AN ANALYSIS OF THE APPLICATION OF DISTRIBUTION MODELS IN
MANUFACTURING FIRMS IN KENYA: A CASE OF PHARMACEUTICAL FIRMS
(NAIROBI)

BY

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Mage, Nduta Grace
An analysis of the
application of

AUGUST 2003
DECLARATION

This research paper is my original work and has not been presented in any other university examination.

Signed: Mage Nduta Grace
Date: 29th August 2003

This research paper has been submitted for examination with my approval as a university student.

Signed: Mr. Phares B. O. Ocholla
Date: 29.8.03
I wish to dedicate this project paper to all my family members and friends without whose encouragement I could not have come this far.
TABLE OF CONTENTS

Declaration i
Dedication ii
Acknowledgement iv
Abstract v

CHAPTER ONE

1.0 BACKGROUND 1
1.1 Introduction 1
1.2 Distribution Models 2
1.3 Integrated Distribution Models 3
1.4 Background to Pharmaceutical companies in Kenya 4
1.5 Statement of the Problem 5
1.6 Research Objectives 6
1.7 Research Questions 7
1.8 Importance of the study 7

CHAPTER TWO

2.0 LITERATURE REVIEW 8
2.1 Distribution models as a cost cutting tool 8
2.2 Transportation model 8
2.3 Assignment model 9
2.4 Heuristics model 10
2.5 Approximate Algorithm 13

CHAPTER THREE

3.0 RESEARCH METHODOLOGY 14
3.1 Research design 14
3.2 Population 14
3.3 Sampling Strategy 14
3.4 Data types and data collection procedure 14

CHAPTER FOUR

4.0 DATA ANALYSIS AND INTERPRETATION 16
4.1 Response to questionnaire 16
4.2 Classification of companies 16
4.3 Period of existence 17
4.4 Transportation of the products 18
CHAPTER FIVE

5.0 SUMMARY, CONCLUSIONS AND RECOMMENDATIONS 25
5.1 Summary and conclusions 25
5.2 Recommendations 26
5.2 Limitations of the study 27
5.4 Suggestions for further study 27

Appendices
I would like to honor God who has given to me this opportunity to see my dream come true.

Many thanks to my supervisor Mr. Phares B.O Ocholla of School of Humanities and Social Studies for his advice and encouragement throughout the length of time of this course.

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For those not mentioned here but played a pivotal role in one way or another in the length of time of this program, take this note as a show of my gratitude and the almighty bless you abundantly in all your endeavors.
ABSTRACT

Organizations continually consume resources from the environment, transform them and release them as final products. The success, and indeed survival of every organization depends on how well it positions itself to the environment. The objective of this research was to determine the extent to which the pharmaceutical manufacturing companies in Nairobi make use of Distribution Models. The study helped to document the distribution models used by these companies. Factors influencing the use or non-use of models were investigated. The problems and the challenges facing firms in this industry were also investigated and finally the researcher recommended appropriate distribution policies to the stakeholders.

The researcher considered all the pharmaceutical manufacturing companies in Nairobi. A sample of 20 companies was randomly selected. Out the 20 companies, 18 responded. The data was collected using a questionnaire. The study concludes that companies need to apply distribution models in the physical distribution of their products. The study reveals that 72 percent of these organizations are aware of the transportation model. Regarding the frequency on the application of models, 55 percent of the companies frequently apply the transportation model while 16 percent moderately apply the same model. Both the assignment and the heuristics models are moderately applied by 5 percent and 11 percent of the companies respectively. 11 percent of the companies combine all the three models. It was concluded that application of distribution models is therefore practiced in pharmaceutical manufacturing firms in Nairobi. The major problem highlighted was the high cost of distribution. Cost of the other overheads e.g. water, electricity and insurance was also reported to be high. Despite all the problems in the sector, firms need to understand and apply operations research techniques while allocating the scarce resources.
CHAPTER ONE

1.0 BACKGROUND

1.1 INTRODUCTION

In today's dynamic and challenging business environment firms have no choice but to be globally competitive. The role of coordination in an integration environment is becoming increasingly critical for the development of efficient strategies towards the management of the dynamic and unpredictable business environment. Needless to say, firms are organized in an integrated fashion even through some don't operate in that way. The benefits of managing operations in an integrated manner are noteworthy; better management of inventory, better response to market changes and reduction in efficiencies in individual operations (Pankay and Marshall, 2001).

For manufacturing companies, physical distribution costs represent a large percentage of sales. Kotler (1985) discussed the components of total physical distribution costs. He said that modern decision tools are not being adequately used in coordinating inventory levels, transportation models and plant, warehouse and store location. The table below shows the components of total physical distribution costs as given by Kotler.
Table 1.1 components of total distribution costs expressed as percentage of the total

<table>
<thead>
<tr>
<th>Components</th>
<th>Proportion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transportation</td>
<td>46%</td>
</tr>
<tr>
<td>Warehouse</td>
<td>26%</td>
</tr>
<tr>
<td>Inventory carrying</td>
<td>10%</td>
</tr>
<tr>
<td>Receiving and Supplying</td>
<td>6%</td>
</tr>
<tr>
<td>Packaging</td>
<td>5%</td>
</tr>
<tr>
<td>Administration</td>
<td>4%</td>
</tr>
<tr>
<td>Order processing</td>
<td>3%</td>
</tr>
</tbody>
</table>

The above table indicates that transportation costs have the highest proportion meaning that, for manufacturing firms to survive and compete effectively, there is need to design a distribution model. Distribution model ensures efficiency and effectiveness in customer relation management and hence boosts profits (Alan and John, 1990).

