MARKETING DECISION SUPPORT SYSTEM (MDSS)

Case studies on ASPSC & Mobil Oil East Africa Limited

By

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MARKETING DECISION SUPPORT SYSTEM (MDSS)
Case studies in Akaki Spare Parts and Hand Tools S. Co, and Mobil Oil East Africa Limited

BY

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Table of Contents

Acknowledgment i
Table of Contents iii
List of Tables vi
List of Figures vii
Notations viii
Abbreviations ix
Appendixes x
Abstract xi

CHAPTER-ONE:- INTRODUCTION 1
1.1 Background of the Thesis 1
1.2 Statement of the Problem 2
1.3 Objectives of the Thesis 4
1.4 Scope and Limitations 5

CHAPTER-TWO:- BACKGROUND OF THE COMPANIES 6
2.1 Akaki Spare Parts and Hand Tools S. Co. (ASPSC) 6
2.1.1 Historical Background of ASPSC 6
2.1.2 Product Types of ASPSC 7
2.1.3 Production Capacities of ASPSC 8
2.1.4 Organizational Structure of ASPSC 9
2.1.5 Major Customers of ASPSC 9
2.1.6 Current Status of ASPSC 11
2.2 Mobil Oil East Africa Limited 14
2.2.1 Introduction to Ethiopian Petroleum Market 14
2.2.2 Historical Background of Mobil Oil Corporation 16
2.2.3 Type of Products and Services 19
2.2.4 Mobil in Africa 20
2.2.5 Mobil in Ethiopia 23

2.2.5.1 Profile of Mobil in Ethiopia *23*
2.2.5.2 Current Status of Mobil in Ethiopia *25*

CHAPTER-THREE:- LITERATURE REVIEW 27
3.1 Introduction 27
3.1.1 What Is Marketing? 27
3.1.2 What is Market? 28
3.1.3 Functions of Marketing 29
3.1.4 Impact of Marketing on Other Function 31
3.2 Marketing Decisions 33
3.2.1 Types of Decisions 33
3.2.2 Nature of Marketing Decisions 34
3.2.2 Quantitative Approaches of Marketing Decisions 36
3.2.3.1 Queuing theory *36*
3.2.3.2 Linear programming (LP) *38*
3.2.3.3 Game theory *39*
3.2.3.4 Forecasting *40*
3.3 Decision Support System (DSS) 40
3.3.1 Overview of DSS 40
3.3.2 Possible Analysis of DSS 43
3.3.3 Benefits and Limitations of DSS 45
3.3.4 Acquiring a DSS 46
3.3.5 The Process of Designing DSS 48
3.3.6 Application Areas of DSS 50
3.4 Marketing Decision Support System (MDSS) 51
3.4.1 Marketing Research vs. Marketing Information System 51
3.4.2 Marketing Decision Support System (MDSS) 53
3.4.3 Functional Components of MDSS 55
3.4.4 Implementation of MDSS 58

CHAPTER-FOUR:- PROBLEM FORMULATION 60
4.1 Introduction 60
4.2 Case-One, ASPSC 61
4.2.1 Formulation of Decision-One 61
4.2.2 Formulation of Decision-Two 64
4.3 Case-Two, Mobil 67
4.3.1 Formulation of Decision-One 67
4.3.2 Formulation of Decision-Two 71

CHAPTER-FIVE:- THE COMPUTER PROGRAMMING 73
5.1 Introduction 73
5.2 Steps in Using the Program 74
5.3 Case-One, ASPSC 76
5.3.1 Programming of Decision-One 76
5.3.2 Programming of Decision-Two 79
5.4 Case-Two, Mobil 83
5.4.1 Programming of Decision-One 83
5.4.2 Programming of Decision-Two 88

CHAPTER-SIX:- CONCLUSIONS AND RECOMMENDATIONS 91
6.1 Conclusions 91
6.2 Recommendations 94
6.3 Future outlooks 95

References 96
Appendixes 102
Appendix- I 102
Appendix- II 103
Appendix- III 103
Appendix- IV 108
Appendix- V 113

List of Tables

Table 2. 1. Major customers of ASPSC 10
Table 2. 2. Annual petroleum consumption of Ethiopia 15
Table 2. 3. Distribution of service stations in Ethiopia 15
Table 2. 4. Mobil in Africa 22
Table 2. 5. Holding capacities of Mobil Depots 24
Table 2. 6. Performance status of Mobil 26
Table 3. 1. Main functions of marketing 30
Table 3. 2. Structured Vs. unstructured decisions 34
Table 3. 3 Marketing information system Vs. marketing research 52

List of Figures

Figure 2. 1. Utilized capacity of ASPSC 12
Figure 2. 2. Sales trend of ASPSC 13
Figure 2. 3. Profitability trend of ASPSC 13
Figure 2. 4. The organizational structure of ExxonMobil corporation 18
Figure 2. 5. The net income of Mobil in 1999-2003 18
Figure 3. 2. Decision Support System (DSS) 43
Figure 3. 3. Marketing Decision Support System (MDSS) 53
Figure 3. 4. Major analytical models 56
Figure 5. 1. Splash form of the program 74
Figure 5. 2. Quick review form 75
Figure 5. 3. Option chart form 75
Figure 5. 4. Flow diagram of demand forecasting 76
Figure 5. 5. Input form of demand forecasting 77
Figure 5. 6. Output form2 of demand forecasting 78
Figure 5. 7. Comment form 79
Figure 5. 8. Message form 79
Figure 5. 9. Flow diagram of selling price model 80
Figure 5. 10. Input form of selling price 81
Figure 5. 11. Output form of selling price 82
Figure 5. 12. Output form of analysis 83
Figure 5. 13. Flow diagram of Queuing model 84
Figure 5. 14. Input form of Queuing program 85
Figure 5. 15. Output form3 of queuing models 85
Figure 5. 16. Output form4 of alternative analysis 86
Figure 5. 17. An example of message box 87
Figure 5. 18. An example of comment form 87
Figure 5. 19. Flow diagram of IAT model 88
Figure 5. 20. Input form of IAT model 89
Figure 5. 21. Output form of IAT 89

Notations

F_{t+1} The forecast for next period

D_t Actual demand in present period

F_t The previously determined forecast for the present demand

α The smoothing constant (weighing factors)

Y Sales demand (as dependent variable)

X Advertisement budget (as independent variable)

a The slope

b The intercept

ρ The shops utilization factor

n Number of customers

P_0 Probability that no customer are in the queuing system

P_n Probability that n-customers are in the queuing system

L The average number of customers in the queuing system

L_q The average number of customers in the queuing lines

W The average time a customer spends in queuing system

W_q The average time a customer waiting in the queue

I The probability that the shop is idle

μ The pervious service rate

μ_{new} The new service rate

λ The previous arrival rate.

λ_{new} The new service rate

Abbreviations

ASPSC = Akaki Spare Parts and Hand Tools Share Company

EPE = Ethiopian Petroleum Enterprise

DSS = Decision Support System

MDSS = Marketing Decision Support System

MIT = Massachusetts Institute of Technology

MIS = Management Information System

DMC = Direct Material Cost

DLC = Direct Labor Cost

TOHC = Total Overhead Cost

SP = Selling price

S.N = Serial Number

OPEX = Operation expense

GM = Gross Marginal Performance

FAE = Foreign Area Expense

IAT = Income After Tax

$IAT_{(div.)}$ = Income After Tax at division level

Appendixes

Appendix- I Organizational structure of ASPSC..... 102
Appendix- II The programming codes of demand forecasting..... 103
Appendix- III The programming codes of selling price 103
Appendix- IV The programming codes of Lube shop..... 108
Appendix- V The programming of IAT calculation..... 113

Abstract

Many marketing decisions are made in complex environments where numerous variables are affecting the decision outcomes. Faced with these difficulties, marketing executives seek decision aid tools like Marketing Decision Support System (MDSS). It is a tool to utilize relevant information from business environment and return it in to basis for making actions.

Most of the international enterprises use this MDSS to improve the effectiveness of their decision making process. However, several of the domestic companies shy away from the use of decision support tools. The good examples of such companies are: Akaki Spare Parts and Hand Tools S. Co. and Mobil Oil East Africa Limited.

The main intention of this thesis is to prepare tools that assist these two companies' marketing decision makers in carrying out their tasks. To be successful, the companies' current working systems are analyzed in detail with reference to the surveyed literatures. Then, selected decision problems are formulated using appropriate modeling techniques. Finally, computer programs that match with the diagnosed situations have developed by using visual basic computer programming language and its database by access computer programming language.

The proposed MDSS works for four decision types, two from ASPSC and two from Mobil. It can be further implemented to other decision types with slight modifications.

CHAPTER-ONE

INTRODUCTION

1.1 Background of the Thesis

Certainly in this day and age no one quarrels with the marketing concept. Every thing that a business does must be pointed to the market. However, marketing decisions are often more complex than those required of mangers in other functional business areas. In addition to complexity, marketing decisions are of fundamental importance because of the financial risk they pose to organizations. This is because marketing decisions often bear the dual responsibility of revenue generation and cost control.

Therefore, to support managerial decision makers in decision situations, a system so called Marketing Decision Support System (MDSS) is important. It is a coordinate collection of data, systems, tools and techniques with supporting software and hardware by which an organization and enterprise utilize relevant information from business environments and return it into basis for marketing action.

The main focus of this thesis is to develop a Marketing Decision Support System (MDSS). The case studies in Akaki Spare Parts & Hand Tools Share Company (ASPSC) and Mobil Oil East African Ltd.

1.2 Statement of the Problem

The world economy has undergone a radical transformation in the last two decades. Basically, geographical and cultural distances have shrunk significantly due to globalization. The globalize market means that domestic companies can count on a much larger market potential for their goods and services; the bad news is that they will face a greater number of competitors.

Domestic companies can no longer ignore foreign competitors, foreign markets, and foreign sources of supply. They cannot ignore emerging technologies, materials, equipments and new ways of organizing and marketing. It is known that some of our nation companies are not only increasingly sourcing their companies, suppliers, and goods, but also they are trying to sell some of their locally made goods abroad. Nevertheless, they are not doing this in meticulously planned and organized manner, so there is no much options opened to them.

Decisions in all marketing areas are becoming increasingly complex. To cope up all these in integrated computerized data management and data analysis, methods like marketing decision support system are basic requirements. However, the domestic companies are not in a position to customize the new methodologies in their day-to-day marketing activities. They perform marketing decision and plunge related activities in the traditional fashions. Unless they can introduce and adapt the coming technologies like MDSS they cannot jump on competitors and maximize their profit.

For example; one of the biggest manufacturing enterprises in the nation, ASPSC, is running in its 34.6% of capacity due to inability to sense the market and adapt and adopt the product mix to the ever changing situation. The service giving company, Mobil Oil East African Ltd., has smaller share of Ethiopian petroleum market due to the greater competitors attack. Some of the main reasons behind their weaknesses are: their staffs of marketing decision makers have limited capability to handle several alternatives, their intuition and judgmental capability is not improved and they don't incorporate subjective as well as objective factors so that they lack to solve complex marketing decisions. Moreover, they don't have flexible database for quick access of information.

Those weaknesses are solvable. Implementing MDSS is the right tool that gives flexible database incorporate mathematical/statistical models that approximate the decisions situation better and improves the effectiveness of decision making process (currency, timelines and quality). Therefore, unless both companies able to use MDSS techniques they can not find themselves in a win-win situations.

Even if the current situations of our country emphasize the need for the researchers to work hard, in reality decision support system researches are few. I strongly believe this is the moment of expanding researches for take-off, for pulling together and marshalling available resources.

1.3 Objectives of the Thesis

The desired outcomes that are to be achieved by carrying out this thesis works in general and specific are the following.

The general objectives of the thesis:

1- To help ASPSC & Mobil Oil East African Ltd. marketing decision makers, by preparing appropriate computer program.
2- To introduce Marketing Decision Support System (MDSS) for those companies.
3- To apply practically the different mathematical/ statistical tools and models in the decision making activities.

The specific objectives of the thesis:

1- To initiate and be a ground base for future researches related to marketing decision areas.
2- To practice the proper software development techniques in practical work areas.
3- To facilitate an easy way of external and internal information utilization for the pertinent and correct decision making activities of ASPSC and Mobil Oil East African Ltd.
4- To improve the awareness of how to adapt new methodologies in those chosen companies.

1.4 Scope and Limitations

The concerns of marketing are wide and correspondingly the MDSS can be applied on each of them. However, due to the limited availability of resources (time, materials, etc.) it is difficult to cover the whole portion in this thesis work. The following are the maximum and minimum scope and limitations of the study:

⇒ This thesis is concentrated to the issues of demand forecasting, pricing, shops management systems, and net income calculation methods.

⇒ From modeling and analytical tools: exponential smoothening forecasting, linear regression, queuing modeling, and other mathematical methods are used.

⇒ In part of review literature collection different journals have extensively utilized. In addition, books and internet outputs are incorporated.

⇒ Because of its special feature to communicate with database, the visual basic computer programming language has selected for this MDSS development.

⇒ The software has designed to provide support to individuals as well as groups at various managerial levels, ranging from executives to line managers.

⇒ There were scarcities of data of Mobil Oil East Africa Limited, especially on economical aspects. Therefore, limited discussions were held in these areas.

⇒ There were no sufficient reference materials, especially in decision support system aspects.

CHAPTER-TWO

BACKGROUND OF THE COMPANIES

2.1 Akaki Spare Parts and Hand Tools S. Co. (ASPSC)

2.1.1 Historical Background of ASPSC

The idea of establishing a spare parts factory was conceived sometime in 1976, consequent upon the growing shortage of spare parts in the Ethiopian industries. Most of the factories at that time were very old and in a poor physical condition. Their spare part requirements were, therefore, very high while obtaining them from abroad had a number of difficulties. To alleviate all these problems and thereby ensure a sufficient and smooth supply of spare parts, establishment of a spare part factory became imperative.

The German Democratic Republic (GDR) and UNIDO conducted preliminary studies for the establishment of a spare part factory in 1977 and 1979, respectively. Subsequent to this a Swedish company (SWECO) between 1980 and 1982 conducted a detailed feasibility study, financed by the Swedish International Development Agency (SIDA). SWECO conducted extensive study covering four major industries (the sugar industries, the textile industries, the cement industries and the metal work industries) and recommended the establishment of a spare parts factory that can manufacture 3600 different items.

Following the singing of a contract in January 1984 between the then called National Metal Works Corporation and an Italian engineering firm (FATA) for erection and commissioning of a spare parts factory, the project implementation started on April 1985 and the factory was inaugurated on February 1989.

The main objectives of the company were:

1- Alleviating shortage of industrial spare parts through local production
2- Laying down the basis for engineering industries.
3- Saving foreign currency and generating same by exporting spare parts to neighboring countries.
4- Generating employment opportunities.

Its capital is 142,298,000 birr and is located at the Akaki site, situated about 25 km south of Addis Ababa, adjacent to the main asphalt road of Debrezeit. The distance from the company to the main asphalt road of Debrezeit, which runs along an embankment, is about 450m. A railway of 300m long branch line is available to link the company with the main Addis Ababa-Djibouti railway line. ASPSC was implemented in the total area of 155,000m^2, with sufficient vacancy of further expansion.

2.1.2 Product Types of ASPSC

- **Spare Parts and Various Castings**

Such as: Shafts, Rollers, Sleeves, Gears, Sprockets, Coil springs, Sugar Mill rollers, Ingot moulds, Armor plates and so on.

