

**WAREHOUSE LOCATION AND DESIGN DECISIONS AMONG LARGE  
SCALE MANUFACTURING FIRMS IN NAIROBI, KENYA**

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## DECLARATION

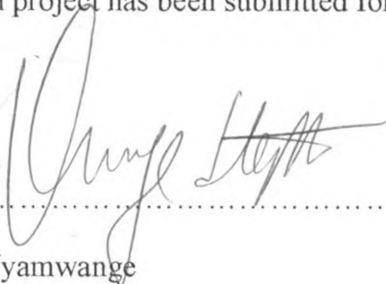
This research project is my original work and to the best of my knowledge it has not been submitted for award of degree in any other university

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## **Dedication**

To my Loving and dear wife Zaye Kuoh Tozay, my children Leroy, Collins and Gondella for their inspiration for being my source of inspiration throughout the entire process of my MBA Programme. Your steadfast prayers towards completion of my studies have indeed been answered. To my children that you should endeavor to achieve academically more than what I ever did.

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## ABBREVIATION

|       |   |
|-------|---|
| AS/RS | Automated Storage and Retrieval Systems   |
| CH    | Controlled Humidity                       |
| GDP   | Gross Domestic Product                    |
| HVAC  | Heating, Ventilating and Air Conditioning |
| KAM   | Kenya Association of Manufacturers        |
| SPSS  | Statistical Packages for Social Sciences  |
| WMSD  | Work-related musculoskeletal disorders    |



## **Abstract**

A key decision manufacturing firms must make is the location and design of their warehouses. Warehouse location and design selection problem include both quantitative and qualitative factors. The importance of warehouse location and design has increased during the recent decade and has become value adding centers, meeting customer satisfaction and corporate profitability. The objectives of this study are to determine the factors that influence warehouse location decision; to determine the factors that influence warehouse design decision and to determine the challenges in the location and design of a warehouse among large scale manufacturing firms in Nairobi.

Descriptive survey design was used to carry out the study. The population of the study constituted all the large scale manufacturing firms within Nairobi. The sample of this study consisted of 100 large scale manufacturing firms. Self administered drop and pick questionnaires were distributed to warehouse managers currently employed by the large scale manufacturing firms in Nairobi. The data collected was analyzed with the use of means, standard deviation, correlation analysis and factor analysis with the aid of statistical packages for social sciences (SPSS). The factors that influenced warehouse location and design decisions positively aided manufacturing firms possess competitive advantage. Of primary consideration, the factors considered in warehouse location decision included host community, proximity to market, space availability, security and utilities (such as electricity), and for warehouse design factors, available space, accessibility, safety, cost effectiveness and product type.

The challenges that the research indicated to be affecting the location and design decisions of warehouses included space availability, lack of expertise, lack of reliable source of information, poor transportation network, and globalization. Globalization is the least with means and standard deviation of 3.8333 and 1.2545. Analysis also indicates that challenges affecting the warehouse design decision were financial resources, lack of expertise, available space and government rules and regulations. Overall warehouse structure has the least means and standard deviation of 4.1333 and 1.0006.

The study will be of great importance to the policy makers in the manufacturing industry as they will use strategic factors in determining warehouse location and design decisions in meeting target customers and corporate profitability.

## CHAPTER ONE: INTRODUCTION

### 1.1 Background

In an effort to meet Supply Chain Management objectives, organizations make various decisions which include: location, layout and design of warehouses. Supply Chain Management is influenced by site selection and product quality (Heizer and Render, 2006). Supply Chain Management entails not only the movement of goods but also decisions about: where to produce, what to produce, and how much to produce at each site; what quantity of goods to hold in inventory at each stage of the process; how to share information among parties in the process; and where to locate plants and distribution centers.

Warehousing has become an important enabler in the globalized production network and often short lead time, volume and mix flexibility, postponed customizing in terms of assembly and packaging as well as corporate profitability, are being achieved through warehousing outlets serving particular trade areas (Christopher, Peck and Towill, 2006; Baker, 2007; Koskinen and Hilmola, 2008; Hilletofth, 2009). Despite the fact, warehousing remains an important enabler of performance among manufacturing firms; it is often outsourced by most firms in the manufacturing sector. Most of the firms get warehousing services from other service providers (CapGemini, 2007; Selviaridis and Spring, 2007; Marasco, 2008; Hilletofth and Hilmola, 2010; Hilmola and Tan, 2010). In an international or global setting, warehouses or distribution centers play a key role in supporting supply chain strategies.

According to Lurie (2010), a business is fundamentally an economic enterprise, and its primary goal from the perspectives of its shareholders is to maximize profit. In current thinking, the focus may have shifted to the role of the facility, such as a warehouse, distribution or logistics centre, in supporting the overall business strategy of a firm (Yang and Lee 1997). Manufacturers are faced with the problem of deciding the best site for location of plants or factories. Facilities location refers to the choice of region and the selection of a particular site for setting up a plant, distribution center or warehouse. Facility location decision involves organizations seeking to locate, relocate or expand their operations (Yang and Lee, 1997).

The design and operation of a warehouse has been a rich source of research questions and problems for the past twenty years. In warehouse design, there are many trade-offs that should be considered. More automation may reduce the labor cost, but increase the investment cost. More storage zones may improve the space utilization, but require more control. Zone picking may improve the productivity of the stock selectors, but requires more planning and control of picking. The warehouse design provides the specification of the function flow network, and the elaboration of each function and flow, employing a process of profiling, architectural design, and detailed engineering (McGinnis, Goetschalckx, Sharp, Bodner, and Govindaraj, 2000).

### **1.1.1 Warehousing Location and Design Decisions**

In warehousing, a number of decisions have to be made in order to attain effective management. Decisions made in warehousing include strategic decisions such as location, design, flow, material handling, equipment and number of warehouses. The target market and the products that will be carried in the warehouse must also be addressed. Ownership decisions are also important in warehousing since a business entity can either own the facility or outsource from a service provider. The factors to consider when making ownership decisions include: flexibility; services available and the degree of control that an organization desires. There are other factors that may affect the type of ownership decision that an organization makes, which include: throughput volume, demand variability, market density, special physical control, customer service required, security requirements and multiple use needed (Selviaridis and Spring, 2007).

Warehouse location is the decision addressed from the perspective of the organizations seeking a site for a new facility, or relocation of an existing facility. Location decision in the manufacturing industry is highly promoted by various public and private interest groups who have a high stake behind warehouse location selection decisions (Galbraith, DeNoble, and Estavillo, 1990). In the private sector for instance, location decisions concern many stakeholders, including venture capitalists, financial investors, industrial site developers, as well as hotel and convention center managers. In contrast, the primary public interest about warehouse location decision is from the local government or their economic development agencies (Linton, Klassen, and Jayaraman, 2007).

The determinants of location of a warehouse include service and cost. Product availability can greatly be enhanced by locating the warehouse close to the market place. However, transportation cost, which is a major element in logistical cost, depends on the location of the warehouse. Additionally, the location determinants also includes availability of proper infrastructure such as approach roads, electricity and communication, climate, proximity to market, availability of suppliers of raw materials, industrial or commercial incentives, company policy and favorable labor. The non-availability of a proper road or rail siding facility will have a serious impact on the location and operation of a warehouse (Sople 2004; and Yang and Lee 1997).

Design is an integrated distribution network which encompasses decisions that are among the most critical operational and logistical management decisions that face a firm. A design of a facility is influenced by the location decision of the firm (McGinnis et al, 2000).

For the determinants of design, Pickard (2002) stated that in the design of a warehouse layout, personnel circulation and escape route, international and local regulations, fire control, goods circulation and processing, service routing, lorry and private vehicles access and parking should be considered. In the development of a warehouse design decision, the Architect should highlight the space required for operational requirements and the essential design attributes for a warehouse layout, such as loading/unloading bays and circulation space, area and height of unit (Alder, 1999).

### **1.1.2 Large Scale Manufacturing Firms in Nairobi**

The importance of warehousing has increased during the recent decade. These distribution and storage outlets have become value adding centers, responding to market changes with maximized corporate profitability. Warehouses play an important role in the Supply Chain Management. Manufacturing firms' utilized warehouses to serve the markets, hold raw materials, work-in-process, finished goods, other supplies and therefore provide means for appropriate customer service in the local and international environment prone to long lead time and disruptions (Hilmola and Lorentz, 2011). Kenya has a large manufacturing sector serving both the local market and exports to the East African region. The sector, which is dominated by subsidiaries of

multi-national corporations, contributed approximately 13% of the Gross Domestic Product (GDP) in 2004 (PricewaterhouseCoopers, 2006).

According to Awino and Gituro (2011) large companies today mainly focus on becoming efficient and flexible in their manufacturing methods in order to handle uncertainty in the business environment. These firms also need different strategies to manage the flow of goods from the point of production to the end user. Manufacturing firms have been classified by various scholars and researchers based on different characteristics. Some authors classified firms based on the quality of service or production, the size of the work force, and the numbers of facilities. Parker and Torres (1994) based their classification of manufacturing firms on number of employees. According to their studies in Kenya, large scale manufacturing firms have more than 100 workers, medium firms have from 51 to 100 workers, small scale firms have 11 to 50 workers, and micro firms are those with 10 or fewer workers.

## **1.2 Statement of the Problem**

Warehouse location decision has drawn increased attention from both academic and business communities in the past two decades. Site selection for many large corporations is so involving, such that it is a full time job for which an executive is assigned. Warehouse location problems have attracted researchers with diverse backgrounds such as economists, industrial engineers, and geographers (Ghosh and Harche, 1993). The Site selection of a warehouse starts normally with the recognition of a need for additional capacity. A decision is then made to start the search for the “best” location. It has been well recognized that warehouse location selection has important strategic implications for the operations to be located, because a location decision normally will involve long-term commitment of resources and be irreversible in the short-term. Specifically, the location choice for a manufacturing facility may have a significant impact on the firm’s strategic competitive position in terms of operating cost, delivery speed performance, and firm’s flexibility to compete in the marketplace. The significance of having a defined location increases the attractiveness to the facility. The impact of new technologies on warehouse management system and its location consideration have made the location selection become more strategically important, thus making the location decision process become more complex.

The warehouse location and design decisions have been of concern to manufacturing firms. Almost every private and public sector that can be thought of has been faced with the task of locating and designing its warehouses. Facility location and design models for distribution planning have inspired a large body of literature that spans well over the past two decades (Aikens, 1985). Based on the influence of location and design decisions, the studies aim to provide an understanding and the impact of the concepts of location and design in efficiently and effectively placing large scale manufacturing firms in a competitive advantage. This will also necessitate the fact that large scale manufacturing firms in Nairobi will operate in a dynamic and very competitive environment, enabling them remain relevant and profitable in the market.

A number of studies have been carried in relation to warehouse location and design decisions. For instance, Ada et al (2005) submitted a paper to the 7th Balkan Conference on Operational Research in Romania on the Plant Location Problem by an Expanded Linear Programming Model. The paper discussed various factors considered in facility location including warehouses. The factors include space availability, security, availability of labour, availability of utilities such as electricity, government regulations, trading blocs and nearness to market. Laporte and Revelle (1996) conducted a study on the new models of plant location problems. The study was meant to review any new methods of plant location. Kumral (2004), Verter and Dinçer (1995), also carried out studies on facility location and capacity acquisition. The studies established that companies must take into consideration factors such as security, nearness to market and sociopolitical issues in locating facilities.

The above studies are an indication of ongoing research in warehouse location and design. This study will seek to determine the factors of warehouse location and design decisions among large scale manufacturing firms in Nairobi. It is therefore in this light that the researcher seeks to fill the academic gap by answering the following questions; what are the factors influencing warehouse location? What are the factors influencing warehouse design decisions among large scale manufacturing firms? and what are the challenges in the location and design decisions of a warehouse?

### **1.3 Research Objectives**

The objectives of the study were to

- i. Determine the factors that influence warehouse location among large scale manufacturing firms in Nairobi, Kenya.
- ii. Determine the factors that influence warehouse design decisions among large scale manufacturing firms in Nairobi, Kenya.
- iii. Determine the challenges in warehouse location among large scale manufacturing firms in Nairobi.
- iv. Determine the challenges in warehouse design among large scale manufacturing firms in Nairobi

### **1.4 Value of the Study**

This study is of significant importance to the companies in the manufacturing industry as they will be able to know for certain what factors influence a greater role in shaping their operations and how they affect the warehouse location selection and the design decision to use in order to remain competitive.

The result of this study will also be invaluable to researchers, academicians as it will be a useful guide for future researchers interested in undertaking a study on the factors of warehouse location and design in Nairobi.