1.2 DISTRIBUTION MODELS

Distribution models are special types of linear programmes. Linear Programmes (LPS) models must satisfy two conditions. First, LPS must have an objective to optimize either to reduce costs or increase profits; secondly, the optimization of the objective must be under some constraints.
This study has specifically looked at the transportation model as one of the distribution models. It deals with shipment of commodities from various sources to a number of demand points.

The objective of the distribution model in this study is to determine the number of units of a commodity that can be shipped from supply to demand points at minimum costs. Goyal and Gupta (1989) noted that coordination between the supplier and the buyer can be mutually beneficial to both. Studies have focused on determining the order quantity, which is jointly optimal for both. Using such an order quantity may lead to increase in overall profits, which could be shared in some equitable manner between the two parties. Large orders are beneficial to suppliers because of potential savings in order processing costs, manufacturing set up costs and distribution costs.

Monahan (1984), proposed a quantity discount model in which he showed that the vendor could increase his profits by enticing the buyer to purchase greater quantity in return for a discount on purchase price.

1.3 INTEGRATED DISTRIBUTION MANAGEMENT

This is a concept that emphasizes teamwork in the company and among all the marketing channel organization to maximize the performance of the entire distribution. It also requires proper coordination of all activities in the overall distribution of goods e.g. warehousing coordination, inventory level control e.t.c.

Today, more and more companies are adopting this concept, which recognizes the importance of providing better customer service (Alan and John.1991). Thus the goal of integrated distributing management is to harmonize all of the company’s distribution decisions. Blumenfeld et al. (1987) asserts that some of the companies state logistics objectives as providing maximum customer service and maximum
distribution costs. Unfortunately no distribution system can both maximize customer service and minimize distribution costs. Maximising customer services means rapid delivery, large inventories flexible assortment etc. Liberal return policies to other services, all which raise distribution costs. In contrasts, minimum distribution costs imply slower delivery, smaller inventories and larger shipping lots which imply slow delivery, smaller inventories and larger shipping lots which represent a lower level of customer service.

Integrated Distribution Management (IDM) comes in to ensure that targeted level of customers are served at least cost. IDM also calls for coordination of support company’s agents, that provide their customers, drives loyalty and repeat business. Sometimes, use of support companies has become more difficult due to increased complexity and customization backing end user solution for distribution and support allows the companies or their services agent to provide cost effective support that can drastically increase customer loyalty in just such complex and customized product environments (Alan and John, 1991)

1.4 BACKGROUND TO THE PHARMACEUTICAL COMPANIES IN KENYA

Due to various changes taking place in the business environment, Pharmaceutical firms in Kenya are receiving signals, which require them to change with the changes in the environment (Vinayak, 2001). Increasing competition in the form of multiplicity of products, increased competition, realignment of forces on an economic front through key mergers in the industry has thrown up many challenges to pharmaceutical manufactures in Kenya.

In the pharmaceutical industry the field has been dominated for along time by multinationals. The local manufacturing had a booming period in seventies and
eighties when the government supported the local industry by sourcing its equipment of drugs preferably from local manufactures and by restricting the importation of locally produceable drugs (Vinayak, 2001). After liberalization in mid-80's there was rapid growth in the pharmaceutical industry with the many multinationals either directly or through local trading partners starting their operations in Kenya. Today around three hundred pharmaceuticals companies are selling their products in Kenya leading a very high competition.

Kenyan and Africa in large is in need of good and cheap drugs. Due to market saturation, we are faced with a situation whereby, on one hand we have excess of some drugs available under different brand names while on the other hand, a shortage of directly needed and affordable drugs for diseases like malaria, T.B, Typhoid and HIV/AIDS.

Studies have proved that pharmaceutical industry have the percentage of Return On Investment [R.O.I.] of 12.3% which is gotten by dividing Earnings Before Interest and Tax (E.B.I.T.) by the value of investment (Vinayak, 2001). This percentage shows that pharmaceutical industry is an important sector in the economy. Firms in this industry struggle to survive due to the intensive competition, stagnant economy and declining markets.