- **Cutleries**

Such as: Forks, Spoons and Knives**.**

- **Industrial Hand Tools**

Such as: Wrenches, Utters, Pliers, Screwdrivers, Hammers and so on**.**

- **Commercial Items**

These are standard products like Anvils, Vices, Boiler Electrodes, Hand Pumps, Brake Drums, Pressure Plates and so on.

2.1.3 Production Capacities of ASPSC

I. Spare parts and various castings

- Approximately 36000 types
- 4500 tons annual melting capacity in 2 shifts
- Amount export surplus 1800 tons

II. Industrial hand tools

- Around 222 line items
- Annual capacity 1,600,000 Pcs.
- Annual export surplus 640,000 Pcs.

III. Cutleries

- Around 23 line items
- Annual capacity 600,000 Pcs.
- Annual export surplus 240,000 Pcs.

2.1.4 Organizational Structure of ASPSC

ASPSC is currently running by a general manager, who reports to the board of management. It is further organized in to four functional departments, each with its own functional managers that are under the general manager: [41]

1. Marketing and supplies department
2. Administration & human resource department
3. Finance department
4. Manufacturing department

Each functional department also further subdivided into divisions that are supervised by division mangers. Some divisions have specialized sections or units, each supervised by a section head or foreman. The organization of ASPSC is arranged in accordance with the hierarchy shown in appendix-I.

2.1.5 Major Customers of ASPSC

There are a number of ASPSC's customers, which can be grouped into their respective manufacturing sectors. The following table presents them including the product types purchase and their share from ASPSC's product market.

S.N	Type of Industries / Sectors/	ASPSC's Product Types They Purchased	Market Share
1	SUGAR SECTOR *(Wondji, Metehara & Fincha sugar factories)*	Rollers, Trash and Scrap Plates, Draw eye, Cane knife	33 %
2	TRANSPORT AND COMMUNICATION SECTOR *(Telecommunication, Anbassa City Bus, Woyra Transports…)*	Brake Drum, Brake shoe, Central support, Distribution support, Manhole cover, Bolts, Gears, Shafts, Pins…	20.3%
3	CEMENT SECTOR *(DereDawa, Addis Ababa, and Muger cement fact., Burau bricks facto.,)*	Armor plates, Kiln roller, Jaw plates, Tile mould, Gears, Shaft, Pins, Sprockets, Bolts, and Flanges…	18.50%
4	METAL SECTOR *(Zuqualla steel Rolling, Ethio. Iron & Steel, Kotebe metal, Dan techno craft, Hormat engineering…)*	Rollers, Brackets, Sprockets, Flange, Spaces, Pulley Spindle, Shaft, Ingot Bar, Ingot mould, Chrome plating…	8.5%
5	MINING AND ENERGY SECTOR *(MIDROC Legedmbi, Ethio Marble, Ethiopian Electric light and power Authority…)*	Swan neck hooks, Pins, Gears, Liner plate's shafts, Ingot, Hollow castings…	4.8 %
6	CHEMICAL SECTOR *(Addis Tire, Ethio pulp, Niefas silk paint, Universal plastic, Mobil oil, Yekatit papers…)*	Worm shaft, Worm wheels, Sprockets, Gear, Cast iron sleeves, Manhole cover, and Tire moulds….	3.9%
7	AGRICULTURAL SECTOR *(Elfora industry, Upper awash agric, Coffee technology, Agricultural equip…)*	Mould bold plough, Bearing housing, Gears, Pins, Rings, Bushing….	3 %

Table 2. 1. Major customers of ASPSC

S.N	Type of Industries /Sectors/	ASPSC's Product Types They Purchased	Market Share
8	FOOD SECTOR *(FAFA Food fact., Adama edible oil, Awassa flour mill..,)*	Hammer mills, Oil pressure Screws, Gears, Wheels, Sprockets, Shafts, Steel coupling…	3%
9	CONSTRUCTION SECTOR *(Enterprises including MIDROC, Berta, Batu, Ayat, Blunile, kajima,)*	Jaw plates hammer mills, Concrete mould, and Manhole cover, Sprockets...	3%
10	TEXTILE SECTOR *(Awassa, Bahirdar & Akaki Textile fact; Meher fiber products….)*	Bearing housing, Follower screws, Wheels, Gears, Clutch disc….	2%
11	MISCELLANEOUS SECTOR *(Equatorial Bus Group, A.A university, Selma Vocational commercial bank...)*	Garbage tank, Stone flange, plates, Splinted roller, Pulley assembly, Hoisting mechanism, Gears…	2 %
12	BEVERAGE SECTOR *(Ethiopian Crown Cork, Assel Malt factory, Harar Brewery….)*	Cork opener, Tankers, Bracket elevators, Gears, Sprockets, Shafts, Ducts pipes….	1.5 %
13	LEATHER SECTOR *(Ethiopian tannery, Baru tannery, Awash tannery …)*	Bearing housing, Gear box heisting, Gears, Shafts, Stainless steel pipe…	0.75%

Table-2.1, Continued

2.1.6 Current Status of ASPSC

Even if ASPSC is one of the biggest manufacturing enterprise in the nation, currently it is running below its capacity. It utilizes not more than quarter of its capacity (34.6%), due to some challenging deficiencies and constraints. [2,4 and 5]

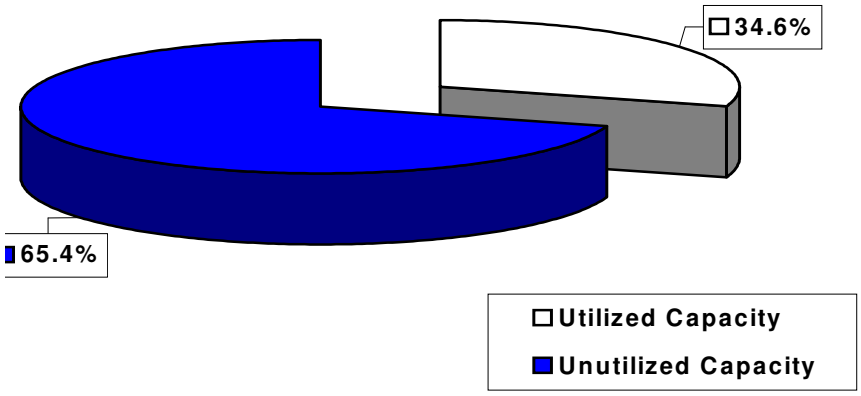


Figure 2. 1. Utilized capacity of ASPSC

Since the company can't manipulate its resources, it covers more than 13 years without fulfilling its intended objectives. There are a number of machines which are not yet functioning due to lack of customer job orders. Examples of these are AS/RS in the store and piston-casting machine in foundry workshop. In all the years, its actual sales as well as production performance trends are below the expected values. There are always deviations between the actual and planned sales volumes as shown in Figure 2.3.

In effect the company didn't become profitable. As shown in its profitability graph (fig-2.4) it didn't approach the profitability margin with the exception of a near by year (1994 E.C.) at the breakeven point.

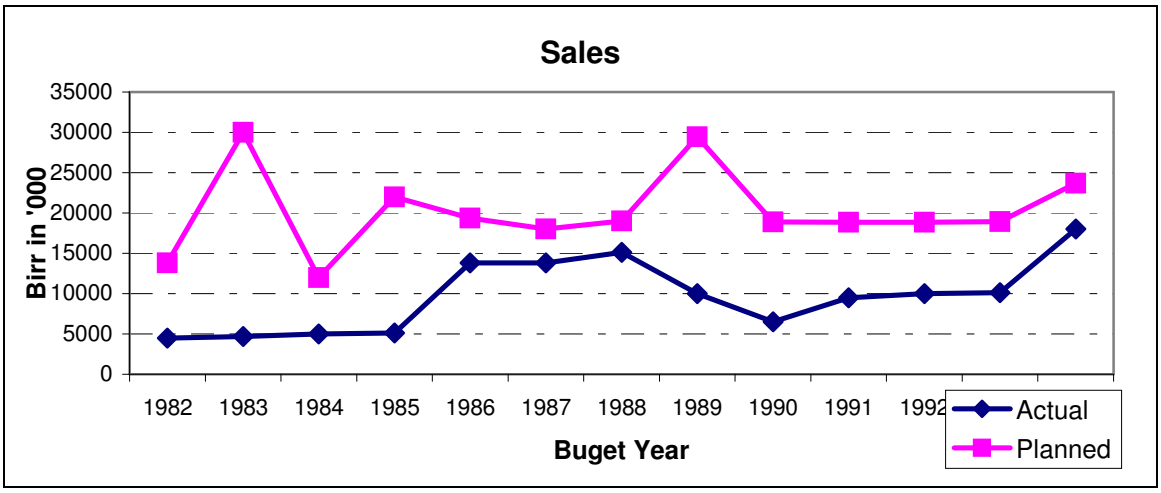


Figure 2. 2. Sales trend of ASPSC

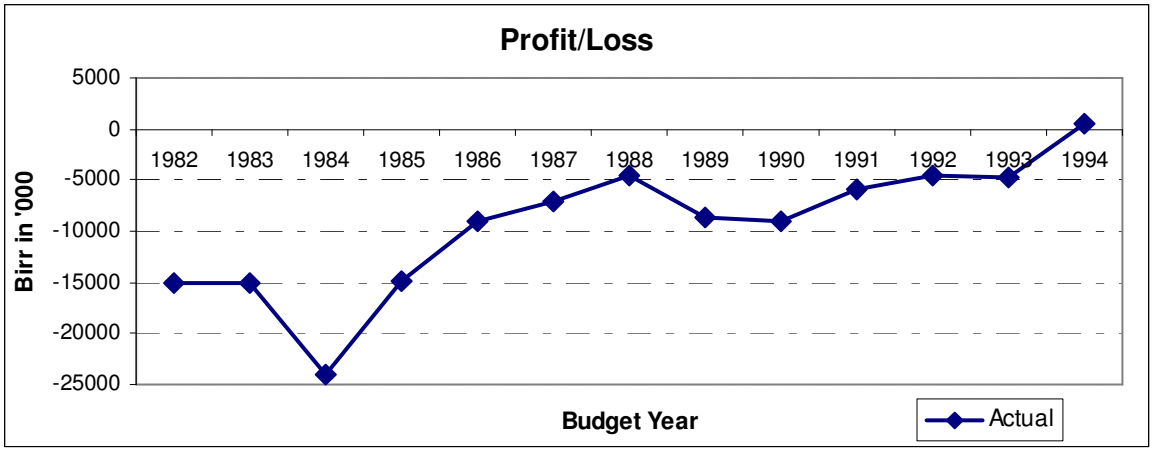


Figure 2. 3. Profitability trend of ASPSC

Different investigations prevail that the company's inability to give quality service deprives its flexibility and further development. ASPSC have thousands of product types, which function in different manner and sold to different customers. Therefore, there are numerous variables affecting its marketing activities and leads to complex marketing decisions.

In order to solve complex marketing decisions more scientific, rational, systematic decision-making methodologies should be applied. The marketing decision maker must easily perceive and analyze the environment, consider strategic alternatives in order to choose the best to implement. Moreover, techniques like Marketing Decision Support System (MDSS) should be used to integrate different analytical models, specialized database and decision makers' own insights.

Nevertheless, ASPSC doesn't customize new methodologies in its day-to-day marketing activities. The marketing staffs are performing decisions and plunge related activities in the traditional fashions. So that, they can't address several factors and achieve more accurate solutions quickly.

ASPSC should not ignore emerging technologies and new ways of organizing marketing activities. Systems that are intended to support decision and extend judgmental capabilities should be adapted. The company should mobilize every resource, financial or otherwise, in meticulously planned manner towards attaining better marketing performance. Unless and otherwise, in this free market orientation and globalization era there is no much options opened to ASPSC.

2.2 Mobil Oil East Africa Limited

2.2.1 Introduction to Ethiopian Petroleum Market

Importing petroleum products for local consumption is the sole responsibility of the state owned Ethiopian Petroleum Enterprise (EPE). It buys refined oil products on the international market and stores them in Djibouti.

The petroleum consumption rate of Ethiopia is increasing annually. For example, the 1989 E.C. annual consumption of Benzene, Nafta and Kerosene was 901,788,000 lt., after five years it was increased by 16.7% to 1,050,237,000 lt. The table-2.2, shows those values briefly.

Y ear (E.C)	**Volume Per Product Type (in '000' lt)**				**Percent Increase Based on 1989 E.C. Consumption**
	Benzene	**Nafta**	**Kerosene**	**Sum**	
1989	182,847	502,909	216,032	901,788	
1990	178,952	528,652	202,719	910,323	0.9
1991	181,851	560,637	181,008	923,496	2.4
1992	187,938	634,005	202,98	842,241	(6.6)
1993	172,082	670,058	208,097	1,050,237	16.5

Table 2. 2. Annual petroleum consumption of Ethiopia

However, oil companies such as Mobil, Total and Shell are monopoly undertake the local distribution of imported petroleum. Those distributors transport the petroleum themselves from Djibouti port and utilize their strategic depots found at different parts of the country. To perform the distribution and marketing of petroleum, they have a sum of 514 service stations throughout the country. The government bodies, Ethiopian Petroleum Enterprise together with Ministry of Trade and Industry, have an authority to control each activity of them. The table-2.3 shows the number of service stations and the company's percent share.

Company	**Number of Service Stations**			**Percent Share**
	In Addis Ababa City	**Out of Addis Ababa City**	**Sum**	
Shell	55	214	269	52.33%
Total	22	100	122	23.73%
Mobil	33	123	123	23.94%
Total number of stations			514	

Table 2. 3. Distribution of service stations in Ethiopia

If a new company wants to enter in Ethiopia petroleum market (other than the three) there are basic requirements to be fulfilled. These are stated in the distribution agreement of Ethiopian government and those three distributors, which is to be judged by rules of conciliation and arbitration of the international chamber of commerce. According to the April 21, 1979 E.C. distribution agreement, a new company should have a minimum of 12 service stations (6 in Addis Ababa and 6 in others cities) and depots of 20,000 m^3 holding capacity. Because of its huge capital requirements, the above agreement couldn't attract new investors. Therefore, at March 11, 1989 E.C. the second distribution agreement was made which decreases the minimum requirements to have 6 service stations (3 in Addis Ababa and 3 in other cities) and depots of 5000 m^3 holding capacity. This also can't attract a new investor and until now the number of oil distributor companies remains to three.

2.2.2 Historical Background of Mobil Oil Corporation

Mobil was formed on August 5, 1882 as component of John D. Rockefeller's Standard Oil Trust. However, in 1911 the United States Supreme Court ordered the dissolution of the D. Rockefeller's Standard Oil Trust, resulting in spin-off of Mobil (along with other 32 companies).

After certain years the product trademark Mobil Oil was registered by a new name called Socony. Over consecutive decades Socony grew significantly. It purchased a 45 percent interest in Magnolia Petroleum Co., which were a major refiner, marketer and pipeline transporter. In 1931, Socony merged with Vacuum Oil Co., an industry pioneer dating back to 1866 and a growing Standard Oil spin-off in its own right. The new company was called

Socony-Vacuum Oil Co. In 1955 Socony-Vacuum became Socony Mobil Oil Co. and in 1966 simply Mobil Oil Co.. A decade later, the newly incorporated Mobil Corporation absorbed Mobil Oil as a wholly owned subsidiary.

In the similar fashion the Standard Oil Co. of New Jersey (commonly known as "Jersey Standard") was one of the dissoluted companies of John D. Rockefeller's Standard Oil Trust. Its name was changed to Exxon Corporation in 1972 and established Exxon as a trademark throughout the world. It had oil production and refineries but not marketing network like the Mobil Oil Co.

In 1998, Exxon and Mobil signed a definitive agreement to merge and form a new company called ExxonMobil Corporation. After shareholder and regulatory approval, the merge was completed November 30, 1999.

