

**A STUDY OF THE APPLICATION OF TECHNOLOGY TO INVENTORY
MANAGEMENT IN COMMUNITY PHARMACIES IN LAGOS, NIGERIA**

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CERTIFICATION

This is to certify that this research work titled: 'A Study of application of Technology to Inventory Management in Community Pharmacies in Lagos, Nigeria' was conducted by Matthew Adesoji ADEGBITE for the award of degree of Doctor of Philosophy (Technology Management) in the African Institute for Science Policy and Innovation, Faculty of Technology, Obafemi Awolowo University, Ile-Ife, Nigeria.

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DEDICATION

This research work is dedicated to the glory of Almighty God, who made the way for the research work and who saw me through; to my late mother, Mrs. Abigail Aina Adegbite, who through hardship and endurance, ensured that I become educated in life; and to my wife, Titilayo for her unwavering support and encouragement.

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TABLE OF CONTENTS

	Page
CHAPTER ONE: INTRODUCTION	1
1.1 Background to the Study	1
1.2 Statement of the Problem	4
1.3 Research Questions	7
1.4 Objectives of the Study	8
1.5 Significance of the Study	8
1.6 Scope of the Study	9
1.7 Contribution to Knowledge	9
1.8 Operational Definition of Terms	10
CHAPTER TWO: LITERATURE REVIEW	15
2.1 The Concept of Inventory	15

	Page	
2.1.1	Types of inventory	17
2.1.2	Demand forecasting	18
2.1.3	Classification of inventory	20
2.1.4	Zero inventory	22
2.1.5	Inventory shrinkage	23
2.1.6	Inventory cost	24
2.1.7	Cost of good sold	25
2.2	Concept of Inventory Management	26
2.2.1	Inventory management	26
2.2.2	Inventory management planning	29
2.2.3	Inventory management system	29
2.2.4	Inventory turnover ratio	34
2.2.5	Inventory management index	34

	Page
2.2.6 Physical inventory counting	35
2.2.7 Inventory valuation methods	36
2.2.8 Inventory decisions	39
2.3 Other Concepts of Inventory Management	50
2.3.1 Vendor managed inventory	51
2.3.2 Supply chain management	51
2.4 Community Pharmacies	52
2.5 History of Pharmacy in Nigeria	55
2.6 Pharmaceutical Industry	56
2.7 Regulatory Agencies	57
2.7.1 National Agency for Food and Drug Administration and Control (NAFDAC)	58
2.7.2 National Law Enforcement Agency (NDLEA)	59
2.7.3 Pharmacists Council of Nigeria (PCN)	60

	Page
2.8 Procurement of Medicine by Community Pharmacies	61
2.8.1 Supplier of medicines to community pharmacies	61
2.8.2 Procurement of medicines in community pharmacies	61
2.8.3 Storage of medicine in community pharmacies	63
2.8.4 Arrangement of medicine in community pharmacies	63
2.9 Technology and Retailing	64
2.10 Types of Technology or Devices used in Inventory Management	65
2.10.1 Computer	66
2.10.2 Networking	69
2.10.3 Internet	69
2.10.4 Intranet	70
2.10.5 Extranet	71
2.10.6 Point of sale	71

	Page
2.10.7 Mobile phone	72
2.10.8 Barcode	73
2.10.9 Bokode	75
2.10.10 Radio frequency identification (RFID)	75
2.10.11 Interactive voice response (IVR)	76
2.10.12 Closed circuit television (CCTV)	77
2.10.13 Telepharmacy	78
2.10.14 Electronic prescribing (e-Prescribing)	79
2.10.15 Electronic payment (e-Payment)	80
2.10.16 Pharmacy image scanning	80
2.11 Security Measures in Community Pharmacies	81
2.12 Technology Strategy	82
2.13 Technology Selection	87

