remains quality within the time schedule. This is will reflected with the highest relative importance index values for the quality of material and quality of work subcontracting factors as allocated construction industry professions from the Amravati region as respondents. The cost aspect has been given less importance in comparison with the quality and time. Further, the financial capability of the subcontractor is overlooked over his capability to deliver quality product and adherence to schedule & company policies. The findings of the study so obtained can be useful as a guideline of subcontractor selection enhance overall productivity and effective construction Management.

I.Jayanth et al.,(2018) This study provides ,factors affecting inventory control management .Construction professionals should focus on these factors to improve their management skills and give some new techniques to implement and to maintain that in inventory control management in construction industries. The results specify that the most significant factors to affect the inventory control management are inventory premises, freight charges, and materials handling equipment, transportation and material cost. Construction professionals should diminish these factors by using some new techniques of inventory management control techniques. This can be accomplished by utilizing material administration methods, for example, ABC, VED and SDE arrangements. By using SPSS analysis of these test Reliability test, Factor analysis and Factors exertion test was analyzed.

V. RathinaKumar et al., (2018) This paper mainly focuses on materials planning and inventory control as these are the major aspects of material management. S-curve analysis is performed to measure the fluctuation between estimated materials cost and market materials cost. The major reasons for this are identified by

interviewing engineers and contractors. Inventory control techniques such as ABC classification as well as EOQ analysis are conducted. Findings: The result of the S-curve analysis show that the actual materials cost is higher than the planned materials cost in most cases. ABC and EOQ analysis are applied to maintain sufficient stock in inventory and any given point of time, to protect the materials in the inventory against damages, to reduce inventory holding costs, to overcome stock-out problems and to maintain the inventory in an optimal level. Sensitivity check is applied to the results of EOQ analysis. The stock-out of A class and B class material problems faced in the construction site can be reduced by the application of ABC classification and EOQ analysis. The total expenditure of inventory is less after the adoption of these simple inventory control techniques.

Conclusion: Instead of using costly software for inventory management, the engineers and contractors may use these simple inventory control techniques which are equally beneficial and economical.

Nabil Ibrahim El Sawalhi et al.,(2012) This research is to explore the local practices used in construction materials management and develop a construction materials management system to facilitate the management of construction materials mainly in the building construction. A survey questionnaire supported by interviews was used to explore the local practices used in construction materials management. The results also show that the problems which have more conscious on its importance "Materials are not available" (81.2%), "Late delivery to the site" (81.2%), and "Deliver materials with wrong quantities" (79.2%). They believe that the factors which have bigger effect on causing waste increase on construction site are improper cutting of material (87.5%), materials damage on site (81.4%), and manufacturing defects (79.2%). All contracting companies are interested in using some techniques for managing construction materials such as building archive for previous projects about the cost of materials to save effort and minimizing errors. Most of contracting companies stated that the main obstacles in using computer in construction materials management are shortage of user-friendly computer program and lack of awareness about the importance of computer program.

N. K. Hannure et al.,(2014) This paper contains the different methods used by the construction companies and also describes the main results of survey carried out

in Pune in different construction companies for their current material management process. By using ICT technique, exact consumption of material, stocked material, and location of material can be obtained. It reduces manual errors and it is easy to communicate. In Pune, there is no construction company which has adopted ICT technique such as RFID or bar code technique for material management. The main barriers of implementation of ICT are its high initial cost and lack of agreement amongst all the board of directors. The construction companies are using maximum ICT techniques in planning and procurement stage while minimum in logistic and inventory stage. The profitability index is more than one and net present value of ICT tool is positive so it can be accepted.

Shabnam Y. Mehr et al.,(2013) The study examines the challenges that affect the effectiveness of materials management in the Malaysian construction industry. The authors conducted a questionnaire survey to extract opinions from sixty professionals who worked in construction companies in Penang Island. Manual error, More paper work, Easily details cannot find out, Easily can't update are the problems in material management. Factors and challenges that affect the effectiveness of material management was also identified in which capable personnel (using computer base materials management system) was identified as the most problematic, project managers therefore need to improve computer base knowledge among all parties related to materials through the construction.