The argument for conducting the transportation function using a distribution model is actually compelling. Use of the model will ensure that customers get the medicine they need at the right time and the suppliers do not suffer from stock outs, this will eventually result in transportation cost reduction and improved customer services.
1.5 STATEMENT OF THE PROBLEM

Within the manufacturing industry in Kenya, the reported lack of use of distribution models has largely inhibited the efficiency and effectiveness, which will help to improve customer relation management and hence boost profits, which its use promises. The economic growth has been declining especially after the attainment of multipartism. This has made some companies to pull their resources either through acquisition, mergers or alliances. Others have opted to close their business. Transportation costs have been too high such that manufacturing companies do not get maximum production capacity. A Nation Business Analyst (on 21/10/2002) mentioned, “In Kenya today many manufacturing companies can only produce up to 60% of their production capacity, due to current economic status”. Despite the foregoing, use of distribution model will greatly improve this situation. Slava et al. (2001) asserts that, companies can achieve competitive edge by applying a distribution model to compete on costs, service and quality.

Despite the optimization benefits resulting from the use of transportation model, firms in Kenya are faced with factors, which inhibit exploitation of these benefits. Some of the major factors include; high costs of insurance, insecurity, poor infrastructure, high taxation, unpredictable demand, incompetent employees, rigid management systems, lack of dialogue among the stakeholders, political instability, unpredictable conditions and high rate of inflation and depression. The pharmaceutical industry is no exception. The industry is also undergoing major changes e.g. the rate of development of new molecules has further gone down, the cost and time taken to introduce a new drug has increased and also the development of generics.

In spite of all the changes, challenges and problems facing pharmaceutical manufacturing companies, no study has been to find out how firms in this industry are
conducting the physical transportation of their products. This study sets to investigate how the goods manufactured from pharmaceutical companies in Nairobi are transported to the customers and suggests the use of a model, which works towards transportation costs reduction.

1.6 RESEARCH OBJECTIVES

The general objective of this study is to determine the extent to which distribution models are used by pharmaceutical manufacturing firms in Nairobi.

Specifically, the study will help to:

1. Document the distribution models in theory and in practice
2. Determine the factors that influence the use and the non-use of distribution models
3. Investigate the problems and the challenges facing these firms
4. Recommend appropriate policies to stakeholders

1.7 RESEARCH QUESTIONS

1. How do the pharmaceutical manufacturing firms in Nairobi carry out the distribution function?
2. Do these firms make use of distribution models transportation of goods?
3. What are the factors leading to the use and the non-use of distribution models?
4. How do they integrate the transportation function with other distribution functions?
5. What are the problems and challenges encountered in the physical transportation of goods?
1.8 IMPORTANCE OF THE STUDY

1. Serve as a source of guidance and point of reference for further research on distribution models.

2. Look into how the Pharmaceutical Manufacturing companies in Nairobi can make use of distribution models so as to achieve optimal results.

3. Provide useful information on how the transportation function is integrated with other functions in these firms.

4. Help to determine problems and challenges encountered while transporting goods in pharmaceutical industry and hence, recommend appropriate policies to the stakeholders.

5. Provide useful information on how far the pharmaceutical manufacturing companies make use of Information Technology and advantages accruing from automating the transporting function.

6. It is also hoped that it will be of importance to firms faced with similar problems.
CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 DISTRIBUTION MODEL AS A COST CUTTING TOOL

The beginning of operations research can be traced to World War II when the United States and the Great Britain employed mathematicians and physicists to analyze military operations. After the war, many of those involved in military research operations research retained their interest in analyzing decision making in peacetime endeavors and developed new techniques that could be directly applied to business problems. The developments in digital computers has since allowed the newly developed techniques to be applied quickly to large scale optimization problems.

Hitchcock (1941) made the first contribution to distribution problems. Koopmans (1949) later made an independent detailed study of the distribution problem. They highlighted that one of the most important and successful application of quantitative techniques analysis in solving business problems has been in the area of physical distribution of goods and getting the right people for various jobs. Great savings have been achieved by the more efficient routing of freights from various demand points to various destinations.

2.2 TRANSPORTATION MODEL.

Transportation model serves as a framework for analyzing physical distribution decisions. The purpose of the transportation problem in its basic form is to minimize the total cost of shipping goods from plants to warehouse distribution centres in such a way that needs of each warehouse are met and each factory operates within its capacity.
A transportation model deals with the shipment of products from various sources to a number of demand points. A transportation problem is characterized by: supply (this is the limited quantity of products), demand (it is assumed that there is a level of demand at each destination), the quantity of supply at each source and the demand at each destination are constant, the cost of shipping from supply to demand points is known, it assumed that there is no shipment from demand point to demand point or from supply point to supply point, all supply and demand quantities are integers (no fractions) and lastly, the objective in the transportation problem is to determine how many units of commodity can be shipped from source to destination at minimum costs. In standard transportation problem the source and the destination constraints consist of only equality constraints.

Formulation of a transportation model from m sources to each of the n destinations, the supplies available are \( a_1, a_2, \ldots, a_m \) and demands at destinations are \( b_1, b_2, \ldots, b_n \) respectively. Sum total of requirement at the source is equal to the sum of destination. The cost of shipping a unit from source \( i \) to destination \( j \) is \( C_{ij} \) and is calculated for all combinations of \( i \) and \( j \). The objective is to determine the amounts \( X_{ij} \) to be transported over all routes \((i,j)\) so as to minimize the transportation costs. If demand is more than supply, add amount of supply equal to the difference between them to the existing supply quantity. This amount is called the dummy supply, and it incurs zero transportation cost. Similarly, if demand is less than the supply add amount of demand equal to the difference between the two. This is called a dummy demand quantity. Then the transportation model is solved as an L.P.
2.3 ASSIGNMENT MODEL

Assignment model ensures that jobs are assigned to the right people so as to ensure efficiency that leads to improvements on cost, service and quality. People's qualification, experience and the cost of assigning a certain job to an individual are the factors to consider in an assignment problem.