	Page
CHAPTER THREE: RESEARCH METHODOLOGY	89
3.1 Introduction	89
3.2 Theoretical and Conceptual Framework for Inventory Management	89
3.3 Study Variables and Measurement	97
3.3.1 Socio-demographic variables	97
3.3.2 Inventory management variables	98
3.3.3 Types of technology applied to inventory management variables	99
3.3.4 Factors affecting inventory management variables	100
3.3.5 Factors influencing technology application variables	101
3.3.6 Impact of technology-based inventory management on business performance variables	102
3.3.7 Customer perception variables	102
3.3.8 Strategies to boost technology enhanced inventory management in community pharmacies	103

	Page
3.4 The Study Area	104
3.5 Study Population and Sampling Technique	104
3.6 Research Instruments	105
3.6.1 Design of questionnaire	105
3.6.2 Validation of questionnaire	106
3.6.3 Primary data collection	107
3.6.4 Secondary data collection	107
3.6.5 Case studies	108
3.7 Data Analysis	109
CHAPTER FOUR: RESULTS AND DISCUSSION	111
4.1 Introduction	111
4.2 Response Analysis	111

	Page	
4.3	Socio-Economic Characteristics of the Respondents	111
4.3.1	Socio-economic characteristics of pharmacist/manager respondents	111
4.3.2	Socio-economic characteristics of customer respondents	114
4.4	Distribution of Respondents on Location Basis	116
4.4.1	Locational distribution of Pharmacist/Manager respondents	116
4.4.2	Locational distribution of Customer respondents	118
4.5	Types of Suppliers of Medicines to the Community Pharmacies	118
4.6	Criteria Used by Community Pharmacists in Choosing Suppliers	120
4.7	Demand Forecasting Methods used by Community Pharmacists	120
4.8	Inventory Lead Time in Community Pharmacies	123
4.9	Inventory Protection and Storage Activities of Community Pharmacies	125
4.10	Security Measures Adopted in Community Pharmacies	125
4.11	Prevention against Inventory Obsolescence and Disposal in Community Pharmacies	128

	Page
4.12 Inventory Monitoring in Community Pharmacies	130
4.13 Inventory Valuation Methods in Community Pharmacies	130
4.14 Effect of Inventory Cost on Inventory Management in Community Pharmacies	133
4.15 Objectives of Inventory Management in Community Pharmacies	133
4.16 Constraints to Inventory Management in Community Pharmacies	136
4.17 Relative Impact of Strategies Employed in Inventory Management	138
4.18 Intensity of Use of Strategies for Inventory Management in Community Pharmacies	138
4.19 Arrangement of Medicine on the Shelves in Community Pharmacies	141
4.20 Method Employed in Inventory Management in Community Pharmacies	141
4.21 Factors Considered in Selection of Technology in Community Pharmacies	144
4.22 Types of Technologies Employed for Inventory Management in Community Pharmacies	144
4.23 Area and Extent of Application of Technology and Software installed in Community Pharmacy	148

	Page
4.24 Impact of Technology on Business Performance in Community Pharmacies	152
Impact of Technology on Inventory Management in Community Pharmacies	
4.25	152
4.26 Factors influencing the use of Technology in Inventory Management in Community Pharmacies	152
4.27 Total Capital Spent in Naira on Inventory Management Technology Maintenance per Month	156
4.28 Types of Inventory Management Software used in Community Pharmacies	158
4.29 Case Studies	158
4.30 Assessment of Customers' Service in Community Pharmacies	174
4.31 Focus Group Discussion (FGD)	176
CHAPTER FIVE: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS	185
5.1 Summary	185
5.2 Conclusion	187

