Critical Factors Affecting Inventory Levels Of an Over the Counter (OTC) Herbal Medicine: A Case Study on a Medicine Manufacturing Company

Palligoda Withanage Chenali Hemanthi

179209K

Research submitted in partial fulfilment of the requirements for the MBA in Supply Chain Management

Department of Transport and Logistics Management

University of Moratuwa
Sri Lanka

March 2019

DECLARATION OF ORIGINALITY

I declare that this thesis is my own independent investigation and does not include any material that has been produced by any other person or institute unless otherwise acknowledged in the thesis and this thesis has not been previously accepted in substance for any degree or in any institution of higher learning to my belief and to best of my knowledge.

P.W.C. Hemanthi — 11th October 2021

Signature — Date

COPY RIGHT STATEMENT

I hereby grant University of Moratuwa, the non-exclusive right to reproduce and distribute my thesis, in whole or in part in print, electronic of other medium. I retain the right to use this content in whole or part in future works.

P.W.C. Hemanthi — 11th October 2021

Signature — Date

STATEMENT OF THE SUPERVISOR

The candidate has carried out research for the MBA in SCM under my supervision.

Dr. Yapa Mahinda Bandara — 11th October 2021

Signature of the supervisor — Date

ACKNOWLEDGEMENTS

First and foremost my sincere gratitude goes to my research supervisor Dr, Yapa Mahinda Bandara, Senior Lecturer, at Department of Transport and Logistics Management, University of Moratuwa, for the support, guidance and encouragement tendered all through the endeavour.

I extend my deepest gratitude to Head of Transport and Logistics Management Department in University of Moratuwa, the former Head of Department Prof. Amal S. Kumarage and all the academic staff members for providing a conducive surrounding, imparting higher learning and creating opportunities for exposure both in the country and overseas and networking to expand the horizon of thinking and decision making for successful navigation through career ladder and life.

I'm immensely grateful to all the lecturers, evaluation panels, industry experts for all the knowledge and skills imparted to make the learning process a success.

I convey my sincere gratitude to all the non-academic staff members of the Department of Transport and Logistics Management for providing all the much needed support and co-ordination to make this MBA programme come to a successful fruition.

Finally, I wish to convey my sincere gratitude to my family, batch mates, colleagues, friends, to all individuals who supported, encouraged, advised and cheered me to make this whole MBA program and Research into a successful realization.

Thank you!!!

ABSTRACT

Herbal medicines have been in existence throughout the ages, giving comfort, cure and wellbeing to human beings all over the world. Although, in the last few decades, herbal medicines weren't given much of a prominence in health and wellbeing, herbal medicines are moving back into limelight, since recent years, as people are moving back to nature cures, trending towards natural products that are more congruent to the physiological, psychological balance of human being and to cost viable products. The market for herbal medicines is being increased at a rapid rate and continuous advertising of herbal medicines are frequent these days unlike in yester years, herbal medicine brands are nowadays becoming household names, proving the increasing trend for herbal medicines in the healthcare sector.

With increasing competition, herbal medicine manufacturers are looking for ways and means of making efficacious, cost viable products available to consumers and gaining market stability for their products. While, availability at the right time being the most crucial factor to make a sale, demand unpredictability and limiting shelf life of product are being contradicting nature of the product segment, maintaining right inventory levels in the supply chain plays a critical role in movement of product in the supply chain and cost viability of product in the market. In this scenario of context, where herbal medicines are gaining a wider market acceptance, it has become imperative to have a closer look at the herbal medicine supply chain, streamline, instigate precautionary measures and implement solutions in instilling right inventory levels, in order to gain an edge over competition, by bringing out efficacious, economically and ecologically viable products to market at the right time,

Supply chain aspects of herbal medicines are yet rather untouched in research studies. As a preliminary to set right inventory levels, this research has tried to identify the critical factors affecting over stocking and under stocking of an Over the Counter (OTC) Herbal Medicine, based on a case study of a selected herbal medicine. In this case study research, critical factors affecting over stocking and under stocking of a herbal medicine has been identified by obtaining information through interviews, questionnaires and by using Pareto Analysis and AHP (Analytical Hierarchical Process) analysis.

The most critical factors affecting over stocking and under stocking, identified in this case study research were Seasonal factor with the highest weight of 0.3195, Product Awareness factor 0.2600, Product Price factor 0.1716, Sales Forecast factor 0.1187, Competitor Products factor 0.0838 and Logistics Delays factor 0.0463.