There is a small but growing body of management science research concerned in various ways of co-ordination of both assignment and transportation functions. Glover et al. (1979) developed a network flow model of the distribution decisions of an agrichemical. They embedded this model in a decision support system that was used to analyze both short-run planning decisions and long-range strategic decisions such as the sizing and location of distribution centers, the size of transportation equipment and the nature of supply options. They concluded that use of a distribution model works towards ensuring optimal operations.

2.4 HEURISTICS MODEL

Burns et al. (2000) developed heuristics model to determine where to use direct trips to customers from warehouse as opposed to delivering the load to a set of customers on the same trip. The authors adopted the interchange heuristic of deterministic of vehicle routing problem for solving the integrated problem. The distribution lot size is determined (i.e. number of units of products that should be sent to each customer location from the warehouse) and the delivery routes in every period. They assumed that the delivery takes place at the end of each trip and that there are enough vehicles at the depot (the fixed distribution cost will, however, penalize empty trucks). The unique features that the inventory at customer locations needs to be taken to account
during distribution and that each customer location can exceed vehicle capacity in any period.

It is becoming increasingly clear that companies will need to make the necessary organization changes that will facilitate coordination of these operational functions and develop an ability to make more complex decisions within their structure (Pankaj and Marshall, 2001)

A number of authors have considered an enriched version of the vehicle routing problem in which both the timing and amount of deliveries as well as schedule of vehicle fleet must be determined so as to ensure that customers do not run out of inventory. Research in this inventory is reported in Bell et al. (1983), Federguen and Zipkin (1984) Federguen et al. 1986 and Pror and Ball (1987). For distribution function to work optimally there is need to explore closer coordination in the production and distribution functions. For example, John & Johnson is testing a linkage between their brand-aid factory in North Brunswick, New Jersey and a small retail chain (Fortune, 1990).

Blumenfield et al. (1986) Considered a very specific scenario that featured one destination per part type, identical production cycles with each production cycle including a delivery vehicle. This leads to the issue of how to consolidate demands of various customers together such that delivery and other costs at the warehouse are minimized. Such an integrated approach towards the distribution function is clearly required in order to enhance service level at reduced costs.

The literature on integrated models, which consider vehicle routing, is quite recent and not extensive. Feder Gruen and Zipkin (1999, ) developed a single period model
which determined vehicle schedules and delivery sizes and simultaneously when customer locations face random demands. The integrated models minimized holdings and storage costs along with transportation costs.

As early as 1915, writing from Harvard business school, Arch Shaw took a view of distribution activity, which was characteristically far sighted. He said:

"The physical distribution of goods is a problem distinct from the creation of demand. Not a few worthy failures in business distribution companies have been due to such a lack of co-ordination between demand creation and physical supply. Instead of being a subsequent problem, this question of supply must be met and answered before the work of distribution begins".

Alan and John (1991) states that value analysis is a systematic procedure aimed at ensuring the necessary functions are achieved at minimum costs without detrimental to quality, reliability, performance and delivery. A transportation model ensures effective movement of goods from manufacturing place to the place of consumption while providing an acceptable service to the customer and ensuring minimum costs.

Slava et al. (2001) found that exploring the trade off between customer service and operating costs in redesign effort using liner program-based models resulted to reduction in distribution costs and improved customer service.

Since decisions occur in uncertain world and often address conflicting objectives, distribution models are agreed to have potential of assisting decision markers to come up with decisions, which lead to optimization. Despite the foregoing, little is known about their application in Kenya’s manufacturing industry. There is a wide gap between the theory and the application of distribution models.

Donal et al (2001) in their paper, “optimization models for restructuring BASF North America distribution system” found that although optimizers and computing
environments required to solve problems with millions of decision variables are available, this approach has potential problems; the massive efforts required to collect accurate and complete data, the need for complex and time consuming solution method, the difficulty of finding a human decision maker willing to trust the results generated by a complex tool and the investment required to develop the system and user skill needed to collect and validate data and interpreted solutions.

2.5 APPROXIMATE ALGORITHM

Pankaj and Marshall (2001) found that the size and complexity of transportation problem makes the determination of optimal politics, or even data dependent bounds on these policies difficult to obtain the reasonable time instead they compared the approximate solution to the overall integrated problem with the case where the two sub-problems (i.e. warehouse replenishment and customer replenishment) are solved separately. The difference in the two solutions gives us the extent of the reduction in cost due to integration. They intended to illustrate the interdependency of customer and warehouse replenishment policies and the need to consider them together in order to operate an efficient logistic system. They outlined an iterative approximate model to evaluate the impact of coordinating warehouse and customer replenishment requirements. The idea was very simple. They started with initial feasible solutions to the warehouse replenishment problem and solved the resulting distribution problem sequentially. Then they saw how the warehouse ordering decisions were affected if the delivery schedules for the customers were changed. In other words, they estimated the here case of integration in terms of cost reduction over the case when the warehouse and the customer's decisions are made independently. They adopted the change that led to the greatest reduction over all
costs. This process was repeated until they reached the stage where there was no further gain by coordinating the two decisions.

