# Planning materials supply for construction works

**Faith Osawaru, Lekan Amusan, Oladipupo Awotinde, Cinwonsoko Akanya, Olatomide Asiyanbola, Faith Akinbo**

Department of Building Technology, Covenant University, Ota, Ogun State, Nigeria

faithy012@yahoo.com; lekan.amusan@covenantuniversity.edu.ng; ladiawotinde@yahoo.com; cinwon_akanya@yahoo.com; olatomidefnc@gmail.com; tomiakinbo03@gmail.com

**Abstract**. This study focused on planning materials supply for construction works. In achieving the objectives, various construction firms and their sites within the area studied was sampled through structured questionnaires. The paper first presented a theoretical background of the study based on the relevance of material planning. A total number of 80 sample size was used for the study; Random sampling technique. Data collected were analyzed using percentage distribution and mean supply index shown in a table to obtain a comprehensive and accurate analysis in the descriptive statistics as applicable. From the results of the analysis of data, conclusion were made and it is recommended that the planning of building materials should be effectively done to avoid delays in construction works caused by untimely ordering and delivery of materials to sites.
**Keywords:** Planning, Supply, Building Material, Construction Work.

## 1. Introduction

Planning is a management approach that involves developing a project plan to achieve specified objectives. Planning material supply is very important at the formulation stage of a project. To determine what type of material is required for a particular stage of work, what activity the materials will be required for, how the material will be ordered, stored and utilized, when the materials should be available to site for construction work and who should be responsible for the supply of those materials. This is done so that the work in which the material is needed for can be efficiently delivered at the appropriate time. Building materials are materials used for construction purposes. However, in construction no two projects are similar. The type and quality of construction materials differ from project to project. Although some basic materials like aggregates, wood, cement, steel, water and blocks are common items, others vary with the type of project. For example, most of the finishing materials used in housing projects are not required in industrial project. Materials are planned according to time and usage to avoid delay in transporting and delivery, to avoid delay of execution of work, to prevent improper storage could lead to wastage of materials on site. Materials are sourced according to the contract specifications and construction requirements. Material planning is very important at the feasibility stage of construction, which is significant in materials management, and it has a strong relationship in project planning and control set-up. Both at which this study is to develop a plan for procurement and stocking of construction materials. This is on the direction to determine the type of materials to be used so as to provide the right quantity and quality of materials to site as well as the right prices from the right sources at the right time for work. Planning for materials is a management process that involves materialsidentification, quantities estimation, defining

Content from this work may be used under the terms of the Creative Commons Attribution 3.0 licence. Any further distribution of this work must maintain attribution to the author(s) and the title of the work, journal citation and DOI.
Published under licence by IOP Publishing Ltd

specifications,forecasting requirements, locating sources for procurement, getting samples of materials approved, designing materials inventory, developing procurement plans and monitoring flow of materials from inception till the construction works are completed (Chitkara 2008).
In the same vein, Olubodun and Kanga (1997) submitted that materials are the most central construction input around which the efficiency and inefficiency of labor, plant and equipment in construction sites revolve. These materials do not just appear on the construction site to achieve the delivery of the construction work but, there is need to plan for materials to be used. This research therefore aims at the importance of planning for materials and to devise effective method of planning for material sup-ply for construction works. The objectives are to determine the various methods of planning for materials, determine the factors affecting the supply of materials to sites and identify the best method of materials supply planning and management. This study is significant because it will help construction and/or project managers to plan and manage materials required for construction work from inception to completion. Also, it will provide insight into criteria that determine effective planning for material supply on sites with a view to guiding against delay in supply and delivery.