These factors affect different products in different ways, which means effect of these factors for demand fluctuation for each product or for each therapeutic class is different or unique to the product or to the respective therapeutic class. Hence, it is important to do further research focused on above factors related to the product in this case study, in order to implement effective sustainable solutions to minimize the over stocking and under stocking and in maintaining a sustainable Inventory level.

Key words, herbal medicines, supply chain, under stocking, over stocking, Inventory Level, Pareto analysis, AHP analysis.

ACRONYMS AND ABBREVIATIONS

AHP - Analytical Hierarchical Process

API - Active Pharmaceutical Ingredient

ARIMA – Auto Regressive Integrated Moving Average

BPNN - Back-Propagation Neural Network

CAGR - Compound Annual Growth Rate

DTCA - Direct-to-Consumer Advertising

FGS – Finished Goods Stores

GWH – General Ware House

ICT – Information, Communication Technology

MAD - Mean Absolute Deviation

MAPE - Mean Absolute Percentage Error

MSE - Mean Squared Error

OTC - Over-The-Counter

Q.C. – Quality Control

Q.O. – Quality Operations

R&D – Research & Development

RMSE - Root Mean Square Error

T&CM - Traditional and Complementary Medicine

US FDA – United States Food & Drug Administration

VAR – Vector Auto Regression

WHO - World Health Organization

WHO GMP - World Health Organization Good Manufacturing Practices

Table of contents

DECLARATION OF ORIGINALITY ii
COPY RIGHT STATEMENT iii
STATEMENT OF THE SUPERVISOR iv
ACKNOWLEDGEMENTS v
ABSTRACT vi
ACRONYMS AND ABBREVIATIONS viii

CHAPTER 1 – INTRODUCTION 1

1.1 Background to the Research 1
1.1.1 Introduction 1
1.1.2 Herbal Medicine Market Growth in Sri Lanka 2
1.1.3 Definition of a Herbal Medicine 2
1.1.4 Over-the-Counter (OTC) Medicines 3
1.1.5 Regulatory background to OTC Herbal Medicines in Sri Lanka 3
1.1.6 XYZ Company Background 3
1.1.7 Background of Herbal Medicine Product selected for this Research Study 4
1.2 Problem Statement 4
1.3 Need for the study 8
1.4 Research Gap 9
1.5 Research Question 9
1.6 Research Objectives 9
1.7 Research Process 10
1.8 Research Scope 11
1.9 Significance of the study 11

CHAPTER 2 – LITERATURE REVIEW 13

2.1 Introduction 13

2.2 Supply Chain of a Herbal Medicine: key issues 13
2.3 Factors affecting demand volatility 14
2.4 A case study of supply chain aspect of herbal medicines in Malaysia 16
2.5 Demand Effects in Prescription Drug Promotion 18
2.6 Forecasting seasonality trend – statistical technique application 18
2.7 Effect of Advertisements on Buying Behavior of OTC Medicines 19
2.8 Herbal Remedies, Issues in Licensing and Economic Evaluation 20
2.9 Factors affecting demand, identified in Literature Review 20

CHAPTER 3 – RESEARCH METHODOLOGY 21

3.1 Introduction 21
3.2 Research design 23
3.3 Problem Diagnosis 25
3.3.1 Problem Diagnosis stages 25
3.3.2 Map process flow of product 26
3.3.3 Map Data in main data points in Process Flow 30
3.3.3.1 Data Collection for Problem Diagnosis 30
3.3.3.2 Map Data trends for Problem Diagnosis 30
3.4 Selection of population and sample 34
3.4.1. Background to population and sample selection 34
3.4.2. Population 37
3.4.3 Characteristics of selected population 38
3.4.4 Sample 38
3.5 Data Collection 40
3.5.1 Introduction 40
3.5.2. Primary Data Sources 41
3.5.3. Secondary Data Sources 41
3.5.4. Questionnaire 41
3.5.4.1 Overview 41
3.5.4.2 Questionnaire I - Initial Interview - Appendix I 42