The current CEO of ExxonMobil is Lee Raymond.
The head office of ExxonMobil is located in Fairfax, Virginia, USA.

The corporation has eleven functional companies (core global businesses) as shown in fig-2.4. Globally the company is running through 200 countries with 17 refineries and 900 marine ports. The net income of the corporation for the last five years is shown in fig-2.5.

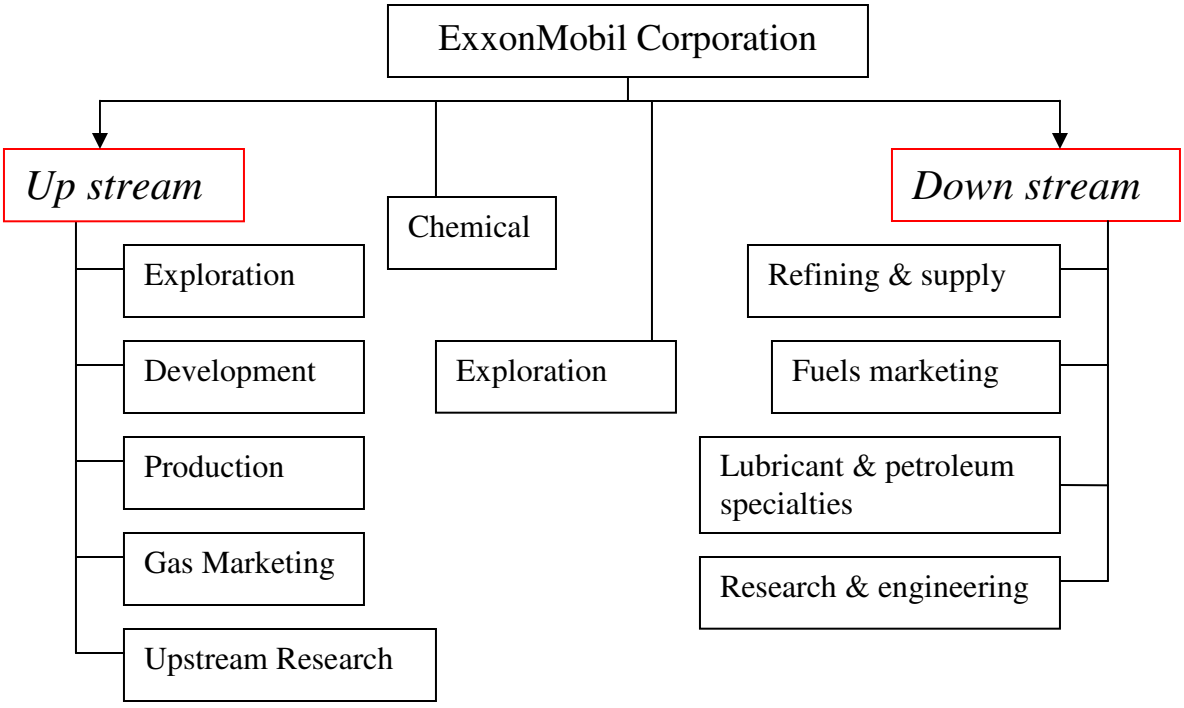


Figure 2. 4. The organizational structure of ExxonMobil Corporation

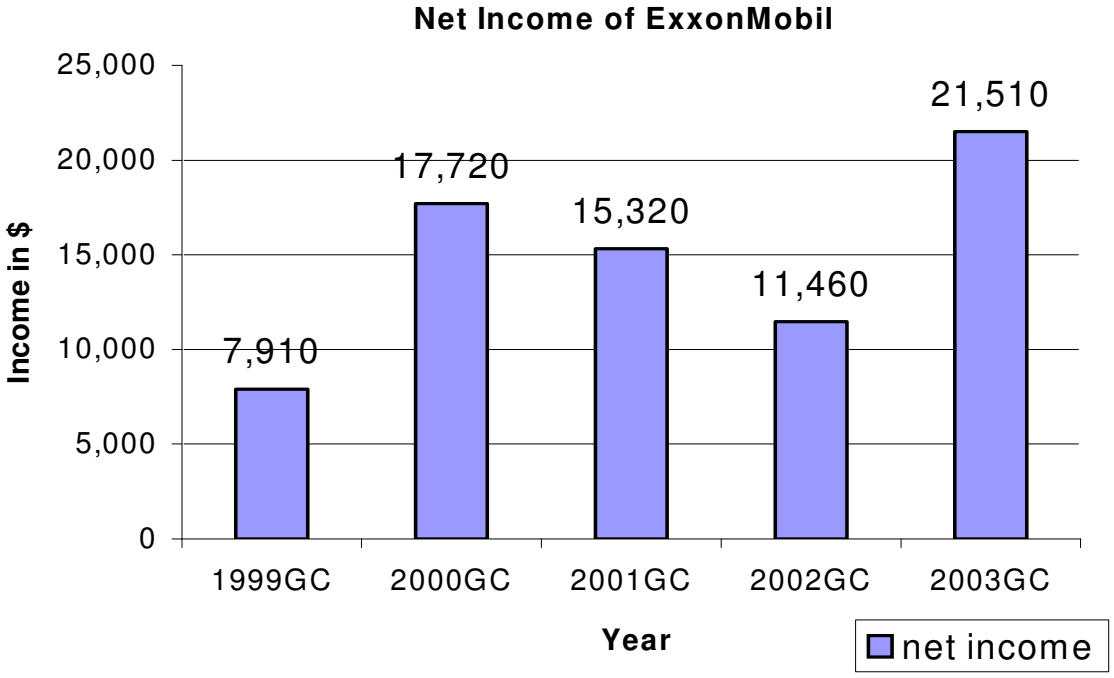


Figure 2. 5. The net income of Mobil in 1999-2003

2.2.3 Type of Products and Services

The main type of products and services of the corporation are the following:

I. Fuels

A. Gasoline

B. Heating oil

C. Kerosene

D. Diesel fuel

E. Marine fuel

F. Aviation fuel

II. Lubricants

A. Personal vehicles lubricants. Such as: Automotive engine oils, Gear oil, Greases and so on.

B. Commercial vehicle and industrial lubricants. Such as: Bearing lubes, Cutting oils, Electric motor lubes and so on.

C. Aviation lubricants

D. Marine lubricants

III. Petroleum Specialties

A. White oils. Such as: Baby oils, Cosmetics, Pharmaceuticals and so on.

B. Process oils. Such as: Printing ink, Tires, Agricultural spray oils and so on.

C. Waxes. Such as: Coating, Candles, Chewing gum, Lipsticks and so on.

D. Asphalts. Such as: Road paying, Tennis courts, Playgrounds and so on.

IV. Chemicals

Such as: Polyethylene, Synthetic rubber, Bicor, BTXtra, Acropol, Adeva and so on.

V. Lubrication Services

A. Oil Analysis. This is by using software, to provide advance warning of abnormal conditions that could continue to equipment or oil degradations.

B. Expertise Services. This is by utilizing the application of knowledge of their own staff engineers to deliver documented performance benefits through system and component inspections, lubrication training system studies and troubleshooting.

2.2.4 Mobil in Africa

ExxonMobil has been active in Africa for over 100 years. It operates in most African countries, whether in exploration and production or the sales of end products to industries and consumers.

Oil productions

It is one of the largest oil producers in Africa. Today, ExxonMobil participates in production of about one million barrel per day in Nigeria, Equatorial Guinea, Angola, Cameron and Chad. Over the last five years, Africa has represented 25% of ExxonMobil resource additions world wide, making it the single largest region of reserve for the company.

Fuels & lubricant retails

ExxonMobil is one of the leading fuel and lubricant retailers in Africa with an average of 20% market share. It sells fuel in over 30 Africa nations thorough network of almost 2000 Esson or Mobil branded service stations. The lubricant divisions have markets for passenger vehicles, trucks and industries in almost every country. ExxonMobil also has equity in 12 lubricant blending plants, and 60 distribution centers throughout Africa.

Chemical products

ExxonMobil chemical in Africa supply a wide variety of products ranging from polyethylene to synthetic rubber. These products provide the raw material for thousands of consumer items like shopping bags, greenhouse film, plastic bottles, household containers, pipes & tires. The chemical division has sales offices in Egypt, Kenya, Morocco and South Africa.

Aviation fuels and lubricants

ExxonMobil aviation started in Tunisia in 1904 and has grown extensively since. Currently supply 6.2 million barrels of jet fuel per year, giving an average market share of 25% at 57 airports located in 27 African countries. In aviation lubricants ExxonMobil is market leader with 60% market share.

Marin fuels and lubricants

Marine fuels and lubricants are the one that ExxonMobil has been closely involved for over 100 years. With coverage in over 60 African ports, ExxonMobil is the undisputed market leader with 40% market share.

	WEST AFRICA	EAST AFRICA	NORTH AFRICA	SOUTH AFRICA
Started in	Nigeria, 1907	Ethiopia, 1952	Egypt, 1902	Malawi, 1950
Main Presence	Angola, Cameroon, Chad, Equatorial Guinea, Ghana, Ivory Coast, Nigeria, Senegal	Ethiopia, Kenya, Mauritius	Egypt, Morocco, Tunisia	Mozambique, South Africa, Zambia, Zimbabwe
Type of products in sell	LPG, Lubricant & specialties, Chemical, Aviation fuels and lubricants, Marine fuels and lubricants.	LPG, Lubricants & specialties, Chemical, Aviation fuels & lub., Marine fuels & lub.	Lubricants & specialties, Chemicals, Aviation fuels and lubricants, Marine fuels & lub.	Lubricant & specialties, Chemicals, Aviation fuels and lubricants,
Exploration Areas	Angola, Cameroon, Chad, Equatorial Guinea, Nigeria, Republic of Congo	-	Algeria	-
Number of Service Stations	680	260	830	150
Number of Lubricant Blending Plants	6	1	4	1
Number of Employees	3500	400	700	330

Table 2. 4. Mobil in Africa

2.2.5 Mobil in Ethiopia

2.2.5.1 Profile of Mobil in Ethiopia

It has been operating in Ethiopia for over 50 (fifty) years in distribution and marketing of petroleum products. From the eleven cores global businesses of ExxonMobil Corporation only two of the subsidiaries (Fuel marketing, and Lubricant and petroleum specialties) are running in the country through Mobil branded service stations. The main office is located in Debrezeit road, at Woreda 19, kebele 49.

At present it has 123 service stations operating as a network over all the country in supplying flues and lubricants to individuals, public and private enterprises. From those service stations 33 of them are opened by the company and controlled by individual persons, but 90 of them are opened and controlled by individuals. Accordingly, there are agreements of support between those individual persons and the Mobil Corporation. Most of the time such agreements are made for duration of 2 years and up to 20 years in the former and later cases respectively.

The Mobil Branded 123 service stations can hold 11,151,000 lt. of different oils, such as:

- Benzene = 2,615,000 lt
- Naphtha = 5,044,000 lt
- Kerosene = 3,492,000 lt

  11,151,000 lt

The corporation has depots in Addis Ababa, DereDawa & Jima with holding capacity of 7,676,000 lt., the details are shown in table-2.5. In Ethiopia there are 321 direct consumer enterprises that have service stations in their own compounds. From these only 57 of them are Mobil branded service stations.

Oil Type	**Depots Holding Capacity (in '000' lt)**			**Sum ('000' lt)**
	Addis Ababa	**DereDawa**	**Jima**	
Benzene	1,120	490	-	1,610
Nafta	1,480	600	-	2,080
Kerosene	610	300	-	910
Jet oil	3000	-	76	3,076
			Grand sum	7,676

Table 2. 5. Holding capacities of Mobil Depots

Mobil is the dominant supplier of lubricants to the international and local construction companies and the mining industries. The following are some of major customers of Mobil lubricants:

- MIDROC Lege Deinbi Gold Mines
- Ethiopian Power and Electric Corporation (EEPCO)
- Ethiopian Roads Authority (ERA)
- Ethio- Djibouti Railways
- Messobo Cement Mill
- Ed-Zublin AG-Gilgel Gibe Hydro Electric Project
- Kajima Construction
- Keangnam Enterprise Ltd.
- Ministry of National Defense

2.2.5.2 Current Status of Mobil in Ethiopia

Mobil has poor performance in Ethiopia petroleum market as compared to the other distributors. These can be verified by taking different measuring criterion as shown in table-2.6.

Since the corporation is a service-giving industry, most of its operations have based on the market and marketing principles. In today's competitive market places where customers are having virtually unlimited choices, the success or failure of the corporation will be determined by the quality of its marketing activities. This is because marketing activities have greater impact on other functional areas of the corporation. These marketing activities should include: assessing the environment, analyzing customers buying behaviors, analyzing competitors, managing product lines and so on.

In accomplishing these tasks the marketers should make a number of consistent decisions at pressurized time. However, the marketing decisions are often more complex than those required of mangers in other functional areas. To cope up this complexity in an integrated computerized data management and data analysis methods like marketing decision support system should be used.

Even if the Mobil Corporation has great desire to increase its market share, until now they don't have implemented marketing decision support system. Due to this reason their marketing decision makers have limited capacity to handle several alternatives. They don't incorporate subjective as well as objective factors, so that, they lack to solve complex

marketing decisions. Unless and otherwise, they implement decision support tools, they cannot approximate the decision situation better and improves the effectiveness of decision making process (accuracy, timeliness and quality).

S.N.	Measuring Criterion	Mobil's	All the Distributor's	Mobil's Share
1	Number of service stations	123	514	23.93 %
2	Holding capacity of service stations	11,151,000 lt	42,996,000 lt	25.93 %
3	Holding capacity of depots	7,767,000 lt	23,558,000 lt	32.58 %
4	Number of direct consumer enterprises	57	321	17.75 %
5	Number of tracks used	215	1053	20.42 %

Table 2. 6. Performance status of Mobil

CHAPTER-THREE

LITERATURE REVIEW

3.1 Introduction

3.1.1 What Is Marketing?

Most people think that marketing is only about advertising and selling, but these are just two of the many activities. As a subject it draws upon a wide range of other disciplines [39, 53] and broad that is difficult to conceptualize. However, its view is consistent with the following definition given by the American Marketing Association (AMA) which is widely accepted by academicians and marketing managers: "Marketing is the process of planning and executing the conception, pricing, promotion, and distribution of ideas, goods, services, organizations, and events to create and maintain relationship that will satisfy individuals and organizational objectives."

It is a managerial process to identify, anticipate and satisfy customer needs. That is why Phillip Kotler [45] expresses his view as "Marketing is a social and managerial process by which individuals and groups obtain what they need and want through creating, offering and exchanging products of value with others."

In general, from the above definitions we can understand that marketing activities are all those associated with identifying the particular wants & needs of a target market of

customers. This involves doing to satisfy customers by analyzing their needs and then making strategic decisions about product design, pricing, promotion, distribution, etc.

The Japans Marketing Association adds the following points on the definitions of marketing:

1- It refers to integrated and coordinated activities of research, product, price, promotion, distribution, customers' relation and environmental activities among other which are directed toward both inside and outside of the organization.
2- Including institutions and groups in the filed of education, medicine, administration and so on.
3- View paying respects for the society culture and natural environments.
4- Basing upon mutual understanding with customers, clients, business associations, individuals, regional residents, employee members and other parties concerned.

