**EFFECT OF STORE DESIGN ON MATERIALS HANDLING**

**A CASE STUDY OF POWER HOLDING COMPANY OF NIGERIA (PHCN) KADUNA**

ABSTRACT

This study examined the effect of Store design on the material handling of an organisation, taking PHCN Kaduna as the case study. The study was guided by the following research objectives; to examine the relationship between materials handling and the Store design of PHCN; to examine the types of store design systems used by PHCN and to examine the factors affecting the Store design of PHCN. Using a sample of 40 respondents, a case study design, involving the use of both qualitative and quantitative methods of data collection was employed to assess the effect of Store design on the materials handling of an organisation. A cross sectional research design which employed both quantitative and qualitative techniques was employed in data collection and analysis purposive and simple random sampling techniques were employed to attain responses from 40 respondents which comprised of the staff of PHCN. The findings revealed that there is a positive relationship between materials handling and the Store design of PHCN since materials handling facilitates a shorter operating cycle, reduces handling costs, eliminates unproductive handling of materials, reduces idle machine capacity, reduces idle time for labour, eliminates factory hazards, maintains quality of materials, enables optimum usage of space, facilitates materials issues, facilitates better customer care and better quality products and ensures timely production.

The study recommended that organisations should invest in store design equipment. The study also recommended that organisations should prioritize the material handling function since it is a very vital cost center. The study concluded that every successful organisation must have an efficient materials handling department and also give keen interest on the other factors that influence the profitability of the organisation.

**CHAPTER ONE**

**INTRODUCTION**

**1.1 Background of the Study**

A store is an essential limb of an organization. It is the depository of all materials required by the organizations in the organization and supplies materials as an when required.

It is important to note that the store is an area of great expenditure in manufacturing and assembling plant. It is true that store function is a major cost centre which make use of 70-75% annual budget of the firm (Dangana 2005) and thus it can affect saving and therefore contribute significantly and therefore contribute significantly to the profit of the organization.

However, in today’s highly competitive and globalized business world, store design is of great importance as a substantial number of instances have show that people charge with the function and responsibility of designing and managing the store are given little or no attention in the organization. This may be as a result of poor understanding store design or inappropriate application of it.

More so, the variety of items sometimes, store is so large that a planned system is necessary to keep the secured and in order. The stored items should be identified and issues with minimum effort and minimum time. Thus this calls for a store structure suitable to carry on various activities efficiently and productivity and developing a system that ensure safety of men and materials.

Most often the design of a store house determiners to a large extent the materials movement pattern and the limited type of handling equipment that can be used. This result in fact that most customers demand for goods and services within and outside the organization are incremental in nature as they opt for speedy, convenient and reliable delivery of materials and service.

However, the need to curtail the amount of waste and improve the level of customer’s service within such organization has brought the use of the term store design ad its impact in materials handling. It should also be noted at this junction that any knowledge of how a store should be designed must incorporate the knowledge of how a store should be designed must incorporate the knowledge of how materials would be moved.

Therefore, the research work develops the effective utilization of store design and it prospect in the organization with reference to enhancing and ensuring effective materials handling in the organization.

**1.2 Statement of the Problem**

One vital decision that firms make is how to design and where locate their storage facilities. This decision goes a long way in determining the extent to which the firm will achieve its objectives. That is to get products and services to customer faster and at lesser cost to the firm and customers.

Neglecting to manage the activities effectively can result in inefficiencies that out weigh gains or benefit in good management of such vital activities as transportation materials handing, inventory management and maintenance and information flow.

However, organizations are faced with various problems to design a store house. Some of these problems may include; construction cost, cost of installation, cost of land, rate levied upon the new building by local authority and cost of survey, planning designing. Other problems may also include cost of materials handling i.e (equipment needed to load and off load materials and also for transporting materials), cost of storage equipment needed, and payment to building contact and for other incidental cost.

As a result, a poor storage design will result in poor performance such as materials damages and obsolescence, theft and pilfering, poor communication network, difficulties in the movement of materials within and outside etc regardless of the firms position in the industry or its product acceptability in other location.

**1.3 Objective of the Study**

 i. To examine the effect of store design on materials handling

 ii. To ascertain difficulties associated with store design on materials handing.

 iii. To identify necessary solution to curb these difficulties.

 iv. To determine the degree of importance of placed to store building in PHCN.

**1.4 Significance of the Study**

The findings of the research will be useful to power holding company of Nigeria (PHCN) Kaduna as it will enhance or improve the store design system and techniques effectively and efficiently.

Prospective researchers may find findings of the researcher as a reference point particularly for those who may wish to carry out further research on the related field under study.

To the entire populace, that come across this research work, the research work will provide them with the knowledge on the important store design on material handling is to an organization and it will also add value to their knowledge. Also it will serve as pre-requisite for the award of Higher National Diploma (HND) in Purchasing and Supply management.

**1.5 Scope of the Study**

This research work is based on the effects of store design on materials handling with consideration to power holding company of Nigeria (PHCN) Kaduna. Ali Akilu road Kaduna north local government. The research work will be centered on the effect of store design on materials handling in the organization with regard to the management and staff of PHCN.

The findings of this research work will primarily base on the data from the stores, distribution, marketing and production management of power holding company of Nigeria located at Ali Akilu road kaduna north local government kaduna.

**1.6 Research Questions**

 i. Does store design have any effect on material handling?

 ii. What are the difficulties associated with store design?

 iii. What are the solution to curb these difficulties?

 iv. What is the degree of importance placed on store building in PHCN?

**1.7 Definition of Terms**

Store: is a place where items may be accumulated or routinely kept. It is set up in order to receive, inspect, hold and issue all assets of an organization while helping to maintain its original quality and balance flow of materials as well as achieving the very important roles of store function.

Design: the way that something has been planned or made to draw or plan something that will be made, done or built in other to permit a smooth handling and storage of materials at the lowest possible cost.

Store design: could be described as the planning and layout of store house structure to permit smooth handling and storage of store at the lowest possible.

Material handling: as that operational activity involving manuals or automated movement of materials and other goods from one location to another within an organization or time in good condition and efficiently.

Shelves: a board for laying thing on or this is pieces of woods or iron that are placed on the wall where goods and other office materials are kept. In some places they are designed in cubes.

Pallets: a sample device that place mechanically operated forks under a load so that it can be raised up from grounds and are usually made of woods.

Gangways: this is a long and normally a narrow way in store house and environment for operating of handling equipment to facilitated movement of materials in and out of the store.

Stockyard: this is an open storage space with an organization in other words. It is a type of store not housed but segregated purposely for storage not of non perishable.

Receipt: is the process of accepting from all resource all materials and parts which are used in the organization including supplier for manufacturing, plant maintenance officer, capital installation and finished products.

Effect: change produced by an action or the result produced from the collusion of two or more variables.

Organization: are artificially continued structure with procedures and objectives defining responsibilities and highlighting who does what they of job task.

Dispatch: refer o terms being selected from stock and when marshaled documented loaded and subsequently delivered to their given destination.

CHAPTER TWO

LITERATURE REVIEW

**2.0 Introduction**

This chapter provides the reader with important facts, theories and models in order to increase the understanding of the area under investigation. The chapter also identifies what other authors have found out in the area of stores design.

**2.1 Theoretical Review**

**2.1.1 History of Stores**

Stores’ roots go back to the creation of granaries to store food, which was historically available for purchase during times of famine. As European explorers began to create shipping-trade routes with other nations, stores grew in importance for the storage of products and commodities from afar. Ports were the major location for stores. (Give a good flow)As railroads began to expand travel and transportation, the creation of rail depots for the storage of materials became necessary. In 1891 the American Warehousemen's Association was organized to challenge the railroad companies' control over freight depots. President Theodore Roosevelt significantly strengthened the Interstate Commerce Commission with passage of the Hepburn Act in 1906. Commercial storage began to grow after the government placed more restrictions on railroads.

