

# Architectural Evaluation of Multipurpose Storage Facility in Bauchi-Nigeria

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**Abstract-** An investigation conducted to determine the nature of storage facilities among major markets/shopping centres in four locations; Central market & Naheem Heights in Bauchi, Dawanau International grain market and Singer market in Kano. Three main activities in storage and warehousing were considered in the research work and these are; method of operation, handling and security of goods and the storage techniques involved. The major problem encountered within and around these business areas evaluated. Interviews conducted with all the managers/chairpersons of these business centres, the information gathered, and the other observation made are used in analytical comparisons of activities in these markets. Naheem Heights operates 100% wholesale and deal mainly with household consumables only without any avenue for retail sales. In contrast with central, singer and Dawanau markets, which have both wholesale and retail section, dealing in bags, kilos and unit sales. The mode of operations in all the studied area is the same, order picking, other received, and payment at the counter. Handling and picking of goods are manually as there is no provision for mechanical handling equipment. The security is controlled by the shop owner through various union by employing the services of vigilante group for the protection of their property. The use of modern security surveillance equipment is completely out of the contest, which is very important for many reasons. The major problem encountered in most business transactions in these centres is the lack of basic auxiliary facilities such as management, fire safety and security and mechanical handling equipment. It is necessary, that businesses involved in storage activities are engaged in uncomfortable facilities, in haphazard and not ideal manner and situation. This made it possible for the government and other private developers to invest

heavily in the design and construction of a storage and warehouse facilities.

**Indexed Terms-** Architecture, Storage Facilities, Mode of Operations, Security

## I. INTRODUCTION

Storage refers to the method of stocking something in a particular place. The commodities are stored in case it is not in use but planned to be used in the nearest future. Storage facilities is a planned space for the storage and handling of goods and material (Emmett, 2005). Large building plays an important part in the organisation related to its business purpose (Tompkins & Smith, 1998; Frazzle, 2001), therefore, warehouse and storage facilities are words used interchangeably.

A study by (ELA/AT Kearney survey 2004) states that there are more than 900,000 storage facilities worldwide from retail to service parts distribution centres. Storage facilities frequently involve large expenses such as investments for land and facility equipment's (storage and handling activities), costs connected to work force intensive activities to information systems. Lambert et al. (1998) identify so many mission activities of storage, among which are;

- i. Enhance transportation economies (i.e combine shipment, full-container load).
- ii. Encourages make-to-stock production policy.
- iii. It postures quantity purchase discounts and forward buys.
- iv. Maintain a source of supply.
- v. Overcome the time and space differences that exist between most producers and customers.
- vi. Provide temporary storage of material to be disposed or recycled
- vii. Provide a buffer location for trans-shipments (i.e., direct delivery, cross docking).

Studies established that, Over the past half century, there has been a rapid growth in population and economic growth globally (Hamza et al., 2022). The world population growth rose from 2.4 billion in the 1960's to 7.6 billion in 2017. (populationlogistics.com) which means that the population has increased by 300% and with the corresponding increase in economic growth and business activities to 100% of GNP in most part of the world. Moreover, infrastructures like roads, housing, school, markets/shopping centres etc. were constructed and took over the natural landscape. (African digest, 2015).

In recent times, Bauchi town has witnessed an upsurge in population growth, which significantly increases the volume of trades and other commercial activities within the city centre and its environs. In spite of the evolution of the city through being a provincial headquarters to its present status as a state capital, and consequently a centre of trade and commerce, it lacks a suitable place where large amount of goods and raw materials are brought-in stored and taking-out to the final users in a conducive atmosphere. A study in the UK has shown how urban road traffic congestion, by constraining the benefits of agglomeration, can serve to reduce achievable levels of productivity in congested urban areas (Graham, 2007). It is a known fact that trailer/long-vehicles are increasingly taking over from train in transporting goods or finish products, from industries to the final consumers and process/unprocessed raw materials to final destination for further processing. This trend has generated many arguments in relations to urban traffic, safety and convenience. In the design, control of roads apart from the unwanted traffic, accident and inconveniences to other road users, the major problem in access roads, within the city to architects is to ensure that the carriageways and verges are not use for parking and loading/unloading of goods. Legal restraints require enforcement, which is expensive and intermittent, traffic rules and regulations is being abused with impunity and enforcement is becoming a herculean task for those that are responsible at keeping law and order.