3.1.2 What is Market?

People sometimes use the word market to refer to a specific location where products are brought and sold. A new concept of market denotes an aggregate of people who, as individual or as organization, have needs for products and who have the ability, willingness and authority to purchase such products [25,62]. This means a market is a group of people who have a similar need for a product or service, the resource to purchase the product or service, and the willingness and ability to buy it. Kotler [45] express this as: "a market consists of all the potential customers sharing particular needs or wants who might be

willing and able to exchange to satisfy that needs or wants." Generally, market possesses four basic characteristics: [31]

1- People with common needs.

2- People with financial resource to buy (purchasing power).

3- People that are willing to buy.

4- People with the ability to buy (authority to buy).

We can divide the market types into five categories that bring us full circle to the concept of marketing. These are the resources market, manufacturers market, intermediaries market, customers market and government market. Then, marketing means working with these markets to actualize potential exchange for the purpose of satisfying human needs and wants.

3.1.3 Functions of Marketing

The principal tasks of marketing are not to manipulate what to suits the interests of the company, but rather what to suits the interest of customers by finding effective and efficient means of making the business [62]. Its overall objective is obviously to identify groups of potential customers with an unsatisfied needs and which can be fulfilled by the business. Considering the broad factors of the environment, the research process identifies these needs and moving on to a narrow analysis of individual consumer expressed and latent needs.

Marketing in practice embraces a host of activities designed to attract, satisfy and retain customers. Included in these activities are needs assessment, product development planning, pricing, distribution, promotion, customer service programs, etc. The final steps are evaluation and control of the process that is intended to improve the quality of marketing activities [33,53]. Table-3.1, briefly describes some of the main functions of marketing.

MARKETING ACTIVITIES	RESPONSIBILITIES
- Market analysis and researches	- Evaluation of economic and competitive influences that will affect the company marketing strategies and activities.
- Customers analysis	- Evaluation of customer needs behaviors and the purchasing process as well as the identification of defined target market.
- Product planning	- Design & development of goods and services, packaging, brand names and accessories that meet the needs of the market place.
- Price planning	- The establishment of fair and profitable pricing strategies that include least prices, discounts and credit terms.
- Distribution planning	- Organizing transaction between manufacturers and wholesalers and also wholesalers and retailers. The focus is on wholesaling & retailing, inventory management and transportation.

Table 3. 1. Main functions of marketing

MARKETING ACTIVITIES	RESPONSIBILITIES
- Promotion Planning	- Combining the promotion elements of advertising, sales promotion, personal selling and public relation to generate customer interest for the product, service or ideas.
- Social responsibilities	- Marketing urge the company to sale products in an ethical manner, being socially responsible and acting as a good corporate citizen for the well being of society.
- Marketing management	- It is the planning, implementing, evaluating and controlling of marketing activities. The firm analyzes all available information and makes the appropriate decisions as to the goods and services afforded for sales.

Table-3.1, continued.

3.1.4 Impact of Marketing on Other Function

In many business organizations of the past, the marketing function was misunderstood. It was put only under the control of a marketing department that operates independently from other parts of the business organization. Today emphasize has shifted so much that the entire culture of the organization is apt to be market-oriented. Market orientation is the organization wide generation of market intelligence pertaining to current and future customer needs, dissemination of the intelligence across departments and organization wide responsiveness to it. [1]

The marketing functions have greater impact on other activities of the organization. Understanding of its effects will help top management to adjust and keep the overall business activities in focus of customers and market needs [43,55].

Manufacturing

The manufacturing department typically design and produce products at an optimal cost consistent with good quality, producing in quantities that provide long enough manufacturing runs. In a company with market-minded management, all aspects of manufacturing should be geared to customer needs and demands. Products should be manufactured in terms of customer specification and must are tailored to the needs, demands, and attitudes of customers.

Finance

If customer demand is likely to change frequently, inventories are kept low so as to minimize the risk of write-off. On the other hand, stable customer demand permits long manufacturing runs and inventory buildups, so the finances department raises the money necessary to support the resulting level of inventories. Understanding the customer demands and buying behaviors have great influence for the organization financial activities.

Research and Development

If research and development objectives, plans and projects are closely geared to customer needs and attitudes, waste of money and time, the risk of losing competitive positions can

be reduced. Moreover, the establishment of research and development objectives, budgets and projects can be made more effective if customer needs are used as guidelines for action.

In brief, the marketing functions require maximum corporate success in order to play an important role in all phases of the organization management. How best to serve the customers become the underlying optimization force for all management actions.

3.2 Marketing Decisions

3.2.1 Types of Decisions

One way of classifying decisions is based on their structureness that conceded with routine and repetitiveness of the process [18]. A highly structured decision is one that has made in an established context, where as unstructured decisions tend to be produced in emergent context. The semi-structured decision types are found in between the two extremes of structured and unstructured decisions.

Decisions made at the operational management level tend to be more structured those at tactical management level more semi-structured and those made at the strategic management level more unstructured [26].

NATURE OF STRUCTURED DECISION	NATURE OF UNSTRUCTURED DECISION
- The issues are understood. - Required knowledge is available. - Made at established situation. - They are Programmable. - They are ordinary. - They are repetitive. - Uses specialized strategy.	- The issues are elusive. - The required knowledge difficult to get. - Made at emergent situation. - They are creative. - They are novel, unique. - They are one-shot. - Uses general strategy.

Table 3. 2. Structured Vs. unstructured decisions

3.2.2 Nature of Marketing Decisions

Many marketing decisions are made in complex environments where numerous variables are affecting their outputs and leads to complex decisions. They are often more complex than those required of managers in other functional areas of the company.

Essentially there are number of reasons for these high degrees of complexities:

⇒ Due to lager number of variables to be included. Many marketing decisions are not single events but rather are based on a series of ongoing circumstances that provide a reference with in which a single decision is grouped.

⇒ The variables lack stability [60]**.** An unexpected government tax on a given product can have a devastating effect on sales, or a declining trend in consumer spending can discourages a product sales.

⇒ Many of the variables are external and uncontrollable. For example, to introduce a new product, certainly the decision markers cannot control how competition will attempt to counter the new product in the market.

⇒ The market responses can be non-linear which are difficult to predict**.** For example, doubling an advertisement rarely doubles sales, but mostly it produce a small increase result which is non-linear to advertisement.[60]

⇒ Marketing decisions are often further complicated by the fact that the alternatives are in conflict with respect to each criterion. They can have important strong and weak points that will "pull" in opposite directions.

⇒ There are numerous strategic decisions and each decision has promising alternative that are attractive for different reasons. Marketing mangers make decisions about target markets, positioning products, price charging and wide variety of decision variables. [32]

⇒ Undoubtedly adding to the complexity of marketing decisions is the fact that multiple decision makers are mostly involved both on the buyer and the seller sides.

In addition to their complexity, marketing decisions are of fundamental importance because of the financial risk they pose to the organization. Marketing costs involve a large percentage of the final price of many products, so that, its decisions often bear the dual responsibility of revenue generation and cost control. Marketing decisions may trigger many other important decisions in finance, production, personnel, and other functional areas.

The importance of marketing decisions is tied to the fact that they are among the most visual decisions in public scrutiny than other functional areas. Decisions involving advertising, product design, pricing, and distribution are highly visible and thus subjected to public scrutiny. Visibility means that marketing decisions are likely to be looked at closely by the organization major customers, regulatory agencies, unions, and competitors.

3.2.2 Quantitative Approaches of Marketing Decisions

The increasing complexity of marketing decision has led to the demand for more scientific, rational and systematic methods of decision-making. Quantitative methods are more consistent, where the reasoning behind the decision can be logically explained and which can be analyzed after the events in order to improve future decision-making.

The use of quantitative methods in marketing is already large and continuous to grow [40]. The discipline of marketing draws from several quantitative areas such as operation management, economics and statistics. They used in function of marketing mix analysis, designing marketing strategies and controlling operations. The quantitative tools include queuing theory, linear programming, game theory, forecasting techniques, markov analysis, and others. Let's see some of these in details.

3.2.3.1 Queuing theory

We are familiar with the ideas of the queue or waiting line. The analysis of the queue attempts to describe the waiting process by producing statistic such as the average length of

the queue, the amount of the time the server is idle and the average time the person will wait for service. [34]

The queue analysis can help marketers to achieve an acceptable balance between customers' satisfaction and costs. If customers have to wait too long for service, they may leave the queue. Prospective customers seeing a lager queue may not even join it at all. If the service is obtainable elsewhere, those dissatisfied customers may be lost entirely. However, providing so many servers that nobody has to queue may be prohibited in terms of costs.

A queue is formed whenever there is congestion for service, i.e., when more customers arrive than that can be served by the available service. Thus the following four features characterize a queue:

1- Arrival pattern: - Which describes the frequency of customers arriving for service.

2- Service pattern: - Which describe statistically how the customers are served.

3- Capacity of the service: - The number of servers who can serve in the system.

4- Queuing discipline: - Which specifies the rule by which the customers are served.

The customers' arrival time can be deterministic or probabilistic. If the inter-arrival time, that is, the time elapsed between two consequent arrivals is constant, then the arrival pattern is deterministic. If it follows non-constant distribution, then the arrival pattern is probabilistic. The same classification applies to the service pattern. For probabilistic

models it is customary to assume that the random arrival pattern follows a Poisson distribution and the associated service pattern is given by an exponential distribution.

3.2.3.2 Linear Programming (LP)

Linear programming is member of group of optimization techniques that include integer programming, transport programming, assignment programming and others a lot of which seek to maximize or minimize a single goal. This goal could be profits, costs, revenues or advertising effectiveness. Linear programming has a number of uses in marketing that include:

- Deciding on the product mix a company should make.
- Determining the maximum capacity level of the firm.
- Deciding the profit maximizing position for the firm.
- Deciding on the optimum use and mixes of advertising budgets.

Linear programming has two basic approaches, namely, the graphic approach and the simplex method. The simplex method involves an iterative technique to search for the optimal solution that can be used to solve complex problems. Although linear programming is a powerful technique and has many uses, there are a number of critical assumptions that need to be understood. Some of these are: [34]

1- The firm should follow the maximization or minimization of a single goal.

2- The constraints the firm faces can be measured and expressed.

3- The constraints the firm faces are linear or approximated by linear relationship.

4- The prices and constraints faced do not change and there is no differential pricing.

3.2.3.3 Game theory

John Von Neumann and Oskar Morgansteen first put game theory forward in their classic book "Theory of game and economic behaviors" [57]. John Von Neumann was a mathematical genius and was one of the three inventors of the Hydrogen Bomb in the mid-1940s.

Game theory is concerned with what is the best strategy for the company to adopt in an attempt to gain a competitive advantage over others [34]. However, the choices of which strategy to adopt become complex since there will be uncertainty to what competitors are considering and can adopt counter strategies that could affect the effectiveness of the chosen strategy. Therefore, the strategy the firms choose will depend on what strategy they think, the opposition will adopt as well as the effectiveness and cost of the chosen strategy.

There are different types of games. Some of these are:

- The zero-sum game.
- Positive-sum game.
- Negative-sum game.
- Corporative game.
- Non-corporative game.
- Nash equilibrium.
- Aggressive price-cutting games.

3.2.3.4 Forecasting

Effective planning for the future is one of the critical aspects of any organization management. Indeed, the long run success of any firm is closely related to how well management is able to forecast the future and develop appropriate strategies. In order to plan for the future and make effective decision it is very important to apply proper forecasting technique. It is an estimation or calculation of future events or developments, derived from a model of simple or complex, heuristic or analytic [41].

There are varieties of forecasting methods. The applicability of which is dependent on the time frame of the forecast, the existence of patterns in the forecast, and the number of variables the forecast is related on [9]. These factors determine the type of forecasting methods that can be or should be used. The basic types of forecasting are: time series, casual methods, and qualitative methods. Time series is a category of statistical techniques that uses historical data to predict future behaviors. Casual methods attempts to develop mathematical relationship between the item being forecast and factors that cause it to behave the way it does. Qualitative methods employee managerial judgment, expertise, and opinions to make forecast.

3.3 Decision Support System (DSS)

3.3.1 Overview of DSS

Michael S.Scott-Morton under the term “management decision system” provided the first articulation of the concept involved in decision support system in the early 1970. After a

certain years, in 1978, the first book on decision support system was published [36,37]. Since these publications, both the decision support system literature and applications have grown exponentially.

Decision Support System (DSS) is generally accredited to the Massachusetts Institutes of Technology [MIT] [17]. It is a computer-based system for supporting human decision-making. Understanding the human decision-making process underline the development and design of decision support system. It benefits decision-marker in various ways such as: faster decision making, more comprehensive information, improve accuracy, improve communication, decrease his workload and increase his satisfaction.

It differs from the Management Information System (MIS) in that the manger typically acts as an internal component in a DSS, rather than an external component as in an MIS. In other words, the manger interacts with the computer-based information system so as to reach a decision through an interactive process. Therefore, DSS is typically thought of as having interactive capability where by the manger can establish a dialogue with the information system. It is tightly focused on a specific decision or classes of decisions such as routing, queuing, evaluating, predicting, and so forth.

Commonly, MIS answer questions like, “how much will be the next month sales volume,” “which machine is currently idle.” But, DSS analysis what-if scenarios like, “if I cut advertising budget by $100 what would happen to sales volume.” “What will happen to the

delivery data and cost, if I use this machine rather than the others," The different between MIS and DSS can be summarized as follows: [26,49]

Management Information System (MIS)

- Provides information about the performance of the organization.
- Provides periodic, demanded and push reports and responses.
- Provides information in pre-specified and fixed formats.
- Provides information by extraction and manipulation of business data.

Decision Support System (DSS)

- Provides information and decision support techniques to analyze specific problems and opportunities.
- Provides interactive inquires and responses.
- Provides information in Ad hoc, flexible and adaptive formats.
- Provides information by analytical modeling of business data.

A DSS frequently integrates different analytical models, specialized databases, decision maker's own insights, and an interactive computer-based modeling process. Its general framework can be designated in a block as data, as computer system data processing and information flow to management as shown in figure-3.1.

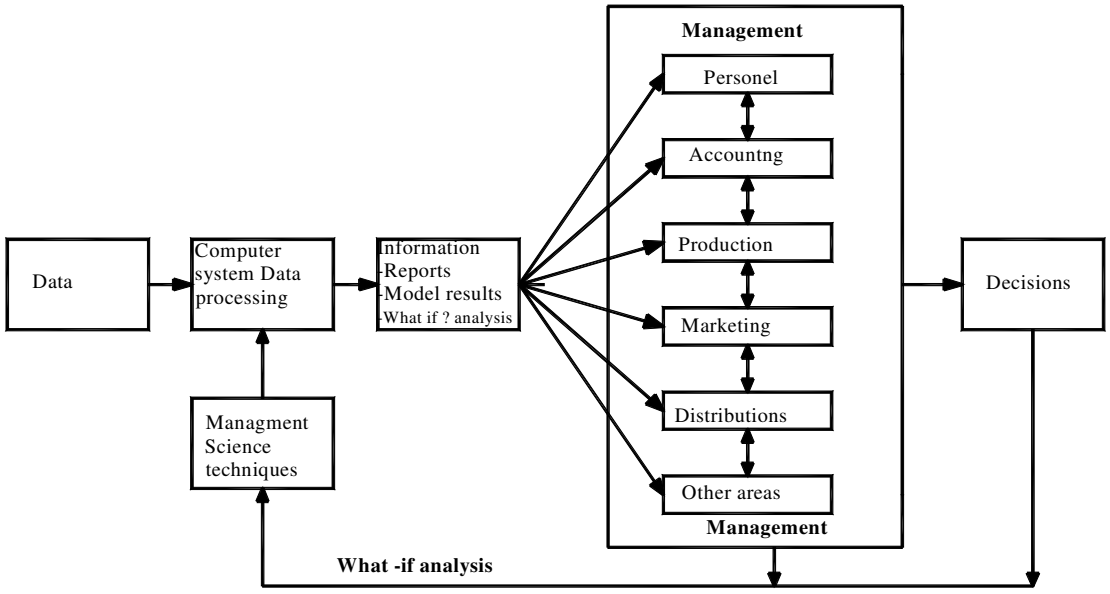


Figure 3. 1. Decision Support System (DSS)

3.3.2 Possible Analysis of DSS

A decision support system possibly uses four main different types of analysis: what-if analysis, sensitivity analysis, goal-seeking analysis and optimization analysis. [26]

1- What-if analysis

In this, an end-user makes changes to variables or relationships among variables and observes the resulting changes in the values of other variables. This type of analysis would be repeated until the decision maker is satisfied with the result found due to the effects of various possible changes.