World War II impacted storage in several ways, including the need to increase the size of stores and the need for more mechanized methods of storing and retrieving the products and materials. As mass production grew throughout manufacturing, the needs of efficient and effective storage capabilities grew with it. (Encyclopedia of Business, 2006)

**2.1.1 Stores Organisation.**

Store is a function of materials management in an organization. Hence it is generally found that stores function reports to the materials manager. But in some situations stores function reports to the production function. The earlier type of arrangement is based on the concept that stores along with other functions of materials management can be integrated into the materials organization. This will stream line all materials management functions effectively. The other arrangement is leaning on the fact that production function is very closely linked to stores and a common command can reduce cost and increase effectiveness and also keep material accounting outside the scope of procurement function.

Centralized stores concept is to store all items at a central place and control materials movement from this central place whereas decentralization concept is moving the material to the respective consumer function or directly to the points of use. Centralization or Decentralization then is a matter of convenience. However, one basic organizational feature must be observed. The entire stores setup should be under the unified control of one department with senior controller of stores in charge, in order to efficiently achieve the objectives of the function of stores.

**2.1.2 Stores Systems and Procedures.**

Stores Systems and Procedures operate the stores every day. Systems and procedures should undergo continuous review to avoid redundancy and rigidity. Continuous review in the form of PDCA should provide the benefit experience of implementation. Operation of stores is made up of number of activities involving various functions inside and outside the organization. These activities are tied together by procedures so that transparency comes in and variations due to individual personalities are limited. The system should take care of physical flow of materials and flow of information.

2.1.3 Identification System.

When one deals with large number of items, depending on physical description of the item becomes unreliable. Hence we need a system which provides a unique identification for each item in the stores. Materials suppliers to stores follow their own numbering system for identification. Hence it is primary responsibility of stores management to develop a unique identification system to facilitate clear communication internally.

**2.1.3.1 Arbitrary Approach.**

 Serial numbers are assigned in sequence to the materials as they arrive in the stores. This is a unique system as every item will possess a unique identification number. But it will not be possible to identify the family of parts to which this particular part belongs. This type of numbering will not reveal any classification of the part.

**2.1.3.2 The Symbolic Approach.**

This is a system using numerical, alphabets or a combination of both for identifying a part or item. Following is an example: 1 52 43 25 First digit 1, stands for general class to which this item belongs like say, raw material. Second two digits indicate the generic class like say, bars. Third two digits indicate steel rounds and the last two digits indicate the specific number. Similarly alphabets or alphanumeric can be used in place of numbers.

**2.1.3.3 Engineering Drawing Number.**

This is quite useful internally. But has a serious limitation that it is applicable to manufactured parts only receipt system: Stores receive materials from various sources. Some of them are internal and some are external. Receipt system is specific to the source. When materials arrive from an external source following system handles the receipts. Purchase function raises a PO on the source of supply a copy is sent to the stores. Stores are now advised about the order. When the supplier on whom the order is placed supplies the goods he sends goods dispatch note, giving information about carrier, value of the goods, date of dispatch etc. to the receiving stores. The carrier sends a document called consignment note. These documents enable the store to make arrangement for receipt of the consignment.[handling equipment, space etc.] When the consignment arrives at the receiving section it is checked against the documents already received with respect to the consignment. General condition of the goods also is checked.

**2.1.4 Types of Storage.**

 In actual practice we come across different types of stores classified as per the nature of the products stored, types of the materials stored and function of the storage. As per types of the materials stored, raw materials store, components store, work in process store, finished goods store, semi finished goods store, tools store and consumable materials store. As per nature of the materials stored; LPG store, chemicals store, hazardous materials store and refrigerated materials store. As per function of the storage; receiving store, central store, general stores and sub stores.

**2.1.5 Storage Systems.**

 Physical systems physical storage of material is very important from the point of view of identification, retrieval and issue. Various methods adopted for physical storage are mentioned below.

**2.1.5.1 Closed Door System.**

 The stored material is held under lock and key. Entry into the store is restricted to authorized persons only. Physical movement of the material is only with authorized documents only. Maximum security and tight control on movement are features of this system.

 2.1.5.2 Open Stores System.

 In this system material is stored near point of use and there is restriction on consumption. Control passes on to the operations department Random access stores system: There is no fixed location for an item. Item occupies the available physical slot when it enters the store. Stores address is fixed to the occupying item electronically. For issue the item is located by this address. This system facilitates maximum space utilization but electronic control is needed.

**2.1.6 Stores Accounting And Verification Systems.**

Purpose of stores accounting is to know; cost of materials consumed in production, levels of wastage produced, value of material lying in stock. For ascertaining the above following factors are taken into account; material price; freight charges; insurance; duties; tax; packaging charges etc.

**2.1.6.1 FIFO System.**

First in first out system- when the material is issued it is assumed that the one which came first is going out. Hence the rate pertaining to the first in is applied. To the stock latest price is applied. When there are several price changes this system becomes complex.

**2.1.6.2 LIFO System.**

Last in first out at the time of issue- When the material is issued latest entrant is assumed to be going out. Hence latest prices are applied to the issue. And receipt price is applied to stock. Average cost system: an average is established with price of each item in every shipment taken into account. Total items received and price paid for these items is calculated. And average price for each item from this lot is calculated and applied to the issue and stock.

**2.1.6.3 Standard Cost Method.**

Standard cost method charges issued materials at a predetermined or estimated price reflecting a normal or an expected future price. The difference between the actual and standard cost is recorded in a purchase price variance account. The variance account enables management to observe the extent to which actual materials costs differ from planned objectives or predetermined estimates. Materials are charged into production at the standard price, thereby eliminating the erratic costing inherent in the actual cost methods.

**2.1.7 Stock Verification Systems.**

Discrepancies invariably occur between physical stock and books in spite of good store keeping. Hence a system is needed to locate this gap and apply correction. Purpose of Stock verification is; to reconcile stock figures with books, to identify areas for tighter control, to keep a check on pilferage and fraudulent practices and to back up balance sheet stock figures.

**2.1.8 Systems Of Physical Stock Taking**

**2.1.8.1 Annual stocktaking.**

Stock is checked once a year, generally at the end of financial year. This method is quite popular among large number of engineering industries. Total stop is enforced on items entering and leaving the stores and physical counting is done. This may necessitate stoppage of production for a few days. Discrepancies are noted for management action. Nonmoving items are identified for action. Main features of this system, correct position of stock is ascertained without any confusion about any item , stoppage of production is generally required, final list of surplus or shortage items is prepared, final list of damaged or lost items is made.

**2.1.8.2 Perpetual Inventory and Continuous Stock Taking System**

 When the firm is very large and number of items and quantity per item is huge, annual stocktaking becomes complicated and hence impractical. Production stoppage also may not be possible. Many firms follow following simple method of continuous stocktaking. Inventory is divided into 52 parts and year also is divided 53 weeks. Every week stocktaking is done. Discrepancies and damages etc. are identified and corrected continuously.

**2.1.9 Obsolete, Surplus And Scrap Management.**

Obsolete items are good in all respect but have no useful role in the company due to changes that have occurred in the course of time. They have economic worth in the market. Surplus items are those that have accumulated due to faulty planning, forecasting and purchasing. Hence a usage value is associated with these items. Scrap is wastage generated due to processes like turning, boring, drilling etc. and also due to bad manufacturing.

**2.2 Theoretical review**

**2.2.1 Systems Theory**

A system is a collection of part unified to accomplish an overall goal. If one part of the system is removed, the nature of the system is changed as well. A system can be looked at as having inputs (e.g., resources such as raw materials, money, technologies, and people), processes (e.g., planning, organizing, motivating, and controlling), outputs (products or services) and outcomes (e.g., enhanced quality of life or productivity for customers/clients, productivity). Systems share feedback among each of these four aspects of the system.