The Kenya Association of Manufacturers will also find the results of the study very valuable, as it will be able to ascertain the extent of competition within the manufacturing industry and the warehouse location selection and the design decision that mitigate the effect of the competition of the firm as so determine whether such decisions adopted conform to the guidelines provided for the industry by the government.

The study will also be important to all the manufacturing firms in Liberia, as it will serve as a benchmarking instrument which will enable firms to determine the factors that influence warehouse location and design decisions.

## CHAPTER TWO: LITERATURE REVIEW

### 2.1 Introduction

Locating a warehouse or several warehouses is a classic logistics problem, and a sub-problem of production-distribution system design, that has been extensively covered in the logistics and operations research literature (Baumol and Wolfe, 1958; Ballou, 1968; Kaufman, Vanden, and Hansen, 1977). Warehouse location decision has drawn increased attracted researchers with diverse backgrounds such as economists, industrial engineers and geographers (Ghosh and Harche, 1993). In current thinking, the focus may have shifted to the role of the facility, such as a warehouse or a distribution/logistics center, in supporting the overall business strategy of a firm (Yang and Lee, 1997). The specific areas covered are overview of warehousing, warehouse location factors, challenges of warehouse location warehouse design factors, challenges of warehouse design and emerging issues in warehouse location and design.

### 2.2 Overview of Warehousing

Warehousing refers to the activities involving storage of goods on a large-scale in a systematic and orderly manner and making them available conveniently when needed. In other words, warehousing means holding or preserving goods in huge quantities from the time of their purchase or production till their actual use or sale. Warehousing is one of the important auxiliaries to trade. It creates time utility by bridging the time gap between production and consumption of goods (Hilmola and Lorentz, 2011).

Warehousing plays a very important strategic role in an organization. Rommel (2006) argues that there are a number of strategic roles played by warehouses. They are used to hold buffer inventory in a physical distribution system, bulk breaking, reconstitution of loads, Consolidation and customer specific forward delivery. Warehouses are value addition and distribution centers, their proximity to production units ensures minimal production cycle times. Warehouse numbers, locations, sizes and roles have long term impact on supply network operations and logistics costs. Operational efficiencies from warehouses can make marginal difference in otherwise cost inefficient strategic decisions, while well designed supply networks provide long term competitive advantage.



According to Hilmola and Lorentz (2011), warehousing is necessary for a number of reasons. Seasonal Production is one of the important reasons in warehousing. Agricultural commodities are harvested during certain seasons, but their consumption or use takes place throughout the year. Large-scale production also makes it necessary to operate a warehouse. In case of manufactured goods, nowadays production takes place to meet the existing as well as future demand of the products. Manufacturers also produce goods in huge quantity to enjoy the benefits of large-scale production, which is more economical. The other reason why firms need warehouses is due to continuous production of goods in factories that requires adequate supply of raw materials. So there is a need to keep sufficient quantity of stock of raw material in the warehouse to ensure continuous production (Hilmola and Lorentz, 2011).

There are several basis of classifying warehouses. They can be classified on the basis of the type of ownership, the type of storage and even according to the services offered. Min (2009) indicates that there are various types of warehouses such as: Private Warehouses-which are owned and managed by the manufacturers or traders to store exclusively their own stock of goods; Public Warehouses which are run to store goods of the general public; Government Warehouses that are owned, managed and controlled by central or state governments or public corporations or local authorities; Bonded Warehouses that are owned, managed and controlled by government as well as private agencies used to store imported goods for which import duty is yet to be paid and Co-operative Warehouses- owned, managed and controlled by co-operative societies and provide services at the most economical rates to the members of their society.

Lorentz (2011) equally classify warehouses into three categories: heated and unheated general warehouses that provide space for bulk, rack, and bin storage, aisle space, receiving and shipping space, packing and crating space, and office and toilet space; refrigerated warehouses that are used to preserve the quality of perishable goods and general supply materials that require refrigeration. They include freeze and chill space, processing facilities, and mechanical areas; and controlled humidity (CH) warehouses that they are constructed with vapor barriers and contain humidity control equipment to maintain humidity at desired levels. Special-designed warehouses meeting strict requirements can also provide liquid storage (fuel and non-

propellants), flammable and combustible storage, radioactive material storage, hazardous chemical storage, and ammunition storage.

### **2.3 Warehouse Location Factors**

In real life there exist many factors that directly or indirectly affect the facility location selection. The factors to consider in a global location decisions include the following; government stability, governed regulations, political and economic systems, exchange rates, culture, climate, export & import regulations, tariffs and duties, raw material availability, availability of suppliers, transportation & distribution systems, labor force, available technology, technical expertise, cross-border trade regulations and group trade agreements. On the other hand, for the selection of the region, city or country the factors considered are; labor, proximity to customers, number of customers, construction costs, land cost, availability of modes and quality of transportation, transportation costs, local business regulations, business climate, tax regulations, financial services, incentive packages applied to that region and labor force education are both critical and important in facility location selection. Therefore it is clear that there is a need in location problem approaches concentrating on the combination of qualitative and quantitative factors (Ada and Ozkan (2005)).

Location factors can be subdivided into three general functional categories, namely, site, accessibility and socioeconomic environment. Site is the Specific micro-geographical characteristics which includes the availability of land, basic utilities, the visibility (for activities related to prestige such as head offices), amenities (quality of life) and the nature and level of access to local transportation (such as the proximity to a highway). These factors have an important effect on the costs associated with a location. Accessibility include a number of opportunity factors related to a location, mainly labor (wages, availability, level of qualification), materials (mainly for raw materials dependent activities), energy, markets (local, regional and global) and accessibility to suppliers and customers (important for intermediate activities). These factors tend to have a meso (regional) connotation. The socioeconomic environment is the specific macro-geographical characteristics that tend to apply to jurisdictional units (nation, region, and locality). They consider the availability of capital (investment, venture), varied

subsidies, regulations, taxation and technology. The role and importance of each factor depends on the nature of the activity which locational behavior is being investigated (Rodrigue, 1998).

According to Laporte and Reville (1996), the transport of materials and products to and from warehouse will be an overriding consideration in site selection. If practicable, a location should be selected that is close to at least two major forms of transport: road, rail, waterway or seaport. Road transport is being increasingly used, and is suitable for local distribution from a central warehouse. Rail transport will be cheaper for the long-distance transport of bulk chemicals. Air transport is convenient and efficient for the movement of personnel and essential equipment and supplies. Labour will be needed for construction of the warehouse and its operation. Skilled construction workers will usually be brought in from outside the site, but there should be an adequate pool of unskilled labour available locally. The proposed warehouse must fit in with and be acceptable to the local community. Full consideration must be given to the safe location of the warehouse so that it does not impose a significant additional risk to the community. Adverse climatic conditions at site will increase costs. It will be important to consider the climatic effects in location decision making.

### **2.3.1 Steps in Location Decision Process**

Murari (2010) has suggested that it is very difficult to find an optimal location for a supply chain facility. Satisfying decisions are developed by approximation. There is no standard procedure. He further suggests that the following steps may be taken as guidelines: The process begins by defining the location objectives and associated constraints. It will be important to define the objectives that drive the location process. They may include basis, promoters, owners, employees, suppliers and customers. The second stage will include identifying the relevant decision criteria. This includes determination of the factors that will assist the organization to make a location decision, for instance, economic factors, material cost and non-economic factors such as environment. The third stage relates to the objectives to the criteria using appropriate models such as break even analysis, linear programming, qualitative factor analysis etc. are used for decision making. The last stage involves doing a field research to obtain relevant data and to use the models to evaluate the alternative locations through the review of professional journals for necessary information.

### **2.3.2 Warehouse Location Methods**

There are several methods that can be used in the location of a warehouse or any business facility. Bartness (1994), suggested the following methods as appropriate in warehouse or facility location: Factor-rating Method- a method where several factors to be considered are assigned different weights and the locations are considered. The location with the highest percentage is then selected. Transportation Method of Linear Programming- a method that aims at minimizing the cost of shipping  $n$  units to  $m$  destinations thus maximizing the profit of shipping  $n$  units to  $m$  destinations and Centroid Method takes into consideration the existing facilities, the distances between them, and the volumes of goods to be shipped to the various destinations. Its major aim is to locate the new facility in a more central location that can be convenient and cost effective when serving the other existing facilities.

### **2.4 Warehouse Design Factors**

Low and Show (2008), state that warehouses are facilities that provide a proper environment for the purpose of storing goods and materials that require protection from the elements. Warehouses must be designed to accommodate the loads of the materials to be stored, the associated handling equipment, the receiving and shipping operations and associated trucking, and the needs of the operating personnel. The design of the warehouse space should be planned to best accommodate business service requirements and the products to be stored/handled. The economics of modern commercial warehouses dictate that goods are processed in minimal turnaround time.

In warehouse design, there are a number of factors to be considered. It should be designed around the handling equipment rather than starting with a racking layout and then seeking equipment to fit the design. Handling equipment requires specific working aisles sized according to loads being handled and the heights being utilized. The racking, in turn, needs to conform to these parameters. Failure to consider this could lead to aisles that are too tight with resultant damage to product and racking, as well as reduced performance with more resources required to do the work. However, if there is a need for picking at lower levels and/or high throughput design wider aisles that will allow for both equipment and people to pass each other safely and quickly (Steenhuisen, 2010).

Gu, Goetschalckx, and McGinnis (2007) also indicate that there are five major factors involved in determining the overall warehouse design; the size of the warehouse, departmental layouts, equipment to be used in the warehouse, detailed layout of each department and the operational strategies to be used in the warehouse. The sizing and dimensioning decisions determine the size and dimension of the warehouse as well as the space allocation among various warehouse departments. Department layout is the detailed configuration within a warehouse department, for example, aisle configuration in the retrieval area, pallet block-stacking pattern in the reserve storage area, and configuration of an Automated Storage/Retrieval System (AS/RS). The equipment selection decisions determine an appropriate automation level for the warehouse, and identify equipment types for storage, transportation, order picking, and sorting.

## **2.5 Challenges of Warehouse Location**

According to Owen and Daskin (1998), when determining the location of a warehouse, there are a number of challenges that firms must overcome. Determining a suitable location that can be able to serve the customers efficiently and effectively is not an easy task. Firms must be able to come up with a location that can not affect the business. The other challenge is to come up with a warehouse location that will minimize average travel time as well as transportation costs. It requires a lot of careful evaluation for managers to come up with such a location. Firms must also meet government as well as environmental regulations when considering a site for warehouse location. When choosing a site for warehouse location, it may not be easy to come up with one that can minimize average response time.

In location decisions, manufacturers need to consider where to locate their warehouses. As such, Firms need to consider the greenfield site locations, which deal with vacant site, gives maximum flexibility for the design, and the operation of a new facility. On the other hand, the brownfield sites have some existing buildings that may be refurbished, require some compromises and in these constraints may significantly outweigh the higher initial capital investment required in greenfield sites. Each option of the warehouse location decisions has its own disadvantages. For the Greenfield site location, the follow disadvantages are faced during the warehouse location process: Some sites are not fully developed and have additional development costs, Council approval time frames may be longer for new sites, and High demand of industrial sites. In the

case of the brownfield site selection, it's challenges include, Design and operation efficiency is often compromised to suit existing constraints, Site location within the city may pose operating difficulties in the future, such as, traffic congestion, noise if residential close, Higher risk of cost blow-outs for unforeseen situations and, Often difficult to find an ideal site (Wiley-Engineer, Design, and Construct Food Facilities, 2011).

## **2.6 Challenges of Warehouse Designs**

Designing warehouses is challenging because it involves so many trade-off decisions. Each warehousing function needs to be carefully implemented in order to achieve operational target. These targets are often expressed in term of capacity, throughput, and customer service level. It has been acknowledged that warehouse design process is highly complex. The overall warehouse design problem is to specify the relations between systems and processes by which material information flow are governed. A warehouse must be designed to accommodate the load of materials to be stored, the associated trucking in receiving and shipping operations, and the need of the operating personnel (Baker and Canesa, 2009).

When designing a warehouse the challenge is to optimize a combination of processes, handling and storage equipments, system and organization. The optimal combination is defined by input (order profile) are on one side, and costs and availability of the influencing factors, personnel, equipment and building on the other. The challenges in warehouse design vary greatly throughout industries. Some challenges experienced by firms include the availability and costs of buildings, land and personnel, not only presently, but also in the future; can differ greatly depending on the country and even the region. Locally, it will take many more years before these differences will have diminished (Dermout and Kuijk, 2005).

According to Gu et al. (2007), the most common warehouse design problems are divided into five interrelated categories. The design related issues comprise decision about the overall warehouse structure, department layout, operational strategy, equipment selection, and sizing and dimensioning of departments.