## 2. Literature Review

Planning is said to be a task without end during construction. According to Ogbadu (2003) planning for materials involves budget preparation (what is required and by what means to fulfill the objective of the organization), product research and improvement, value engineering, analysis and standardization of specification. It is pre-pared after careful and extensive research. For a comprehensive material plan, the client and contractor have to: clearly define the materials that will be required for the project in writing, identify all the main materials that are needed at different stages of work, decide budgetary requirement, determine who the suppliers of each material are and how will the materials be made available to sites, what will be the likely duration for the supply of the materials and time for delivery so as to avoid the extension time of project work completion. Management of materials includes material procurement, materials forecasting, recording, plans and monitoring flow of materials from inception to completion. (Chitkara, 2008). This section reviews how to plan for construction materials to avoid delay in delivery of project work. Planning materials for construction works is the key function of material management which helps to develop a plan for procurement and stocking of construction materials so as to provide at site, materials of right quality, in right quantity, at right prices, from the right source and at the right time. Chitkara (2008) said efficient materials management in project environment calls for integrated approach covering numerous functions such as materials purchasing, inventory control, store-keeping and warehousing, materials transportation and handling at site, materials codification and standardization, and the disposal of surpluses. Material management can be done in different ways. Below is a list of various methods of material management.

### *2.1 Scheduling Method:*

Adeweso and Windapo (2008) defined this as the encoding technique used to note the data for material requirements and deliveries. This is the lack of modern planning techniques used in project management by local contractors. In the planning stage, the contractor has to check the availability of materials, quantities, the quality of construction material necessary, the distribution of materials to various parts of the project, purchase of materials, supply and delivery process of materials, specification, the size and dimension of the required materials and communication methods.

### *2.2 Material Variance Analysis Method*

According to Adeweso and Windapo (2008), it is the comparison of definite material usage against the approximation. It is also revenue to track and examine the variability on material cost, quality, size and expenditure.

### *2.3 Material recording method*

Material recording comprises of note taking and the use of material record on site. The records include the supplier, receiver, loading and offloading, transit and handling of materials. It is commended that arrangements be made for materials to arrive on time. Once materials are delivered to site, it should be checked for damage, quality, size and requirement (Adeweso and Windapo, 2008).

### *2.4 Methods of Planning for Materials*

Planning for materials can be done using different methods. Below are some of the methods of planning for materials for construction works.

i. Demand planning: Prasad (2006) defined this method as a simple technique used. This is based on the historic data of materials. The contractor should derive an approximate consumption of materials for a period of construction and then calculates the quantity of materials needed to be maintained for the work.

ii. Material inventory: Chitkara (2008) defined inventory as the cost of materials in stock at a given time. This stock of materials is held to act as a cushion between supply and demand. It is therefore necessary to hold a planned stock of construction materials at the project site to ensure a timely supply of the expected quantity of materials at the appropriate time for smooth execution of planned construction activities with least inventory.

iii. Material budget planning: Materials budget can be prepared once the requirements are worked out for the activity as follows:

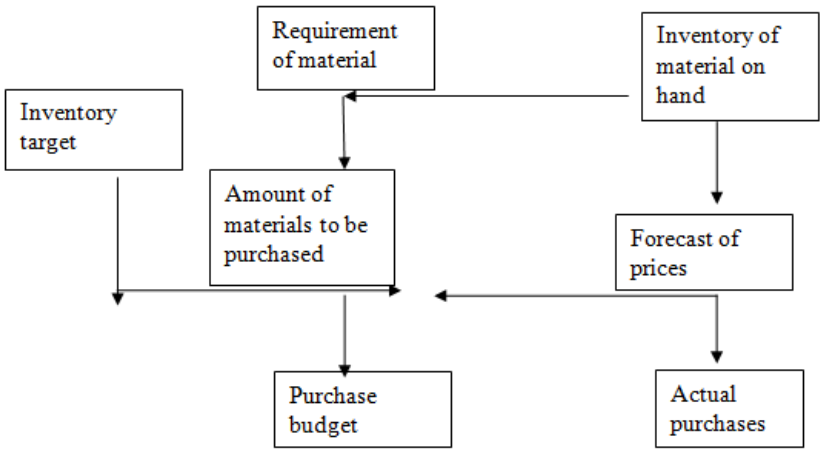



Fig. 1. Material budget planning flow

## 3. Research Methods

The study used a literature survey and a survey research design to devise effective method of planning for material supply for construction works. Related literature was reviewed to help gather information on the methods used in planning for materials to construction sites. The population of the study was construction professionals in Lagos State, Nigeria. Questionnaire was designed to elicit data from the respondents. A random sampling technique was used to select a sample size of 80 professionals from the frame. Questionnaire was generated for professionals to obtain preliminary information regarding the methods used in planning for materials and how the materials are procured when executing a project from inception to completion. The questionnaire consists of questions that bother on the objectives of the study. The methods of data analysis used in this study were frequency and percentage distribution.