The Systems Theory may seem quite basic. Yet, decades of management training and practices in the workplace have not followed this theory. Only recently, with tremendous changes facing organizations and how they operate, have educators and managers come to face this new way of looking at things. The effect of systems theory in management is that it helps managers to look at the organization more broadly. It has also enabled managers to interpret patterns and events in the workplace – i.e., by enabling managers to recognize the various parts of the organization, and, in particular, the interrelations of the parts.

**2.2.2 Inventory Control Theory**

Inventory control involves the actual control of inventory; this can mean inventory of raw materials, works-in-progress or finished goods. Regardless of the type of inventory in question, inventory requires storage, and there is always a cost associated with that storage. Therefore, inventory control theory is concerned with all actions related to the storing of items and the consequences, both positive and negative, thereof.

One of the most common applications of inventory control theory is in the determination of the optimal quantity of inventory to be held. There are several mathematical models in use that can act as a useful tool in inventory control. These models strive to balance storage costs with order costs; the cost of shortages is also considered. While inventory control theory tends to be a bit shortsighted regarding the non-monetary costs of storage, and it makes assumptions regarding future demand and delivery that could not be known, inventory control theory is still a cost-saving tool, and is considered part of good business practice in manufacturing environments. (O'Farrell 2010)

**2.2.3 Theory of Constraints.**

One of business management theories is the theory of constraints (TOC), it was created by Dr. Eli Goldratt, and it is based on: "a assumption that every system has at least one constraint limiting it from getting more of what it strives for. If this were not true, then the system would produce infinite output." The theory of constraints is both descriptive and prescriptive in nature; it not only describes why system constraints happen, but also offers guidance on what to do about them. Goldratt states that there is only one constraint in a system at any given time limiting the output of the entire system. The remaining “links” are known as non-constraints. When one constraint is strengthened, however, the system does not become infinitely stronger. The constraint simply migrates to a different component of the system, i.e., some other link is now the weakest and all other links are non-constraints. The system is stronger than it was but still not as strong as it could be. Overall, the theory of constraints emphasizes fixing the weakest link in the chain—the system constraint—and temporarily ignoring the non-constraints. In this way, the theory has a profound impact on process improvement. Rather than spreading limited time, energy, and resources across an entire system (which may or may not result in tangible results), teams focus on that part of the system with the potential to produce immediate system improvement. (Suneetha 2010)

**2.3. Empirical Review.**

According to Mitral ( 2008),stores function as an element of materials department, has an interface with many user departments in its daily operations. The basic purpose served by stores is the provision of uninterrupted service to manufacturing divisions. Stores act as a cushion between purchase and manufacturing on one hand and manufacturing and marketing on the other. The inherent limitations of forecasts make the stores function a necessity. Stores function is an inseparable part of all business and non – business concerns, whether they are industrial or service oriented, public or private, small or large. The task of store keeping relates to safe custody and stocking of materials, their receipts, issues, and accounting with the objective of efficiently and economically providing the right material at the right time whenever required in the right condition to all user departments. The financial view considers stores as an overhead i.e. a cost with no return. This all the more highlights the need for economic operation and efficient stores management.

 The cost of stores can be categorized into a capital cost component and revenue expenditure component. The capital cost consist of the sunk cost in land building, roads, yards, material handling equipment and related facilities. Because of the very irreversible nature of this cost, proper planning of stores can go long way in reducing this capital expenditure that may also have a bearing on the revenue expenditure in the stores. The revenue component of stores expenditure consists of salaries and wages of store personnel, maintenance cost, stationary cost, communication expenses, and inventory carrying cost.

 One must always remember that efficiency in stores operations cannot be built overnight but has to be thought of right from the initial planning stage. Stores must be visualized as an integral part of the purchasing – manufacturing – marketing link. Unfortunately, stores management is looked down upon by many as an operational clerical function and fails to attract appropriate talent because of its underdog nature. One has to bear in mind that the stores manager heads the single largest group of current assets and his performance is the key to smooth production and subsequent marketing. Many decisions related to stores have a dramatic impact on the operational efficiency of the production department and Store design of the entire organization. Even seemingly routine decisions such as selection of racks, shells, bins, material handling equipment, safety practices, inspection procedures etc. are reflected in the operational efficiency.

According to Ameetdub (2006) stores function is a vital part of organizations whether they are industrial concerns, public or private utility undertakings, agriculture enterprise, municipal authorities or armed services of Government departments. There are many varieties of materials stored – chemicals, metals, liquids, gases, spare parts, equipment, or finished goods, ranging from engineering components to drugs and pharmaceuticals. Each of these items will require a specific type of storage. And their handling and preservation methods will vary accordingly. There is high degree of specialization of degree required to store and handle these products and in many cases special storage licenses need to be obtained from the government, e.g., the storage of petroleum products.

The relative importance of the function of stores depends upon the nature and size of the industry or activity concerned, and in all cases it has to be designed to suit the particular needs of the organization it serves. There is, therefore, no standard system, which can be universally recommended or applied, but in the course of time, certain principles and practices of general application have been evolved. The understanding of these principles is most important in the practice of the art of store keeping.

According to Chandra (2007) inventory Management is concerned with the determination of optimum level of investment for each components of inventory and the operation of an effective control and review of mechanism. The main objectives of inventory management are operational and financial. The operational objective mean that the materials and spares should be available in sufficient quantity so that work is not disrupted for want of inventory. The financial objective means that inventory should not remain idle and minimum working capital should be locked in it. Every industry on average spends 70% on raw materials (inventory). Therefore there is a need to know the raw material cost and also there is great importance to understand the inventory management system of this industry. In this competitive business world each and every business organization need inventory management system for determining what to order, when to order, where and how much to order so that purchasing and storing costs are the lowest possible without affecting production and sales. Thus, inventory management control incorporates the determination of the optimum size of the inventory-how much to be order and when after taking into consideration the minimum inventory cost. The overall inventory management includes design and inventory control organization with proper accountability establishing procedure for inventory handling disposal of scrap, simplification, standardization and codification of inventories, determining the size of inventory holdings, maintaining record points and safety stocks.

**2.3.1 System Setup**

Modern day stores are managed by sophisticated system applications that are designed to manage complex stores plans and to a large extent contain processes that initiate and streamline the operations and stores management. Quite often one can find that the system setup and process defined in the system is not user friendly and cumbersome. An efficient system should define and guide the physical process as well as documentation process, (Chandra 2007).

The system process should in turn be developed based on the business process requirement. In many cases the operations are made to suit the system setup, which already exists in some basic form and not suited to the particular business process on hand. Poor system setup that does not match with the shop floor warehouse set up renders operations in efficient. It is very common to come across complaints from users with regard to non-availability of features to work around the processes; at times processes are lengthy and cumbersome leading to operational delays. Non availability of different reports and loops and bugs in the system can often push the operations teams to find shortcut methods to by-pass the system processes and carry on with the work, resulting in stores inefficiencies as well as inefficient operations.

**2.3.2 Staff Skills.**

Stores operations management is a process-oriented operation. Every task and action required to be carried out by the operatives will impact the stores as well as the delivery lead times and other parameters. Therefore knowledge of what one is required to do and the effect of the action should be known to the operatives who are on the shop floor.

**2.3.3 Standard Operating Procedures (SOP’S)**

When a inventory management project kicks off at a third party warehouse location, both the principle customer as well as the third party service provider work on the project and setup basic processes, document them in Standard Operating Procedures and conduct training as a part of the project management methodology, (Mitra 2006). However over a period of time, the nature of business requirements changes resulting in change in the operating processes. These do not get documented in terms of amendments and the SOPs become outdated. Thereafter one finds that the new comers who are introduced on the shop floor are required to learn the processes by working along with others where as no training or SOP document is provided to him for reference. With the result they often have half-baked knowledge of the processes and carry on tasks not knowing why they are doing and what they are required to do.