Warehouse design related issues may also be situated on three different levels; strategic, tactical and operational. This hierarchical framework reflects the horizon of warehouse decisions on

long-term, mid-term and short-term time frame. This approach is practical especially when information on current operation is not available or does not exist, in the case of starting a new warehouse facility. When warehouse design is often started with limited information, outlining higher level issues, first provide constraints for lower level problems and the outcome should be a more coherent design plan (Rouwenhorst, Reuter, Stockrahm, van Houtum, Mantel and Zijm, 2000).

## **2.7 Emerging Issues in Warehouse Location and Design**

According to (Hilmola and Lorentz, 2010) automated Storage and Retrieval Systems (AS/RS) are reshaping the ways in which goods and services are manufactured, stored, and distributed. AS/RS have become a means to control and immediately report the movement of material, providing a critical link in the chain of information systems that control work-in-process, manufacturing schedules, and distribution. AS/RS warehouses are designed for maximum storage and minimum personnel on site. They are built for lower temperature operation with minimal heat and light needed, but require a tall structure with super level floors. In the private sector competition, technology and e-commerce are forcing distributors to look for ways to move larger quantities of their products more quickly and efficiently to the consumer. Clustering distribution centers in a single geographic area is among the new trends (Laporte and Revelle, 1996).

Labor availability and technology advances are factors driving many companies to consolidate their distribution systems into fewer but larger, regional facilities. However, not all companies are consolidating their distribution centers in many areas. The trend in consolidation is producing a new generation of smaller, local distribution centers. Experts say that there is use of third-party logistics providers in logistics handling systems. New "flex" warehouses in well landscaped industrial park settings for smaller businesses is a growing trend. These buildings accommodate small businesses such as contractors, light industrial fabricators, and mechanics that do not need exposure to heavy retail street traffic. In older industrial areas, small warehouse buildings with low roofs, no longer suitable for large single commercial users, are being repositioned and renovated as multi-tenant "flex" warehouse buildings (Laporte and Revelle, 1996).

Even though warehousing has a number of advantages, it equally has demerits. If warehousing location and design decisions are not properly made, they may affect the organization in various ways. As an organization runs into storage problems or strategic changes in the warehousing process and the design no longer fits the need, operating costs begin to rise (Rafla, 2006). Congestion is also another problem that may occur due to poor warehouse location and design decisions. Products may not be moved as fast as required due to poor location and design decisions. When there is congestion, the lead times may be longer since the retrieval process is slow. The costs of holding the inventory due to congestion such as insurance, labour costs and obsolescence will also go up. Poor warehouse location and design may also cause shipment errors that can easily result to inventory management problems. Items may easily be shipped to wrong destinations. This is likely to lead to increased order cycle times (Freese, 2000).

## **2.8 Critical review**

This study stands on one of the most strategic decisions i.e facility location, which is made by the management. It is implied that the facility selection problem should be based on the systems approach and for the problem both plant and warehouse locations can be discussed as a whole. In global competition as strategic management implies long-term aims should be stated. So for success limiting the management with just a certain number of criteria can be misleading for the global competition. The studies reviewed mention the importance of quantitative factors in the location of warehouses. It is important to note that qualitative factors also play a very important role in the location and design of warehouses. There is also need for a new way of thinking and new methodology is required for the management in order to combine quantitative and qualitative factors in warehouse location and design decisions. Warehousing in manufacturing firms especially in developing countries has not been adequately addressed. From the reviewed of the literature, no study had being done on warehouse location and design decisions among large scale manufacturing firms in Nairobi, There is need to address this knowledge gap.



## CHAPTER THREE: RESEARCH METHODOLOGY

### 3.1 Introduction

In this chapter the researcher discusses the methodology that he will use in conducting the study. The issues discussed are the research design, the target population, the sampling design and the sample size, the data collection methods as well as the data analysis and presentation methods.

### 3.2 Research Design

This research will involve a survey of the large manufacturing companies operating in Nairobi. The study will adopt a descriptive approach in trying to investigate the factors that influence warehouse location decisions. There are other designs but the researcher chose descriptive since it will enable him to come up with descriptive statistics that will assist in better understanding the problem under investigation.

### 3.3 Population of the Study

The population of the study in this research will be all the large scale manufacturing companies that are based in Nairobi. According to the Kenya Association of Manufacturers, there are a total of 455 large scale manufacturing companies operating in Nairobi (See Appendix 2). These companies belong to various sectors. All these companies will represent population of the study.

### 3.4 Sample Design

Stratified random sampling method as described in Cooper and Schindler (2006) will be applied to come up with the sample size, since the population in different large manufacturing firms were heterogeneous, implying that a simple random sample would have been unrepresentative of the population. Stratified random sampling ensures that each manufacturing firm was represented in the sample in sufficient numbers for fair comparison and generalization of the findings.

According to Mugenda and Mugenda (2003), at least 10% of the total accessible population is regarded as an adequate sample for a study which uses descriptive research design. Therefore, based on this rationale, 100 large scale manufacturing firms which form approximately 21.98% of the target population was regarded as adequate representative sample for this study.

The researcher will calculate the percentage each sector represents among the total number of companies and use the same percentage to calculate the number of respondents. The researcher will select warehouse managers or administrators from each of the companies to participate in the study. Table 3.1 shows how the sample size is arrived at.

**Table 3.1: Sample Size**

| Sector           | Companies  | Percentage (%) | No. Selected | Respondents selected |
|------------------|------------|----------------|--------------|----------------------|
| Building         | 6          | 21.98          | 1            | 1                    |
| Food, Beverages  | 100        | 21.98          | 22           | 22                   |
| Chemical         | 62         | 21.98          | 14           | 14                   |
| Energy           | 42         | 21.98          | 9            | 9                    |
| Plastics         | 54         | 21.98          | 12           | 12                   |
| Textile          | 38         | 21.98          | 8            | 8                    |
| Wood Products    | 22         | 21.98          | 5            | 5                    |
| Pharmaceutical   | 20         | 21.98          | 4            | 4                    |
| Metal and Allied | 38         | 21.98          | 8            | 8                    |
| Leather          | 8          | 21.98          | 2            | 2                    |
| Motor            | 17         | 21.98          | 4            | 4                    |
| Paper            | 48         | 21.98          | 11           | 11                   |
| <b>TOTAL</b>     | <b>455</b> |                | <b>100</b>   | <b>100</b>           |

Source: Kenya Association of Manufacturers (KAM) Directory. June, 2011

### 3.5 Data Collection

Both primary and secondary data will be used. Primary data is information gathered directly from the respondents and the secondary data is information gathered from studies done by others (Kothari, 1990). The primary data will be collected by use of a questionnaire. The questionnaire is considered appropriate because it is more convenient to administer. The questionnaire will contain both open and close ended questions. The questionnaires will have two sections. The first part will contain questions on the bio data of the respondents; the second section will contain questions on the specific objectives of the study.

### **3.6 Data Analysis**

The study will collect both quantitative and qualitative data. Two methods of data analysis will therefore be adopted to enable the researcher conduct a comprehensive analysis. The quantitative data will be analyzed using Statistical Packages for Social Sciences (SPSS) while the qualitative data will be analyzed by content analysis. The findings from the quantitative data will be presented in pie charts and tables. The study will also conduct a means, standard deviation, correlation and factor analysis. The correlation analysis will establish how the various factors are related to each other, while the factor analysis will also be used to establish the various factors themselves. The factor analysis procedure will be used to determine the warehouse location and design decisions factors in the study as applied by various large scale manufacturing firms in Nairobi.

## **CHAPTER FOUR: DATA ANALYSIS AND INTERPRETATION**

### **4.1 Introduction**

This chapter discusses the data collected was analyzed using both qualitative and quantitative analysis and presented in tables and pie charts. One hundred questionnaires were distributed to warehouse managers in large manufacturing firms in Nairobi who were selected through a stratified sampling method to avoid biased selection. Out the total number of 100 sample size, 90 responses were received thus giving a response rate of 90% in the study. The 90% was considered successful for this study. All of the 10 responses were non-responsive with some respondents communicating that they will complete the questionnaires during the following week, but eventually did not do so despite the many follow-up by the researcher.

### **4.2 Research Findings, Analysis and Results**

This section addresses the responses, findings, analysis and results from the questionnaires received and returned to the researcher. The responses and findings from the respondents were analyzed through the use of content analysis, means and standard deviation, correlation analysis and factor analysis with the aid of statistical packages for social sciences (SPSS) to derive the results of the study. The findings have been presented and explained below.

#### **4.2.1 Demographic data of respondents**

This section sought data on the demographic data of the respondents who participated in the study such as gender, age, academic qualification, the duration they had worked in the company and the duration they had served as managers in the manufacturing firm. The purpose of this analysis is to establish unique responses on the different background of the respondents. The findings have been presented and explained below.

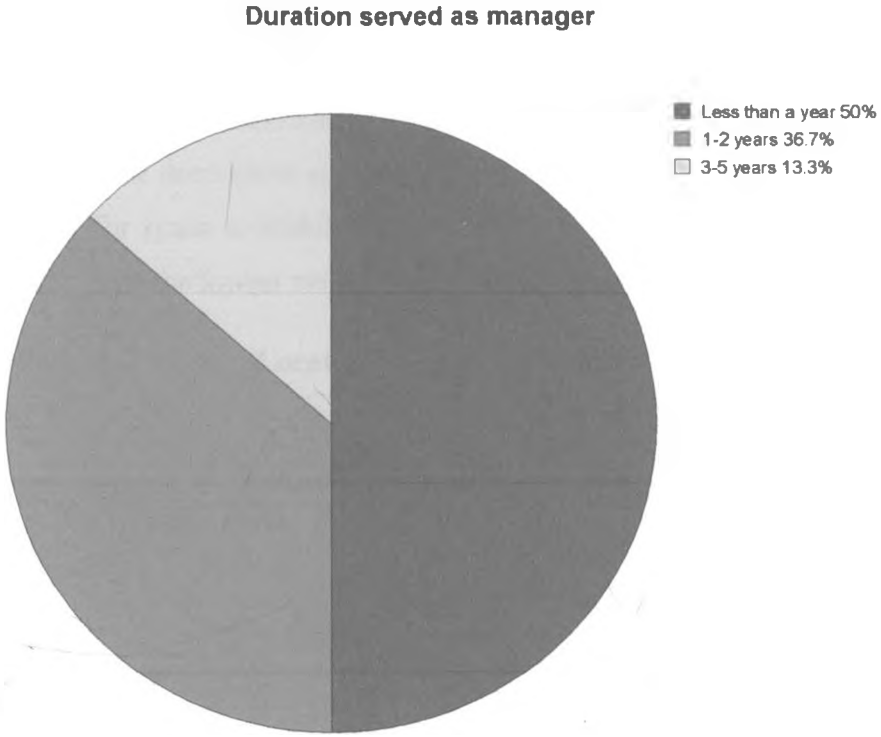
The analysis of gender in the study revealed that respondents who are male warehouse managers in large scale manufacturing firms represented 73.3%, while 26.7% of the respondents comprised of female who participated in the study. The findings from the respondents indicate that majority of the warehouse managers in large manufacturing firms in Nairobi are males. The findings also

revealed that both male and female were represented in the study. The analysis of the age of respondents indicated that 33.30% of the respondents involved in warehouse location and design decisions fall in the category of 31 to 35 years. Respondents in two of the age categories, 41 to 45 years and 46 years and above both had the least percent of 5.60% and 6.70% respectively.

The analysis of the academic qualifications of the respondents in the study who are involved in making warehouse location and design decisions revealed that 44 managers hold a bachelors degree, which constitute 48.89%, followed by diploma holders represented by 37.78%, certificate holders comprised 11.11% and 2 master holders represented as 2.22%. This is an indication that most of them have the necessary training to enable them work as warehouse managers. The researcher was also interested in finding out the duration the warehouse managers had worked in their respective manufacturing firms. From the analysis of the responses, it was noted that 51.11% of the respondents have been engaged in making warehouse location and design decisions for 1 to 2 years and 32.22% of the respondents have worked with their companies for between 3-5 years. The findings also revealed that 16.67% of the respondents had worked for the company for less than a year.

The researcher was also interested in knowing the duration the warehouse managers had served in their positions. The findings as indicated in the pie chart below indicate that 50% of the respondents had served for less than one year as managers, while 36.70% and 13.30% of the respondents have served as managers for 1 to 2 years and 3 to 5 years respectively. The reasons for the 50% of respondents who have served for less than one year could be attributed to the fact that those in this category were promoted to the manager positions. The 13.30% of the warehouse managers who had worked for 3 to 5 years is an indication that many of the managers in this category are older and are found within the age category of 41 and above constituting 12.23%. The analysis of these responses is an indication that many of those who had worked for this period and fall in this age category may have been retired from active service and some could not cope with the changes in technology within the supply chain.