Narimah Kasim et al., (2012) This paper provides a review of the inventory management and on-site inventory tracking in construction projects. It is important to manage all materials and inventory throughout construction activity and processes. Failure in managing site inventory will result in cost overrun, delays in project completion and reduce overall project performance. Thus, there is a need for ICT implementations in construction project. The use of ICT, for example RFID in materials tracking could facilitate the effective and efficient control over materials in construction. Furthermore, it has potential to reduce construction costs, reduce project delays, improve productivity, reduce labour working hours and promote time savings.

Abdussalam Shibani et al.,(2022) This research revealed the existing condition of the Lebanese

construction industry and the benefits and barriers of implementing RM. This research aimed to identify major risks inherent in the Lebanese construction projects, where there was particular attention to the financial and economic risks due to the current situation of the country. To achieve this aim, an investigation was required to clarify the principles and core problems of RM. Therefore, the quantitative process methodology applied through a survey explained the attitude and understanding of construction industry experts in Lebanon regarding the significant risks and the concept of RM in construction, who underlined the value of implementing RM. To fulfil the research objectives, the questionnaire was carefully designed and structured to achieve the participant's perceptions of the risk factors in construction projects as well as the benefits and barriers of RM implementation. Therefore, the participants have approved most of the advantages of RM stated in the Likert scale questions, as well as most of the barriers. The results were concluded and analysed using SPSS.

Hemishkumar patel et al., (2015) This paper discuss that construction materials usually constitute a major portion 50-60% of the total cost in a building construction project. Materials management is made problematic by materials shortages, delays in supply, price fluctuations, damage and wastage, and lack of storage space. To manage a productive and cost efficient site efficient material management is very essential. Inventory management system involves procurement, storage, identification, retrieval, transport and construction methods. This study proposes to apply the Material management and Inventory management technique which includes well documented procedures to decrease the cost and increase in profit during any construction project lifecycle. The waste of materials should also be minimized during construction stage in order to avoid loss of profit. Failure in managing site material and inventory will result in cost overrun, delays in project completion and reduce overall project performance. Better coordination among purchase and finance department will help in achieving greater efficiency in Inventory management. Firm, employing proper material management system can have increased their overall efficiency by 35%.

Mayur Verma et al.,(2020) The purpose of this paper is to analyse the causes of delays in the completion of construction projects due to the failure of the owner, consultant and contractor during the construction phase. The paper presents a framework for the causes of delays

in construction projects using Student's T-test and the value proposition (RII) method. Decision making , Improper site management and supervision ,Complexity in financing the project by contractor,Shortage of construction materials , Shortage of equipment and/or equipment failure ,Improper communication and coordination with other parties, Financing and payments by owner , Inexperience of contractor , Lack of experience of consultants these are the delay factors. The reliability of the questionnaire was assessed using Cronbach's alpha, which is widely used to show internal data consistency .The study concludes with some recommendations to reduce and control delays in construction projects .

Ashwini R. Patil et al.,(2013) This paper is written to explore the current practices of material management so this study is conducted in two phases, first phase gives the qualitative information regarding deviation in planned and actual materials in terms of S curve analysis using MSP tool and reasoning over the deviation is essential to know the effect of material planning before execution of project. Various comments on S curve analysis have given in terms of problems of administrative causes, consultant's causes, contractor's faults, and unavailability of resources. These major reasons of changes represented in terms of pie chart. To maintain sufficient stock of raw material in period of short supply, to protect inventory against deterioration and control investment in inventories and to keep it in an optimum level an inventory control techniques such as ABC and EOQ analysis is carried out in second phase of study to overcome the problems of stock out.

N.B. Kasim et al.,(2005) This paper has presented a brief overview of materials management practices on fast track construction projects. It is clearly important to manage all materials from the design stage to the construction stage. Poor handling of construction materials affects the overall performance of construction projects in terms of time, budget (cost), quality and productivity. The wastage of materials should also be minimised during construction in order to avoid loss of profit for construction companies. There is a need to develop new approaches to materials management in fast-track construction projects in order to improve the efficiency of the production process. The potential of IT applications provides a basis for developing an effective framework to support the improvement of materials management for such projects. The next stages of this



research will examine the extent and nature of automation of the materials management process and will develop new ICT-enabled approaches to improving materials management.