**2.3.4 Inventory Audit**

Any inventory of Raw materials, finished goods as well as intermediate in process inventory has an economic value and is considered an asset in the books of the company. Accordingly any asset needs to be managed to ensure it is maintained properly and is stored in secure environment to avoid pilferage, loss or thefts etc. Inventory control assumes significance on account of many factors. First of all inventory of raw materials as well as finished goods can run in thousands of varieties. Secondly inventory can be in one location or spread over many locations. Thirdly inventory may be with the company or may be under the custody of a third party logistics provider. These factors necessitate inventory maintenance mechanisms to be devised to ensure inventory control. Inventory control is also required as an operational process requirement. Inventory is has two different dimensions to it. On one level it is physical and involves physical transactions and movement of inventory. While on the other hand, inventory is recognizable by the book stock and the system stocks maintained. This necessitates inventory control mechanism to be implemented to ensure the book stocks and the physical stocks match at all times.

Thirdly the inventory always moves through supply chain and goes through various transactions at various places. The number of transactions and handling that it goes through from the point of origin to the point of destination is numerous. Therefore it becomes essential to control inventory and have visibility through the pipeline including transit inventory.

Inventory control is exercised through inventory audits and cycle counts. An inventory audit essentially comprises of auditing the books stocks and transactions and matching physical stocks with the book stock. Cycle count refers to the process of counting inventory items available in physical locations. Depending upon the nature of inventory, number of transactions and the value of items, cycle count can be carried on periodically or perpetually.

**CHAPTER THREE**

**RESEARCH METHODOLOGY**

**3.1 Introduction**

In this chapter, we would describe how the study was carried out.

**3.2. Research Design**

The study was both qualitative and quantitative in nature.

3.2.1 Quantitative Design

Quantitative design was used to process data which could be quantified and was numeric in nature. For example the respondents’ age, income, costs and revenues related to material handling. According to Creswell et al. (2003), quantitative research helps in getting an in-depth analysis of the problem under investigation.

**3.1.2 Qualitative Design**

This was used to describe qualitative data which could not be quantified in numbers. This included respondents’ opinions and ideas. Qualitative research was also applied in order to describe current conditions or to investigate relationships, including effects relationships. In addition, it helped in answering questions concerning the current state of the subject under study

**3.3 Sources of Data**

The data for this study were generated from two main sources; Primary sources and secondary sources. The primary sources include questionnaire, interviews and observation. The secondary sources include journals, bulletins, textbooks and the internet.

**3.4 Population of the study**

A study population is a group of elements or individuals as the case may be, who share similar characteristics. These similar features can include location, gender, age, sex or specific interest. The emphasis on study population is that it constitute of individuals or elements that are homogeneous in description (Prince Udoyen: 2019). The study population constituted mainly PHCN’s staff especially those working in the Stores and Finance department. According to the Human Resource officer, this population amounts to 120 staff

**3.6 Sample size determination**

A study sample is simply a systematic selected part of a population that infers its result on the population. In essence, it is that part of a whole that represents the whole and its members share characteristics in like similitude (Prince Udoyen: 2019). In this study, the researcher used the [TARO YAMANE FORMULA] to determine the sample size.

**3.7 Sample size technique**

Yamane (1967:886) provides a simplified formula to calculate sample sizes.

ASSUMPTION:

 95% confidence level

 P = .5



n= 45/1+45(0.05)2

n= 45/1+45(0.0025)

n= 45/1+0.1125

**n=40**

**3.8 Instrumentation**

This is a tool or method used in getting data from respondents. In this study, questionnaires and interview are research instruments used. Questionnaire is the main research instrument used for the study to gather necessary data from the sample respondents. The questionnaire is structured type and provides answers to the research questions and hypotheses therein.

This instrument is divided and limited into two sections; Section A and B. Section A deals with the personal data of the respondents while Section B contains research statement postulated in line with the research question and hypothesis in chapter one. Options or alternatives are provided for each respondent to pick or tick one of the options.

**3.9 Reliability**

The researcher initially used peers to check for consistence of results. The researcher also approached senior researchers in the field. The research supervisor played a pivotal role in ensuring that consistency of the results was enhanced. The instrument was also pilot tested.

**3.10 Validity**

Validity here refers to the degree of measurement to which an adopted research instrument or method represents in a reasonable and logical manner the reality of the study (Prince Udoyen: 2019). Questionnaire items were developed from the reviewed literature. The researcher designed a questionnaire with items that were clear and used the language that was understood by all the participants. The questionnaires were given to the supervisor to check for errors and vagueness.

**3.11 Method of Data Collection**

The data for this study was obtained through the use of questionnaires administered to the study participants. Observation was another method through which data was also collected as well as interview. Oral questioning and clarification was made.

**3.12 Method of Data Analysis**

Data was presented in form of tables, graphs, pie charts and triangulation

Qualitative data analysis was done by narrative as were recorded during face to face interview and through observation. The researcher used a quick impressionist summary in analyzing qualitative data

**3.13 Ethical consideration**

The study was approved by the Project Committee of the Department. Informed consent was obtained from all study participants before they were enrolled in the study. Permission was sought from the relevant authorities to carry out the study. Date to visit the place of study for questionnaire distribution was put in place in advance.

# CHAPTER FOUR

# DATA PRESENTATION, ANALYSIS AND INTERPRETATION OF THE FINDINGS

# 4.0 Introduction

This chapter analyses, interprets and presents the findings gathered from PHCN. In order to achieve the main objective of this research specific objectives and research questions had to be answered

The study targeted 40 respondents and managed to obtain responses from all of them thus representing a 100% response rate as shown in table 1. This response rate has been achieved because the researcher gave the respondents enough time to fill the questionnaires. Babbie (2003) explains that a 50% response rate is adequate, 60% good and above, while 70% rated very good. This collaborates with Mugenda and Mugenda (2003) recommendation of a response rate of 50% based on the rule of thumb. Therefore, this study considered the response rate adequate for analysis and generalization since it exceeded the minimum recommended.

**Table 1 Response Rate**

|  |  |  |
| --- | --- | --- |
| **Response** | **Frequency** | **Percentage** |
| Returned | 40 | 100 |
| Not returned | 0 | 0 |
| **Total**  | **40** | **100** |

**Source: Primary data 2017**

These findings are also presented in the graph below:

Figure 1: Response Rate

Source: Primary Data

**SECTION A**

# 4.1 General Information

This section showed the general information of the respondents. All sampled respondents were staff of PHCN Kaduna. They were asked to fill the questionnaires. Sampled characteristics of the respondents included gender, age, education level and their experience.

**4.1.2 Gender characteristic of respondents**

Table 2: Gender characteristic of respondents

|  |  |  |
| --- | --- | --- |
| **Sex of respondents** | **Frequency** | **Percentage** |
| Male | 25 | 62 |
| Female | 15 | 38 |
| **Total** | **40** | **100** |

**Source: Primary Data 2017**

From table 2 above, response indicated that the majority of respondents were male who accounted for 25 (62%) and female respondents accounted for 15 (38%). This implies there is a marginal majority of males over the females among the staff of PHCN.

# 4.1.3 Age of the Respondents

Respondents were asked to choose their age brackets and the findings are presented in the table below:

**Table 3. Showing the age brackets of the respondents**

|  |  |  |
| --- | --- | --- |
| **Age bracket (years)** | **Frequency**  | **Percentage** |
| 18 – 30 | 15 | 38 |
| 31-45 | 20 | 50 |
| Above 45 | 5 | 12 |
| **Total**  | **40** | **100** |

**Source: Primary data 2017**

These findings are further presented in graph below:

Figure 2: Age bracket of respondents

Source: Primary Data 2017

The findings in the table 3 and figure 2 above show that 15 (38%) of the sample were in the age bracket of 18 – 30 years, 20 (50%) in the age bracket of 31 – 45 and 5 (12%) in the age bracket of 45 years and above.