**Figure 4.1**



**4.2.2 Factor in Warehouse Location and Design**

Factor analysis is used to find latent variables among observed variables. With factor analysis one produces a small number of factors from a large number of variables which explain the observed variance in the larger number of variables. The reduced factor will be used for further analysis.

Section B of the questionnaires was used to identify the factors considered by warehouse managers and the challenges faced in making warehouse location and design decisions among large scale manufacturing firms in Nairobi. To answer the research questions, 20 factors (explanatory variables) and 12 challenges were identified as possible variables that influence warehouse location and design decisions. Each of the respondents reviewed each factor and challenge captured on the questionnaire and responded on a scale from one (strongly disagree) to five (strongly agree). From the questionnaires completed and returned, factor analysis was used in analyzing the data through the use of the statistical packages for social sciences (SPSS).

Descriptive statistics captured in Table 4.1 and 4.2 derived from the location and design factor analysis indicated the mean and standard deviation. The mean scores in the tables below are arranged in order of highest to lowest. The findings indicated in Table 4.1 for location revealed that security has the highest mean score of 4.9444, follow by utilities with 4.8111 and infrastructures with score of 4.7889. The variable with the lowest mean score was the trade bloc, with a score at 3.6222. The descriptive statistics for the design factor analysis in Table 4.2 indicated that the mean score for space availability is the highest at 4.8111, followed by product type at 4.7667. The variables with the lowest means scores are cost effectiveness and throughput at 4.1222.

**Table 4.1 Descriptive Statistics (Location)**

| <b>Variable</b>                  | <b>Mean</b> | <b>Standard Deviation</b> |
|----------------------------------|-------------|---------------------------|
| Security                         | 4.9444      | 0.2299                    |
| Utilities                        | 4.8111      | 0.4464                    |
| Infrastructures                  | 4.7889      | 0.4097                    |
| Space availability               | 4.7444      | 0.4864                    |
| Government rules and regulations | 4.6889      | 0.5322                    |
| Raw material availability        | 4.2444      | 1.3005                    |
| Availability of labour           | 4.2444      | 0.9735                    |
| Proximity to market              | 4.1778      | 0.9535                    |
| Host community                   | 3.8667      | 1.1642                    |
| Trade bloc                       | 3.6222      | 1.1745                    |

**Table 4.2 Descriptive Statistics (Design)**

| <b>Variable</b>                      | <b>Mean</b> | <b>Standard Deviation</b> |
|--------------------------------------|-------------|---------------------------|
| Space availability                   | 4.8111      | 0.4464                    |
| Product type                         | 4.7667      | 0.4792                    |
| Safety                               | 4.7222      | 0.5665                    |
| Accessibility                        | 4.6667      | 0.7761                    |
| Separation of receiving and shipping | 4.6222      | 0.6094                    |
| Flow of product                      | 4.6222      | 0.6094                    |
| Material handling                    | 4.6111      | 0.4894                    |
| Floor type                           | 4.5778      | 0.6167                    |
| Cost effectiveness                   | 4.1222      | 1.2596                    |
| Throughput                           | 4.1222      | 1.2596                    |

The study also conducted a factor analysis in order to come up with the most important factors that determine warehouse location among large manufacturers in Nairobi. The results of the factor analysis have been presented in the following tables.

#### 4.2.2.1 Warehouse Location Factor Analysis

This subsection discusses the first research question asked in chapter one of the studies and the result of the data analysis. The researcher seeks to address the question; what are the factors influencing warehouse location decisions among large scale manufacturing firms in Nairobi? Factor analysis was used by researcher to determine those factors that influence the warehouse location decisions by large scale manufacturing firms in Nairobi. The correlation matrix in Table 4.3, gives the correlation coefficients between each single variable and every other variable in the investigation. Correlations between all the possible pairs of variables in the analysis are obtained. The diagonal elements which are all 1.000 are omitted. From the correlation matrix below it is clear that most of the variables have a weak positive or negative correlation.

**Table 4.3 Correlation matrix (Location)**

| Variable                      | Security | Raw materials | Host community | Gov't rules and regulation | Utilities | Trading blocs such as EAC | Space availability | Availability of labour | Infrastructure such as roads | Proximity to market |
|-------------------------------|----------|---------------|----------------|----------------------------|-----------|---------------------------|--------------------|------------------------|------------------------------|---------------------|
| Security                      | 1        | 0.086         | -0.028         | -0.142                     | -0.103    | -0.286                    | 0.072              | -0.189                 | -0.125                       | -0.2                |
| Raw materials                 | -0.09    | 1             | 0.303          | -0.108                     | 0.228     | 0.363                     | 0.037              | 0.407                  | 0.126                        | 0.58                |
| Host community                | -0.03    | 0.303         | 1              | 0.005                      | -0.07     | 0.403                     | -0                 | 0.107                  | -0.036                       | 0.27                |
| Gov'tt rules and regulation   | -0.14    | 0.108         | 0.005          | 1                          | 0.175     | 0.258                     | -0.14              | 0.018                  | -0.304                       | -0.4                |
| Utilities                     | -0.1     | 0.228         | -0.07          | 0.175                      | 1         | -0.18                     | 0.189              | 0.107                  | -0.097                       | -0.1                |
| Trading blocs such as EAC     | -0.29    | 0.363         | 0.403          | 0.258                      | -0.18     | 1                         | 0.065              | 0.356                  | 0.066                        | 0.16                |
| Space availability            | 0.072    | 0.037         | -0.001         | -0.137                     | 0.189     | 0.065                     | 1                  | 0.37                   | 0.289                        | 0                   |
| Availability of labour        | -0.19    | 0.407         | 0.107          | 0.018                      | 0.107     | 0.356                     | 0.37               | 1                      | 0.411                        | 0.29                |
| Infrastructure such as labour | -0.13    | 0.126         | -0.036         | -0.304                     | -0.097    | 0.066                     | 0.289              | 0.411                  | 1                            | 0.3                 |
| Proximity to market           | -0.21    | 0.584         | 0.272          | -0.376                     | -0.105    | 0.16                      | 0.002              | 0.291                  | 0.298                        | 1                   |



The next item from the factor analysis output is the Kaiser-Meyer-Olkin (KMO) and Bartlett's test. The KMO measures the sampling adequacy which should be greater than 0.5 for a satisfactory factor analysis to proceed. Looking at Table 4.4, the KMO measures is 0.503. From the table we can see that the Bartlett's test of Sphericity is significant.

**Table 4.4 KMO and Bartlett's Test (Location)**

|   |                         |         |
|---|-------------------------|---------|
| Kaiser-Meyer-Olkin Measure of Sampling Adequacy |                         | 0.503   |
| Bartlett's test of Sphericity                   | Approximate: Chi Square | 223.032 |
|   | Degree of Freedom       | 45      |
|   | Sig.                    | 0.000   |

Principal component analysis is used as a method of extraction as it seeks a linear combination of variable such that maximum variance is extracted from variables. It then removes the variance and seeks a second linear combination which explains the maximum proportion of the remaining variance.

From the results in Table 4.5 overleaf, R-mode factor analysis was used to cluster the variables as shown on the component matrix Table 4.6. Component loadings from the principal component analysis were used to explain the percent of variance in the variable explained in the factor. The component matrix Table 4.6 summarizes the loadings for the 10 location variables and the 5 components (Factors). Varimax Rotation was used to make it easy to identify each of the 10 variables with a single factor. Table 4.7 illustrates the rotated component matrix for the data.

**Table 4.5 Total Variance Explained**

| Component                      | Initial Eigenvalues |               |              | Rotation Sums of Squared Loadings |               |              |
|--------------------------------|---------------------|---------------|--------------|-----------------------------------|---------------|--------------|
|                                | Total               | % of Variance | Cumulative % | Total                             | % of Variance | Cumulative % |
| Host community                 | 2.6                 | 26            | 26           | 2.6                               | 26            | 26           |
| Proximity to market            | 1.64                | 16.396        | 42.396       | 1.64                              | 16.396        | 42.396       |
| Space availability             | 1.426               | 14.259        | 56.654       | 1.426                             | 14.259        | 56.654       |
| Security                       | 1.138               | 11.379        | 68.034       | 1.138                             | 11.379        | 68.034       |
| Utilities                      | 1.041               | 10.409        | 78.443       | 1.041                             | 10.409        | 78.443       |
| Trade bloc                     | 0.677               | 6.77          | 85.212       |                                   |               |              |
| Raw materials                  | 0.52                | 5.202         | 90.414       |                                   |               |              |
| Availability of labour         | 0.399               | 3.99          | 94.404       |                                   |               |              |
| Government rules & regulations | 0.363               | 3.632         | 98.036       |                                   |               |              |
| Infrastructures                | 0.196               | 1.964         | 100          |                                   |               |              |

Extraction Method: Principal Component Analysis

**Table 4.6 Component Matrix**

| Variable                        | Component |        |        |        |        |
|---------------------------------|-----------|--------|--------|--------|--------|
|                                 | 1         | 2      | 3      | 4      | 5      |
| Security                        | -0.021    | -0.023 | -0.023 | -0.902 | -0.052 |
| Raw materials                   | 0.556     | 0.521  | 0.104  | 0.126  | 0.453  |
| Host community                  | 0.797     | 0.128  | -0.063 | -0.154 | -0.042 |
| Government rules and regulation | 0.24      | -0.765 | -0.119 | 0.291  | 0.2    |
| Utilities like electricity      | -0.134    | -0.099 | 0.094  | 0.039  | 0.928  |
| Trading blocs such as EAC       | 0.77      | -0.168 | 0.217  | 0.343  | -0.181 |
| Space availability              | -0.012    | -0.073 | 0.818  | -0.274 | 0.152  |
| Availability of labour          | 0.303     | 0.122  | 0.715  | 0.272  | 0.152  |
| Infrastructure such as labour   | -0.146    | 0.394  | 0.661  | 0.218  | -0.253 |
| Proximity to market             | 0.311     | 0.818  | 0.056  | 0.23   | 0.036  |

Extraction Method: Principal Component Analysis

Rotation Method: Varimax with Kaiser Normalization

Rotation converged in 12 iterations

**Table 4.7 Rotated Component Matrix**

| Variable                        | Component |        |       |        |       |
|---------------------------------|-----------|--------|-------|--------|-------|
|                                 | 1         | 2      | 3     | 4      | 5     |
| Host community                  | 0.797     |        |       |        |       |
| Trading blocs such as EAC       | 0.77      |        |       |        |       |
| Proximity to market             |           | 0.818  |       |        |       |
| Raw materials                   | 0.556     | 0.521  |       |        |       |
| Government rules and regulation |           | -0.765 |       |        |       |
| Space availability              |           |        | 0.818 |        |       |
| Availability of labour          |           |        | 0.715 |        |       |
| Infrastructure such as labour   |           |        | 0.661 |        |       |
| Security                        |           |        |       | -0.902 |       |
| Utilities such as Electricity   |           |        |       |        | 0.928 |

Extraction Method: Principal Component Analysis

Rotation Method: Varimax with Kaiser Normalization

Rotation converged in 12 iterations

From the rotated component matrix above, it is clear that factors such as utilities, security, space availability, proximity to market and host community have the highest loading in their specific categories. These are therefore the factors that are considered significant in making warehouse location decisions.

The total variance table above shows the total variance of the components has been given. In the first column of the rotated component matrix table, the variable with the highest value is host community and therefore is the first component. The second component is proximity to market, the third component is space availability, fourth is security and the fifth is utilities. There were a total of ten factors under consideration. The total variance table indicates that only five factors attained Eigenvalues of more than 1. These are therefore considered as the most significant factors large scale manufacturing firms in Nairobi take into account when making warehouse location decisions.

#### 4.2.2.2 Warehouse Design Factor Analysis

The sub-section under section B of the questionnaires was used to identify the factors considered by large scale manufacturing firms in making warehouse design decisions in Nairobi. To answer this research question, 10 factors (explanatory variables) were identified as possible factors that influence warehouse design decisions.