3.5.4.3 Questionnaire II - Appendix II……..43
3.5.4.4 Questionnaire III - Appendix III……...44
3.6 Strategies for error control.....46
3.7 Data analysis 47
3.7.1 Data Analysis stages.....47
3.7.2 Method selection for Identification of factors.....48
3.7.3 Method selection for Identification of the most contributing factors.....49
3.7.4 Weight calculation of factors using AHP 49
3.8 Chapter Summary.....52
CHAPTER 4 – RESEARCH FINDINGS AND DISCUSSION 53
4.1 Introduction.....53
4.2 Data screening.....53
4.3 Findings 53
4.4: Discussion of Research Results 62
4.4.1 Most critical factors identified 62
4.4.2 Seasonal effect of the product.....62
4.4.3 Product Awareness 64
4.4.4 Product Price 65
4.4.5 Sales Forecast.....66
4.4.6 Competitor Products.....67
4.4.7 Logistics Delays 68
CHAPTER 5 – CONCLUSIONS AND FUTURE RESEARCH DIRECTIONS 70
5.1 Introduction.....70
5.2 Summary of Research Findings 70
5.3 Conclusions.....72
5.4 Research Limitations.....73
5.5 Future Research Directions.....74

5.6 Chapter Summery 74

REFERENCES 75

ANNEXURES 79

Appendix 1- Questionnaire 1 79

Appendix II - Questionnaire II 80

Appendix III - Questionnaire III 81

List of Figures

Figure 1.1: Supply Chain of two Herbal Extracts……...4

Figure 1.2: Product Flow……... 5

Figure 1.3: Herbal based cough syrup medicine supply chain ……...6

Figure 1.4: Cough syrup Sales Revenue as a percentage of Herbal Business Category …..... 8

Figure 1.5: Research process …….. 10

Figure 3.1: Overall approach for the research …… 22

Figure 3.2: Research design milestones …….. 25

Figure 3.3: Problem diagnosis stages ……...25

Figure 3.4: Process flow of the product ……...26

Figure 3.5: Problem diagnosis – trend analysis of main data points in the process ……..... 31

Figure 3.6: MAD (Mean Absolute Deviation) trend ……32

Figure 3.7: MSE (Mean Squared Error) trend …… 33

Figure 3.8: RMSE (Root Mean Square Error) trend ……... 33

Figure 3.9: MAPE (Mean Absolute Percentage Error) trend …….. 34

Figure 3.10: Demand pull point selected for the research ……...34

Figure 3.11: Categories of staff at XYZ Company …….. 35

Figure 3.12: Managerial staff category, department wise breakdown …… 36

Figure 3.13: Selected population of XYZ Company……... 38

Figure 3.14: Total selected population …… 38

Figure 3.15: Total population and selected sample ……. 39

Figure 3.16: Data collection stages ……..40

Figure 3.17: Data analysis methods …… 47

Figure 3.18: Analysis Process for factor identification …….. 48

Figure 3.19: AHP hierarchy …… 49

Figure 4.1: Problem diagnosis – trend analysis of main data points in the process …… 54

Figure 4.2: MAD (Mean Absolute Deviation) trend ……... 55

Figure 4.3: MSE (Mean Squared Error) trend ..……..55

Figure 4.4: RMSE (Root Mean Square Error) trend ……... 56

Figure 4.5: MAPE (Mean Absolute Percentage Error) trend …….. 56

List of Tables

Table 2.1: Factors identified in literature review …… 20

Table 3.1: Geographical area wise sales % for herbal medicine product ……... 39

Table 3.2: Summary of Questionnaire I responses ……. 43

Table 3.3: Summary of Questionnaire II responses …… 44

Table 3.4: The weight scale of AHP ...…….45

Table 3.5: Comparison Matrix …… 50

Table 3.6: Consistency index for random judgments ……. 52

Table 4.1: Data Collection method and number of responses …… 53

Table 4.2: Summary of Questionnaire I responses ……. 57

Table 4.3: Questionnaire II response results ……58

Table 4.4: Notations used to denote factor ……. 59

Table 4.5: Weight calculation stage 3, Pair wise matrix of 14 responses by Average ……... 59

Table 4.6: Weight calculation stage 4, normalized matrix …….. 60

Table 4.7: Most critical factors with weights ……. 60

Table 4.8: Consistency index for random judgments ……. 61

Table 4.9: CR Calculations ……. 61

Table 4.10: Influence level of identified factors …… 62

Table 5.1: Summary of research results ……..... 71