## 4. Results

Table 1. Results of professional qualification of respondents

| Variable Name | No of Respondents | Percentage (%) |
|---|---|---|
| MNIOB | 18 | 22.5 |
| ANIA/ARCON | 14 | 17.5 |
| ANIQS | 12 | 15 |
| ANIESV | 14 | 17.5 |
| Others | 22 | 27.5 |
| **Total** | **80** | **100%** |

Table 1 reveals the respondent's level of professions respectively. Eighteen respondents are Builders, 14 are Architect, Twelve are Quantity Surveyors, Twenty-two are Civil Engineers and fourteen are Estate Surveyor.

Table 2. Percentage of years of working experience of the respondents

| Variable Name | No of Respondents | Percentage (%) |
|---|---|---|
| 2-5 years | 21 | 26.25 |
| 7-10 years | 24 | 30 |
| 11-15 years | 16 | 20 |
| 16-20 years | 11 | 13.75 |
| Above 20 years | 8 | 10 |
| **Total** | **80** | **100%** |

The above table shows that twenty-two have 1 to 5 years construction experience, twenty-three have 6 to 10 years, sixteen have 11 to 15 years, eleven have 16 to 20 years and eight has over 20 years construction experience.

Table 3. Results on placing of order for materials

| Variable Name | No of Respondents | Percentage (%) |
|---|---|---|
| 1 week | 33 | 41 |
| 2 weeks | 31 | 39 |
| 4 weeks | 13 | 16 |
| Others | 3 | 4 |
| **Total** | **80** | **100%** |

Table 3 result identifies placing of materials order; where, 41% of construction sites chose 1 week, 39% of the construction sites chose 2 weeks, 16% of the construction sites chose 4 weeks, while 4% of the construction sites chose "others" which ordering is being done for 2 days and 4days before its requirement date, depending on when the materials are needed to be used.

Table 4. Result on preferred market for procuring of materials to site

| Variable Name | No of Respondents | Percentage (%) |
|---|---|---|
| Local market | 12 | 15 |
| Foreign/Importation | 10 | 12.5 |
| Through suppliers | 36 | 45 |
| Materials merchants | 12 | 15 |
| Directly from manufacturer | 10 | 12.5 |
| **Total** | **80** | **100%** |

The above Table shows the response on the preferred market for procurement of materials, 15% of construction sites prefer of materials from the local market, 12.5% prefer importation of materials, 45% of construction sites prefer their materials from suppliers, 15% prefer their materials from materials merchants, while 12.5% of construction sites prefer materials directly from the manufacturers.

Table 5. Percentage composition of the methods used in planning for materials

| **Variable Name** | **No of Respondents** | **Percentage (%)** |
|---|---|---|
| Demand planning/re-order point planning | 8 | 10 |
| Material requirement planning | 39 | 49 |
| Budgeting for materials | 16 | 20 |
| Production planning | 8 | 10 |
| Materials inventory planning | 9 | 11 |
| **Total** | **80** | **100%** |

The table above shows the result of the methods used for planning for materials, 10% of construction sites use demand planning for their materials, 49% of construction sites use materials requirement planning, 20% use budgeting planning for their construction materials on site, 10% chose production planning, while 11% of construction sites use materials inventory planning for their materials. Most construction sites in Nigeria practice the method of materials requirement planning when it comes to the aspect of planning for their materials on site. This is a good practice method to be adopted (Joshua et al. 2018).

Table 6. Percentage of material management methods used on site

| **Variable Name** | **No of Respondents** | **Percentage (%)** |
|---|---|---|
| Scheduling method | 46 | 57.5 |
| Material variance analysis | 0 | 0 |
| Material recording method | 34 | 42.5 |
| Others | 0 | 0 |
| **Total** | **80** | **100%** |

Table 6 shows the method used for material management, 57.5% of the construction sites use scheduling method for managing their materials on site, 42.5% of the construction sites use material recording method, while material variance analysis method of material management is not used by any construction site which is 0% and “others” show 0%. It was observed that most construction sites in Lagos State and Ota use two methods in the management of their materials on site (Amusan et al. 2017).