**Table 4.8 Correlation matrix**

| Variable                           | Product type | Material handling systems | Space available | Accessibility | Safety | Cost effectiveness | Throughput | Separation of receiving and shipping | Floor type | The flow of products |
|------------------------------------|--------------|---------------------------|-----------------|---------------|--------|--------------------|------------|--------------------------------------|------------|----------------------|
| Product type                       | 1            | -0.006                    | 0.083           | 0.023         | 0.122  | -0.131             | -0.022     | -0.117                               | 0.18       | 0.059                |
| Material handling systems          | 0.006        | 1                         | 0.533           | -0.048        | 0.064  | -0.076             | -0.072     | 0.029                                | 0.305      | 0.217                |
| Space available                    | 0.083        | 0.533                     | 1               | 0.074         | 0.111  | -0.029             | 0.029      | -0.017                               | 0.603      | 0.22                 |
| Accessibility                      | 0.023        | -0.048                    | 0.074           | 1             | 0.015  | -0.142             | -0.038     | 0.503                                | 0.168      | 0.051                |
| Safety                             | 0.122        | -0.064                    | -0.111          | 0.015         | 1      | -0.035             | 0.008      | 0.136                                | -0.13      | 0.509                |
| Cost effectiveness                 | 0.131        | -0.076                    | -0.029          | -0.142        | 0.035  | 1                  | -0.091     | -0.088                               | 0.216      | -0.01                |
| Throughput                         | 0.022        | -0.072                    | 0.029           | -0.038        | 0.008  | -0.091             | 1          | -0.062                               | 0.024      | 0.122                |
| Separation of receiving & shipping | 0.117        | 0.029                     | -0.017          | 0.503         | 0.136  | -0.088             | -0.062     | 1                                    | -0.01      | 0.166                |
| Floor type                         | 0.18         | 0.305                     | 0.603           | 0.168         | 0.134  | 0.216              | 0.024      | -0.011                               | 1          | 0.24                 |
| The flow of products               | 0.059        | 0.217                     | 0.22            | 0.051         | 0.509  | -0.01              | 0.122      | 0.166                                | 0.24       | 1                    |

The correlation matrix in Table 4.8 above was derived to give the correlation coefficients between each single design variable and every other variable in the investigation. Correlations between all possible pair of variables in the analysis are obtained. The diagonal elements which are all 1.000 are omitted. The correlation matrix below indicates that there are a few factors that have a strong positive correlation. Space availability verses material handling system, separation of receiving verses shipping and accessibility, floor type verses space availability as well as flow of products verses safety.

One of the objectives of this study was to determine the factors that influence warehouse design among large scale manufacturing firms in Nairobi. With the use of the factor analysis, the tests employed the use of Kaiser Meyer-Olkin (KMO) and Barlett’s Test. In this case, KMO measures the sampling adequacy which should be greater than 0.5 for a satisfactory analysis to proceed. From the analysis, the KMO measure was 0.506, an indication that the Barlett’s Test of sphericity is significant.

**Table 4.9 KMO and Bartlett's Test**

|   |                        |         |
|---|------------------------|---------|
| Kaiser-Meyer-Olkin Measure of Sampling Adequacy |                        | .506    |
| Bartlett's Test of Sphericity                   | Approx. Chi-Square     | 170.715 |
|   | Degree of freedom (df) | 45      |
|   | Sig                    | .000    |

All the ten factors were given Eigenvalues as shown in the total variance explained in Table 4.10. In order to determine the number of factors to retain, the factors with eigenvalues greater or equal to one were considered to be the most significant determinants of warehouse design decisions and were retained. These factors therefore include the variables from component 1 to 5 five (Space availability, Accessibility, Safety, Cost effectiveness and Product type) respectively. Therefore, according to this study, these are the factors which large scale manufacturing firms in Nairobi should consider in making warehouse design decisions.

**Table 4.10 Total Variance Explained**

| Component                          | Initial Eigenvalues |               |              | Rotation Sums of Squared Loadings |               |              |
|------------------------------------|---------------------|---------------|--------------|-----------------------------------|---------------|--------------|
|                                    | Total               | % of Variance | Cumulative % | Total                             | % of Variance | Cumulative % |
| Space availability                 | 2.158               | 21.582        | 21.582       | 2.158                             | 21.582        | 21.582       |
| Accessibility                      | 1.675               | 16.748        | 38.33        | 1.675                             | 16.748        | 38.33        |
| Safety                             | 1.396               | 13.962        | 52.292       | 1.396                             | 13.962        | 52.292       |
| Cost effectiveness                 | 1.143               | 11.428        | 63.72        | 1.143                             | 11.428        | 63.72        |
| Product type                       | 1.047               | 10.472        | 74.192       | 1.047                             | 10.472        | 74.192       |
| Floor type                         | 0.996               | 9.961         | 84.154       |                                   |               |              |
| Separation of receiving & shipping | 0.524               | 5.24          | 89.393       |                                   |               |              |
| Flow of product                    | 0.407               | 4.074         | 93.468       |                                   |               |              |
| Material handling                  | 0.378               | 3.777         | 97.244       |                                   |               |              |
| Throughput                         | 0.276               | 2.756         | 100          |                                   |               |              |

Extraction Method: Principal Component Analysis

From the result in Table 4.10, the R-mode factor analysis was used to cluster the variables as shown on the component matrix Table 4.11. Component loadings from the principal component analysis were used to explain the percent of variance in the variable explained in the factor. The component matrix Table 4.11 summarizes the loadings for the 10 design variables and the 5 components (Factors). Varimax Rotation was used to make it easy to identify each of the 10 variables with a single factor. Table 4.12 illustrates the rotated component matrix for the data.

**Table 4.11 Component Matrix**

| Variable                             | Component |        |        |        |        |
|--------------------------------------|-----------|--------|--------|--------|--------|
|                                      | 1         | 2      | 3      | 4      | 5      |
| Product type                         | 0.083     | -0.082 | 0.103  | -0.015 | 0.914  |
| Material handling systems            | 0.722     | -0.015 | 0.037  | -0.13  | -0.068 |
| Space available                      | 0.883     | 0.022  | -0.006 | -0.06  | 0.055  |
| Accessibility                        | 0.077     | 0.859  | -0.042 | -0.011 | 0.093  |
| Safety                               | -0.209    | 0.052  | 0.869  | 0.002  | 0.138  |
| Cost effectiveness                   | 0.067     | -0.235 | 0.085  | 0.794  | -0.327 |
| Throughput                           | 0.068     | -0.2   | 0.151  | -0.637 | -0.279 |
| Separation of receiving and shipping | -0.026    | 0.839  | 0.174  | 0.002  | -0.178 |
| Floor type                           | 0.792     | 0.06   | 0.031  | 0.263  | 0.132  |
| The flow of products                 | 0.306     | 0.072  | 0.841  | -0.068 | -0.04  |

Extraction Method: Principal Component Analysis

Rotation Method: Varimax with Kaiser Normalization

Rotation converged in 12 iterations

**Table 4.12 Rotated Component Matrix**

| Variable                             | Component |       |       |        |       |
|--------------------------------------|-----------|-------|-------|--------|-------|
|                                      | 1         | 2     | 3     | 4      | 5     |
| Space available                      | 0.883     |       |       |        |       |
| Floor type                           | 0.792     |       |       |        |       |
| Material handling systems            | 0.722     |       |       |        |       |
| Accessibility                        |           | 0.859 |       |        |       |
| Separation of receiving and shipping |           | 0.839 |       |        |       |
| Safety                               |           |       | 0.869 |        |       |
| The flow of products                 |           |       | 0.841 |        |       |
| Cost effectiveness                   |           |       |       | 0.794  |       |
| Throughput                           |           |       |       | -0.637 |       |
| Product type                         |           |       |       |        | 0.914 |

Extraction Method: Principal Component Analysis

Rotation Method: Varimax with Kaiser Normalization

Rotation converged in 12 iteration

#### 4.2.3 Warehouse location and design challenges

This sub-section sought to investigate the challenges that large scale manufacturing firms in Nairobi encounter when making their warehouse location and design decisions. The findings from the respondents were analyzed with the use of descriptive statistics involving the use of mean and standard deviation in determining the challenges faced by large scale manufacturing firms in Nairobi. To answer the questions, 12 challenges for both location and design were identified as possible challenges faced by large scale manufacturing firms in making their warehouse location and design decisions.

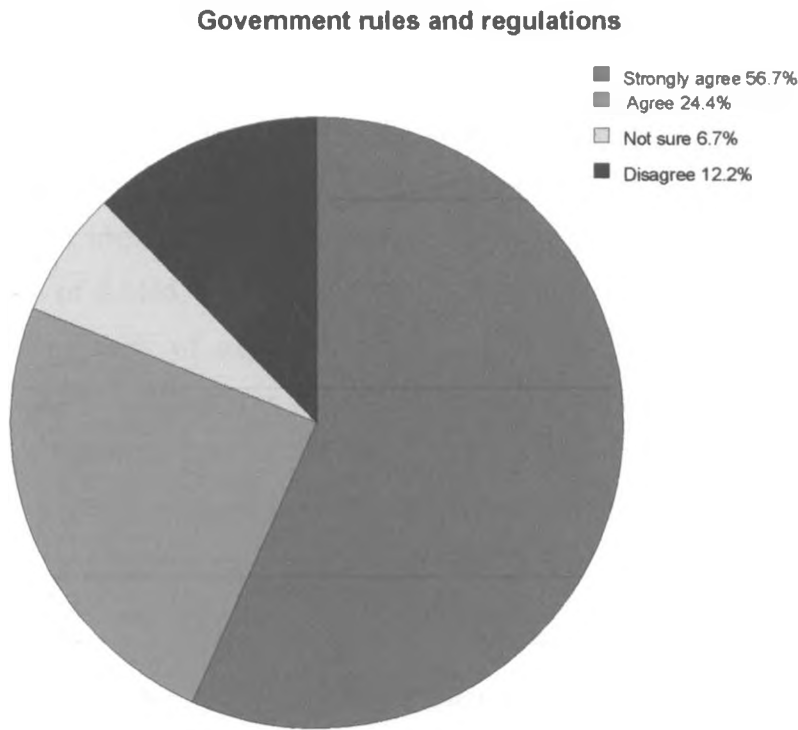
**Table 4.13 Descriptive Statistics (Warehouse Location Challenges)**

| Factor                                 | Mean   | Standard deviation |
|--|--------|--------------------|
| Space availability                     | 4.8111 | 0.393              |
| Lack of expertise                      | 4.5556 | 0.6876             |
| Lack of reliable source of information | 4.5556 | 0.5419             |
| Poor transportation network            | 4.5556 | 0.5419             |
| Government rules and regulations       | 4.2556 | 1.0322             |
| Globalization                          | 3.8333 | 1.2545             |

score of 4.5556, followed by lack of expertise at 4.5111. The findings indicate that these two are the major challenge faced in making warehouse design decisions. The overall warehouse structure with a mean score of 4.1333 is the lowest challenge faced by large scale manufacturing firms in making warehouse design decisions.

It was also established from the study that government rules and regulations posed a challenge to large scale manufacturing firms in constructing warehouses. The mean score indicating the challenge experience from government rules and regulation in making both location and design decisions are 4.2556 and 4.2222 respectively. The pie chart below indicates the response rate by respondents. From the findings of the study, 56.7% of the respondents indicated that they considered government rules and regulations as a challenge when making warehouse location and design decisions. The difference between the highest and lowest mean score for the warehouse design challenges is 0.4223. This is an indication that all the warehouse design challenges should thoroughly be considered when making warehouse design decisions.

**Figure 4.2**



**Table 4.14 Descriptive Statistics (Warehouse Design Challenges)**

| <b>Factor</b>                    | <b>Mean</b> | <b>Standard deviation</b> |
|----------------------------------|-------------|---------------------------|
| Financial resources              | 4.5556      | 0.7648                    |
| Lack of expertise                | 4.5111      | 0.7059                    |
| Space availability               | 4.3889      | 0.5002                    |
| Government rules and regulations | 4.3778      | 0.8139                    |
| Equipment                        | 4.2222      | 0.9199                    |
| Overall warehouse structure      | 4.1333      | 1.0006                    |

Descriptive statistics captured in Table 4.13 and 4.14 above are derived from the analysis of warehouse location and design challenges indicated through the means and standard deviation. The mean scores in the tables below are arranged in order of highest to lowest. The highest mean score indicating the highest challenge faced by large scale manufacturing firms in making warehouse location and design decisions. The Lowest mean score indicates a minimum challenge faced by the manufacturing firms in making their warehouse location and design decisions.

The findings in Table 4.13 indicate the challenges face in making warehouse location decision revealed that space availability has the highest mean score of 4.8111, follow by lack of expertise, lack of reliable source of information and poor transportation network all with the mean score at 4.5556. The analysis revealed that these are the variables which posed the highest challenge to large scale manufacturing firms in making warehouse location decision. The difference between the highest challenge identified through the analysis of the data and the subsequent ones that follow had a mean of 0.2445. This shows that the difference is not significant. Therefore, the availability of space, lack of expertise, lack of reliable source of information and poor transportation network are all major challenges faced by large scale manufacturing firms in making warehouse location decisions in Nairobi. Globalization has the lowest mean score at 3.8333 indicating a minimum challenge in making warehouse location decision. The difference between the highest and lowest mean score is 0.9778.