This implies that most of the employees of PHCN were in the age bracket of 31 – 45 years. This category of staff were in the prime of their careers and are normally deemed competent, experienced and committed to their work. This indicates that the majority of the respondents were in the productive age group and not minors, and therefore had the ability to respond appropriately to the questionnaire. This implies that valid and reliable information was got.

# 4.1.4 Level of Education

Respondents were asked their level of education and the findings are presented in the table below:

**Table 4. showing the level of education of the respondents**

|  |  |  |
| --- | --- | --- |
| **Level of Education**  | **Frequency** | **Percentage** |
| Certificate | 4 | 10 |
| Diploma | 5 | 13 |
| Bachelor’s Degree | 25 | 62 |
| Masters  | 4 | 10 |
| PhD | 2 | 5 |
| **Total**  | **40** | **100** |

Source: primary data 2017

This information is further presented in the figure below:

**Figure 3 Education Level of the Respondents**

Source: Primary Data 2017

From the table 4 and figure 3 above, it can be observed that 4 (10%) of the sample were certificate holders, 5 (13%) were Diploma holders, 25 (62%) were Bachelor’s degree graduates, 4 (10%) were Masters holders and lastly 2 (5%) were PhD holders.

This implies that PHCN hires mostly bachelor’s degree candidates to join their work force and least of all are the PhD holders who mainly comprised of the senior management personnel. These statistics indicate that PHCN has qualified staff and these would adequately have comprehended the questions in the questionnaire used in the survey and answer the questions appropriately. Hence valid and reliable information was got as most of the respondents were well versed about the topic of study.

# 4.1.5 Working Experience with PHCN

Respondents were asked how long they had been working with PHCN and the findings are presented in the table below:

### Table 5: Period of Employment of Respondents

|  |  |  |
| --- | --- | --- |
| **Period of employment** | **Frequency** | **Percentage** |
| Over 10 yrs. | 4 | 10% |
| 6 – 10 yrs. | 30 | 75% |
| 3 – 5 yrs. | 4 | 10% |
| Less than 2 yrs. | 2 | 5% |
| **Total** | **40** | **100** |

**Source: Primary Data 2017**

These findings are further presented in the graph below:

Figure 4: Working Experience of the Respondents

Table 5 and figure 4 shows that 4 (10%) of the respondents had spent over 10 years and 30 (75%) had spent between 6 - 10 years working in PHCN, 4 (10%) had worked with PHCN for 3 – 5 years and 2 (5%) had been in PHCN for less than 2 years. Therefore the majority of the respondents had information about the PHCN and the topic under study that is; materials handling and the store design of the organisation. This also implies that PHCN has very low staff turnover. It also implies that the respondents were knowledgeable enough about the organisation and the topic under study

**SECTION B**

# 4.2 Relationship between Store design and Materials Handling in the Organization

To find out the relationship between materials handling and store design of the organisation, the following question was asked to the respondents. What is the relationship between having an effective Materials Handling department and the store design of PHCN? The findings are presented in the table below:

**Table 6 Relationship between Store design and Materials Handling of the Organisation.**

|  |  |
| --- | --- |
| **Relationship between materials handling and store design of an organisation.** | **Response** |
| **Strongly agree** | **Agree**  | **Not sure** | **Disagree**  | **Strongly disagree** | **Total**  |
| **F** | **%** | **F** | **%** | **F** | **%** | **F** | **%** | **F** | **%** | **F** | **%** |
| Material Handling facilitates a shorter operating cycle | 16 | 40 | 20 | 50 | 2 | 5 | 2 | 5 | - | - | 40 | 100 |
| Material Handling reduces in handling cost | 25 | 62 | 13 | 33 | 2 | 5 | - | - | - | - | 40 | 100 |
| Material Handling eliminates unproductive handling of materials  | 30 | 75 | 8 | 20 | - | - | 2 | 5 | - | - | 40 | 100 |
| Material Handling reduces idle machine capacity | 28 | 70 | 8 | 20 | - | - | 4 | 10 | - | - | 40 | 100 |
| Material Handling reduces idle time for labour | 20 | 50 | 16 | 40 | - | - | 4 | 10 | - | - | 40 | 100 |
| Material Handling eliminates factory hazards  | 25 | 62 | 8 | 20 | 4 | 10 | 3 | 8 | - | - | 40 | 100 |
| Material Handling maintains quality of materials | 30 | 75 | 8 | 20 | - | - | 2 | 5 | - | - | 40 | 100 |
| Material Handling enables optimum usage of space | 16 | 40 | 20 | 50 | 2 | 5 | 2 | 5 | - | - | 40 | 100 |
| Material Handling facilitates Materials issues | 25 | 62 | 13 | 33 | 2 | 5 | - | - | - | - | 40 | 100 |
| Material Handling facilitates better customer care | 30 | 75 | 8 | 20 | - | - | 2 | 5 | - | - | 40 | 100 |
| Material Handling facilitates better quality of products | 28 | 70 | 8 | 20 |  | - | 4 | 10 | - | - | 40 | 100 |
| Material Handling facilitates Timely production | 20 | 50 | 16 | 40 | - | - | 4 | 10 | - | - | 40 | 100 |

**Source: Primary data 2017**

From the table 6 above, it can be observed that 16 (40%) of the respondents strongly agreed to the fact that material handling facilitates a shorter operating cycle, 20 (50%) agreed, 2 (5%) were not sure and 2 (5%) disagreed. It can therefore be stated that material handling facilitates a shorter operating cycle because machines handle materials faster than humans.

25 (62%) strongly agreed to the assertion that material handling reduces on handling costs, 13 (33%) agreed. This therefore affirms the fact that material handling reduces on the handling costs.

It can also be observed that 30 (75%) of the sample strongly agreed that material handling eliminates unproductive handling of materials, 8 (20%) agreed to the assertion and 2 (5%) disagreed. This implies that indeed materials handling eliminates unproductive handling of materials since the majority agreed to the assertion.

Furthermore, 28 (70%) strongly agreed that materials handling reduces idle machine capacity, 8 (20%) agreed while 2 (5%) disagreed to the assertion. This implies that indeed materials handling reduces idle machine capacity.

20 (50%) of the sample strongly agreed that material handling reduces idle time for labour, 16 (40%) agreed to the assertion and 4 (10%) disagreed to the assertion. It can conclusively be stated that material handling reduces idle time for labour.

25 (62%) strongly agreed that materials handling eliminates factory hazards, 8 (20%), 4 (10%) were not sure and 3 (8%) disagreed. It can therefore be stated that materials handling eliminates factory hazards.

30 (75%) of the respondents strongly agreed that material handling maintains quality of materials. 8 (20%) agreed and 2 (5%) disagreed to the assertion. This implies that materials handling maintains quality of materials by eliminating damages.

It can also be observed that 16 (40%) of the respondents strongly agreed that materials handling enables optimum usage of space; 20 (50%) agreed, 2 (5%) were not sure and 2 (5%) disagreed. It can therefore be stated that materials handling enables optimum usage of space in the stores and the organisation as a whole.

25 (62%) strongly agreed that materials handling facilitates materials issues; 13 (33%) agreed but 2 (5%) were not sure of that assertion. This implies that indeed materials handling facilitates materials issues.

Furthermore, 30 (75%) of the respondents strongly agreed that material handling facilitates better customer care; 8 (20%) agreed, and 2 (5%) disagreed, implying that indeed material handling facilitates better customer care since it enhances quick processing of orders and dispatches.

28 (70%) strongly agreed that material handling facilitates better quality products; 8 (20%) agreed to the assertion while 4 (10%) disagreed to this assertion. This implies that materials handling facilitates better quality of products since damages and wastage is minimized.

Finally, 20 (50%) strongly agreed to the assertion that materials handling facilitates timely production, 16 (40%) agreed while 4 (10%) disagreed to the assertion. This therefore implies that materials handling facilitates timely production since materials are assured to be in the right place at the right time hence facilitating timely production.