	Page
5.3 Recommendations	188
5.4 Suggestions of Further Studies	188
REFERENCES	189
APPENDICES	
I Questionnaire Survey of Pharmacist s/Managers on the Application of Technology to Inventory Management in Community Pharmacy	208
II Questionnaire Survey of Customers' Perception of Customer Service in Community Pharmacy	224
III Interview Schedule for Pharmacists on Application of Technology to Inventory Management	228
IV Interview/Focus Group Discussion Guide for Community Pharmacists	230
V A Basket of Medicines (Document Review)	231
VI Brands of Medicine Used	232
VII Registered Pharmaceutical Premises in Southwestern Nigeria	233
VIII Reliability of Suppliers	234

		Page
IX	Employees' Attitude to Inventory Management in Community Pharmacies	235
X	Overall Customer Satisfaction Assessment of the Pharmacy	236
XI	Accuracy of Demand Forecasting Method Adopted by Community Pharmacies	237
XII	Bin Card	238
XIII	ANOVA for Area and Extent of Application of Technology and Software installed in Community Pharmacy	239
XIV	ANOVA for Factors influencing the use of Technology in Inventory Management in Community Pharmacy	240
XV	Maintenance Cost of Inventory Management in Community Pharmacies per Month (FGD)	241
XVI	Perceived Effects of Cost of Technology Application (FGD)	242

LIST OF FIGURES

Figure		Page
2.1	Cost of Goods Sold	27
2.2	Inventory Management Planning	30
2.3	Inventory Management System	33
2.4	Various Valuation Methods	38
2.5	Fixed Order Quantity Model	42
2.6	Economic Order Quantity	43
2.7	Fixed Interval Order System	47
2.8	Supply Chain Management	53
2.9	Hax and Majluf's model for Technology Strategy Formulation Process	86
3.1	Seven Steps in Theory of Constraint	91
3.2	Conceptual Framework for Technology Application to Inventory Management	94

LIST OF TABLES

Table	Page
4.1 Questionnaire response analysis for both pharmacist and customer respondents	112
4.2 Socio-economic characteristics of pharmacist/manager respondents	113
4.3 Socio-economic characteristics of customer respondents	115
4.4 Distribution of respondents based on location variable	117
4.5 Types of suppliers of medicines to community pharmacies	119
4.6 Criteria used by community pharmacists in choosing suppliers	121
4.7 Demand forecasting method adopted by community pharmacies	122
4.8 Inventory lead time in community pharmacies	124
4.9 Inventory protection and storage activities in community pharmacies	126
4.10 Security measures adopted in community pharmacies	127
4.11 Prevention against inventory obsolescence and disposal in community pharmacies	129
4.12 Inventory monitoring in community pharmacies	131
4.13 Inventory valuation methods in community pharmacies	132
4.14 Effect of inventory costs on inventory management in community pharmacies	134
4.15 Objectives of inventory management in community pharmacies	135

Table	Page
4.16 Constraints to inventory management in community pharmacies	137
4.17 Ranking of impact of strategies on inventory management in community pharmacies	139
4.18 Intensity of use of strategies for inventory management in community pharmacies	140
4.19 Arrangement of medicines on the shelves in community pharmacies	142
4.20 Methods used in inventory management in community pharmacies	143
4.21 Factors considered in selection of technology in community pharmacies	145
4.22 Types of technologies employed for inventory management in community pharmacies	146
4.23 Area and extent of application of technology and software installed in community pharmacies	149
4.24 Impact of technology on business performance in community pharmacies	153
4.25 Impact of technology on inventory management in community pharmacies	154
4.26 Factors influencing the use of technology in inventory management in community pharmacies	155
4.27 Total naira capital spent on inventory management technology maintenance per month	157

Table	Page
4.28 Types of inventory management software used in community pharmacies	159
4.29 Comparison of business performance and inventory management variables of two community pharmacies	167
4.30 Comparison of inventory procurement (case study A)	168
4.31 Comparison of inventory procurement (case study B)	169
4.32 Comparison of inventory sales turnover (case study A)	171
4.33 Comparison of inventory sales turnover (case study B)	172
4.34 Assessment of customer services in community pharmacies	175
4.35 Type of inventory management software adopted	177
4.36 Effect of technology application on pharmacy business	179
4.37 Perception of participants on problems encountered in technology application	180
4.38 Attitude of employees to technology application to inventory management in community pharmacies	183
4.39 Acquisition cost of inventory management technologies and devices in community pharmacies	184

ABSTRACT

The study investigated the types of technologies applied to inventory management in community pharmacies in Lagos, Nigeria. It also examined the factors influencing the use of technologies and assessed their impact on business performance and inventory management. This was with a view to recommending strategies for enhancing technology application to inventory management in the industry.