The descriptive statistics in Table 4.14 indicates the findings of the challenges faced by large scale manufacturing firms in making warehouse design decisions. Through the application of the mean and standard deviation, it was revealed that financial resources have the highest mean



### 4.3 Discussion and Interpretation of Findings and Results

The results of this study reflect that the respondents viewed all the twenty factors and the twelve challenges in warehouse location and design decisions by large scale manufacturing firms in Nairobi. A detailed examination of all the factors and challenges were undertaken for deriving authentic conclusion.

The evaluation of the factors that influence warehouse location and design decisions is a high priority for research over the years. Researchers have examined the various impact of the factors in developed countries. However, existing studies devoted to assessing factors influencing warehouse location and design decision are on the increase in Nairobi. This study complements existing literature by focusing on the determination of factors of importance in influencing the warehouse location and design decisions.

Using the following information from the tables above, Table 4.15 and 4.16 were produced to provide an interpretation which can be used to answer the overall purpose of this research, which was to determine the factors that influence warehouse location and design decisions among large scale manufacturing firms in Nairobi.

Following the analysis, 10 factors from both location and design were derived (for Location: host community, proximity to market, space availability, security and utilities. For design: space availability, accessibility, safety, cost effectiveness and product type). By looking at the 10 labels derived from the factors for both location and design, it is possible to interpret the important role of these factors to the large scale manufacturing firms in making warehouse location and design decisions.

**Table 4.15 Interpretation of the Location components**

| Type     | Component | Factors                       |
|----------|-----------|-------------------------------|
| Location | 1         | Host community                |
|          | 2         | Proximity to market           |
|          | 3         | Space availability            |
|          | 4         | Security                      |
|          | 5         | Utilities such as electricity |

Source: Researcher (2012)

**Table 4.16 Interpretation of the Design components**

| Type   | Component | Factors            |
|--------|-----------|--------------------|
| Design | 1         | Space availability |
|        | 2         | Accessibility      |
|        | 3         | Safety             |
|        | 4         | Cost effectiveness |
|        | 5         | Product type       |

Source. Researcher (2012)

Host community's interest in having the warehouse in its midst is required for obtaining products and services at a competitive advantage over those outside of the vicinity of the firms operations. Local educational facilities and the broader issue of quality of life are also important. The environmental regulations put in place greatly influence the relationship with the local community. Proximity to market implies that locations of warehouses are planned in close proximity to the markets or consumption centers for offering better service to the customers. Frequent deliveries with small quantities as required by the customers can be organized due to limited geographical area coverage. The availability of warehousing space in the urban area, particularly in metros at cheaper rates, is a remote possibility. In a case the site has to be shifted beyond the municipal city limit where storage space is available at a considerably cheaper rate. However, this arrangement may add to the transportation cost. The roles of utilities (such as electricity) on the location of a warehouse seriously impact the effective and efficient operation. The provisions of public utilities enable manufacturing firms to add value to performance, reduce cost and provide quality products.

Security as a factor in warehouse location is essential in ensuring the stability of the site in which the warehouse is to be housed. Large scale manufacturing firms need to consider variables which may greatly impact the security of their operations. Conditions such as political, economic and social stabilities must be considered as a security factor in making a location decision. A well designed security system will bar unauthorized access to the inventory ensuring protection against pilferage and theft.

In the context of the design of a warehouse, space availability relates to the proper design of storage space scheme which can result in a substantial saving on the available space. This helps in planning for additional storage load without any investment in space. Accessibility as a factor

of design decision among large scale manufacturing firms addresses the following questions: How frequently will the warehouse be accessed, by who and when? How often will you require access to your products? Will shipping and receiving be frequent and steady or only occasional? Access to a warehouse has the greatest effect on the primary transportation cost. Difficulties in access to a warehouse will have an influence on the transportation cost.

Safety in relations to the design of a warehouse environment should ensure the safety of the people, product, and equipment and during product storage and movement. Sharp blind bends in the movement paths of equipment in the warehouse should be avoided. The layout should ensure ease in proper supervision to detect pilferage or stealing of the stored materials. A clean and safe working condition indirectly helps in increasing labour productivity of a warehouse. Hence, a warehouse layout planning should begin with keeping in mind housekeeping as an important objective. A well designed system will bar unauthorized access to the inventory ensuring security against theft and pilferage. This system will also reduce the accidents due to fatigue, strain and collapse of the equipment. As the number of product handlings is reduced, the risk of damage of the products is greatly minimized. The single most important measure for safety is information - make sure that all personnel in the warehouse are aware of safety issues by disseminating information. One way to do this is to post signage announcing various considerations. For instance, mark aisles concerning clearance limits, post floor loading capacity concerning joisted floors, post No Smoking signs in high visibility areas, and identify correct lifting and materials handling techniques through posters and other signage.

The objective of cost effectiveness as a factor in determining the design of a warehouse relates to select a design with the lowest total cost in meeting the overall objective of management in the conduct of its operations. The product type relates to the nature of a product which will primarily decide on the design of the warehouse required for the storage of goods. The type of product will have a profound effect on the number of warehouses and their location and design. For instance, perishable agro products will obviously require a temperate-controlled facility, while hazardous or explosive products will call for extra safety and handling requirements during storage as per the regulations. Additionally, perishable products need to be delivered to the consumer within their expiry period and hence they should be located near consumption centers. Warehouse with

a delivery limitation and geographical reach should be small and numerous. In designing the layout of the warehouse, it is essential to use space wisely so that it is possible to store the most products in the smallest space without sacrificing safety or organization. Doing this will enhance the efficiency of the warehouse.

The evaluation of the challenges faced in warehouse location and design decisions is a high priority for research over the years. Researchers have examined the different impact of the forces that affect manufacturing firms in making their warehouse location and design decisions. However, existing studies devoted to assessing factors that influencing warehouse location and design decision is on the increase in Nairobi.

According to Owen and Daskin (1998), when determining the location of a warehouse, there are a number of challenges that firms must overcome. Determining a suitable location which can serve the customers efficiently and effectively is not an easy task. Firms must be able to come up with a location that can not affect the business. This study complements existing literature by focusing on the determination the challenges faced by manufacturing firms in making warehouse location and design decisions. Space availability and lack of expertise by the manufacturing firm remain major challenges to manufacturing firms in their warehouse location decisions. Others locational challenges include lack of reliable source of information and poor transportation network.

The major challenges also faced by manufacturing firms in their warehouse design decisions process include lack of expertise of the firm in making a better design decision and available space. The challenges in warehouse design vary greatly throughout industries. Some challenges experienced by firms include the availability and costs of buildings, land and personnel, not only presently, but also in the future; can differ greatly depending on the country and even the region. Locally, it will take many more years before these differences will have diminished (Dermout and Kuijk, 2005).

## **CHAPTER FIVE: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS**

### **5.1 Summary of findings**

The aim of this study was to establish the factors that determine warehouse location and design decisions among large manufacturing firms in Nairobi. The objectives of the study were: To determine the factors that influence warehouse location among large scale manufacturing firms in Nairobi, Kenya; To determine the factors that influence warehouse design decisions among large scale manufacturing firms in Nairobi, Kenya; To determine the challenges in the location of warehouses among large scale manufacturing firms in Nairobi and to determine the challenges of warehouse design among large scale manufacturing firms in Nairobi. Thereafter, established the most important factors which large scale manufacturing firms are required to focus on.

#### **5.1.1 Factors determining warehouse location decisions**

A number of factors were examined to establish whether large manufacturing firms in Nairobi considered them as determinants of warehouse location decisions. The study established that the host community, proximity to market, space availability, Security and utilities (such as electricity) are areas which are given serious consideration when making warehouse location decisions. Security of both the products and the employees are important and therefore companies usually analyze the security situation before arriving at location of choice. . Of great significance too, is the infrastructure such as road network which most of the firms considered to be very important in making location decisions since it determines smooth flow of products.

#### **5.1.2 Factors determining warehouse design decisions**

There are a number of factors that were identified from the study which are very significant in the design of a warehouse by large manufacturers in Nairobi. The type of the products that will be inventoried matter so much to most of the firms. Products have different shapes and even forms; some are perishable whereas others are not, hence the need to consider the product type when making design decisions. The space available for the warehouse will also determine its design. A firm can only design its warehouse to fit the available space.

Most firms also indicated that they consider accessibility of the warehouse when making design decisions. If a warehouse is designed in a way that can make it inaccessible, it is likely to derail the movement of inventory. Safety is another important factor to be considered in warehouse design. Manufacturing firms indicated that they have to consider the safety of the employees who will work in the warehouse and that they also comply with government requirements on safety measures when designing their warehouses. Throughput was also found out to one of the factors that firms must consider when making warehouse design decisions. It was also noted that firms consider the separation of loading and offloading when they make warehouse location decisions. This enables them to decongest the warehouse and provide fast services. The flow of products was also considered as an important factor in making warehouse design decisions.

### **5.1.3 Challenges in warehouse location and design**

A number of challenges were identified that affect warehouse location and design decisions. Lack of expertise in warehouse design and location is a challenge when making location and design decisions among large manufacturers in Nairobi. Getting reliable sources of information in order to be able to make prudent location and design decisions is also a challenge to most large manufacturing firms in Nairobi. Government requirements in locating and designing a warehouse were noted as a challenge too.

Availability of space for warehouse construction is also a major challenge among large manufacturing firms in Nairobi. Space is scarce to find in Nairobi and is expensive when found. Companies consider this as one the major challenges in warehouse location and design. There are also few experts who are qualified in the area of warehouse design. This makes it difficult for firms to make informed warehouse design decisions. The last challenge is the financial resources required in the location and design of a warehouse. This is a costly undertaking and most firms find it challenging

The study also indicated that infrastructure such as transport network are a big challenge to warehouse location and design decisions. Without a proper transport network, products may not be able to move smoothly through the supply chain. This makes it difficult for most of the companies to locate their warehouses in areas with poor infrastructure. Additionally, most

companies are already feeling the effects of globalization and Kenyan large manufacturers are no exception. It was noted that a good number of firms were concerned that globalization was a challenge in making warehouse location decisions.

## **5.2 Conclusions**

The study suggests that large scale manufacturing firms can determine their warehouse location and design using the 10 labels or factors identified to predict reasons for making warehouse decisions. It can be concluded that there are several factors that determine the warehouse location decisions among large manufacturing firms in Nairobi: However the factor analysis conducted came up with five significant factors each that determine the location and design of a warehouse by large scale manufacturers in Nairobi. These factors include: Host community, proximity to the market, space availability, security and utilities. Factors such as space available, Accessibility, Safety, Cost effectiveness and Product type were identified as determinants of warehouse design. These were the factors given a lot of significance from the factor analysis conducted.

The most dominant challenges in warehouse location and design decisions include: lack of people with expert knowledge in warehouse location and design; inability to access reliable sources of information; scarcity of space in Nairobi and financial resources. In order for a better and successful warehouse location and design decisions, large scale manufacturing firms need to develop strategies in meeting customer satisfaction, improving operational performance, and value added at the lowest cost in overcoming these challenges.

## **5.3 Recommendations**

Based on the findings of the study, the researcher was able to come up with the following recommendations:

Large manufacturers in Nairobi should ensure that they engage services of qualified individuals who can assist in making informed warehouse location and design decisions. This will assist them to avoid making location and design related mistakes.

The government of Kenya should also ensure availability of enough security and provide good infrastructure in order to assist the large manufacturers in making proper warehouse location and design decisions.

Utilities such as water and electricity should be made available so that large manufacturers will not have a problem trying to identify suitable places to locate their warehouses. The government rules and regulations need to be amended to attract more investments into warehousing activities.

#### **5.4 Limitations of the Study**

The study findings were concluded on the basis of the strategic responses to a changing environment of the large scale manufacturing firms in Nairobi only. The findings can therefore not be generalized to all organizations. Another challenge faced was the administration of the questionnaires. The fact that the intended mode of the data collection was to furnish the respondents with questionnaires and get them back immediately was not possible. Therefore, the questionnaires were dropped and picked after some days and this meant that the control to who filled the questionnaires could not be verified. Scarcity of funds was another limitation. The limitations therefore dictated the number of respondents and the duration of the study.

#### **5.5 Suggestions for further research**

This study was only able to address warehouse location and design decisions among large manufacturers in Nairobi. It will be necessary to carry out a study featuring other areas outside Nairobi in order to find out if there are any similarities and differences in the findings of this study.