In essence, they first identified all such shifts that led to a reduction in distribution costs if implemented. Then for a subset of such selected shifts they wanted to know the impact on to warehouse costs. In the experimental study they selected ten such shifts, which produced the highest reduction in distribution costs. For each subset the selected shifts, they solved the modified warehouse-ordering problem where each set provided a different overall cost. The entire process was repeated by perturbing the new distribution schedule until there is no potential shift found or when none of selected shifts field a new overall cost which is less than the current overall cost.
CHAPTER THREE

3.0 RESEARCH METHODOLOGY

3.1 RESEARCH DESIGN

The research was conducted through elite interviewing of the personnel dealing with the actual distribution of goods. It enabled possible collate of views of various well informed personnel within this industry.

3.2 POPULATION

The population of the study consisted 26 pharmaceutical manufacturing companies based in Nairobi, which are licensed by the Ministry of Health to manufacture pharmaceutical products. The companies are listed in the Kenya Medical Directory. (a list of these companies can be found in appendix i). The choice of Nairobi as the area to be covered by the study is mainly due to the convenience in terms of accessibility, time schedule, and financial resources available to the researcher. According to the Kenya medical directory, many pharmaceutical manufacturing companies are found in Nairobi. Responses were considered as representatives of the companies.

3.3 SAMPLING STRATEGY

For the purpose of this study, simple random sampling method was used without replacement to select 20 companies. This sample was considered enough to provide the general information on the extent to which pharmaceutical firms in Nairobi make use of distribution models and hence provide a basis for valid and reliable conclusions.
3.4 DATA TYPES AND DATA COLLECTION PROCEDURE

To achieve the objectives of the study, both primary and secondary data were used. Primary data was collected through a questionnaire (appendix ii). The targeted respondents were the officers/ managers responsible for the physical distribution of goods. Some of the respondents were under the marketing department while others were under the warehousing department. The questionnaire was divided into two sections. The first section sought the general characteristics of the firm while the second section sought to achieve the objective of the study i.e. the extent of use of distribution models in the selected firms. Secondary data was used to supplement primary data. This data was obtained from firms' magazines, weekly review, published annual reports and journals.

Because of differences in nature of companies, the interviews were conducted differently to try and understand the phenomenon under investigation from the perspective of that organization. The sequence of questions was random in nature so as to preclude guessing on the underlying factors that were being sought.
CHAPTER FOUR

4.0 DATA ANALYSIS AND INTERPRETATION

4.1 RESPONSE TO QUESTIONNAIRE

A total of 18 companies responded representing 90 percent of the sample. This response was considered enough to provide the general information on the extent to which pharmaceutical firms in Nairobi use distribution models and hence provide a basis for valid and reliable conclusions.

Table 4.1 Response to questionnaire

<table>
<thead>
<tr>
<th>feedback</th>
<th>No. of companies</th>
<th>percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>actual response</td>
<td>18</td>
<td>90</td>
</tr>
<tr>
<td>no response</td>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>TOTAL</td>
<td>20</td>
<td>100</td>
</tr>
</tbody>
</table>

Source: Questionnaire

4.2 CLASSIFICATIONS OF COMPANIES

From the data collected, it was noted that firms are evenly distributed as per the researcher's classification i.e. 6 companies were locally owned, 6 companies foreign owned while the rest were joint ventures, this represents (33 1/3 %) in each case. Figure 4.1 indicates the classification of the companies in the industry under study.
4.1 CLASSIFICATION OF PHARMACEUTICAL COMPANIES IN NAIROBI

![Diagram showing classification]

Source: Questionnaire

4.3 PERIOD OF EXISTENCE

According to the data collected, majority of the companies have been in existence for more than 20 years. All the companies have existed for more than 10 years. The following table gives the summary of firms' period of existence.

<table>
<thead>
<tr>
<th>Period of Existence</th>
<th>No of Companies</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between 10 - 20 yrs</td>
<td>5</td>
<td>27.8</td>
</tr>
<tr>
<td>More than 20 yrs</td>
<td>13</td>
<td>72.2</td>
</tr>
<tr>
<td>Total</td>
<td>18</td>
<td>100</td>
</tr>
</tbody>
</table>

Source: Questionnaire
4.4 TRANSPORTATION OF THE PRODUCTS

All the companies under study highlighted geographical location as the major factor to consider while determining the transportation arrangement. It was clarified that, if the customers are in Nairobi, it was cost effective for the company to carry out the distribution function other than engaging a third party. Outsourcing was also not recommended where the orders were urgent and small in quantities. Financial instability and inability to network were also factors limiting the outsourcing of the function.

The following table indicates the transportation arrangement within the firms.