Example: What would happen to sales, if we cut advertising budget by 10 percent?

2- Sensitivity analysis

It is especial case of what-if analysis. The value of only one variable is changed repeatedly, and the resulting changes on other variables are observed. Sensitivity analysis is used when decision makers are uncertain about the assumption made in estimating the value of that variable.

Example: Let's cut advertising budget by $50 repeatedly, so we can see its relationships to sales volume.

3- Goal-seeking analysis

It reverses the direction of the analysis done in what-if and sensitivity analysis. Instead of observing how changes in a variable affect other variables, goal-seeking analysis sets a target value for a variable and then repeatedly changes other variables until the target value is achieved. Therefore, it would help to answer the question, "how can we achieve $2 million in net profit after taxes?" instead of the question, "what happens if we change revenue or expenses?"

Example: Let's increase the advertising budget until sales reach $1 million.

4- Optimization analysis

It is a more complex extension of goal-seeking analysis. Instead of setting target value for a variable, the goal is to find the optimum value for one or more target variable with given constraints.

Example: What is the best amount of advertising to have, with given budget and choice of communication media?

3.3.3 Benefits and Limitations of DSS

might be expected from DSSs are presented below. [22]

⇒ -maker's position, helping the decision maker agreement or cooperation to others.

⇒ The decision maker can use a DSS to check on or confirm the results of problem solved by other systems. Especially for decision making trainings.

⇒ It has theoretical sound foundation. The activities of a DSS may reveal new ways of thinking about the decision domain or even partially formalize various aspects of decision-making.

⇒ In making decisions, mangers constantly have to recall information or the operations conducted at various times. A DSS can provide the decision makers memory aids.

⇒ It can support individuals as well as groups. It assists in the integration and communication among individuals whenever possible.

⇒ It can support all phases of the decision-making process. Available resources can be utilized efficiently and effectively. So it can enhance productivity of the organization and gives competitive advantage over others.

Limitations of DSS

⇒ essed. A given DSS will be more limited if it is being run on a relatively slow computer with relatively small memory capacity than if it is being used in a more powerful computer.

⇒ There may be some human skills and talents that cannot be incorporated into DSSs.

requests by responding to menus of options, whereas others prefer to state a command directly. A command-oriented DSS may be unpalatable to those who prefer menus, and vice versa.

⇒ A DSS is constrained by the kind of knowledge designed to process. Its knowledge may or may not be sufficient to respond any type of decision-maker's requests. For instance, if a DSS have the ability to process sensitivity analysis, then it may not give sufficient response for goal-seeking requests.

⇒ A DSS may be designed to accomplish fairly narrow, be quite specific decisions. Thus, several such DSSs need to be used in reaching other decision. In such case, there is the question of how to coordinate the use of multiple DSSs. Thus another DSS limitation is the degrees to which it can pass knowledge to and accept knowledge from other DSSs.

3.3.4 Acquiring a DSS

For its successful implementation, a DSS requires careful planning of the organization management. Executives of that organization must answer the following two points in order to ensure the selection of most appropriate and most beneficial DSS: [27]

- Does the business need a DSS?
- What DSS features are desired to serve the needs of the business?

Determining business needs of DSS

The organization must determine what kinds of decisions are being made, how respective these decisions are, and what information is needed to make them. They must find out by

which the decisions are expected to be made, how the ideas are communicated with the organization, and where the results of decisions are presented. Answering to the following questions will help to identify the need for DSS.

1- Is the problem completely understood by the decision-maker? It is impossible for the DSS to interpret any problem that cannot be described by the decision-makers.
2- Is the problem quantifiable? If a decision-maker cannot reduce the problem to numeric relationship, the model may not be formulated.
3- Can the problem analyzed by appropriate models? If the problem is analyzed using inappropriate model, the results of that analysis will be quiet useless and misleading. This may lead to costly errors in the decision-making process.
4- Can the developed model be implemented? In some quantifier analyses it may be physically impossible to implement the solution generated by the model.
5- Does the decision-maker understand that he, not the DSS, is ultimately responsible for the decision? The system does not make the final decision, he himself does. [58]

Determining the Desired DSS Features

The features to be incorporated in DSS are determined by the current and future needs of the organization. Among the questions to be asked in this phase are the following:

1- How sophisticated does the executive wish to be in their interactions with the DSS? In other words, do they want the DSS to do it all or just some?
2- Does the executive foresee future expansion of the DSS?
3- Does the modeling capability exist? If it doesn't, can it be acquired if it is needed?

4- Can the business offer finance for the acquisition of a DSS even though it may not have immediate returns?

If the answers to the above questions are affirmative, then next issue to be explored further is how to practically design DSS.

3.3.5 The Process of Designing DSS

If companies cannot design and implement it properly then, there is a great danger that a DSS will be treated as the latest novelty. The quality measure of its end product determined by the way in which it is actually designed. Unless the data dictionary that derives a DSS is structurally robust, simply creating a data dictionary doesn't automatically resolve the need of information required for decision. By the same token, simply making a graphic "package" available for use/manipulation thorough a terminal in the executives' office doesn't create an effective DSS. Besides these; its linkage, selectivity and retention determines the system specification process. What is important throughout the process of designing such a system is that, the end result must be usable as a decision making aid.

There are four general considerations in structuring a particular DSS. These are: [8]

1- **Size**: - How many entry points are required? How large is the database to be created? How fast can it be expected to grow?
2- **Input: -** How many file keys are generated by a particular item addition? Are there seasonal fluctuations in the rate and/or volume of information collection?

3- **Usage:** - How many terms are required to formulate an inquiring or search? What are the normal time limits for a response to an inquiry? How mush holding? How much retention time for a data manipulation should be allowed? How much waiting time-before being able to present an inquiry?

4- **Maintenance**: - What constraints exist on unlimited growth of system content? What are the overall operating costs? How can those costs be expected to grow and how are they to be recovered?

The developer must follow stepwise approach, from the first of planning or diagnosing a problem until the last step of adapting the DSS in to the organizational system [49]. Successfully, DSSs are developed through an essentially analytical process that has these phases: [8].

1- Identify the prospective user of the information to be gathered.

2- Determine their probable interest in that information.

3- Refine the terms and manipulate the concepts in to a consistent and logical information analysis structure.

4- Isolate the likely source of the information to be analyzed and retained for later retrieval.

5- Arrange to gather the required information.

6- Organize this information in the manner that conforms to the previously developed information analysis structure.

7- Provide a workable mechanism for user selection of desired information.

8- Develop a feedback mechanism that will reflect changes in information, need and permits adjustments in information sources and refinement analysis structure.

3.3.6 Application Areas of DSS

There are wide varieties of organizational activities in which a DSS can exist. Some possible examples are: [51]

Manufacturing

A company wants to maximize its profit by manufacturing an optimal amount of products with limited amount of labors, raw materials, equipments and other resources. Benefits to handle the optimal allocation of available resource**,** the DSS can support various decision types in product manufacturing process.

Investment

A DSS handles portfolio management issues. Its objectives are to provide maximal return on investment while maintain liquidity of assets. It addresses the trade-off involved in selecting high-risk, high-return verses low-risk, and low-return investments.

Planning and Administration

A DSS produces an optimal time schedule to meet deadline with given limited resources. Various scheduling techniques (PERT/ CPM, etc.) are used in these situations. The DSS identifies bottlenecks and critical task items, estimates the cost, completion times, and updates the plan as per the tasks to be completed.

Budgeting

Each department in the company establishes an operating budget for the coming seasons. A budget represents a decision about how to allocate available funds. In reaching the allocation decision, a manger has to weight various trade-offs. A DSS can help the mangers to assess the effects of making trade-offs and adjustments in the budget. [26]

Marketing

A DSS helps to decide an optimal policy to maximize sales and maintain profits. The appropriate allocation of resources for advertising, the optimal number of employees to serve customer and other marketing activities can be determined by Marketing decision Support System (MDSS).

3.4 Marketing Decision Support System (MDSS)

3.4.1 Marketing Research vs. Marketing Information System

These decades are often referred to as the "information era" and the "age of information." Marketing mangers require reliable information in order to perform their tasks efficiently. The Marketing Information System (MkIS) that can provide such reliable information is formally defined by the American Marketing Association (AMA) as: "a set of procedures and methods for the regular and planned collection, analysis and presentation of information for use in marketing decisions" [42]. It generates an orderly flow of pertinent information, collected from both internal and external sources, for use as the basis of marketing decision-making in specified responsibility areas [39,61 and 62]. By interacting

persons, machines and procedures MkIS can provide many benefits. A few of them are: more timely information and reports, more flexible and selective retrieval of data, and use of a multitude of different information sources with rapid integration. [13, 14 and 59]

MkIS grew out of marketing research, but the two are not the same. Marketing research tends to be research of a particular fact of marketing over a discrete time period. It identifies marketing opportunities and problems, generate and evaluate marketing actions, monitor marketing performances, and improve understanding of marketing as a process. Marketing research specifies the information required to address the above issues, design the methods for collecting information, mange and implement the data collection process, analysis the results and communicate the findings and then the implications.

As compared to MkIS it is a snapshot of one or more aspects of marketing for a fixed time period. MkIS differs from marketing research in the following ways.

MARKETING INFORMATION SYSTEM (MkIS)	**MARKETING RESEARCH**
- Continuous output	- Output when sought
- Use more data sources	- Uses only data sources relevant to the research problems
- Receives, analyzes and distills a greater volume of information	- Receives, analyzes and distills a lesser volume of information

Table 3. 3 Marketing information system Vs. marketing research

3.4.2 Marketing Decision Support System (MDSS)

Because of the complexity and criticality of marketing decisions, marketing mangers should utilize available information to the fullest extent possible,. However, there is an ample evidence, confirmed by numerous psychological experiments, that shows the human mind requires support when dealing with such complexity. These underlying the important of Marketing Decision Support System (MDSS) [10]. It is a coordinated collection of data, systems, tools and techniques with supporting software and hardware by which an organization gathers and interprets relevant information from business and environment and turns it into a basis for marketing action.

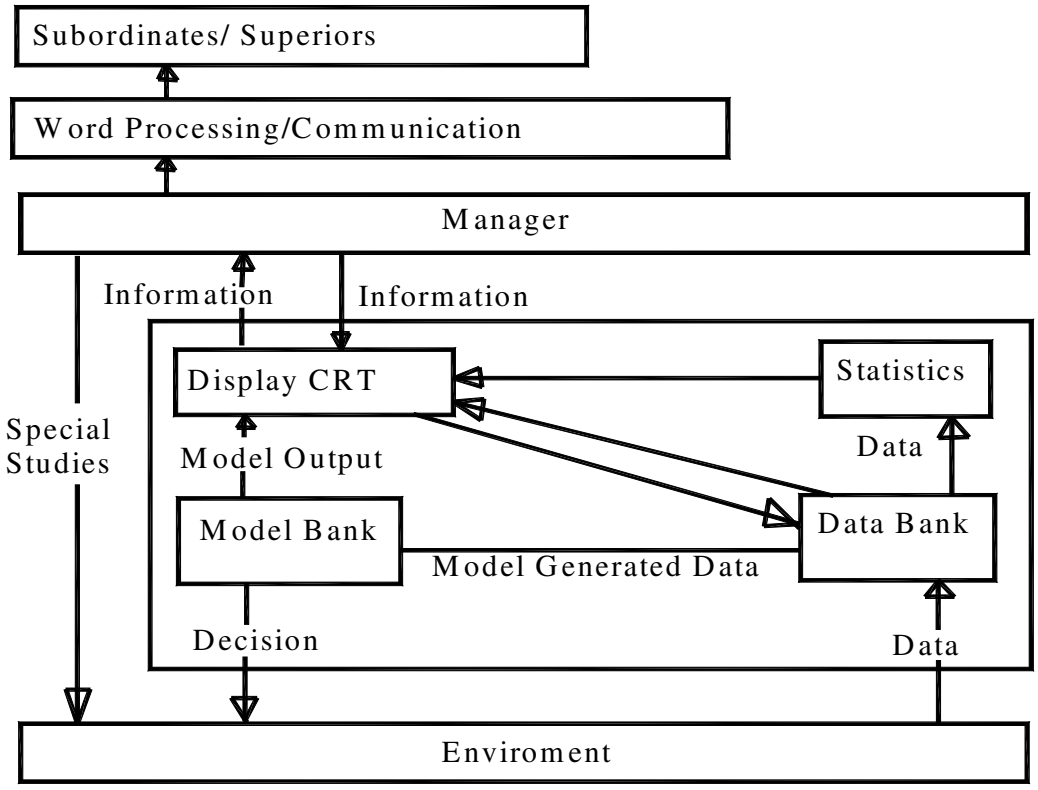


Figure 3. 2. Marketing Decision Support System (MDSS)

MDSS is little more than that of MkIS [10, 75]. Under MDSS the manger is viewed as the strategist that must perceive and analyze the environment, consider a strategic alternative, and choose the best to implement. The emphasis shift from simple information retrieval to analysis. The MkIS answer questions such as "What were sales of brand X in September?" and "Did we meet our marketing budget?" The MDSS, however, carried the analysis to cause and effect, and also focused on asking simulating changes "What would happen if ….?" questions. In short, the MDSS supports and amplifies the skills of the mangers by eliminating data barriers to problems solving.

The Marketing Decision Support System (MDSS) must: [48]

- ⇒ Be capable of supporting decisions involving several alternatives.
- ⇒ Be capable of addressing several (often complexity) criterion or factors.
- ⇒ Allow the decision maker to incorporate subjective as well as objective factors.
- ⇒ Be capable of accommodating the decision maker's expert judgments about the relative important of these factors.
- ⇒ To increase its effectiveness it should have user friendliness, flexibility, strong graphic capabilities and simple language.
- ⇒ Incorporate the decision makers' expertise, allowing them to express insight and judgments.
- ⇒ Allow the decision makers to synthesize or combined judgments made relative to the many facts of a complex problem.
- ⇒ Have a theoretically sound foundation, and

⇒ Not make or pretend to make any decision. The decision makers must be able to structure the problem as they see it, provide their judgments, request the decision support system to help in synthesizing, examine the results of the synthesis, restructure the problem as they think necessary, and eventually arrive at their decision. [70]

3.4.3 Functional Components of MDSS

The following MDSS components represent functional breakdown of the system and should not be confused with, formal subsystem, or stages of the decision making process. The DSS design literature identifies three major functional or conceptual components: [48]

I. The Analytical Models Management Component

The mechanism for explicit management of modeling and analyzing activities are what distinguishes decision support system from the more traditional information processing system. For many problems confronting the marketing mangers, the real world is far too complex to be completely described by "off-the-shelf" models [58]. The ability to invoke, run, change, combine, and inspect models is a key capability in MDSS. Therefore, it is often necessary to develop appropriate costume-made mathematical/statistical model that can approximate the decision situation better.