It will also be important to do a comparative study with another country both in the developed and developing world to ascertain the similarities and differences in warehouse location and design decisions. Firms do not necessarily own warehouses but do at times outsource the service. There is need to carry out a study on the warehousing trends among large manufacturers in Nairobi.



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## APPENDICES

### Appendix I: Questionnaire

#### Introduction

This questionnaire is designed to collect data on warehouse location and design among large scale manufacturers in Nairobi. Kindly respond to the questions honestly by ticking the most appropriate responses. The information you provide will be treated with a high degree of confidentiality.

#### SECTION A: DEMOGRAPHIC INFORMATION.

1. Gender:

- Male                       Female

2. Age:

- 20-24                       25-30  
 31-35                       36-40  
 41-45                       46-50  
 50 and above

3. Academic Qualification

- College certificate                       College/University Diploma  
 Bachelors Degree                       Masters Degree  
 Other (specify).....

4. For how long have you worked in this company?

- Less than 1 year       1-2 year       3-5 years       More than 5 years

5. How long have you served as a manager in this company?

- Less than 1 year       1-2 year       3-5 years       More than 5 years

## SECTION B: LOCATION AND DESIGN OF WAREHOUSES

I) kindly indicate to what extent you agree with the following statements concerning factors that determine warehouse location in your organization.

Use the scale of:

1. Strongly disagree
2. Disagree
3. Not sure
4. Agree
5. Strongly Agree

| No. |  | 1 | 2 | 3 | 4 | 5 |
|-----|--|---|---|---|---|---|
| 1   | Security is an important factor to consider in location                            |   |   |   |   |   |
| 2   | Availability of raw materials determines location decisions                        |   |   |   |   |   |
| 3   | The host community is always considered before making location decisions           |   |   |   |   |   |
| 4   | Government rules and regulations must be adhered to                                |   |   |   |   |   |
| 5   | Utilities such as electricity are important in warehouse location                  |   |   |   |   |   |
| 6   | Trading blocs, e.g. EAC, ECOWAS play an important role in warehouse location       |   |   |   |   |   |
| 7   | Space availability is considered in warehouse location                             |   |   |   |   |   |
| 8   | Availability of labour must be considered in warehouse location                    |   |   |   |   |   |
| 9   | Infrastructure such as roads and railways are very important in warehouse location |   |   |   |   |   |
| 10  | Proximity to market is a determinants in warehouse location                        |   |   |   |   |   |

11. Other than the factors mentioned above, List any other factors that your company considers in making warehouse location decisions.

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II) To what extent do you agree with the following statements concerning the factors that influence warehouse design decisions among manufacturing firms in Nairobi?

Use the scale of:

1. Strongly disagree
2. Disagree
3. Not sure
4. Agree
5. Strongly Agree

| No. |   | 1 | 2 | 3 | 4 | 5 |
|-----|---|---|---|---|---|---|
| 1   | The firm considers the type of products in warehouse design decisions                       |   |   |   |   |   |
| 2   | Material handling systems are important in design decisions                                 |   |   |   |   |   |
| 3   | Space is an important consideration in warehouse design                                     |   |   |   |   |   |
| 4   | Warehouses should be designed to permit accessibility                                       |   |   |   |   |   |
| 5   | Safety is factored when designing warehouses  |   |   |   |   |   |
| 6   | The design for warehouses takes into consideration cost-effectiveness                       |   |   |   |   |   |
| 7   | Throughput is one of the factors considered in designing warehouses                         |   |   |   |   |   |
| 8   | Separation of receiving and shipping is important to avoid congestion at loading dock areas |   |   |   |   |   |
| 9   | Proper floor types are an important consideration in the warehouse design                   |   |   |   |   |   |
| 10  | One of the key factors of warehouse design is the flow                                      |   |   |   |   |   |



11. Other than the factors mentioned above, List any other factors that your company considers in a warehouse design decision.

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III) Please indicate the extent to which you agree with the following statements concerning the challenges of warehouse location decisions among manufacturing firms.

Use the scale of:

1. Strongly disagree
2. Disagree
3. Not sure
4. Agree
5. Strongly Agree

| No. |  | 1 | 2 | 3 | 4 | 5 |
|-----|--|---|---|---|---|---|
| 1   | Lack of expertise in location decisions affects the nature of decisions made               |   |   |   |   |   |
| 2   | Lack of reliable sources of information hinders effective location decisions               |   |   |   |   |   |
| 3   | Government rules and regulations are a major challenge to location decisions               |   |   |   |   |   |
| 4   | Globalization has made location decisions more complicated                                 |   |   |   |   |   |
| 5   | Poor transportation networks seriously hinder the location of a warehouse                  |   |   |   |   |   |
| 6   | Availability of space for warehouse construction is a challenge especially in large cities |   |   |   |   |   |

7. Kindly mention any other challenges that your organization faces when making warehouse location decisions

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IV) Please indicate the extent to which you agree with the following statements concerning the challenges of warehouse design among manufacturing firms.

Use the scale of:

1. Strongly disagree
2. Disagree
3. Not sure
4. Agree
5. Strongly Agree

| No. |  | 1 | 2 | 3 | 4 | 5 |
|-----|--|---|---|---|---|---|
| 1   | Lack of expertise in design affects the nature of decisions made                   |   |   |   |   |   |
| 2   | Government rules and regulations are a major challenge to design decisions         |   |   |   |   |   |
| 3   | Space availability in the preferred places is usually a challenge                  |   |   |   |   |   |
| 4   | One of the most common warehouse design problem is the overall warehouse structure |   |   |   |   |   |
| 5   | The equipment to be used in a warehouse largely affect the design                  |   |   |   |   |   |
| 6   | Financial resources affect the warehouse design                                    |   |   |   |   |   |

7. Kindly mention any other challenges that your organization faces when making warehouse design decisions

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**Thank you for your participation**

**APPENDIX II: LARGE SCALE MANUFACTURING FIRMS IN NAIROBI, KENYA**

| <b>Sector: Building, Construction and Mining (6)</b> |                                 |
|--|---------------------------------|
| Central Glass Industries Ltd                         | Kenya Builders & Concrete Ltd   |
| Karsan Murji & Company Limited                       | Manson Hart Kenya Ltd           |
| Kenbro Industries Ltd                                | Mombasa Cement Ltd              |
|  |                                 |
| <b>Sector: Food, Beverages and Tobacco (100)</b>     |                                 |
| Africa Spirits Ltd                                   | Highlands Mineral Water Co. Ltd |
| Agriner Agricultural Development Limited             | Homeoil                         |
| Belfast Millers Ltd                                  | Insta Products (EPZ) Ltd        |
| Bidco Oil Refineries Ltd                             | Jambo Biscuits (K) Ltd          |
| Bio Foods Products Limited                           | Jetlak Foods Ltd                |
| Breakfast Cereal Company(K) Ltd                      | Karirana Estate Ltd             |
| British American Tobacco Kenya Ltd                   | Kenafriic Industries Limited    |
| Broadway Bakery Ltd                                  | Kenblest Limited                |
| C. Czarnikow Sugar (EA) Ltd                          | Kenya Breweries Ltd             |
| Cadbury Kenya Ltd                                    | Kenya Nut Company Ltd           |
| Centrofood Industries Ltd                            | Kenya Sweets Ltd                |
| Coca cola East Africa Ltd                            | Nestle Kenya Ltd                |
| Confec Industries (E.A) Ltd                          | Nicola Farms Ltd                |
| Corn Products Kenya Ltd                              | Palmhouse Dairies Ltd           |
| Crown Foods Ltd                                      | Patco Industries Limited        |
| Cut Tobacco (K) Ltd                                  | Pearl Industries Ltd            |
| Deepa Industries Ltd                                 | Pembe Flour Mills Ltd           |

|                                |                                 |
|--------------------------------|---------------------------------|
| Del Monte Kenya Ltd            | Premier Flour Mills Ltd         |
| East African Breweries Ltd     | Premier Food Industries Limited |
| East African Sea Food Ltd      | Proctor & Allan (E.A.) Ltd      |
| Eastern Produce Kenya Ltd      | Promasidor (Kenya) Ltd          |
| Farmers Choice Ltd             | Trufoods Ltd                    |
| Frigoken Ltd                   | UDV Kenya Ltd                   |
| Giloil Company Limited         | Unga Group Ltd                  |
| Glacier Products Ltd           | Usafi Services Ltd              |
| Global Allied Industries Ltd   | Uzuri foods Ltd                 |
| Global Beverages Ltd           | ValuePak Foods Ltd              |
| Global Fresh Ltd               | W.E. Tilley (Muthaiga) Ltd      |
| Gonas Best Ltd                 | Kevian Kenya Ltd                |
| Hail & Cotton Distillers Ltd   | Koba Waters Ltd                 |
| Al-Mahra Industries Ltd        | Kwality Candies & Sweets Ltd    |
| Alliance One Tobacco Kenya Ltd | Lari Dairies Alliance Ltd       |
| Alpha Fine Foods Ltd           | London Distillers (K) Ltd       |
| Alpine Coolers Ltd             | Mafuko Industries Ltd           |
| Annum Trading Company Limited  | Manji Food Industries Ltd       |
| Aquamist Ltd                   | Melvin Marsh International      |
| Brookside Dairy Ltd            | Kenya Tea Development Agency    |
| Candy Kenya Ltd                | Mini Bakeries (Nbi) Ltd         |
| Capwell Industries Ltd         | Miritini Kenya Ltd              |
| Carlton Products (EA) Ltd      | Mount Kenya Bottlers Ltd        |
| Chirag Kenya Limited           | Nairobi Bottlers Ltd            |
| E & A Industries Ltd           | Nairobi Flour Mills Ltd         |
| Kakuzi Ltd                     | NAS Airport Services Ltd        |

|   |                                      |
|---|--------------------------------------|
| Erdemann Co. (K) Ltd                    | Rafiki Millers Ltd                   |
| Excel Chemical Ltd                      | Razco Ltd                            |
| Kenya Wine Agency Limited               | Re-Suns Spices Limited               |
| Highlands Canner Ltd                    | Smash Industries Ltd                 |
| Super Bakery Ltd                        | Softa Bottling Co. Ltd               |
| Sunny Processor Ltd                     | Spice World Ltd                      |
| Spin Knit Dairy Ltd                     | Wrigley Company (E.A.) Ltd           |
| <b>Sector: Chemical and Allied (62)</b> |                                      |
| Anffi Kenya Ltd                         | Crown Berger Kenya Ltd               |
| Basco Product (K) Ltd                   | Crown Gases Ltd                      |
| Bayer East Africa Ltd                   | Decase Chemical (Ltd)                |
| Continental Products Ltd                | Deluxe Inks Ltd                      |
| Cooper K- Brands Ltd                    | Desbro Kenya Limited                 |
| Cooper Kenya Limited                    | E. Africa Heavy Chemicals (1999) Ltd |
| Beiersdorf East Africa td               | Elex Products Ltd                    |
| Blue Ring Products Ltd                  | European Perfumes & Cosmetics Ltd    |
| BOC Kenya Limited                       | Galaxy Paints & Coating Co. Ltd      |
| Buyline Industries Limited              | Grand Paints Ltd                     |
| Carbacid (CO2) Limited                  | Henkel Kenya Ltd                     |
| Chemicals & Solvents E.A. Ltd           | Imaging Solutions (K) Ltd            |
| Chemicals and Solvents E.A. Ltd         | Interconsumer Products Ltd           |
| Coates Brothers (E.A.) Limited          | Odex Chemicals Ltd                   |
| Coil Products (K) Limited               | Osho Chemicals Industries Ltd        |
| Colgate Palmolive (E.A) Ltd             | PolyChem East Africa Ltd             |