Table 4.3 transportation arrangements

<table>
<thead>
<tr>
<th>transportation arrangement</th>
<th>No. of firms</th>
<th>percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outsource</td>
<td>3</td>
<td>16.7</td>
</tr>
<tr>
<td>Doing it themselves</td>
<td>5</td>
<td>27.8</td>
</tr>
<tr>
<td>Outsourcing and doing it themselves</td>
<td>10</td>
<td>55.5</td>
</tr>
<tr>
<td>TOTAL</td>
<td>18</td>
<td>100</td>
</tr>
</tbody>
</table>

Source: Questionnaire

In regard to the transportation of the products, majority of the firms in the industry seemed to combine both outsourcing services and doing it themselves (55.5%). 16.7% of the companies outsource the service while 27.8% did not engage third parties in the transportation of their products.

4.5 AUTOMATION OF THE DISTRIBUTION FUNCTION

Majority of the companies makes use of the current technology in handling the distribution function. The areas of interest included packaging, warehousing,
receiving /supplying and inventory carrying. The following table indicates the extent to which the industry under study automates the distribution function.

Table 4.4 automation of the distribution function

<table>
<thead>
<tr>
<th>Extent of automation</th>
<th>No of Companies</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fully automated</td>
<td>6</td>
<td>33.3</td>
</tr>
<tr>
<td>Moderately Automated</td>
<td>11</td>
<td>61.1</td>
</tr>
<tr>
<td>Not Automated at all</td>
<td>1</td>
<td>5.6</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>18</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Source: Questionnaire

The above table indicates that only 5.6% of the firms are not automated at all. This was noted especially in Beta healthcare international where it was highlighted that majority of the customers do not even own computers and hence they cannot automate some functions like order processing- the sales representatives make regular visits to their customer taking orders. 61.1% were moderately automated and were looking forward to full automation. It was also noted that most of the companies falling under fully automated category (33.3%) are international companies. According to the data collected, lack of resources was the major reason as to why the distribution function was not fully automated. Other reasons included vast operations and lack of qualified personnel who could design and apply distribution models. Demand instability and supplier unreliability due to changes in weather conditions were other reasons highlighted.
4.6 AWARENESS IN THE APPLICATION OF DISTRIBUTION MODELS

Transportation model seemed to be very popular in that it was known and applied in almost all organizations (72.22%). The following table indicates the extent of the awareness of the distribution models.

**Table 4.5.1 awareness of the distribution models.**

<table>
<thead>
<tr>
<th>Model used</th>
<th>No. of companies</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>transportation</td>
<td>13</td>
<td>72.2</td>
</tr>
<tr>
<td>Assignment</td>
<td>1</td>
<td>5.6</td>
</tr>
<tr>
<td>Heuristics</td>
<td>2</td>
<td>11.1</td>
</tr>
<tr>
<td>Combination of the three</td>
<td>2</td>
<td>11.1</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>18</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Source: Questionnaire

Only one company (5.56%) was applying the assignment model, two companies (11.11%) were applying the heuristics model while only two of the companies (11.11%) combined the transportation, assignment and the heuristics models.

Transportation model was mentioned to be easy to understand and apply. Reasons for the application of a certain model was determined by its flexibility, efficiency and effectiveness when used and the costs of developing and applying the model.

Table **4.5.2** indicates the extent of the use of distribution models. The number of companies falling under each category has been indicated.

**Table 4.5.2 extent of use of distribution models**

<table>
<thead>
<tr>
<th>model</th>
<th>Frequently used</th>
<th>Moderately used</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transportation</td>
<td>10</td>
<td>3</td>
<td>13</td>
</tr>
<tr>
<td>Assignment</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Heuristics</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Combination</td>
<td>2</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>13</strong></td>
<td><strong>5</strong></td>
<td><strong>18</strong></td>
</tr>
</tbody>
</table>

Source: Questionnaire
4.7 DESIGNING OF A DISTRIBUTION MODEL

Different companies had different designers of the models as the table below indicates.

Table 4.6 model designers

<table>
<thead>
<tr>
<th>Designer</th>
<th>No of companies</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Out side Consultation</td>
<td>1</td>
<td>5.6</td>
</tr>
<tr>
<td>Operation Manager</td>
<td>1</td>
<td>5.6</td>
</tr>
<tr>
<td>Marketing Manager</td>
<td>2</td>
<td>11.1</td>
</tr>
<tr>
<td>Distribution Manager</td>
<td>6</td>
<td>33.3</td>
</tr>
<tr>
<td>Management</td>
<td>8</td>
<td>44.4</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>18</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Source: Questionnaire

Managers were mentioned to be involved in the development of the models and in many organizations, it was mentioned that they also supported the application of the models. Outside consultation was discouraged since the designing of the models needed someone who is in tune with the organization’s operations.

Regarding the time of designing the models, 85% of the firms fell under the category of having designed them at between 5 and 10 years, 5% had no ideas to when the models were designed while 10% were under the category of less than 5 years.