Moreover, with many small cars, motorcycles and auto-rickshaw competing for driving and parking space on our roads, the tasks has become an

insurmountable problem. In a recent paper presented at the annual conference on business opportunity in Bauchi, organised by the Bauchi state chambers of commerce and industry stated that, about 150 number of trailer trucks, load of goods enters into Bauchi town on a weekly basis and are mostly ship directly to the market for storage and sales (Bauchi State Ministry of Commerce and Industry, 2019).

It is in this backdrop that the design of storage facility has become imperative to serve as a place where storage and central parking for trailers/long vehicles and other small commercial vehicles, will load/off load goods and other materials. The goods can be received, stored and be distributed in a smaller vehicle to various markets without causing much problem of traffic in the city. The essence of the storage facility is to create a proper and well-planned meeting point for personal storage and transactions in bulk buying, and harmonious interaction between merchants and transporters.

## II. LITERATURE REVIEW

Storage and warehousing are words used interchangeably, as warehousing is also a type of storage. It is one of the important marketing functions in which goods are stored before final delivery to the retailer. Storage emerges as an important activity that is primed right after the production of the goods. However, sometimes-raw material are stored for later use. Place of storage can be a very small room known as a storeroom or the commodities may be stored in special structure known as storage facility. Storage facilities are actually scientific types of storage structures, built to protect the stored products. They ensure that the quantity and quality of goods remain intact. A storage facility is generally associated with a large building. However, there are several small storage facilities too. There are many terms associated with storage facility/ warehousing, among which are;

### *a. Logistics*

Logistics is the management of the flow of goods, information and other resources, between the point of origin and the point of consumption in order to meet the requirements of the consumers. Logistics involve the integration of information, transportation, inventory, storage facility, material handling,

packaging, delivering to the right customer, and doing this at the right cost (The seven R's)" (Shapiro, Heskett, 1985; Lumsden, 1998). Majorly, logistics seen from the perspective of an operative way of transporting or moving materials from one point to another or producing service. . It is involved in all levels of planning and execution – strategic, operational, and tactical. The credibility of this operation based on how good is the design of the system that leads to this kind of logistics.

*b. Supply chain management*

Supply chain management integrates supply and demand management within and across businesses. It is an integrating function with primary responsibility for linking major business functions and business processes within and across businesses into a cohesive and high-performing business model. (Meltzer, 2001).

- Types of Storage facilities

Many types of storage facilities have been identified. These includes;

- i. Raw material and component storage facilities: It hold raw materials and always in a position to induct raw materials onto a manufacturing or assembly process.
- ii. Work-in-process storage facilities: This storage facilities hold partially completed products and assemblies at various points along production line or an assembly line.
- iii. Finished goods storage facilities: It holds inventory usually to balance the variation between production schedules and demand. Normally these storage facilities are located near manufacturing plant, and it is characterised by the flow of full pallets in and full pallets out, assuming the product size and volume authorizes pallet-sized loads.

*c. The Ideal storage facilities*

In the present business world, all the storage facilities are striving to attain an ideal storage facility in which every equipment is automated and integrated with the computer systems which minimize the effort put on to perform the operation and cuts down the cost for the operation. This will reduce the work force required to perform various operations in a storage facilities.

In an automated storage facility, materials are received in unit loads or on a case conveyor or a

pallet, then these are made into unit loads and sent to automated storage and retrieval system. The unit loads can easily be picked from the automated storage and retrieval systems to fill the customer orders. The major problems in this kind of storage facilities are that there is non-standardization for the pallet size, case, and the inner pack and not all goods have the same shape and size even among the same company products. This ideal storage facilities system can be useful only when there is standardization of the pallets or the inner packs for the materials (Raymond, 1985).