Conclusively effective material handling positively affects the store design of the organisation by shortening the operating cycle, reducing handling costs, eliminating unproductive handling of materials, reduces idle machine capacity, reduces idle time for labour, eliminates factory hazards, maintains quality of materials, enables optimum usage of space, facilitates materials issues, facilitates customer care, facilitates better quality of products and timely production thus increasing the productivity of the organisation.

**SECTION C**

# 4.3 Types of store design.

**Table 7. Showing store design systems**

|  |  |
| --- | --- |
| **Store design** | **Response** |
| **Strongly agree** | **Agree**  | **Not sure** | **Disagree**  | **Strongly disagree** | **Total**  |
| **F** | **%** | **F** | **%** | **F** | **%** | **F** | **%** | **F** | **%** | **F** | **%** |
| Forced-Path Store Layout | 30 | 75 | 10 | 25 | - | - | - | - | - | - | 40 | 100 |
| Grid Store Layout | 32 | 80 | 8 | 20 | - | - | - | - | - | - | 40 | 100 |
| Loop Store Layout  | 36 | 90 | 4 | 10 | - | - | - | - | - | - | 40 | 100 |
| Straight Store Layout | 38 | 95 | 2 | 5 | - | - | - | - | - | - | 40 | 100 |
| Diagonal Store Layout | 30 | 75 | 10 | 25 | - | - | - | - | - | - | 40 | 100 |
| Angular Store Layout | 40 | 100 | - | - | - | - | - | - | - | - | 40 | 100 |

**Source: primary data 2017**

Table 7 shows that 30 (75%) of the respondents strongly agreed to the fact that PHCN uses Forced-Path Store Layout, while 10 (25%) agreed that PHCN uses Forced-Path Store Layout. None of the respondents disagreed and none was not sure. It can therefore be stated that Forced-Path Store Layout are one of the material handling system used by companies.

32 (80%) strongly agreed to the use of Grid Store Layout and 8 (20%) of the respondents agreed and no one disagreed while all the respondents were sure of their respondents. This confirms the fact that Grid Store Layout are one of popular material handling system.

36 (90%) of the respondents strongly agreed to the use of Loop Store Layout while 4 (10%) of the respondents agreed to the use of Loop Store Layout.

38 (95%) of the respondents strongly agreed to the use of Straight Store Layout as one of the material handling systems used by PHCN while 2 (5%) of the respondents agreed to the use of Straight Store Layout.

30 (75%) strongly agreed to the use of Diagonal Store Layout while 10 (25%) of the respondents agreed to the use of Diagonal Store Layout

Finally, 40 (100%) of the respondents strongly agreed to the use of Angular Store Layout. It can therefore be stated that companies use Angular Store Layout as one of the material handling system.

It can be observed that all the respondents agreed to the material handling system.

Conclusively, the most commonly used materials handling systems in most modern organisations include conveyor, Grid Store Layout, Loop Store Layout, Straight Store Layout, Diagonal Store Layout and Angular Store Layout. These are intended to ensure proper, efficient and effective operations of the organisation.

**SECTION D**

# 4.4 Factors affecting the store design

Table 8 showing the factors affecting the store design of PHCN

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Factors affecting the store design** | **Strongly Disagree** | **Agree** | **Not Sure** | **Disagree** | **Strongly Disagree** | **Total**  |
| **F** | **%** | **F** | **%** | **F** | **%** | **F** | **%** | **F** | **%** | **F** | **%** |
| Flow of materials | 16 | 40 | 20 | 50 | 2 | 5 | 2 | 5 | - | - | 40 | 100 |
| Demand trends | 25 | 62 | 13 | 33 | 2 | 5 | - | - | - | - | 40 | 100 |
| Material movement | 30 | 75 | 8 | 20 | - | - | 2 | 5 | - | - | 40 | 100 |
| Space available  | 28 | 70 | 8 | 20 | - | - | 4 | 10 | - | - | 40 | 100 |
| Relative costs of operation | 20 | 50 | 16 | 40 | - | - | 4 | 10 | - | - | 40 | 100 |
| Economies of scale | 25 | 62 | 8 | 20 | 4 | 10 | 3 | 8 | - | - | 40 | 100 |
| Level of production and Management efficiency | 30 | 75 | 8 | 20 | - | - | 2 | 5 | - | - | 40 | 100 |
| Types of operations | 16 | 40 | 20 | 50 | 2 | 5 | 2 | 5 | - | - | 40 | 100 |
| Price discrimination | 25 | 62 | 13 | 33 | 2 | 5 | - | - | - | - | 40 | 100 |

From the table 4.7 above, it can be observed that 16 (40%) of the respondents strongly agreed to the fact that the Flow of materials is one of the factors affecting the store design of PHCN, 20 (50%) agreed, 2 (5%) were not sure and 2 (5%) disagreed. It can therefore be stated that the Flow of materials in the industry affects the companies’ store design.

25 (62%) strongly agreed to the assertion that the level of demand for the company’s products and services affects the store design of PHCN, 13 (33%) agreed. This therefore affirms the fact that the demand trends in the market place affects the company’s store design.

It can also be observed that 30 (75%) of the sample strongly agreed that the general economic conditions like inflation, interest rates and exchange rates affect the store design of the company, 8 (20%) agreed to the assertion and 2 (5%) disagreed. This implies that indeed the general economic conditions affect the store design of the company since the majority agreed to the assertion.

Furthermore, 28 (70%) strongly agreed that the level of advertising of the company affects the company’s store design, 8 (20%) agreed while 2 (5%) disagreed to the assertion. This implies that indeed a company’s commitment to advertising will affect its store design.

20 (50%) of the sample strongly agreed that the relative costs of operations affects the overall store design of the company, 16 (40%) agreed to the assertion and 4 (10%) disagreed to the assertion. It can conclusively be stated that the costs of operation definitely affects the store design of the company.

25 (62%) strongly agreed that the economies of scale of the company affects the store design of the company, 8 (20%), 4 (10%) were not sure and 3 (8%) disagreed. It can therefore be stated that the level of economies of scale of the company affects the store design of the company.

30 (75%) of the respondents strongly agreed that the level of production and management efficiency affects the store design of the organization. 8 (20%) agreed and 2 (5%) disagreed to the assertion. This implies that the level of production and management efficiency will affect the store design of the organisation.

It can also be observed that 16 (40%) of the respondents strongly agreed that the firm’s objective determines the level of store design of the company; 20 (50%) agreed, 2 (5%) were not sure and 2 (5%) disagreed. It can therefore be stated that if the company is not a profit motivated company, it will not pursue making profits while a profit oriented company is likely to make profits keeping other factors constant.

Finally 25 (62%) strongly agreed that the level of price discrimination determines it’s level of store design; 13 (33%) agreed but 2 (5%) were not sure of that assertion. This implies that indeed the level of price discrimination can affect a company’s store design.

It can conclusively be stated that the store design of an organisation is affected by a combination of actors ranging from competition, demand, economic situation, Space available, relative costs of operation, economies of scale, level of production, management efficiency, objectives of the firm and price discrimination.

# CHAPTER FIVE

# DISCUSSION OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

# 5.0 Introduction

This chapter gives a discussion of findings, a summary, conclusion and recommendations which are in line with the objectives of the study as well as suggestions for future research.

# 5.1. Discussion of findings

# 5.1.1 Relationship between Materials Handling and the Store design of the Organisation

From the table 4.5, it can be observed that there are a number of ways that material handling relates with the store design of the organisation.