4.8 FACTORS INFLUENCING THE USE AND THE NON-USE OF DISTRIBUTION MODELS

Efficiency and effectiveness was highlighted as the major factor leading to the application of distribution models. Some of the other reasons included; easy to understand and apply, flexibility and the advancement in technology.

Though the industry is facing several problems, the major factor highlighted as an inhibitor to the application of distribution models was the cost of developing and
maintaining the model. Majority of the respondents felt that the distribution arrangement they were using was efficient and they were not willing to change. Many respondents seemed to prefer the status quo. Ignorance was all quoted as inhibitors in that, some of the respondents were not aware of various distribution models.

4.9 IMPROVEMENT ON THE APPLICATION OF DISTRIBUTION MODELS

Different respondents mentioned that companies need to invest more in transportation vehicles. Many companies need more vehicles to carry out the transportation function. Management support is also another area that needs to be addressed.

4.10 INTEGRATION OF TRANSPORTATION FUNCTION WITH OTHER DISTRIBUTION FUNCTIONS

According to the data collected, there seemed to be a wide integration of the transportation function with other distribution functions. The following table shows the extent to which various companies integrate the transportation with the other distribution functions.

Table 4.7 extent of integration of transportation function with the other distribution functions.

<table>
<thead>
<tr>
<th></th>
<th>Widely Integrated</th>
<th>Moderately Integrated</th>
<th>Least Integrated</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warehousing</td>
<td>8</td>
<td>10</td>
<td>-</td>
<td>18</td>
</tr>
<tr>
<td>Inventory carrying</td>
<td>4</td>
<td>13</td>
<td>1</td>
<td>18</td>
</tr>
<tr>
<td>Receiving &amp; supplying</td>
<td>16</td>
<td>2</td>
<td>-</td>
<td>18</td>
</tr>
<tr>
<td>Packaging</td>
<td>17</td>
<td>-</td>
<td>1</td>
<td>18</td>
</tr>
<tr>
<td>Administration</td>
<td>14</td>
<td>4</td>
<td>-</td>
<td>18</td>
</tr>
<tr>
<td>Order processing</td>
<td>12</td>
<td>4</td>
<td>2</td>
<td>18</td>
</tr>
</tbody>
</table>

Source: Questionnaire
4.11 PROBLEMS AND CHALLENGES IN THE MANUFACTURING AND SELLING OF PHARMACEUTICAL PRODUCTS

High overhead costs was mentioned as the major problem / challenge in this industry. This includes water, electricity, packaging, salaries and wages, insurance and the distribution costs. Some of the other challenges include unfair competition from importers, emergence of generic drugs and costs involved in installing new equipment’s necessary to manufacture and sell some of the seriously need drugs.

Inspite of all the problems and challenges, many respondents mentioned that they could see light at the end of the tunnel as the government has just shown interest in supporting the introduction of new drugs/ molecules.
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CHAPTER FIVE

5.0 SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 SUMMARY AND CONCLUSIONS

High overhead costs is the major problem in the Pharmaceutical Manufacturing Companies in Nairobi. This has resulted to the application of distribution arrangements, which lead to maximum savings. Some firms are outsourcing the transportation services, others do it themselves while others are combining the two. The factors leading to these arrangements include; customer’s geographical location, nature and quantity of the products, etc. Companies automate their distribution function according to their customers’ level of automation.

Majority of the respondents were aware and applying the transportation model. Different firms have different reasons for the use of various distribution models as was earlier mentioned. Regarding the designing of distribution models the firms have varied times as to when these models were designed. High distribution costs was mentioned as the major inhibition to the use of distribution models. For the companies that are currently using distribution models, they have some recommendations on the improvements of those models as was discussed earlier.

Generic drugs and counterfeit products are the major challenge for manufacturers in this industry. Changing consumer demand, unreliable suppliers, high costs of raw materials, unfair competition from importers, public ignorance on products, replacing damaged products etc were some of the other problems highlighted.
5.2 RECOMMENDATIONS

The use of operation management strategies in firms has become a requirement. I would like to recommend the application of operations research techniques in using the available resources to find optimal courses of action. Customers need products that meet their needs (good quality, fair prices and efficiency in delivery). Quality, flexibility and price (cost of product) are the main objectives of operations management, Chase, Aquilano and Jacobs (1998).

In order for manufacturing firms to adequately meet the above mentioned customer needs, there is need to adopt operation arrangements which will ensure optimal results. Institutions of higher learning need to embrace the fact that companies of the future will survive due to the operations strategies they adopt.

Pharmaceutical companies and in large all manufacturing companies need to adopt a distribution model which ensures efficiency. Many companies seemed to be well versed with the transportation model only. I would like to recommend the combination of several distribution models including the assignment model and the heuristics model for optimal results.

The government need to also regulate the operations in this sector e.g. the problems from unfair competition from the importers was highlighted. The government also needs to intervene on the development of new drugs and molecules. Overhead costs is also another area that needs the intervention from the relevant authorities.
Companies also need to employ qualified staff to handle the distribution function - it was noted that some of the distribution managers have not only never applied the distribution models but also never heard of them. These managers need some basic knowledge in Scientific Management Operations.

