

**APPLICATION OF MATHEMATICAL
INVENTORY MODELS TO DIGITAL
MULTIPRODUCT STOCK MANAGEMENT OF
SOME PHARMACEUTICAL STORES IN LAGOS,
NIGERIA**

BY

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**A DISSERTATION SUBMITTED TO THE SCHOOL OF POSTGRADUATE
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MATHEMATICS IN THE DEPARTMENT OF MATHEMATICS, COLLEGE
OF SCIENCE AND TECHNOLOGY, COVENANT UNIVERSITY, OTA.**

OCTOBER, 2021

ACCEPTANCE

This is to attest that this dissertation is accepted in partial fulfilment of the requirements for the award of the degree of Master of Science in Industrial Mathematics in the Department of Mathematics, College of Science and Technology, Covenant University, Ota, Nigeria

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DECLARATION

I, **OBI, LAWRENCE CHINEDU (19PCD02033)** declare that this research was carried out by me under the supervision of Dr. M.C. Agarana of the Department of Mathematics, College of Science and Technology, Covenant University, Ota, Nigeria. I attest that the dissertation has not been presented either wholly or partially for the award of any degree elsewhere. All sources of data and scholarly information used in this dissertation are duly acknowledged.

OBI, LAWRENCE CHINEDU

Signature and Date

CERTIFICATION

We certify that this dissertation titled “**APPLICATION OF MATHEMATICAL INVENTORY MODELS TO DIGITAL MULTIPRODUCT STOCK MANAGEMENT OF SOME PHARMACEUTICAL STORES IN LAGOS, NIGERIA**” is an original research work carried out by **OBI, LAWRENCE CHINEDU (19PCD02033)** in the Department of Mathematics, College of Science and Technology, Covenant University, Ota, Ogun State, Nigeria under the supervision of Dr. Michael C. Agarana. We have examined and found this work acceptable as part of the requirements for the award of Master of Science in Industrial Mathematics.

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DEDICATION

To the Almighty God for grace, divine capacity and His wisdom.

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LIST OF SYMBOLS

- $TCU(z, R)$:cost function per unit time.
- $f(x)$:probability density function of demand, x , during lead time.
- D ; Expected demand per unit time.
- h :Holding cost per inventory unit per unit time
- s : Shortage cost per inventory unit.
- K :Ordering cost or setup cost per order.
- $I(t)$: inventory level at time t .
- $Y(t)$: Order cost at time t .
- Q : Number of pieces per order.
- Q^* : Optimal number of pieces per order.
- D :Annual demand in units for the inventory item.
- p : Daily production rate.
- d :Daily demand rate.
- t :Length of the production run in days.

ABSTRACT

Decision-making using accurate data have been a core challenge to Pharmaceutical retail store owners in Nigeria. This is as a result of slow adoption of digital inventory management solutions and the non-recognition of the importance of accuracy of data gathering in cost and decision optimization or lack of knowledge of the availability of this solution or its usage. It is also common knowledge that digital technology adoption for retail business owners in Africa is low compared to its adoption in the western world. Looking at their data and the volume of research work in the western world on digital inventory management, one would realize that data driven decision-making can only be possible through adoption of digital inventory solutions. This study will review the process that pharmaceutical stores in Lagos adopt in procuring a digital solution to manage their multi-product retail management system. This study seeks to determine the suitable digital solutions adopted in selected pharmaceutical stores and how it affects inventory management, pricing and cost optimization, demand and decision optimization. The data collected from the selected pharmaceutical stores was analysed using the "Economic Order Quantity Model and Quantity Discount Model". Also the data was used in building a decision tree that would help pharmaceutical store owners in making right business decisions. The study will help similar business owners in understanding the importance of digital inventory solutions, its benefits and how it will help them optimize their cost. The data collection will be limited to ten top high demand products from five pharmaceutical stores in Lagos, Nigeria.

Keywords: Inventory management, Digital Inventory Management, Economic Order Model, Quantity Discount Model, Cost, Pharmaceutical stores.