S. Ramesh Kumar et al.,(2019) Projects are organized to accomplish complex tasks that cannot be handled by alone individuals but by multidisciplinary teams in the construction industry. The level of success in carrying out construction project development activities will depend heavily on the quality of the managerial, financial, technical and organizational performance. So the performance is one of the main points to decide project success. The factors which affect the construction project performance are to be identified from literature survey and using those factors the questionnaire survey is carried out among the site engineers and owners in various companies. Project overtime cost, Material waste, Lack of coordination between management and labour, Uses of low quality materials and equipments, Unexpected accident, Complexity of project, Rework due to error , Age of the labour, Poor management and supervision are the major factors which affecting the construction project performance. The ranking of the factors will be done by using Statistical Package of Social Sciences (SPSS). Using that data's the major factors that affecting the performance have to be identified. From the results suitable suggestions will be given to the companies for improving their project performance. Thus the study aims on identifying the factors which affecting the construction project performance.

Prof. Jayeshkumar Pitroda et al., (2015) Construction materials usually constitute a major portion 50-60% of the total cost in a building construction project. Materials management is made problematic by materials shortages, delays in supply, price fluctuations, damage and wastage, and lack of storage space. To manage a productive and cost efficient site efficient material management is very essential. Inventory management system involves procurement, storage, identification, retrieval, transport and construction methods. This paper presents the analysis of the factors affecting Material management and Inventory management of the various construction firms in Gujarat region using a Relative Importance Index .

Nazar Mohammad et al,(2018) The study shows that most of contracting companies are still managing

construction materials manually. Shortage of user-friendly construction materials software packages and lack of qualified personnel in using computer-based materials management systems are considered the main obstacles in using computer in construction materials management. The researcher explores Microsoft Excel capabilities and utilizes these capabilities in developing a Construction Materials Management. Microsoft Excel is used in developing CMMS, as most companies in Afghanistan are familiar with it. Full description of CMMS has been given with detailed implementation procedures. CMMS has been evaluated to test its suitability to local practice. Evaluation of CMMS has addressed both conceptual and practical issues. One of the main recommendations of this research is to encourage local contracting companies to have a construction materials management software package and use it in determining the required quantities of construction materials in order to get materials in time and required quantities, save time and minimize error.

Domini Naaemwan Aasonaa (2022) this study explored materials management practices on construction sites and the emerging challenges in material management in the Upper West Region of Ghana. The study found that organizations use buying strategies, material planning methods, transportation methods, material handling, and inventory management. Among the difficulties include theft and vandalism of materials, a lack of technical expertise on the contractor's part, and a shortage of storage space on site. Given the existing materials management practices, the paper argues for the adoption of technology-based material planning and handling methods. This requires capacity building on the adoption and use of technology in material management. This will require capacity building on the use of ICT and consequently an adoption of ICT in material management.

Zairra Mat Jusoh, Narimah Kasim (2017)the aim of this paper is to identify the effects factors of material management on project performance. Literature from books, journal articles and conferences papers related to this topic are reviewed. In conclusion, exploring the implication of material management towards project performance will benefit construction players in improving the efficiency of material management in order to minimize the impacts on construction projects performance.

Narimah Kasim et.al, (2019) From this research, the main problems in material tracking practices were the problems of tracking the materials in term of timely ordering. This problem can be enhanced through the implementation of key factors to enhance material tracking and implement technologies to help in better practices. The technologies tools that can be used is such as Barcoding, RFID and others. With the improvement of material tracking practices, the productivity at the construction site can be improved, the practice to handling material tracking can be enhanced, the time planning can be improved and eventually the cost of the project can be reduced.

Shubham raibole et al (2019) this paper Using RII it has been found material management plays most crucial role in planning phase and it is of least significance in closure phase. Widely used material management method in construction industry is traditional method but as per now all well-known companies using SAP for better accuracy and accountability. The major advantage of using a software is security, accountability and transparency. Since all data is digitalized and records maintained. By using the software we can show the S-curve analysis, which shows significant deviation of actual cost from planned cost. Good planning of material management can help to avoid any delays of works on site and reduce any extra cost for a project. By using the material management technique standards of quality can be maintained.