The type of analytical model is derived from the nature of the tasks to which DSS is applied. Marketing decision-makers can apply a number of analytical systems that include operation research models, statistical analysis, etc; with there own wide variety of choices.

Philip Kotler provides the following major analytical models (fig-3.3) available as component of MDSS.

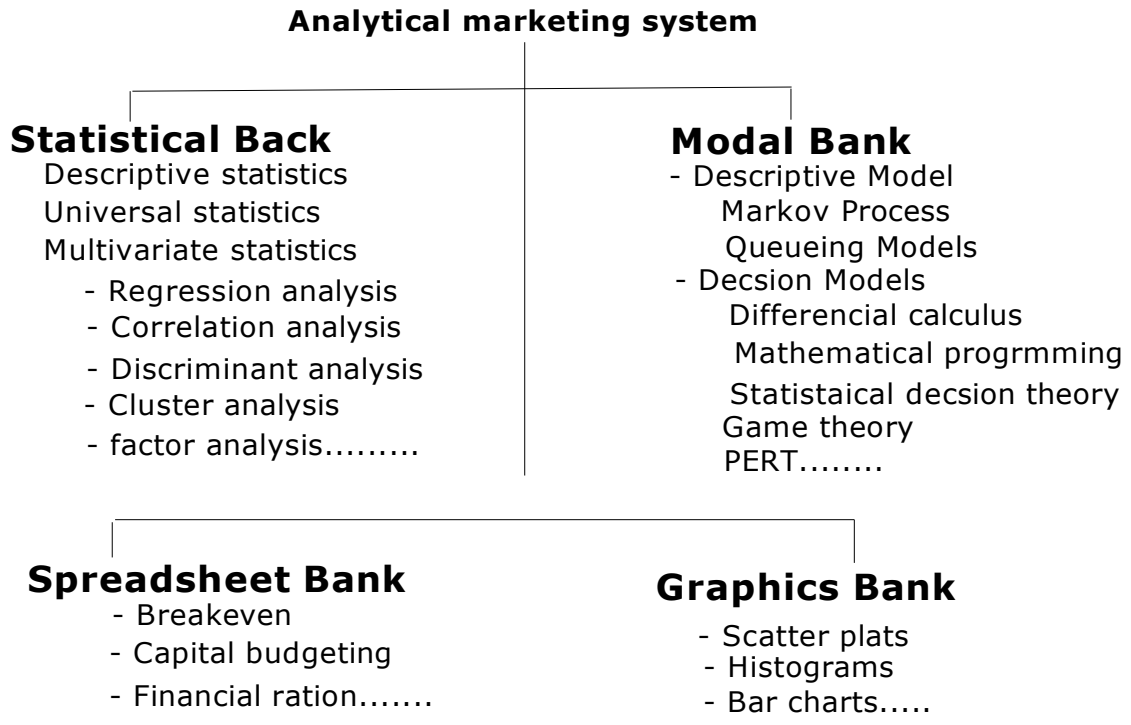


Figure 3. 3. Major analytical models

II. **Data Management Component**

A DSS attempts to combine the use of models or analytic techniques with database and retrieval turnover [49]. The system can contain one or more databases, each holding knowledge element to some problem domain of interest to the decision maker. Databases are mostly designed in table form that consist records of a particular type. For example, the data about the various sales representatives' performance, sales volume and product lines can be the content of the table. A collection of such types of related tables is called database.

Database management provides for the structured representation of data and the flexible processing of the data. It concerned with the representation of knowledge in database tables, and the processing of these tables for the ultimate decision support system aim. Besides these tables a database can contain a data dictionary. The data dictionary keeps track of what tables exists in the database (e.g., their names, structures, sizes), data usage (e.g., when a table came into existence, when it was last altered), and security authorizations (e.g., controlling who can view or update what part of the database).

III. **Dialogue management component**

The dialogue between the user and the system establish the framework in which outputs are presented as well as the context for user inputs. This suggests three dialogue management capabilities.

- User interface to handle the syntactic aspect of the interaction
- A dialogue control function to determine the basic semantics of interaction and maintain the interaction context, which could range between strictly system defined or loosely "user driven."
- A request transformer to provide the necessary (two-way) translation between the user's vocabulary and the system's internal modeling and data-access vocabulary.

3.4.4 Implementation of MDSS

The risks of failure of a job like MDSS are likely to be high. Two primary risks must be stressed. One, the system might work but might be operationally unsound and might have to be redesigned or discarded. Two, the system might not work at all, it might have to be restarted.

Implementation is the activity of using tools to transform the designed MDSS in to operational systems. Prior to putting this MDSS in to operation the developer must examine and test the system to see whether it behaves as expected. It must be tested against functions, interfaces and coordination requirements [26]. If so, the company can implement a working, tested, corrected, and documented decision support system. If there are users other than the developer, this installation may involve some initial hands-on training to orient them to the nature and use of the system. Without effective training in the early phases of computer operation, they may give up and turn back to paper-and-pencil methods. [49]

Generally, thirteen steps were identified as key to successful implementation strategies. Nine are people related and four are system related.

⇒ People related strategies:

- Get management involvement.
- Ascertain that there is a felt need for the system.
- Get user involvement.
- Provide training and education.

- Consider user requirements.
- Consider user attitudes.
- Establish effective communication.
- Keep interface simple.
- Let management determine information usefulness.

⇒ System related strategies:

- Identify the problem.
- Plan the implementation.
- Control the implementation process.
- Do post implementation evaluation.

The above steps are not sequential and several steps may be done simultaneously. Moreover, one step may feedback and improves or reinforces another. The result of one step may require revision or improvement of a previous step. As long as the system is in use, it must be reviewed, reevaluated, revised, and used to improve or maintain system performance.

CHAPTER-FOUR

PROBLEM FORMULATION

4.1 Introduction

Neither ASPSC nor Mobil can cope up the ongoing marketing challenges and develop competitive advantages. The two firms have different operational systems indeed both of them are in a weak state of marketing performance. As discussed in chapter-2 part 2.1.6 and 2.2.5.2, their cursory decision-making hinders their inertia of change and subsequent development.

The available option to remain in business and to find them in a win-win situation is make reluctances effect to adept new ways of sound decision-making system. Unless they do so, the prevailing situation will leave them in a delicate float or sink option- the option they dislike most.

Inabilities of making decisive marketing decisions are solvable. Adapting Marketing Decisions Support System (MDSS) is leverage out of their current situations. By implementing MDSS, they can incorporate different models that approximate the market situation better and improve the effectiveness of decision-making process. It is intended to support the problem solving effort of marketing manger.

The main intention of this thesis work is merely to help those two companies by preparing appropriate MDSS software. Hopping it as momentum for take-off, each development steps are meticulously planned and properly organized. Due to the time and other constraints, however, all the marketing decision types are not formulated and incorporated in this work. Only four decisions (two from ASPSC and two from Mobil) are selected, analyzed and formulated for the computer program development. In order to select (give priority), discussion was held with different officials of the respective companies.

The detail steps of each problem formulations under the two cases (ASPSC and Mobil) are explained in part 4.2 and 4.3.

4.2 Case-One, ASPSC

4.2.1 Formulation of Decision-One

Demand Forecasting

The basic types of forecasting methods are: Time series, Casual methods and Qualitative methods. From these time series is a category of statistical techniques that uses historical data to predict future behaviors. It assumes that what has occurred in the past will continue to occur in the future. This method can be divided in to two types as exponential smoothing and moving average.

For the ASPSC demand forecasting process, exponential smoothing method can be used. Besides the company's production system there are recent development changes which need emphasis on the forecasting process. For this situation exponential smoothing method

is ultra-modern weapon that weights the most recent past data more strongly than more distant past data.

It can be computed using the following formula:

$$F_{t+1}=\alpha D_t+(1-\alpha)\, F_t \quad \text{.......} \quad (4.1)$$

Where F_{t+1} = The forecast for next period

D_t = Actual demand in present period

F_t = The previously determined forecast for the present demand

α = The smoothing constant (weighing factors)

The value of the smoothing constant α, is usually judgmental and subjective, that will often be based on trial-and-error experimentation [9]. Most commonly α must be between zero and one. The higher α is, the forecast will be more sensitive to recent changes of demand. Considering those basic concepts a smoothing value of 0.621 is an appropriate value for the demand forecasting of ASPSC. This can change the above equation 4.1 as follows:

$$F_{t+1} = 0.621D_t + 0.379\, F_t \quad \text{.......} \quad (4.2)$$

There are a number of variables that leads the demand of a product to behave in a certain manner. Such certainty can be determined, and then this can be useful in making decisions that impact on the future. For example, ASPSC community should evaluate their demand trend in terms of the respective year's advertisement budget. Then the decision makers can predict what demand will be in the future based on the budget value of advertisement.

In order to analysis such effects, the linear regression forecasting technique is an appropriate method. By applying it, the ASPSC community can evaluate the effect of their advertisement budget for the respective volume of sales demand.

By considering sales demand as dependent variable and advertisement budget as an independent variable, the following is the basic linear regression equation:

$$Y = a + bX \quad \text{.....(4.3)}$$

Where Y = Sales demand (as dependent variable)

X= Advertisement budget (as independent variable)

a = The slope

b = The intercept

In order to develop the equation, first the values of 'a' and 'b' must be computed using the following formulae:

$$\overline{X} = \frac{\sum X}{n} \quad \text{.....(4.4)}$$

$$\overline{Y} = \frac{\sum Y}{n} \quad \text{.....(4.5)}$$

$$a = \overline{Y} - b\overline{X} \quad \text{.....(4.6)}$$

$$b = \frac{\sum XY - n\overline{X}\,\overline{Y}}{\sum (X^2) - n\overline{X^2}} \quad \text{.....(4. 7)}$$

Based on the ASPSC's past ten years (1984-94E.C.) annual advertising budgets (as an X value) and annual sales volume (as Y value) the slop 'a' and the intercept 'b' has computed. By applying the above equations 4.4, 4.5, 4.6, and 4.7 the appropriate value of 'a' and 'b' are -29024 and 1807 respectively. These values can modify equation 4.3 in the following manner:

$$Y = 1807X - 29024 \quad \text{(4.8)}$$

By using the two formulated equations (equations 4.2 and 4.8) the future ASPSC's sales demand can be forecasted, moreover it can be analyzed with respect to the advertising budget.

After these formulations the details of the algorithm and computer programming are discussed in chapter-5 part 5.3.1.

4.2.2 Formulation of Decision-Two

Selling Price

There is an adapted method to estimate the manufacturing cost in Akaki Spare Parts and Hand Tools Share Company (ASPSC). Prior to starting any manufacturing actions the concerned sales engineers should estimate each costs of manufacturing the products. This estimation process applies not only on the customer-initiated jobs, but also the internal use job. [3]

The cost estimation process is based on: the selected material type and size, the selected manufacturing system in terms of the respective labor costs and overhead costs; also the profit margin of the company. The cost determination is mostly made under increasing time pressure.

However, currently in ASPSC there is no permissible way of performing such action. They process it in time consuming and boring way which can mislead the estimator's judgmental capabilities. Moreover, it is not a computerized method that can facilitate an easy way of analyzing different alternative solutions. In order to solve this problem the system should be rearranged in the manner that can combine different information exhaustively. The following formulation will facilitate the cost estimation process towards the supportive mechanism that can help the problem solving effort of the estimators.

Their basic equations to estimate the manufacturing costs are: [3]

Estimated manufacturing cost = DMC + DLC + TOHC……...…… (4.9)

Selling price = Estimated Manuf. Cost + Profit Margin ……...…… (4.10)

Where DMC = Direct Material Cost

DLC = Direct Labor Cost

TOHC = Total Overhead Cost

The total overhead cost includes the machine overhead and also the selling and administration overheads. Among the different factors the value of costs are highly dependent on the urgency level of the job and the type of machine (cost center) to be used in the manufacturing.

In ASPSC manufacturing system the level of urgency of given job are categorized in to three. These are normal job, urgent job and extraordinary urgent job. The company can claim an additional cost if the customer needs the job to be done at an urgent or extraordinary urgent levels. For the urgent jobs, the actual manufacturing times estimated will be multiplied by a factor of 3. Similarly, for extraordinarily jobs the actual manufacturing times estimated will be multiplied by a factor of 5.

As explained in chapter-2, parts 2.1.2 and 2.1.3, ASPSC is a big complex that has a number of manufacturing facilities. These are grouped in to 18 cost centers (working areas) as per their value of total overheads costs.

When an engineer estimates the selling price of a product he should evaluate the different alternatives of cost centers and also urgency level. These greatly affect the final price of the product and should be evaluated in terms of different alternative solutions. Therefore, the computer programming in chapter-5 part 5.3.2 will facilitate easy methods to do so.

4.3 Case-Two, Mobil

4.3.1 Formulation of Decision-One

Lube shops operation system

As stated in chapter-2 part 2.2.1, there are more than 123 Mobil branded service stations throughout the country. Through every service station, in conjunction with the fuel marketing, there are lubricant shops with the aim of selling different lubricants for their customers. The improvement of the shop service with respect to the customers waiting time is important. Because the effectiveness of such lube shops are greatly affected by the performance of shop assistance's and cashiers. There must be a strategy to monitor and evaluate constantly the effects of such variables. However, properly managing the shop system is not simple for the corporation decision makers and it needs a more through study. Queuing models can analysis and generate a better result for such type of systems with probabilistic operation characteristics [9]. There are a number of different queuing models to deal with different systems that can help the Mobil's decision makers in their lubricant shop management.

Since the operation characteristic of one shop is different from the other, it is necessary to select one sample shop in this thesis work. The Mobil lubricant shop found in Addis Ababa Bole road is selected as pilot shop. The following formulation is designed with special reference to it. However, with slight modification the basic concepts can be applied for the other shops also.

The above selected sample shop can be analyzed by single-server queuing model system with the following characteristic:

- An infinite calling population, and
- A first-come-first-serve queuing discipline.

Normally the arrival rate and service rate are based on the poison and exponential probabilistic distributions respectively. The very difficulty of this work is in determining the exact value of these variables at any give moment of time. In this thesis work's problem formulation the best alternative to find this rates are by applying the simulation technique, which is simulation using the random value.

After having calculated the values of arrival rate λ, and the service rate μ, each operating characteristics of the above selected shop queuing model can be found using the formulas described below:

$$\rho = \frac{\lambda}{\mu} \quad \text{..... (4.11)}$$

$$P_0 = 1 - \rho \quad \text{..... (4.12)}$$

$$P_n = \rho^n * P_0 \quad \text{..... (4.13)}$$

$$L = \frac{\lambda}{(\mu - \lambda)} \quad \text{.....(4.14)}$$

$$L_q = \frac{\lambda^2}{(\mu(\mu - \lambda))} \quad \text{.....(4.15)}$$

$$W = \frac{L}{\lambda} \quad \text{.....(4.16)}$$

$$W_q = \frac{\lambda}{\mu(\mu - \lambda)} \quad \text{……..……..……..(4.17)}$$

$$I = 1 - \rho \quad \text{……..…..…….(4.18)}$$

Where ρ = The shops utilization factor

n = Number of customers

P_0 = Probability that no customer are in the queuing system

P_n = Probability that n-customers are in the queuing system

L= The average number of customers in the queuing system

L_q = The average number of customers in the queuing lines

W = he average time a customer spends in queuing system

W_q = The average time a customer waiting in the queue

I = The probability that the shop is idle

After having the value of all these operation characteristics; in order to make proper decision an alternative solution should be available for the decision makers. In this lube shop case, the decision makers can evaluate alternatively the service value of the shop by adding new shop assistance and by adding a new cahier. Let's formulate a separate equation for each of the two alternatives.