The study covered registered community pharmacies in Lagos, Nigeria and data were collected using questionnaire, observation, interview, case study and focus group discussion approaches. Two sets of questionnaire were used. The first set was administered on 150 selected pharmacists to garner information on the profiles of the pharmacies: the type of technologies used for inventory management, factors influencing the uses and their effects on business performance. The second set was administered on 750 selected patrons of the selected community pharmacies. The questionnaire elicited information on their perceptions on the quality of services rendered by the pharmacies. Furthermore, two community pharmacies using manual inventory management were selected as case studies. Inventory management procedures of the two pharmacies were compared before and after installation of Electroclerk, inventory management software. Focus group discussion, consisting of eight pharmacists, was conducted. Secondary data were collected from publications, journals and records of relevant stakeholders. Descriptive and inferential statistics were employed for data analysis.

Results showed that browsing (67.8%), website (71.9%), e-mail (75.8%), telephone (87.5%), and chatting (76.8%) were adopted by the respondents. In the case of mobile phone technologies, telephone (94.0%), e-mail (87.3%), SMS (86.4%), Internet (71.4%), telephone conferencing (17.2%), and bluetooth 16.7%) were adopted. Other technologies adopted included electronic payment (42.0%),

computer system (53.3%), Closed Circuit Television (CCTV) (18.6%) and barcode (9.3%). There was a significant difference in the areas of application ($F = 12.04$, $p \leq 0.05$) of the technologies. The uses of the technologies were high in accounting integration (3.40), printing invoices (3.75), grouping of products (3.63), and generation of reports (3.69) and fairly high in purchase order generation (3.38), automatic reordering (3.23), and expiration date tracking (3.05). Barcode scanning was rarely used. Based on a 5-point Likert scale, the technologies had high impact on inventory management in the areas of tracking of medicine (3.60) and record keeping of inventories (3.54). They had impact in business performance in the area of customer waiting time (3.46), patronage (3.45), availability of more time for pharmacist (3.42), and customer satisfaction (3.31). Also, case study revealed an increase in sales, purchases, stock level, order frequency, and patronage; and a decrease in time taken to generate purchase order and carry out stocktaking, pilfering, medicine expiration, stock-out, and customer waiting time. It further showed that determination of ordered quantity and inventory monitoring became faster. Furthermore, acquisition cost ($F = 10.957$, $p = 0.000$), sustainability cost ($F = 12.805$, $p = 0.000$), fear of technology application ($F = 5.551$, $p = 0.003$), fear of loss of social interaction ($F = 6.458$, $p = 0.002$), limited knowledge of pharmacist in technology application ($F = 4.932$, $p = 0.042$), and size of pharmacy ($F = 3.242$, $p = 0.000$) were significant factors ($p \leq 0.05$) influencing the use of the technology.

The study concluded that technology application to inventory management in community pharmacies enhanced business performance and inventory management.

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Application of technology in every facet of life is turning the world into a global village and affecting all phases of human endeavour, be it leisure, business, or education (John de Gier, 2000). The global economy is undergoing a series of sweeping changes, driven by rapid technological progress particularly in the industrialised countries. These changes are fundamentally altering the methods and organisation of the production of goods and services, and the skills, information, infrastructure as well as institutions needed to operate an economy efficiently. So broad and far-reaching are these technological developments that researchers see the emergence of a new industrial revolution within the developed and newly industrialised countries (UNCTAD, 1994). Success in an increasingly competitive marketplace of the modern enterprises depends critically on the quality of data, information, and knowledge with which enterprises apply to their business processes in the diverse scope of activities.