5.3 LIMITATIONS OF THE STUDY

Limitations in this study were mainly on;

- Many distribution managers not willing to divulge information. There was fear that the information might be used to benefit the competitors. This resulted to inadequate data in some areas.

- Security was also a major concern. Security guards treated the researcher with a lot of suspicion and in some cases the researcher was not allowed in, the respondent was also requested to attend to the researcher at the security guard’s "office" where the discussion was interrupted by various visitors.

5.4 SUGGESTIONS FOR FURTHER STUDY

There is need to conduct a research on the use of distribution models in other manufacturing companies other than the pharmaceutical companies based in Nairobi. There is also a need to conduct a research on the extent to which pharmaceutical companies use Operations Research Management Strategies in their day-to-day operations.
QUESTIONNAIRE

The information you give in this questionnaire is for academic purposes only and will be treated with ultimate confidentiality. Kindly answer the following questions by placing a tick in the space [ ] provided. For open ended questions kindly answer in the space provided.

SECTION 1

1. Name of the company (optional)_____________________________________________________

2. How would you classify your company with regard to ownership?
   (a) Locally owned [ ]  (b) Foreign owned [ ]  (c) Joint venture [ ]
   (d) Any other (please specify)_____________________________________________________

3. For how long has your firm been in existence?
   (a) Less than 5 years [ ]  (b) Between 5-10 years [ ]
   (c) Between 10-20 years [ ]  (d) More than 20 years [ ]

SECTION 2

4. Who carries out the day to day physical distribution of your goods? (Please tick appropriately) (a) Outsource [ ] (b) Ourselves [ ]
   (c) Other (please specify)_______________________________________________________

5. What factors influence your choice of transportation arrangement in Q 4 above.
6. To what extent does your firm automate the distribution function?

(a) Fully automated  [ ]
(b) Moderately automated  [ ]
(c) Not automated at all  [ ]

7. If the distribution function is not fully automated, what causes the inhibition?

i) Unqualified personnel  [ ]
(ii) Lack of resources  [ ]
(iii) Any other, please specify ____________________________

8. Among the following distribution models, which one(s) are you aware of?

(a) Transportation  [ ]
(b) Assignment  [ ]
(c) Heuristics  [ ]
(d) Any other, please specify ____________________________

9. For the distribution models mentioned above, kindly tick on the one(s) that you apply in the distribution of your products.

(a) Transportation  [ ]
(b) Assignment  [ ]
(c) Heuristics  [ ]
(d) Any other, please specify ____________________________

If your firm is currently using a distribution model, kindly answer Q 10 to 13 below, if it does not answer Q14

10. Which of the following factors influenced the use of the distribution model(s) you are currently using.

a) Efficiency and effectiveness  [ ]
(b) Easy and less costly to develop  [ ]
(c) Easy to understand and apply  [ ]
(d) Flexibility  [ ]
11. To what extent does your company use the distribution model(s) in the day to day distribution of goods?

<table>
<thead>
<tr>
<th>Model</th>
<th>Frequently used</th>
<th>Moderately used</th>
<th>Never Used</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transportation model</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Assignment model</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Heuristics</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Any other (specify)</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
</tbody>
</table>

12. Who designed /developed the distribution model that your firm is currently using?

(a) Outside consultation [ ] (b) Operations manager [ ]
(c) Marketing manager [ ] (d) Distribution manager [ ]
(e) Company staff [ ] (f) Others (please specify) __________________________

13. When did your company design the distribution model that you are currently using?

(a) No idea [ ] (b) Less than 5 years (c) Between 5 and 10 years [ ]
(d) More than 10 years ago.

14. Among the following factors which one(s) inhibit the application of a distribution model?

(a) demand instability [ ] (b) supplier unreliability [ ]
(c) worker inflexibility [ ] (d) high distribution costs [ ]
(e) Rigid management system [ ] (f) inadequate resources [ ]
(g) Others (please specify) __________________________

15. In your opinion, how can the application of a distribution model be improved?
16. How far does your firm integrate the transportation function with other distribution functions?

<table>
<thead>
<tr>
<th>Function</th>
<th>Widely Integrated</th>
<th>Moderately Integrated</th>
<th>Least Integrated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warehousing</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Inventory carrying</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Receiving and supplying</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Packaging</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Administration</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Order processing</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
</tbody>
</table>

17. What are the problems and challenges you face in the manufacturing and selling of your products? (Kindly enumerate them in the space provided)

________________________

Thank you for your co-operation.
BIBLIOGRAPHY


Mazumdar,D  Trends in output real wages and employment in manufacturing industry;An international overview. Department of economics, University of Toronto ,1997.
Meredith, R.J  The management of operations; A conceptual emphasis.

Muhleman.et al  Production and operations management. 6TH edition .

Mushtafi,C.K  Operations research; Methods and practice. Wiley Estern ltd .
        India, 1988.

Ngacho, C  Application of OR/MS in manufacturing firms in Kenya.

Rakesh, V  Strategic marketing of pharmaceutical products manufactured

Suzaki, K  The new manufacturing challenge; Free press, New York,
        1987.