Patel Vatsal et al, (2017) The main aim of this research paper is to examine the current material management practice and its impact on the delivery of building construction projects. A questionnaire survey administered to a purposive sample of main contractors and sub-contractors, eliciting current material management practices through semi-structured interview and obtaining their perception root causes of ineffective material management toward 34 causes that were extracted from an extensive literature review. Moreover, the relationship between different material management practices and project delivery in terms of cost overrun and delay were acquired from this questionnaire. There are three distinguish material management practices that were followed. The top three most common root causes of ineffective material management identified were matching price to competitor's price; time spent investigating non-qualified suppliers and unavailability of material.

Nurul Fathira Misron et al., (2018)This paper shows that Material storage management focuses on starting material into the built-up site to be recorded, the material layout and stored over a certain period until it is taken out of the storage area to the work site and the process is repeated. The emergence of new technologies that are not integrated and have no efficient management methods as well as inexperienced management negatively affect the storage management of overcrowded site sites. This study aims to devise an efficient set of materials storage management on a congested site. Critical studies have been referred on more than 50 previous research journals covering by the elements. The framework of this study comprises four elements that are defined as workflow of storage management, storage management systems, material storage methods and roles of responsible parties. The combination of the elements can contribute to the strengthening or discovery of the theory or concept that can be used by the developmental growth and future of the industry.

Abdi Abdikadir Ibrahim (2016)the study concluded that Procurement and purchasing Reuse, Use and Recycle, and Energy saving practices has a positive and significant effect on sustainability while material cost has a negative and significant effect on sustainability. The study also concluded that purchases affects all business areas in a company and it is therefore important that all business areas can influence the purchases, so the outcome becomes optimal for the whole company. In addition, the study concluded that a wide range of building design approaches and commercially available technologies can help effectively minimize a building's energy costs.

Kunle Ogundipe et al,(2019) The findings of this study revealed that lack of compliance to materials specification and standards, little knowledge on materials specifications and standards, poor communication system, inadequate material schedule plan were the major challenges confronted with by stakeholders in ensuring EBMM on sites. The study recommended that for the effective management of building materials, professional involved in building production process should understand the importance of specifications and standards of building materials to avoid disastrous implications on the projects delivery. The study therefore concluded that it is appropriate for all the construction firms to setup a unit that will be responsible for planning,



reviewing and implementation of EBMM for their construction projects. The findings of this study are applicable in the Nigeria and other developing nations.

Tan Pei Xin et al, (2021) main objective of this research is to investigate the advantages, challenges, and improved ways of barcoding implementation for improving materials tracking at the construction site. The research goals have been accomplished as concluded. During this analysis, there were a few challenges and limitations encountered by the researcher. The limitation is difficult to contact the respondent. Some of the respondents that have been missed and unanswered queries were an issue of data collection. This is because the respondent, who is not able to engage in this study as a result of rushing time to work and does not have any time to complete the questionnaire. Besides, the recommendation for the construction industry is engaged in process tracking for light and heavy equipment, machinery, vehicles, electrical appliances, components and construction parts. Due to the loss and theft of materials, this method can encourage the safety of the construction site. The inventory location can be tracked within 24 hours. However, the recommendations for future studies are offered to support this report. The following suggestion should be viewed and seen as a guide to the continuation of this research on automated equipment identification in the construction industry. This research uses an approach in this analysis, which was a quantitative process, where respondents are asked to fill out the research questionnaire by selecting the answer best to focus on their opinions on each topic.

Oyebiyi Simeon Abiodun et al, (2020)The research centred on the factors affecting the material management strategies of construction works. This study examined the existing strategies of materials supervision on building projects, the challenges of materials management and material management steps for construction projects in the state of Ekiti. This research was carried out by conducting questionnaires and evaluated by means of a Relative Significance Index (RSI) for professionals in advising and contracting firms. The study recommends that there must be sequence of materials delivery to avoid waste and theft, the construction materials must be readily available within the surroundings, stringent laws to eliminate quack/sharp practices and promote professionalism in design and construction works should be enacted and religiously enforced, there must be adequate planning and

coordination and there must be good and effective communication among site workers.

3.1 GENERAL

The detailed literature survey is carried out in phase I. Review of literature is help to develop the knowledge and understand the specific topic of interest . Moreover , reading of various papers of this papers of this specified topic gives the skill to frame the methodology of the work for the particular study.The methodology has been framed from the above literature study for the purpose of the project.The data were collected from the various engineers . the result of the one construction firm was included in this report. Further more are continued in phase II report.