|  |                                   |
|--|-----------------------------------|
| Johnson Diversity East Africa Limited                  | Procter & Gamble East Africa Ltd  |
| Kel Chemicals Limited                                  | PZ Cussons Ltd                    |
| Kemia International Ltd                                | Royal Trading Co. Ltd             |
| Ken Nat Ink & Chemical Ltd                             | Reckitt Benckiser (E.A) Ltd       |
| Magadi Soda Company Ltd                                | Revolution Stores Co. Ltd         |
| Maroo Polymers Ltd                                     | Soilex Chemical Ltd               |
| Match Masters Ltd                                      | Strategic Industries Limited      |
| United Chemical Industries Ltd                         | Supa Brite Ltd                    |
| Oasis Ltd  | Unilever Kenya Ltd                |
| Rumorth EA Ltd   | Murphy Chemical E.A Ltd           |
| Rumorth East Africa Ltd                                | Syngenta East Africa Ltd          |
| Sadolin Paints (E.A.) Ltd                              | Synresins Ltd                     |
| Sara Lee Kenya Limited                                 | Tri-Clover Industries (K) Ltd     |
| Saroc Ltd  | Twiga Chemical Industries Limited |
| Super Foam Ltd   | Vitafoam Products Limited         |
| <b>Sector: Energy, Electrical and Electronics (42)</b> |                                   |
| A.I Records (Kenya) Ltd                                | East African Cables Ltd           |
| Amedo Centre Kenya Ltd                                 | Eveready East Africa Limited      |
| Assa Abloy East Africa Ltd                             | Frigorex East Africa Ltd          |
| Aucma Digital Technology Africa Ltd                    | Holman Brothers (E.A.) Ltd        |
| Avery (East Africa) Ltd                                | IberaAfrica Power (EA) Ltd        |
| Baumann Engineering Limited                            | International Energy Technik Ltd  |
| Centurion Systems Limited                              | Kenwest Cables Ltd                |
| Digitech East Africa Limited                           | Kenwestfal Works Ltd              |
| Manufacturers & Suppliers (K) Ltd                      | Kenya Power & Lighting Co. Ltd    |
| Marshall Fowler (Engineers) Ltd                        | Kenya Scale Co. Ltd/ Avery Kenya  |

|   |                                      |
|---|--------------------------------------|
|   | Ltd                                  |
| Mecer East Africa Ltd                   | Kenya Shell Ltd                      |
| Metlex Industries Ltd                   | Libya Oil Kenya Limited              |
| Metsec Ltd                              | Power Technics Ltd                   |
| Modulec Engineering Systems Ltd         | Reliable Electricals Engineers Ltd   |
| Mustek East Africa                      | Sanyo Armo (Kenya) Ltd               |
| Nationwide Electrical Industries        | Socabelec East Africa                |
| Nationwide Electrical Industries Ltd    | Sollatek Electronics (Kenya) Limited |
| Optimum Lubricants Ltd                  | Specialised Power Systems Ltd        |
| PCTL Automation Ltd                     | Synergy-Pro                          |
| Pentagon Agencies                       | Tea Vac Machinery Limited            |
| Power Engineering International Ltd     | Virtual City Ltd                     |
| <b>Sector: Plastics and Rubber (54)</b> |                                      |
| Betatrad (K) Ltd                        | ACME Containers Ltd                  |
| Blowplast Ltd                           | Afro Plastics (K) Ltd                |
| Bobmil Industries Ltd                   | Alankar Industries Ltd               |
| Complast Industries Limited             | Dune Packaging Ltd                   |
| Kenpoly Manufacturers Ltd               | Elgitread (Kenya) Ltd                |
| Kentainers Ltd                          | Elgon Kenya Ltd                      |
| King Plastic Industries Ltd             | Eslon Plastics of Kenya Ltd          |
| Kingway Tyres & Automart Ltd            | Five Star Industries Ltd             |
| L.G. Harris & Co. Ltd                   | General Plastics Limited             |
| Laneeb Plastics Industries Ltd          | Haco Industries Kenya Ltd            |
| Metro Plastics Kenya Limited            | Hi-Plast Ltd                         |
| Ombi Rubber Rollers Ltd                 | Jamlam Industries Ltd                |

|                                  |                                |
|----------------------------------|--------------------------------|
| Packaging Industries Ltd         | Kamba Manufacturing (1986) Ltd |
| Plastics & Rubber Industries Ltd | Keci Rubber Industries         |
| Polyblend Limited                | Nairobi Plastics Industries    |
| Polyflex Industries Ltd          | Nav Plastics Limited           |
| Polythene Industries Ltd         | Ombi Rubber                    |
| Premier Industries Ltd           | Packaging Masters Limited      |
| Prestige Packaging Ltd           | Plastic Electricons            |
| Prosel Ltd                       | Raffia Bags (K) Ltd            |
| Qplast Industries                | Rubber Products Ltd            |
| Sumaria Industries Ltd           | Safepak Limited                |
| Super Manufacturers Ltd          | Sameer Africa Ltd              |
| Techpak Industries Ltd           | Sanpac Africa Ltd              |
| Treadsetters Tyres Ltd           | Silpack Industries Limited     |
| Uni-Plastcis Ltd                 | Solvochem East Africa Ltd      |
| Wonderpac Industries Ltd         | Springbox Kenya Ltd            |

**Sector: Textile and Apparels (38)**

|                              |                                     |
|------------------------------|-------------------------------------|
| Africa Apparels EPZ Ltd      | MRC Nairobi (EPZ) Ltd               |
| Fulchand Manek & Bros Ltd    | Ngecha Industries Ltd               |
| Image Apparels Ltd           | Premier Knitwear Ltd                |
| Alltex EPZ Ltd               | Protex Kenya (EPZ) Ltd              |
| Alpha Knits Limited          | Riziki Manufacturers Ltd            |
| Apex Appaels (EPZ) Ltd       | Rolex Garments EPZ Ltd              |
| Baraka Apparels (EPZ) Ltd    | Silver Star Manufacturers Ltd       |
| Bhupco Textile Mills Limited | Spinners & Spinners Ltd             |
| Blue Plus Limited            | Storm Apparel Manufacturers Co. Ltd |



|  |                                      |
|--|--------------------------------------|
| Bogani Industries Ltd                                    | Straightline Enterprises Ltd         |
| Brother Shirts Factory Ltd                               | Sunflag Textile & Knitwear Mills Ltd |
| Embalishments Ltd  | Tarpo Industries Limited             |
| J.A.R Kenya (EPZ) Ltd                                    | Teita Estate Ltd                     |
| Kenya Trading EPZ Ltd                                    | Thika Cloth Mills Ltd                |
| Kikoy Co. Ltd  | United Aryan (EPZ) Ltd               |
| Le-Stud Limited  | Upan Wasana (EPZ) Ltd                |
| Metro Impex Ltd  | Vaja Manufacturers Limited           |
| Midco Textiles (EA) Ltd                                  | Yoohan Kenya EPZ Company Ltd         |
| Mirage Fashionwear EPZ Ltd                               | YU-UN Kenya EPZ Company Ltd          |
| <b>Sector: Timber, Wood Products and Furniture (22)</b>  |                                      |
| Economic Housing Group Ltd                               | Rosewood Office Systems Ltd          |
| Eldema (Kenya) Limited                                   | Shah Timber Mart Ltd                 |
| Fine Wood Works Ltd                                      | Shamco Industries Ltd                |
| Furniture International Limited                          | Slumberland Kenya Limited            |
| Hwan Sung Industries (K) Ltd                             | Timsales Ltd                         |
| Kenya Wood Ltd   | Wood Makers Kenya Ltd                |
| Newline Ltd  | Woodtex Kenya Ltd                    |
| PG Bison Ltd   | United Bags Manufacturers Ltd        |
| Transpaper Kenya Ltd                                     | Statpack Industries Ltd              |
| Twiga Stationers & Printers Ltd                          | Taws Limited                         |
| Uchumi Quick Suppliers Ltd                               | Tetra Pak Ltd                        |
| <b>Sector: Pharmaceutical and Medical Equipment (20)</b> |                                      |
| Alpha Medical Manufacturers Ltd                          | Dawa Limited                         |
| Beta Healthcare International Limited                    | Elys Chemical Industries             |

|                                       |                                   |
|---------------------------------------|-----------------------------------|
| Biodeal Laboratories Ltd              | Gesto Pharmaceutical Ltd          |
| Bulks Medical Ltd                     | Glaxo Smithkline Kenya Ltd        |
| Cosmos Limited                        | KAM Industries Ltd                |
| Laboratory & Allied Limited           | KAM Pharmacy Limited              |
| Manhar Brothers (K) Ltd               | Pharmaceutical Manufacturing Co.  |
| Madivet Products Ltd                  | Regals Pharmaceuticals            |
| Novelty Manufacturing Ltd             | Universal Corporation Limited     |
| Oss. Chemie (K)                       | Pharm Access Africa Ltd           |
| <b>Sector: Metal and Allied (38)</b>  |                                   |
| Allied Metal Services Ltd             | Booth Extrusions Limited          |
| Alloy Street Castings Ltd             | City Engineering Works Ltd        |
| Apex Street Ltd Rolling Mill Division | Crystal Industries Ltd            |
| ASL Ltd                               | Davis & Shirtliff Ltd             |
| ASP Company Ltd                       | Devki Steel Mills Ltd             |
| East Africa Foundry Works (K) Ltd     | East Africa Spectre Limited       |
| Elite Tools Ltd                       | Kens Metal Industries Ltd         |
| Friendship Container Manufacturers    | Khetshi Dharamshi & Co. Ltd       |
| General Aluminum Fabricators Ltd      | Nampak Kenya Ltd                  |
| Gopitech (Kenya) Ltd                  | Napro Industries Limited          |
| Heavy Engineering Ltd                 | Specialized Engineer Co. (EA) Ltd |
| Insteel Limited                       | Steel Structures Limited          |
| Metal Crown Limited                   | Steelmakers Ltd                   |
| Morris & Co. Limited                  | Steelwool (Africa) Ltd            |
| Nails & Steel Products Ltd            | Tononoka Steel Ltd                |
| Orbit Engineering Ltd                 | Welding Alloys Ltd                |
| Rolmil Kenya Ltd                      | Wire Products Limited             |

|  |  |
|--|--|
| Sandvik Kenya Ltd  | Viking Industries Ltd                    |
| Sheffield Steel Systems Ltd                                | Warren Enterprises Ltd                   |
| <b>Sector: Leather Products and Footwear (8)</b>           |  |
| Alpharama Ltd  | CP Shoes                                 |
| Bata Shoe Co. (K) Ltd                                      | Dogbones Ltd                             |
| New Market Leather Factory Ltd                             | East Africa Tanners (K) Ltd              |
| C & P Shoe Industries Ltd                                  | Leather Industries of Kenya Limited      |
| <b>Sector: Motor Vehicle Assembly and Accessories (17)</b> |  |
| Auto Ancillaries Ltd                                       | Kenya Vehicle Manufacturers Limited      |
| Varsani Brakelining Ltd                                    | Labh Singh Harnam Singh Ltd              |
| Bhachu Industries Ltd                                      | Mann Manufacturing Co. Ltd               |
| Chui Auto Spring Industries Ltd                            | Megh Cushion industries Ltd              |
| Toyota East Africa Ltd                                     | Mutsumoto Motor Company Ltd              |
| Unifilters Kenya Ltd                                       | Pipe Manufacturers Ltd                   |
| General Motor East Africa Limited                          | Sohansons Ltd                            |
| Impala Glass Industries Ltd                                | Theevan Enterprises Ltd                  |
| Kenya Grange Vehicle Industries Ltd                        |  |
| <b>Sector: Paper and Paperboard (48)</b>                   |  |
| Ajit Clothing Factory Ltd                                  | Conventual Franciscan Friars-Kolbe Press |
| Associated Papers & Stationery Ltd                         | Creative Print House                     |
| Autolitho Ltd  | D.L. Patel Press (Kenya) Limited         |
| Bag and Envelope Converters Ltd                            | Dodhia Packaging Limited                 |
| Bags & Balers Manufacturers (K) Ltd                        | East Africa Packaging Industries Ltd     |
| Brand Printers   | Elite Offset Ltd                         |

|                              |                                      |
|------------------------------|--------------------------------------|
| Business Forms & Systems Ltd | Ellams Products Ltd                  |
| Carton Manufacturers Ltd     | English Press Limited                |
| Cempack Ltd                  | General Printers Limited             |
| Chandaria Industries Limited | Graphics & Allied Ltd                |
| Colour Labels Ltd            | Guaca Stationers Ltd                 |
| Colour Packaging Ltd         | Icons Printers Ltd                   |
| Colour Print Ltd             | Interlabels Africa Ltd               |
| Kenya Stationers Ltd         | Jomo Kenyatta Foundation             |
| Kim-Fay East Africa Ltd      | Kartasi Industries Ltd               |
| Paper Converters (Kenya) Ltd | Kenafric Diaries Manufacturers Ltd   |
| Paper House of Kenya Ltd     | Kitabu Industries Ltd                |
| Paperbags Limited            | Kul Graphics Ltd                     |
| Primex Printers Ltd          | Label Converters                     |
| Print Exchange Ltd           | Modern Lithographic (K) Ltd          |
| Printpak Multi Packaging Ltd | Pan African Paper Mills (EA) Limited |
| Printwell Industries Ltd     | Ramco Printing Works Ltd             |
| Prudential Printers Ltd      | Regal Press Kenya Ltd                |
| Punchlines Ltd               | SIG Combibloc Obeikan Kenya          |

Source: Kenya Association of Manufacturers (KAM) Directory. June, 2011