Adding a shop assistance

If additional shop assistance is hired in the system, customers can be served in a very less period of time. In another word the service rate of the shop can be increased. Assuming that

the newly hired assistance have equal performance rate to the old assistance, their service rate can be calculated using the following formula:

$$\mu_{new} = \frac{\mu}{2} \quad \text{..... (4.19)}$$

Where μ = The pervious service rate

μ_{new} = The new service rate

By inserting this new service rate in the equations 4.11 to 4.18, its changing effect can be tested. Moreover, by considering the salary of shop assistance with respect to the losses he can save, the economic benefits of hiring shop assistance can be evaluated.

Adding a Cashier

If the decision maker applies this alternative, the arrival rate for each queue line would be half of the prior arrival rate. This is by assuming that the customers would divide themselves equally between the old and new cashiers.

Thus, the new arrival rate for each cashier is:

$$\lambda_{new} = \frac{\lambda}{2} \quad \text{..... (4.20)}$$

Where λ = The previous arrival rate

λ_{new} = The new service rate

By inserting this new arrival rate in the equations 4.11 to 4.18, its changing effect can be tested. Moreover, the economic benefits of this alternative can be evaluated by comparing the salary of cashier with respect to the project costs.

4.3.2 Formulation of Decision-Two

Income After Tax (IAT)

In Mobil Oil East Africa Limited there is an adapted methodology to calculate income after tax /net income/. The lubricant and petroleum specialties section of the corporation specially uses this. Its marketing staff members frequently apply this methodology in evaluating their activities and making subsequent decisions. However, the methodology is not designed with in the context of evaluating decision alternatives, their probable consequence and selecting one among the others. The following part, discuses formulation of the Income After Tax (IAT) calculation method towards the appropriate Decision Support System (DSS).

The main formulae applied for the IAT calculation are the following:

$$GM = (SP - NPC)\ \frac{159}{8.8}\ \frac{\$}{barell} \quad \text{..... (4.21)}$$

$$IAT = (GM - OPEX) * 0.3 \quad \text{..... (4.22)}$$

$$IAT_{(div.)} = IAT - FAE \quad \text{..... (4.23)}$$

Where SP = Selling Price

OPEX = Operation Expense

GM = Gross Marginal Performance

FAE = Foreign Area Expense

IAT = Income After Tax

$IAT_{(div.)}$ = Income After Tax at division level

Those decision makers should generate alternative and evaluate the impact of different input variables before making their final decisive decisions. From the above variables OPEX, GM and FAE are on their hand to control and make change. The change can be made in percent or direct value form.

Based on the above-discussed points the computer algorithm and each coding are held. The chapter-5 part 5.4.2 contains this IAT calculation support system.

CHAPTER-FIVE

THE COMPUTER PROGRAMMING

5.1 Introduction

The main part of this marketing decision support system has developed using the visual basic programming language and its database by the access programming language. The visual basic add menus, text boxes, command buttons, option buttons (for making exclusive choice), list boxes, file and directory boxes to blank the windows. Moreover, it uses grids to handle tabular data, communicate with other window applications, and access database.

In this computer program the four selected decision types (as discussed in chapter-4) are separately developed. With respect to their own problem formulations they are treated separately under the case studies of ASPSC and Mobil.

To increase the intended capabilities of the developed marketing decision support system, the algorithms and the coding systems are arranged in the manner that can iterate the situations. These conditions deprive to use a number of 'forms' under each of the decision types. Inside each form there are appropriate computer codes that aim to run the program in a user-friendly manner.

5.2 Steps in Using the Program

When the user want to run the program, first a splash form that contain **Next** and **Exit** command buttons will come to introduce when and where it was developed.

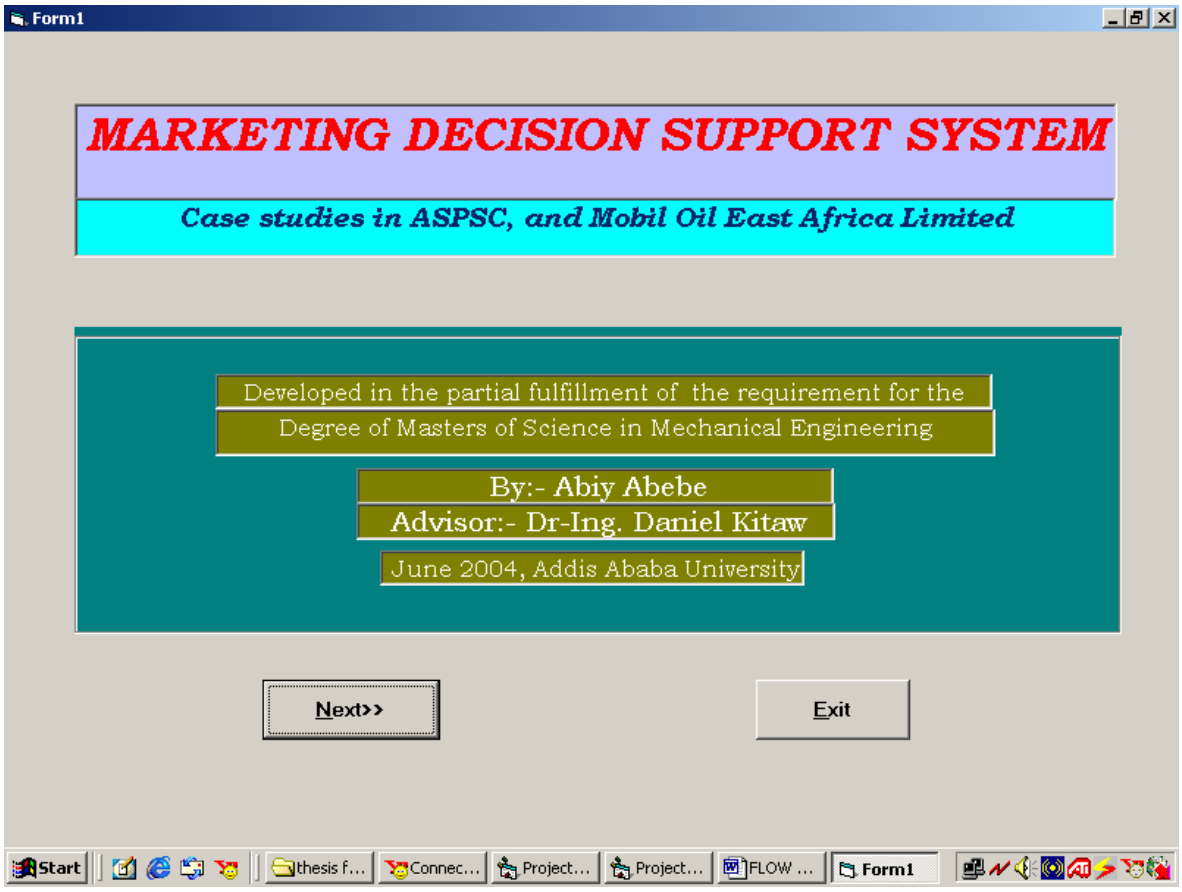


Figure 5. 1. Splash form of the program

If **Next** button is clicked, the program shows quick review form that contains **Next** and **Back** buttons that can help the user what designed behaviors can have in the software.

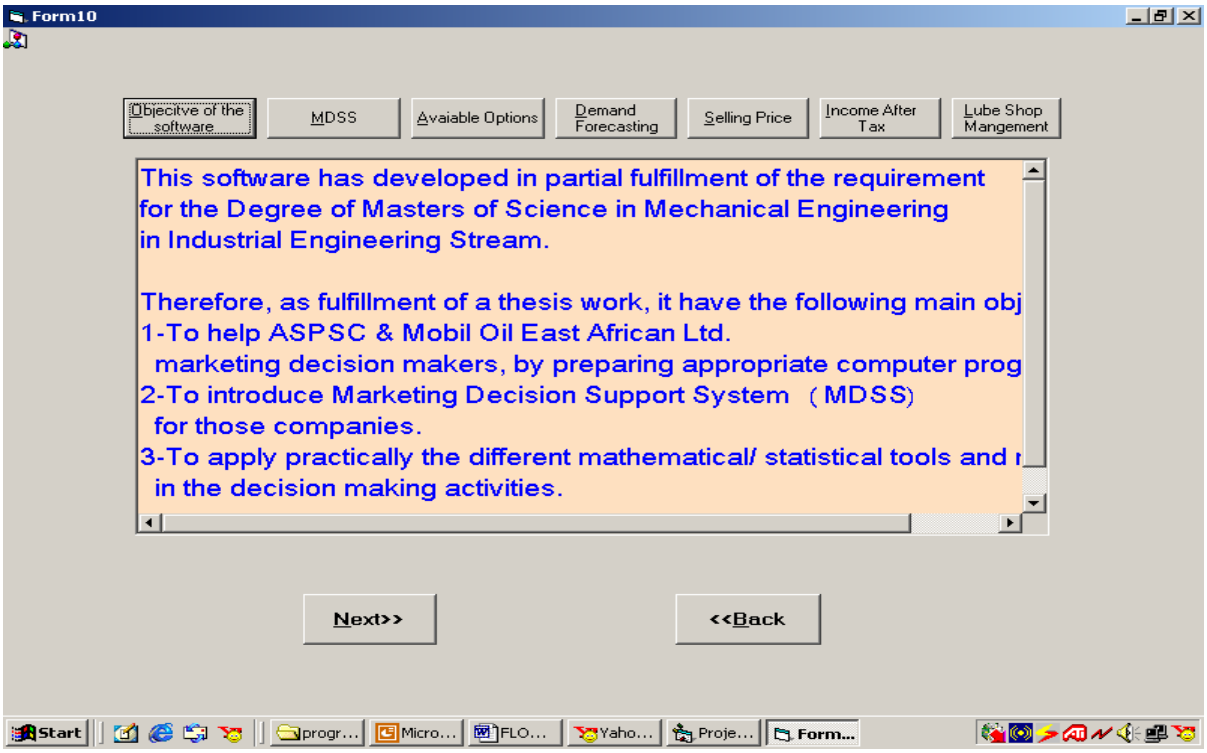


Figure 5. 2. Quick review form

- If **Back** button is clicked the program return one step back to the splash form.
- If **Next** button is clicked the option chart form will appear on the screen.

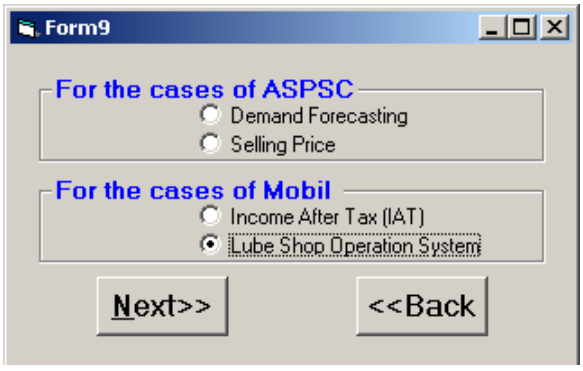


Figure 5. 3. Option chart form

There are four alternatives to be selected in the then chart form. As discussed before, two of them are for ASPSC cases and the remain two are for Mobil cases. The user should

choose only one of the four options then could continue the program based on their own specific manipulation techniques. Let's discuss each of the four options separately.

5.3 Case-One, ASPSC

5.3.1 Programming of Decision-One

Demand forecasting

This is developed based on the formulated equations on chapter-4 part 4.2.1. The flow chart that guides the over all coding system is shown in figure-5.4. The codes that used to run each forms of this program are attached in the appendix-II.

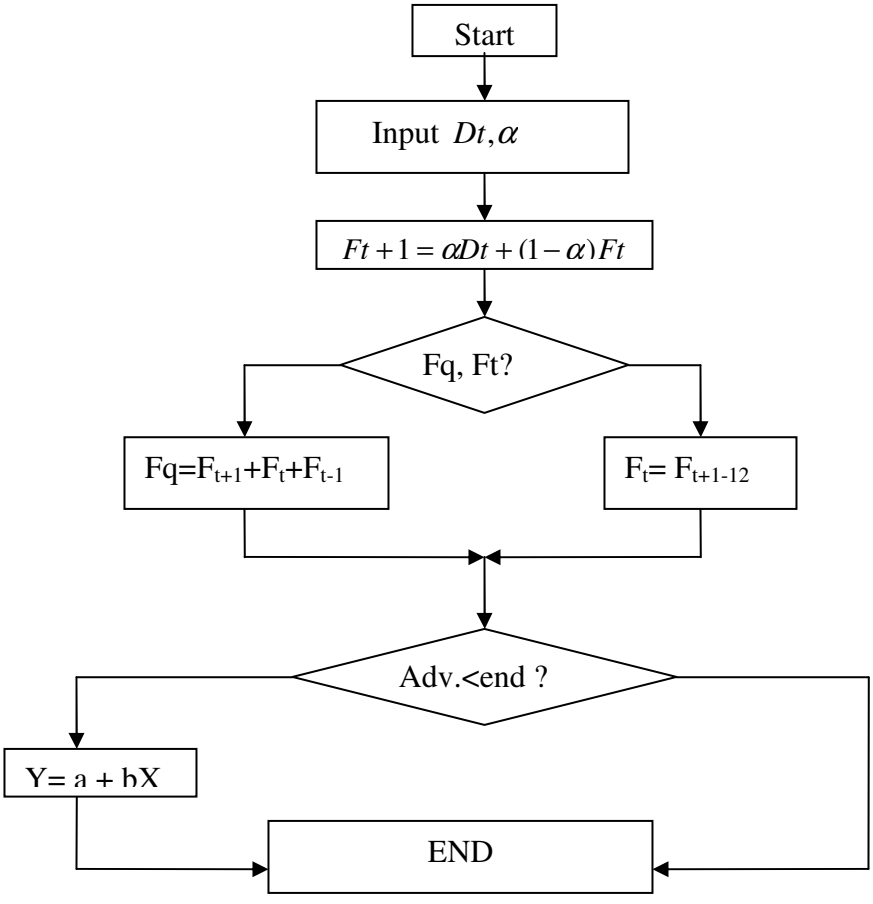


Figure 5. 4. Flow diagram of demand forecasting

If demand forecasting is selected from the option chart form and the **Next** button is clicked, the input form that used to enter the value of past months sales data can appear on the screen. The input form has **Continue**, **Back** and **Help** command buttons.

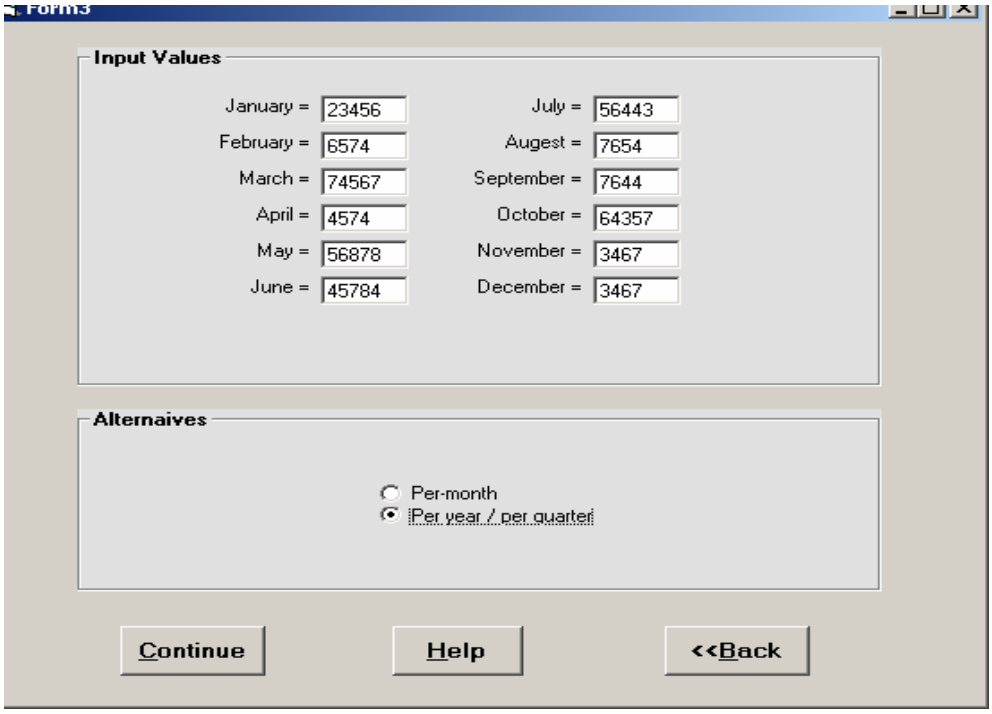


Figure 5. 5. Input form of demand forecasting

By clicking the **Help** button the user can have an immediate understanding of the system in addition to the main help of the program that explain the general concepts.