The aim of any profession is to see that optimal services are provided to those who need them. It follows that the fundamental goal of pharmacists is to make medicines and pharmaceutical services available to all who need them. The elements of good pharmaceutical services include accessibility, quality, continuity, and efficiency (Sosabowski *et al.*, 1998). In addition, Ilori (2002) also argued that one of the distinctive features of the success of the developed countries has been the development and application of technology. Much of their wealth and power have derived, directly or indirectly, from their ability to bring science from the laboratory to useful application through technology and innovation. This shows that technology and innovation are the key tools for their high rate of industrial development.

Inventory is the amount of stock or merchandise that is available for sale to present and future clientele (NCPA, 2008). Inventory can also be defined as any resource held to meet internal or external customer demand and it is one of the more visible and tangible aspects of doing business. Raw materials, goods in process and finished goods all represent various forms of inventory. Inventory remains one of the most important assets that most businesses possess, because the turnover of inventory represents one of the primary sources of revenue generation and subsequent earnings for the company (Investopedia, 2010). Inventory exists because there is a difference in the timing or rate of supply and demand. If the supply of any item occurred exactly when it was demanded the item would never be stored, but that seems impossible especially for pharmaceutical businesses that keep so many medicines as inventory. All businesses keep inventory, however, the inventory held by organisations vary (Slack *et al.*, 1998). Inventory is typically a pharmacy's largest asset and in a community pharmacy, medicines and other health related items are kept as inventory. Proper inventory management has a strong and direct effect on a pharmacy's return on investment, therefore it is important for a community pharmacy to have proper inventory to serve its customers (Carroll, 2006).

Inventory management is a discipline that encompasses the principles, concepts and techniques for determining what to order, when to order and how much to order. The right amount of inventory involves the balance between what is required to service your customers and what is financially practical. Inventory system for pharmaceutical businesses has the capacity to track inventory, forecast needs, and generate reorders to maintain adequate inventory (Zipkin, 2000).

Traditional or convectional inventory management practices in community pharmacy involve the use of a bin card for each medicine item. Purchases are entered on to the bin card and sales are deducted to give a balance of such medicine item on a daily basis. Traditional inventory management practices are being made obsolete by increasing global supply chains, contract manufacturing, dynamic

life cycles and multi-channel distribution. Inventory management processes and technologies are actively re-evaluated by companies because of serious consequences of traditional inventory management, which includes but not limited to: lack of inventory control, excess inventory levels, frequent stock-outs and costly deliveries, workflow interruptions and expensive rework, and increased health system labour requirements. A minimum buffer level of stock, called safety stock is usually maintained to curtail the incidence of stock-out, which include loss of customers, sale and profit, and goodwill. However, some customers whose order cannot be filled are ready to wait (i.e. backorder).

Efficient inventory management is essential to community pharmacies. The development of inventory management is a dynamic activity, which involves new approaches, techniques as well as emerging challenges. It is imperative that these challenges are met, because competition in the industry is based on continuous improvement in customer services and reduction in inventory costs.

An efficient inventory management framework not only seeks to optimise the available resources in order to enhance productivity levels, but also a key to improving customer service, cash flow, and profitability margin. Efficient inventory management, which may sound simple, is in fact more complex than most managers perceive, because it requires tacit knowledge and technical know-how. In addition, it is based on a complex framework that requires unique tools and techniques if success must be achieved. Thus, effective inventory management consists of optimising two goals: minimising total inventory investment and carrying the right mix of products to satisfy patient demand (Carroll, 2006). The company should be in a position to meet customers' demand in terms of quantity and quality (Mpwanya, 2005).

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