3.2 SAMPLE SIZE OF QUESTIONNAIRE SURVEY

Before starting the questionnaire survey, it is required to decide the target population and sample size. The target population is the total individuals from which the sample might be drawn while sample size is the total count of individuals drawn from target population for study or survey. Questionnaire survey was conducted on the determined sample size. Individual of sample size is called as respondents and information elicited from respondents is called as response in this research. Target Population of construction experts is not definable and countable.

3.3 QUESTIONNAIRE SURVEY

A detailed questionnaire will be prepared as a part of the research. The questionnaire consisted of three sections mainly. The first section to be filled was regarding the company details are included. The second section consisted of open ended questions. The questions basically dealt with: the Current computerised techniques adopted and the material management methods adopted. The third section was divided into two parts: one part dealing with the problems leading to the necessity of an automated system for materials and the next dealing with benefits of any automated material management software if developed. A Five-point scale of 1 to 5 was considered for evaluating the impact of each factor. Questions are attached in annexure page. These numerical impact values are assigned to the respondents' rating:

1)Strongly disagree 2) Disagree 3) Neutral 4) Agree 5) Strongly agree

The problems considered to be leading to the necessity of an automated system for materials were:

- Unavailability of materials
- Variation in quantity of material ordered and received
- Late material delivery to site
- Improper response from suppliers
- Delivery of incorrect materials
- Unnecessary piling up of stock in stores
- Carelessness in placing material PO on time
- Increased material wastage in sites
- Incorrect material quantity estimation to place order
- Material price escalation
- Poor quality of material
- Damage of material in storage
- Poor planning and co-ordination
- Poor communication between sites
- Using of available material instead of material according to specification
- Inadequate knowledge of IT solution on materials management
- Excessive paper work
- Improper handling on site/manual materials handling
- Inadequate waste management plan
- Management of surplus materials

And, the possible benefits of any such automated material management system were noted to be:

- Reducing the overall costs on project materials
- Better handling of materials
- Reducing duplication of material orders
- Timely availability of materials on site in the right quantity
- Improving labour productivity
- Complying to time schedule
- Complying to enhancement of quality control
- Improving follow up and monitoring of construction materials
- Better relationship with suppliers
- Waste reduction
- Reducing the space for materials on site
- Obtaining better price for the construction materials
- Help the contractor to have a better chance to win the tender
- Most effective, efficient and systematic control over materials

- Reduce material transportation costs
- Better use of computerized technologies
- Considerable contribution in profit

IMPORTANCE OF SPSS SOFTWARE

Producing descriptive and summary statistics, frequency tables and cross tabulations, for example, a Figure counting the number of visits made to an exhibition by the age group of the visitors. Modeling different sets of data, for example, regression analysis to determine the strength of the relationship between two or more variables such as staffing levels and workload, this is useful technique for testing efficiency.

RELIABILITY OF QUESTIONNAIRE SURVEY DATA

Reliability analysis is a method to identify the internal consistency of the data having various scales. Reliability of data means degree of stability and internal consistency of data collected in the questionnaire survey.

In this research, reliability of questionnaire is assessed by using Cronbach's alpha, that is most used which shows the internal consistency of data i.e. how much a set of data is closely related. The recommendations for internal consistency based on Cronbach's alpha value as shown below,

$0.9 \leq \alpha$ Excellent

$0.8 \leq \alpha \leq 0.9$ Good

$0.7 \leq \alpha \leq 0.8$ Acceptable

$0.6 \leq \alpha \leq 0.7$ Questionable

$0.5 \leq \alpha \leq 0.6$ Poor

$\alpha \leq 0.5$ Unacceptable

Reliability of questionnaire: To determine the respondent's opinion and the internal reliability of the scale, Cronbach's alpha by using spss software was used. The value ranges from 0 to 1. The higher value indicated greater internal reliability. The acceptable values of Cronbach's alpha must be greater than 0.7 and indicate the research data is valid for further analysis.

ANALYSIS BY USING RELATIVE IMPORTANCE INDEX METHOD (RII)

The relative importance index method (RII) : It is used to determine the relative importance of the various factors.