*d. Storage facilities design guidelines*

Rouwenhorst et al. (2000) state that a design process typically runs through a number of consecutive phases. However, they then go on to group the activities within these steps into a hierarchical framework based on a top-down approach, thus identifying strategic, tactical and operational decisions. They propose that these three clusters of decisions should be considered in sequence. Govindaraj et al. (2000) and Bodner et al. (2002) used ethnographic study techniques to identify how experts actually design storage facilities. They focus on the procedures that are used by designers and experts in the field, trying to understand the decisions they make and the processes they follow when developing a design project. They state that the designer must consider some very complex trade-offs. Design guidelines for storage facility requires the designer to; Define business requirements and design constraints, Define and obtain data, Formulate a planning base, Define the operational principles, Evaluate equipment types, Prepare internal and external layouts, Draw up high level procedures and its requirement, Evaluate design flexibility, Calculate equipment quantities, Calculate staffing levels, Calculate capital and operating costs, Evaluate the design against requirement (Rushton et al. 2006).

### III. METHODOLOGY

This study was designed based on the principles of case study research, using qualitative approach of data collection and analysis. Research information was collected using observation tool. The data that was use for the empirical approach is collected from various sources such as archival records, interviews, observations, physical artefacts etc. This collected

data can be divided into two different types, primary and secondary data. (Kumar, 2005). The case studies were conducted in the Naheem height company in Bauchi, Dawanau international grains market in Kano, Singer market in Kano, and Central market in Bauchi.

*i. Research strategy*

Empirical approach was use for the purpose of this study. The aim was to present a practical case, which based mostly on the empirical studies. The study concentrated on the practical approach and had a glance on how the process works in the real world and what are the problems faced on a daily basis. This was achieved through case studies and interviewing the parties involve in storage activity.

*ii. Validity*

Validity describes the extent to which the results correspond to reality. The connection between the theoretical and the empirical areas is usually difficult, but it must be present in some way or the other. This connection is call Validity, which means measuring what is really supposed to be measured. One way of increasing the validity is to use various perspectives during the study.

All interviews conducted during this research work were performed with relevant experienced people, knowledgeable and highly qualified. The designation of the interviewees was high and all of them were storage facilities managers (Various Chef) who were very much competent, vastly experienced and highly qualified.

*iii. Reliability*

Reliability depends on the accuracy of the techniques used. Some of the things that can make the reliability low in the research studies are wrong samples, problems in interpretations and problems with standardization in the interviews etc. In this study, four organisation administrators who belong to Naheem Heights Company, Singer Market Association, Dawanau International Grain Market Association and Central Market Bauchi, were interviewed using un-structured method of interview. The administrators are highly qualified and competent and have extensive knowledge in the area of the research work. Moreover, the research work was

attained following the basic format of research study. Due to these facts, it is assume that the thesis work is reliable and is achieved based on a standard research framework. (Kumar; Research methodology, 2005).

IV. RESULTS AND DISCUSSIONS

Cross- case analysis was used in analysing the results of the data collected. Cross-case analysis is a research method that can mobilize knowledge from individual case studies. Thus, mobilization of case knowledge occurs when researchers accumulates case knowledge, compare and contrast cases, and in doing so produce new knowledge. The results were discussed under the following headings;

*a. Number of employees*

The results of the empirical study showed that, the number of employees in Naheem height company, Dawanau international grains market, Singer market and Central market is 25, 500, 1500 and above respectively. It can be observed that the number of employees in Dawanau is higher than the other storage facilities. In case of Singer, there are over 1000 employees, which is quite high when compared to the other stores but due to the variety, range of the goods, high number of SKUs there is a requirement for greater number of employees to manage the storage facilities effectively. The other two storage facilities i.e. Singer and Central markets engage 500 and up to 1000 personnel to take care of the storage operations, which are moderate when compared to Naheem height. In case of Naheem height, they apply a very good strategy in order to maintain optimum number of employees by ensuring to have a reserve personnel in case of contingencies.

*b. Training period*

As far as the training period of the employees is concerned, and based on the cases studied, only Naheem Height and some branches at Dawanau offer an initial training period. Other businesses do not give any special training as such; instead, the employees are employ as to when they needed on the spot while they are performing a particular task. The only training given is the training involved in loading and unloading, since it is very important to handle the goods with maximum care and insufficient knowledge

can lead to accidents and damages in the storage facilities.