Table 7. Result on impact of delays to contract on site

| **Variable Name** | **No of Respondents** | **Percentage (%)** |
|---|---|---|
| Contract duration is extended | 17 | 21.3 |
| Disputes with client arises | 12 | 15 |
| Extra expenses may be incurred | 20 | 25 |
| Progress of work is slowed | 20 | 25 |
| financial loss may be incurred | 11 | 13.7 |
| **Total** | **80** | **100%** |

On the impact of delays to the contract been experienced on site, 21.3% of the construction sites indicated that contract duration is extended due to material delivery, 15% of the construction sites indicated that disputes with client arises due to material delivery, 25% of the construction sites indicated that extra expenses may be incurred due to material delivery, 25% of the construction sites also indicated that the progress of their work is slowed down due to material delivery and 13.7% of the construction sites indicated that financial loss may be incurred. This is an indication that most construction sites have impact of delays due to material delivery which is caused by the material suppliers (Amusan et al. 2018).

## 5. Findings

The findings obtained from this study can be said to be as follows:

i. The material requirement method used in planning for materials is averagely practiced but needs to be improved to reduce frequent occurrence of delays.
ii. 75% of construction sites encounter delays due to untimely delivery of some construction materials. This result is found in the research analysis.
iii. This indicates that suppliers are mostly responsible for the procurement and delivery of materials to construction sites.
iv. Most construction site studied; practice the Schedule receipt (placing order on the supplier) in the ordering stage of materials.
v. 80% of construction sites place order for materials between one and two weeks of the requirement date as shown in the result analysis. This is a wrong practice because late ordering for materials may lead to delays by the suppliers.
vi. In the management of materials, scheduling method is mostly used. Where, approximately 58% of the construction sites use scheduling and 43% use the material recording method.

## 6. Conclusion and Recommendation

Due to the findings of this study, there are some facts gotten that should be of improvement to construction industry on planning for the supply of building materials. These include:

i. The prompt ordering of materials should be done to ensure that suppliers de-liver the materials when required for construction work.
ii. Delivery of materials can be improved by sourcing them in the location where it can be made available to reduce impacts of delay in transportation/ traffic congestion.
iii. It is also recommended that Material Requirement Planning should be adopted because, it is the appropriate method of planning for materials which information includes: when to place order, how much to order, who to order from and when the items need to be on hand.

## References

[1] Adeweso, O. S., and A. O. Windapo. "Relationship between material management approach and scheduled project completion time." In Construction and Building Research of the Royal Institution of Chartered Surveyors Conference. 2008.
[2] AmusanLekan.,Jenom, A.,Opeyemi, J.,Ayodeji, O.,Ignatius, O. “Innovative green approach informatics to managing thermal sources and its effect in residential buildings in tropical climate.” International Journal of Civil Engineering and Technology, 2017
[3] AmusanLekan, M, OlonijuLeke, I.,Mariam, A.Adebisi, M.,Farayola Hezekiah,Osawaru, F.(2018) Adopting information and communication technology in construction industry International Journal of Mechanical Engineering and Technology, 2018.
[4] Chitkara, K. Construction Project Management. 2nd Edition. Great Britain: McGraw Hill Publisher, 2008

[5] Joshua, Opeyemi, Kolapo O. Olusola, Kehinde D. Oyeyemi, Ayodeji O. Ogunde, Lekan M. Amusan, David O. Nduka, and Joyce Abuka-Joshua. "Data of the properties of rebar steel brands in Lagos, Nigerian market used in reinforced concrete applications." *Data in Brief* (2018).
[6] Ogbadu, E.E. Introduction to Business, Precious Treasures Ltd. 2003.
[7] Olubodun, F. and Kwanga J. "A Strategy for Effective Control on House Building Sites," A paper presented in the construction and building research conference, 1997.