Relative Importance Index Method (RII) = $\sum W / (A \times N)$

Where: W is the weight given to each factor by the respondents and ranges from 1 to 5,

A = The highest weight = 5

N = The total number of respondent

PHP SOFTWARE

PHP is a free programming language used primarily in web applications (it is used in the ever-popular PHP-Nuke web portal software). It boasts compatibility with countless other protocols, such as CGI, and other programming languages, such as C++ or Python. Over decades of development, it has grown into an imperative, object-oriented programming language that can be used for applications ranging from general to specific. One of PHP's greatest virtues is its compatibility with other programming languages, and indeed, even with concepts. If you want to do something with the 18 language, you can likely do it. Any website idea, or making your website work with any other piece of software in any other programming language: PHP likely can do it. If it can't by default, someone out there probably has tips on how to make it the thing you want. But this compatibility means the language is large and sometimes slow.

4.1 DATA ANALYSIS

The factor analysis carried out generated some relevant outputs like: relative importance of factors, reliability of the questionnaire and checking of sampling adequacy. The inferences drawn are as follows:
 The questionnaire reliability check was done by calculating the Cronbach's alpha value. The analysis was done using SPSS software. As the obtained value for Cronbach's alpha $0.814 > 0.7$, which is an acceptable limit, the designed questionnaire is reliable. The output was as follows

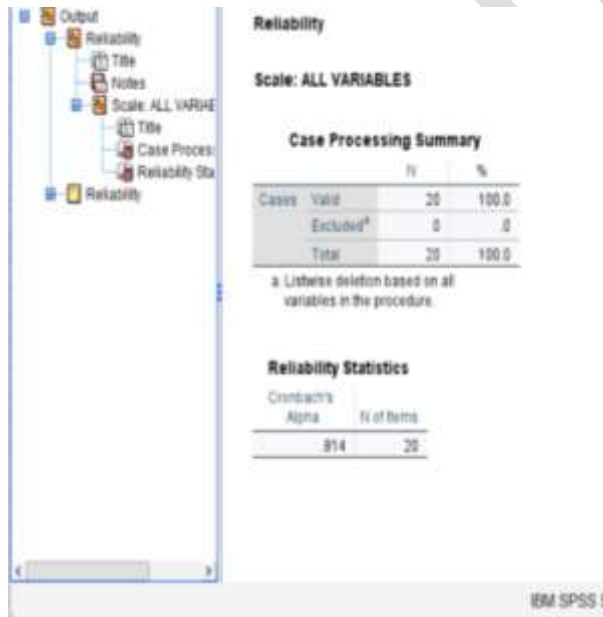


Fig 4.1 cronbach's alpha value



Fig 4.2 Data entry in spss software

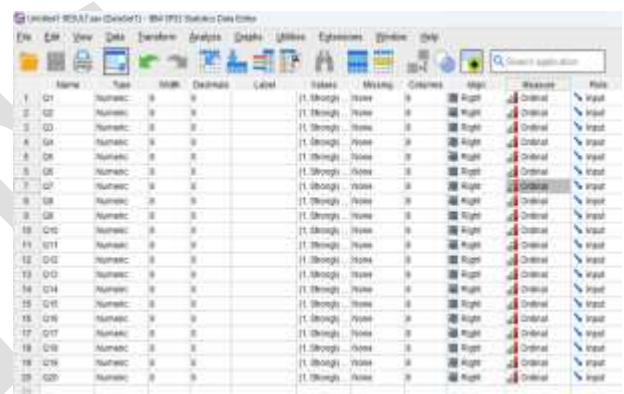


Fig 4.3 Variable view in SPSS software

CONCLUSION

The above literature review explains the material management in construction industry and the problems related to it. In phase I, literatures are collected for the future purpose of the project and for the detailed study about the project. By the detailed study of literature, methodology has prepared and need to follow the methodology for the successful completion of the project.

The problems which may lead to the necessity of automated system was determined by detailed questionnaire survey. Various engineers are the respondents of the survey. They express their opinion through this survey. It was analyzed using SPSS SOFTWARE. The reliability check was assessed using cronbach's alpha and determine the most important



factor which leads to the automated management system using relative importance index method.

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On phase II , work to be done are,

- Questionnaire survey will be done with different construction site
- Comparison of the result
- Solution for the problem
- Web development using HYPERTEXT PREPROCESSOR SOFTWARE
- Result and discussion

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