Material handling facilitates a shorter operating cycle and reduces the handling costs such that the stores and materials handling department, as a cost center, does not inflict a heavy cost burden upon the finances of the organisation. This serves to check on the total operating cost of the organisation, as confirmed by the 40% and 50% of the respondents who strongly agreed and agreed respectively to this assertion. It also eliminates unproductive handling of materials which is highly associated with manual handling, alongside the delays in the operating cycle and therefore this reduces idle time for labour thus enhancing operational efficiency in the organisation. 62% and 33% of the respondents agreed strongly and agreed respectively to the effect of materials handling in reducing the handling costs in the long run. As highlighted by 75% and 20% of the sample strongly agreeing and agreeing respectively, materials handling eliminates factory hazards like accidents and damages on the products and other assets of the company and thus maintains the quality of materials. For example, where the company is dealing or handles bulky materials or products like machines or delicate heavy items like electronics, proper materials handling helps to reduce a good deal of accidents and damages.This is consistent with the findings of Ondiek (2009) who emphasized the role of materials handling in reducing handling costs and unproductive handling of materials. The study also revealed that material handling enables optimum usage of space in such a way that materials can be packed from the floor to the ceiling of the store house using material handling machines like Grid Store Layout and others. 40% and 50% of the sample strongly agreed and agreed respectively that indeed material handling enables optimum use of space. Materials handling facilitates better customer care such that customers’ orders are quickly handled. Dispatches are promptly organized with minimum damages and delays. Materials handling further facilitates better quality of products and facilitates timely production. With a reduction in the process or production cycle, the quality of products is enhanced and the time of production is significantly reduced. This too is consistent with the findings of Zanto (2008)who noted that materials handling facilitates customer care and better quality products. Materials handling is further significant in facilitating quick and efficient materials issues. As can be observed that 62% and 33% strongly agreed and agreed respectively that machine automated system making the issue of materials very quick and safe thus reducing on the order processing time. This is also very important in situations where materials to be issued are bulky and would require much labour force to handle. However, a crane machine operated by one or two personnel can quickly and safely issue bulky materials in a very short time.

# 5.1.2 Types of Materials Handling Systems

The findings in table 4.6 revealed that DHL uses a number of material handling systems including Forced-Path Store Layout which are usually used for intermittent materials handling and when materials to be moved frequently between specific points over a fixed path and when there is a sufficient flow volume to justify the fixed conveyor investment. As noted by 75% and 25% strongly agreeing and agreeing respectively that Forced-Path Store Layout can be of different types for example the roller and flat-belt, power-and-free and trolley are unit-load Forced-Path Store Layout are designed for example to provide the accumulation capability lacking in the trolley conveyor.

Likewise 80% and 20% of the respondents strongly agreed and agreed respectively that companies use Grid Store Layout as one of the material handling systems. Grid Store Layout are normally used to transport loads over variable (horizontal and vertical) paths within a restricted area and when there is insufficient flow volume such that the use of a conveyor cannot be justified. This is consistent with the findings of Jacobs et al (2009) who further noted that Grid Store Layout provide more flexibility in movement than Forced-Path Store Layout because the loads handled can be more varied with respect to their shape and weight.

Loop Store Layout were identified by 90% and 10% of the respondents who strongly agreed and agreed respectively that Loop Store Layout are used to transport heavy items especially in companies that hold heavy cargo. The respondents noted that Loop Store Layout are more flexible in movement than Forced-Path Store Layout and Grid Store Layout because there are no restrictions on the area covered, and they provide vertical movement if the truck has lifting capabilities. This is consistent with the findings of Ademeyi (2010) who further highlighted that Loop Store Layout are designed for different tasks like manual lifting travel capabilities etc. The findings also reveal that PHCN uses Diagonal Store Layout to handle its materials and Angular Store Layout like rackets. This is consistent with the findings of Ademeyi (2010) who identified that companies use a number of materials handling systems like Forced-Path Store Layout, Grid Store Layout, Loop Store Layout and others.

Positioning of equipment were identified by 95% and 5% of the respondents strongly agreeing and agreeing respectively. They noted that Straight Store Layout is used to handle materials at a single location and can also be used at a workplace to feed, orient, load/unload, or otherwise manipulate materials so that they are in the correct position for subsequent handling, machining, transport or storage. These findings agree with Lee, et al (2007) who emphasized that Straight Store Layout is very important to reduce on damages and human fatigue, and reduce on injuries or accidents at work and in the stores.

Similarly 75% & 25% of the respondents identified Diagonal Store Layout as one of the materials handling systems. Respondents noted Diagonal Store Layout is used to restrict materials so that they maintain their integrity when handled a single load during transport and for storage. For example if materials are self-restraining, then they can be formed into a unit load with no equipment. This agrees with Hornby (2005) who further identified pallets, skids, slip sheets, tote pans, bins / baskets, cartons, bags and crates as some of the examples of Diagonal Store Layout used in materials handling.

Finally, all the respondents (100%) identified Angular Store Layout as one of the materials handling equipment. It was noted that Angular Store Layout is used for holding or buffering materials over a longer period of time. Examples identified included cartons, racks, pallets, drawers, bin shelving, carousels, A-frames among others. This was consistent with Guinea (2012) who also highlighted the possibility of using an automated storage / retrieval system (AS/RS) as an integrated computer – controlled storage system that combines storage medium, transport mechanisms and controls with various levels of automation for fast and accurate random storage of products and materials.

# 5.1.3 Factors affecting the store design of PHCN

Table 4.7 indicates that the Flow of materials in the industry affects the store design of the organisation. 40% and 50% of the respondents strongly agreed and agreed respectively that firms with monopoly power have little competition and therefore the demand for their products will be more inelastic leading to higher store design. This is however only true where the entry into the industry is restricted because in an industry where there is free entry of firms, the firms’ profits attract other players into the industry as noted by Lee et al (2007).

Respondents also identified the general economic conditions like inflation, interest rates and exchange rates as a significant factor affecting the store design of companies. For example 75& and 20% strongly agreed and agreed respectively that inflation and high interest rates reduce on the store design of the company, just as Marta (2008) stressed that if there is economic growth, then there will be increased demand for most products especially luxury products with a high income elasticity of demand.

The level of advertising which brings about the awareness of the company’s products to the customers and the relative costs of operation incurred by the company in the production was noted by 70% and 20% of the respondents strongly agreeing and agreeing respectively. Respondents noted that a successful advertising campaign can increase demand and make the product more inelastic in demand. This agrees with Adeloye (2008) who further noted that the increased revenue will need to cover the costs of the advertising though.

Selling, administrative and other overhead costs were identified by 50% and 40% of the respondents strongly agreeing and agreeing respectively to it as a major factor affecting the store design of PHCN. These findings agree with the findings of Marta (2008) who highlighted among others the Flow of materials, level of demand, economic conditions, advertising costs and the relative operational overheads as the main determinants of the store design of the organisation. The study further revealed that the store design of an organisation is highly affected by the level of economies of scale, the level of production and management efficiency, the firm’s objective and the effectiveness of the organisation’s price discrimination campaigns. These findings relate to the findings of (Okpara, 2008) and Ademeyi et al (2010) who both emphasized that for a company to ensure its store design, it has to be operating the economies of scale, with a highly efficient operational management departments, its objective must be a profit motive and should have a successful price discrimination strategy.

At least 90% of all the respondents identified a number of factors including price discrimination, the Types of operations, management efficiency, level of production, economies of scale, relative costs of operation, Space available, general economic conditions and Flow of materials faced by the firm

# 5.2 Summary

Material handling facilitates a shorter operating cycle and reduces the handling costs. It also eliminates unproductive handling of materials and reduces idle time for labour, eliminates factory hazards and maintains the quality of materials. This is consistent with the findings of Ondiek (2009) who emphasized the role of materials handling in reducing handling costs and unproductive handling of materials. The study also revealed that material handling enables optimum usage of space, it facilitates better customer care, facilitates better quality of products and facilitates timely production. This too is consistent with the findings of Zanto (2008)who noted that materials handling facilitates customer care and better quality products.