*c. Storage facilities floor space*

The storage facilities floor space is quite not the same, except Naheem height where the space is less than 450 square meters. Dawanau has a storage facility floor space of more than 21,000 square meters, which is higher than the other storage facilities. This is understandable since Dawanau has a very wide product range and the numbers of SKUs are quite high. Due to this, they need bigger storage facilities space to operate well with a good efficiency. In the case of Singer and Central markets, their floor space is not measurable because of their storage facilities, they are either residential or shops which are converted into storage facilities. However, very few structures were designed for the purpose of storage facility.

*d. ISO certification*

ISO certification obviously helps in growth of confidence for the businesses since the customers are always looking for high standards of the items and compliance to the specifications. Most of the customers look for quality certification when doing business. It is very important to have an ISO certification for the operations in order to gain the confidence of the customers. Hence, just of recent a bill for an Act to provide for the establishment for the Nigerian Independent Storage facilities Regulatory Agency and other related matters, 2016 (SB.255) passes second reading. *Sen. Sam Egwu (Ebonyi North)*.

*d. Storage Methods*

Considering the cases of Naheem height and Singer markets, both are using traditional racks and aisles for storage and this arrangement has its own advantages and disadvantages, when compared to other two cases. The racks and aisles do not come into picture in the case of Dawanau and Central markets, since these businesses directly place the goods, which are receive on to the shelves of the retail store, thus eliminating the storage facilities concept.

*e. Palletizing*

A pallet provides the base for assembling, storing, handling and transporting materials and products. However, material handing is completely with manual

labour or workforce. Nevertheless, as far as storage is concern in all the case studies conducted the use of pallet is completely not in use.

*f. Data Entry*

Not all the storage facilities in the case studies are computerized. However, in the case of Naheem height company, data is put into the computer with less paper work in the system in order to decrease the time taken for entering the data and maintaining the transactions taking place in the storage facilities like invoicing, receiving documents etc.

*g. Loading and Unloading Equipment*

It was observed in all the case studies conducted that, the activities of loading and unloading of goods in all the storage facilities were manually done. There is no any mechanical means for the activities of inbound and outbound logistics. Because of the un-organized storage facilities in all the case studies, cross docking is being use. Cross docking is a practice in logistics of unloading materials from an incoming semi-trailer truck or railroad car and loading these materials directly into outbound small trucks with little or no storage in between. Table 1 presents the summary of results of the storage facilities operations identified in the study.

Table 1: Storage Facilities Operations

Operations	Naheem Height Company	Dawanau Market	Singer Market	Central Market
Identification of goods	Manual/barcode	Manual	Manual	Manual
Data entry	Computerized	Manual	Manual	-
Loading and unloading equipment	Manual lift	Manual lift	Manual lift	Manual lift

*h. Security of Goods*

In case of all the facilities, they have security personnel, but without the provisions for security alarms and CCTV cameras for the security of goods. Extra security garget to the work force may add more cost for the businesses but at the same time, the security of the goods is equally important for the businesses.

*i. Fire Safety*

Safety of all the storage facilities should comply with specific standards of fire safety, thus forcing the businesses for the compulsive installation of fire alarms, fire hose reels, and fire extinguishers. Not all storage facilities in the case areas are equipped with all the fire safety measures according to the required standards of fire protection service. Therefore, there is need to enforce the use of fire extinguishers at all designated point of the building.

CONCLUSION AND RECOMMENDATIONS

A strategy was analyzed and developed for the design of a storage facility and its judicious integration into the design for a multipurpose Storage facility. Building form and orientation, Site planning and landscaping, Construction technology, ventilation, and accessibility have been used and optimized through design techniques. The goal is to establish a framework and common vision of storage Design Approach and to shift people’s perception towards the traditional of storage activity. The study provides that, studying the user needs and behaviour, locally and by integrating the study into design will yield to a building that is socially acceptable, flexible and adaptable, energy efficient, and environmentally friendly (Habibullah et al., 2022).

Finally, a storage facilities should be design to inspire their users. It is only then we can conveniently say that its design is truly functional- when it appropriately meets the social and physiological need of its users.

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