The findings in table 4.6 revealed that DHL uses a number of material handling systems including Forced-Path Store Layout which are usually used for intermittent materials handling. It also identified Grid Store Layout and Loop Store Layout to transport heavy items especially in companies that hold heavy cargo. The findings also reveal that PHCN uses Diagonal Store Layout to handle its materials and Angular Store Layout like rackets. This is consistent with the findings of Ademeyi (2010) who identified that companies use a number of materials handling systems like Forced-Path Store Layout, Grid Store Layout, Loop Store Layout, positioning of equipment, unit load formation and Angular Store Layout.

Table 4.7 indicates that the Flow of materials in the industry affects the store design of the organisation. Others include the demand trends, the general economic conditions like inflation, interest rates and exchange rates, the level of advertising which brings about the awareness of the company’s products to the customers and the relative costs of operation incurred by the company in the production, selling, administrative and other overhead costs. These findings agree with the findings of Marta (2008) who highlighted among others the Flow of materials, level of demand, economic conditions, advertising costs and the relative operational overheads as the main determinants of the store design of the organisation. The study further revealed that the store design of an organisation is highly affected by the level of economies of scale, the level of production and management efficiency, the firm’s objective and the effectiveness of the organisation’s price discrimination campaigns. These findings relate to the findings of (Okpara, 2008) and Ademeyi et al (2010) who both emphasized that for a company to ensure its store design, it has to be operating the economies of scale, with a highly efficient operational management departments, its objective must be a profit motive and should have a successful price discrimination strategy.

# 5.3 Conclusions

Finding reveals that there is a positive relationship between materials handling and the store design of the organisation and the researcher therefore concludes that:

Material handling aids the store design of an organisation in a way that it facilitates a shorter operating cycle, reduces the handling costs, eliminates unproductive handling of materials, reduces idle time for labour, eliminates factory hazards, maintains quality of materials, enables optimum usage of space, facilitates materials issues, facilitates better customer care, facilitates better quality products and timely production. Thereefore for a company to ensure its store design, it has to take deliberate measures to improve and standardize its material handling system through mechanisation of this department.

The researcher further concludes that a company can use a number of materials handling systems available in the industry. These include Forced-Path Store Layout, Grid Store Layout, Loop Store Layout, Straight Store Layout, Diagonal Store Layout and Angular Store Layout among others. These can be used depending on the capital investment of the organisation in the mechanisation of the materials handling function.

Finally the researcher concludes that there are a number of factors affecting the store design of PHCN. These include among others the Flow of materials, the level of demand for the company’s products, the general economic conditions, Space available, relative costs of operation, economies of scale, level of production and management efficiency, the firms’ objective and the level of the effectiveness of the company’s price discrimination strategy.

# 5.3 Recommendations

The researcher recommends that organisations should invest in material handling equipment like Grid Store Layout, Forced-Path Store Layout, Loop Store Layout and others so as to enhance operational efficiency. This will lead to store design

The researcher also recommends that organisations should prioritize the material handling function since it is a very vital cost center

The researcher further organizations should ensure prudent management of materials to minimize wastage of materials.

Material supply should be optimum to avoid "stock outs" while work in process.

Organizations should always take into cognizance the cost of production or price of raw materials before arriving at selling price

There should be good record system of materials for the operations of the organization particularly as it affects production.

Rate of spoilage and wastages should be minimized as much as possible and ensure that products pass quality control.

There is the need to train staff in the area of material management to further enhance the knowledge of the job.

Organizations should computerize their material management system in line with the global changes in order to be able to track the movement of materials in the store.

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**QUESTIONNAIRE**

**PLEASE TICK [√] YOUR MOST PREFERRED CHOICE AND AVOID TICKING TWICE ON A QUESTION**

**SECTION A**

**PERSONAL INFORMATION**

**Gender**

|  |  |
| --- | --- |
| **Sex of respondents** | **Please tick** |
| Male |  |
| Female |  |

# Age of the Respondents

|  |  |
| --- | --- |
| **Age bracket (years)** | **Please tick** |
| 18 – 30 |  |
| 31-45 |  |
| Above 45 |  |

# Level of Education

|  |  |
| --- | --- |
| **Level of Education**  | **Please tick** |
| Certificate | 4 |
| Diploma | 5 |
| Bachelor’s Degree | 25 |
| Masters  | 4 |
| PhD | 2 |

# Working Experience with PHCN

|  |  |
| --- | --- |
| **Period of employment** | **Please tick** |
| Over 10 yrs. |  |
| 6 – 10 yrs. |  |
| 3 – 5 yrs. |  |
| Less than 2 yrs. |  |

**SECTION B**

# Relationship between Store design and Materials Handling in the Organization

|  |  |
| --- | --- |
| **Relationship between materials handling and store design of an organisation.** | **Response** |
| **Strongly agree** | **Agree**  | **Not sure** | **Disagree**  | **Strongly disagree** |
| **Yes**  | **No** | **Yes**  | **No** | **Yes**  | **No** | **Yes**  | **No** | **Yes**  | **No** |
| Material Handling facilitates a shorter operating cycle |  |  |  |  |  |  |  |  |  |  |
| Material Handling reduces in handling cost |  |  |  |  |  |  |  |  |  |  |
| Material Handling eliminates unproductive handling of materials  |  |  |  |  |  |  |  |  |  |  |
| Material Handling reduces idle machine capacity |  |  |  |  |  |  |  |  |  |  |
| Material Handling reduces idle time for labour |  |  |  |  |  |  |  |  |  |  |
| Material Handling eliminates factory hazards  |  |  |  |  |  |  |  |  |  |  |
| Material Handling maintains quality of materials |  |  |  |  |  |  |  |  |  |  |
| Material Handling enables optimum usage of space |  |  |  |  |  |  |  |  |  |  |
| Material Handling facilitates Materials issues |  |  |  |  |  |  |  |  |  |  |
| Material Handling facilitates better customer care |  |  |  |  |  |  |  |  |  |  |
| Material Handling facilitates better quality of products |  |  |  |  |  |  |  |  |  |  |
| Material Handling facilitates Timely production |  |  |  |  |  |  |  |  |  |  |

**SECTION C**

# Types of store design.

|  |  |
| --- | --- |
| **Store design** | **Response** |
| **Strongly agree** | **Agree**  | **Not sure** | **Disagree**  | **Strongly disagree** |
| **Yes**  | **No** | **Yes**  | **No** | **Yes**  | **No** | **Yes**  | **No** | **Yes**  | **No** |
| Forced-Path Store Layout |  |  |  |  |  |  |  |  |  |  |
| Grid Store Layout |  |  |  |  |  |  |  |  |  |  |
| Loop Store Layout  |  |  |  |  |  |  |  |  |  |  |
| Straight Store Layout |  |  |  |  |  |  |  |  |  |  |
| Diagonal Store Layout |  |  |  |  |  |  |  |  |  |  |
| Angular Store Layout |  |  |  |  |  |  |  |  |  |  |

**SECTION D**

# Factors affecting the store design

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Factors affecting the store design** | **Strongly Disagree** | **Agree** | **Not Sure** | **Disagree** | **Strongly Disagree** |
| **Yes**  | **No** | **Yes**  | **No** | **Yes**  | **No** | **Yes**  | **No** | **Yes**  | **No** |
| Flow of materials |  |  |  |  |  |  |  |  |  |  |
| Demand trends |  |  |  |  |  |  |  |  |  |  |
| Material movement |  |  |  |  |  |  |  |  |  |  |
| Space available  |  |  |  |  |  |  |  |  |  |  |
| Relative costs of operation |  |  |  |  |  |  |  |  |  |  |
| Economies of scale |  |  |  |  |  |  |  |  |  |  |
| Level of production and Management efficiency |  |  |  |  |  |  |  |  |  |  |
| Types of operations |  |  |  |  |  |  |  |  |  |  |
| Price discrimination |  |  |  |  |  |  |  |  |  |  |