There are two options that are available for the user to have the forecasted values in two styles. These are per month's styles or per quarter and year styles. Before clicking the **Continue** button the user should choose any one of the two options.

For example, if the user chooses the quarter and yearly option and clicks the **Continue** command button he can have the forecasted values as shown in fig-5.6.

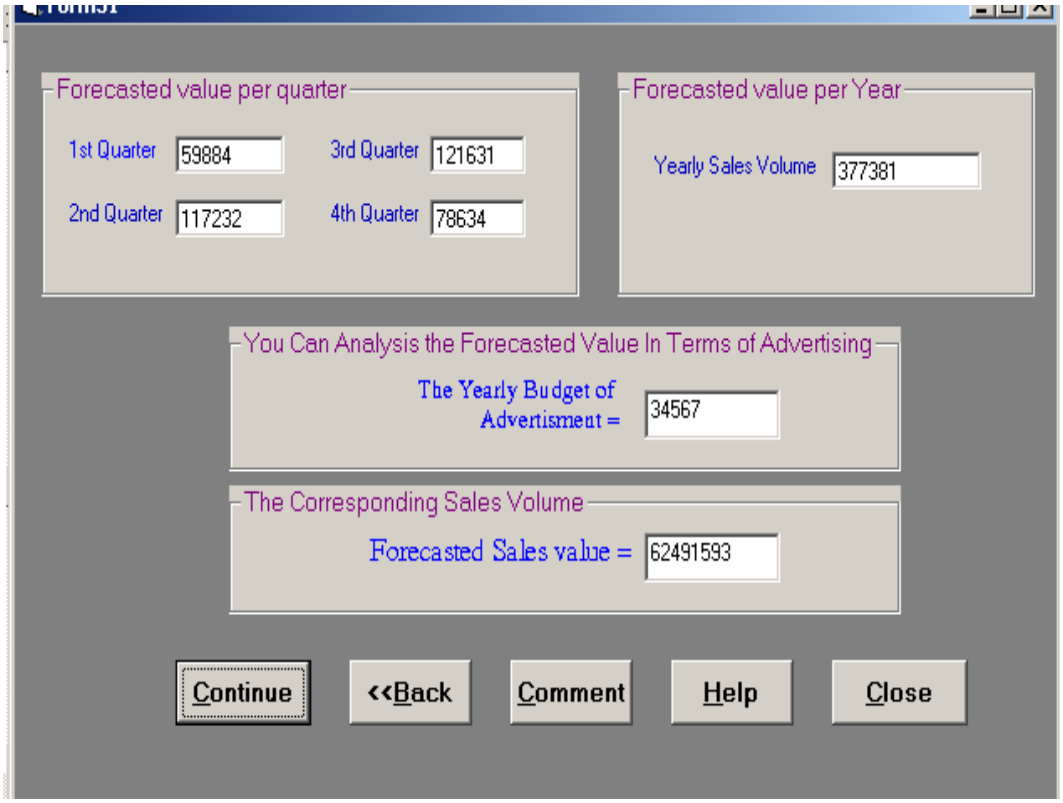


Figure 5. 6. Output form2 of demand forecasting

The output form2 have **Comment, Back, Exit** and **Continue** command buttons.

- If the **Back** button is clicked the program can run one step back to the input form.
- If the **Close** button is clicked the program will end up.
- If the user is interested to know about the state of the forecasted values he can get a comment by just clicking the **Comment** button. Figure-5.7 is an example of comment form.
- If the **continue** button is clicked by the user before entering the value of advertising budget a message box will come to remained him for the action he done. (Fig-5.8) But, if the **continue** button is clicked after entering the advertising budget the user can read the forested values directly from that form.

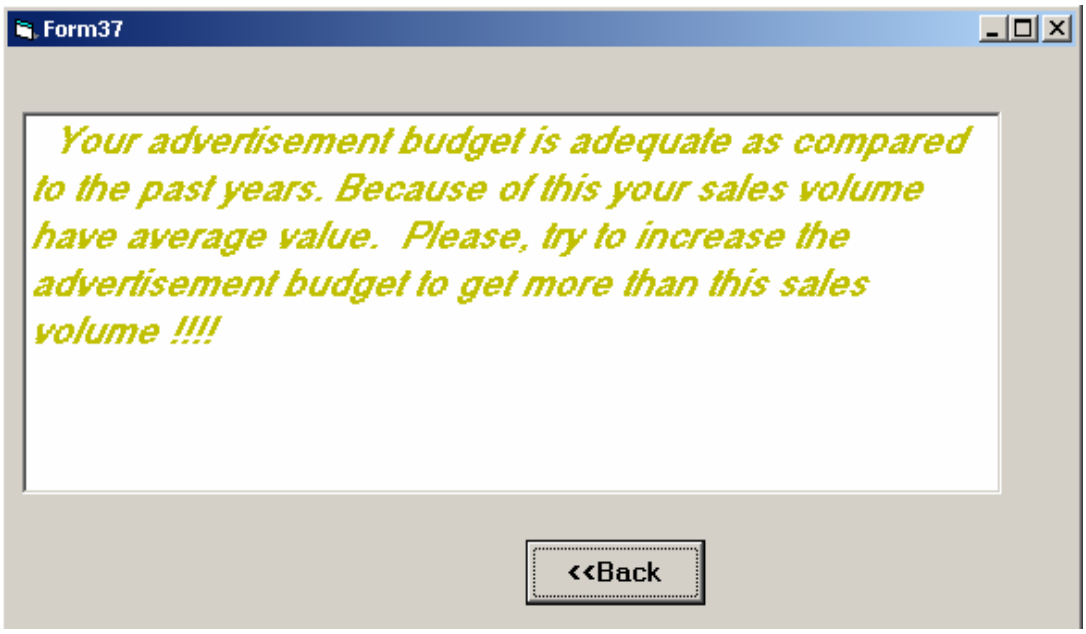


Figure 5. 7. Comment form

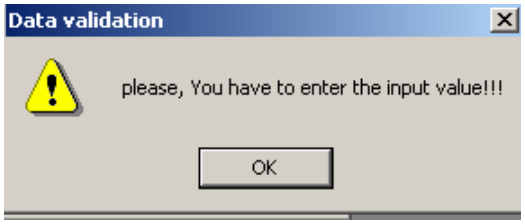


Figure 5. 8. Message form

5.3.2 Programming of Decision-Two

Selling Price

This part of the program is bases the formulated equations on chapter-4 part 4.2.2. The flow diagram of the model is as shown in fig-5.9; the codes of the program inside the forms that used to run the program are attached on appendix-III.

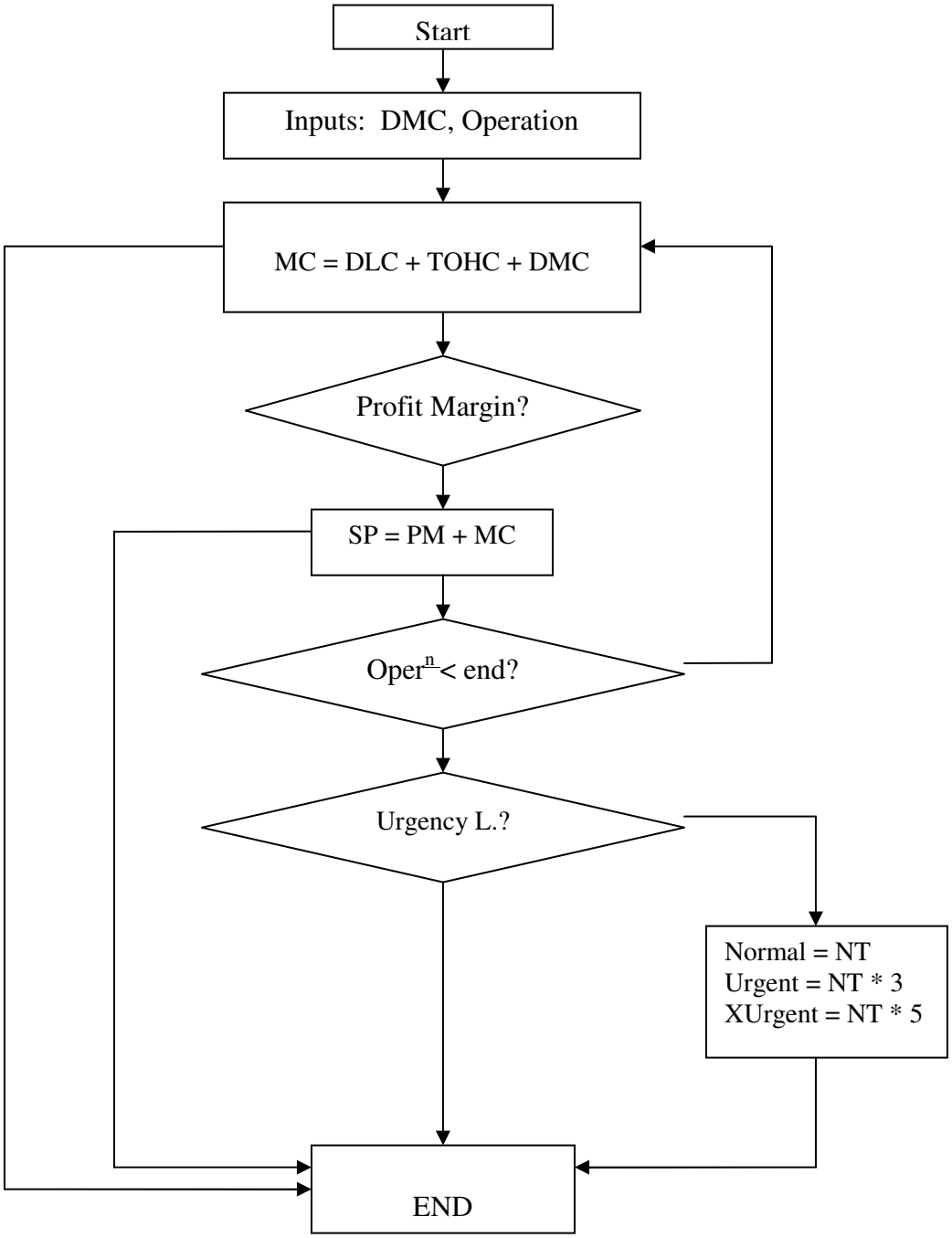


Figure 5. 9. Flow diagram of selling price model

The first form, which comes in picture when running this part of, the program is as shown in fig-5.10. It asks a number of input values and has a **Continue** and **Back** commands.

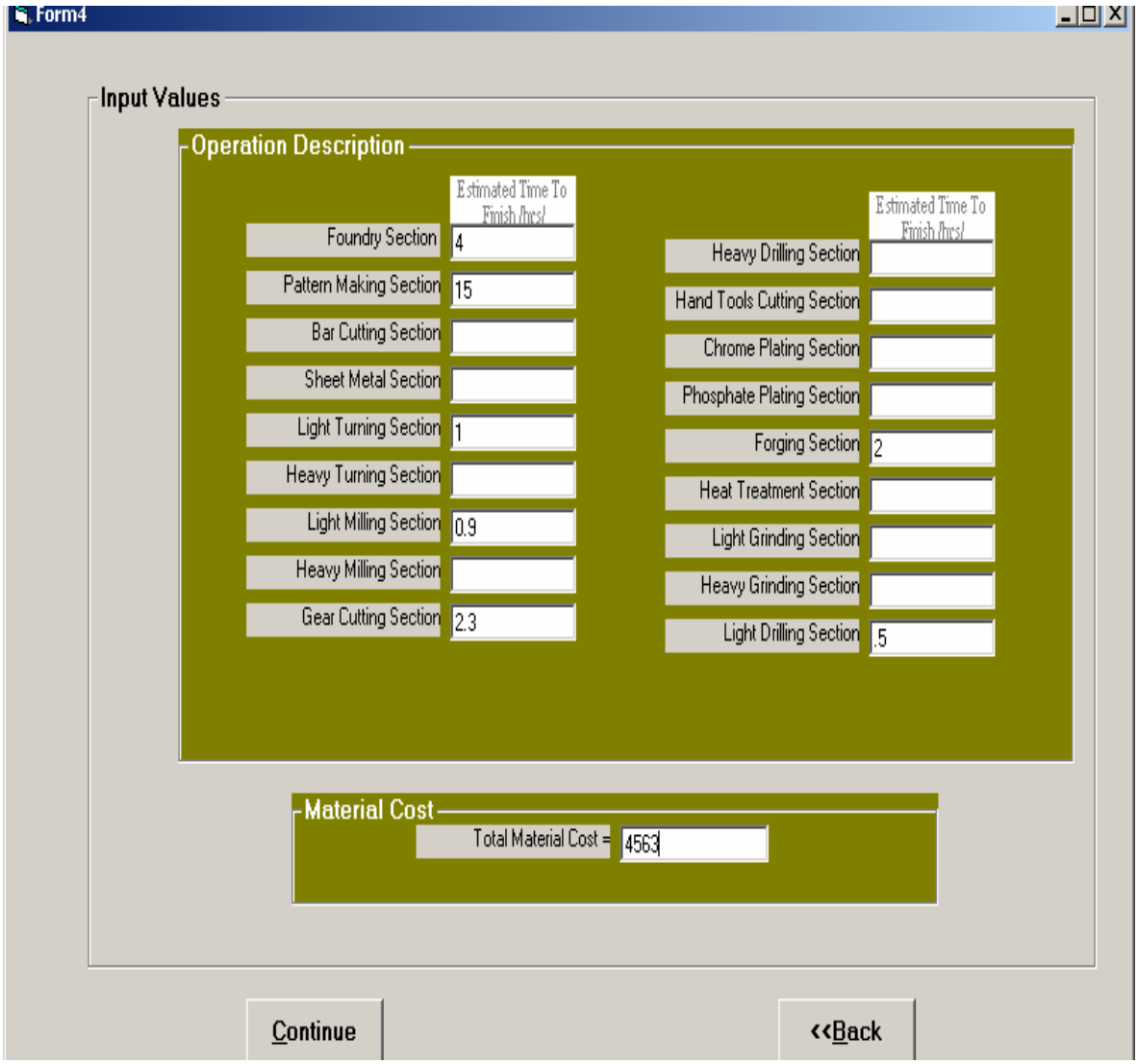


Figure 5. 10. Input form of selling price

- If the **Back** command button is clicked the program will move to the option chart form.
- If the **Continue** command button is clicked after entering input values, the program can display the demanded values in one of the output forms.

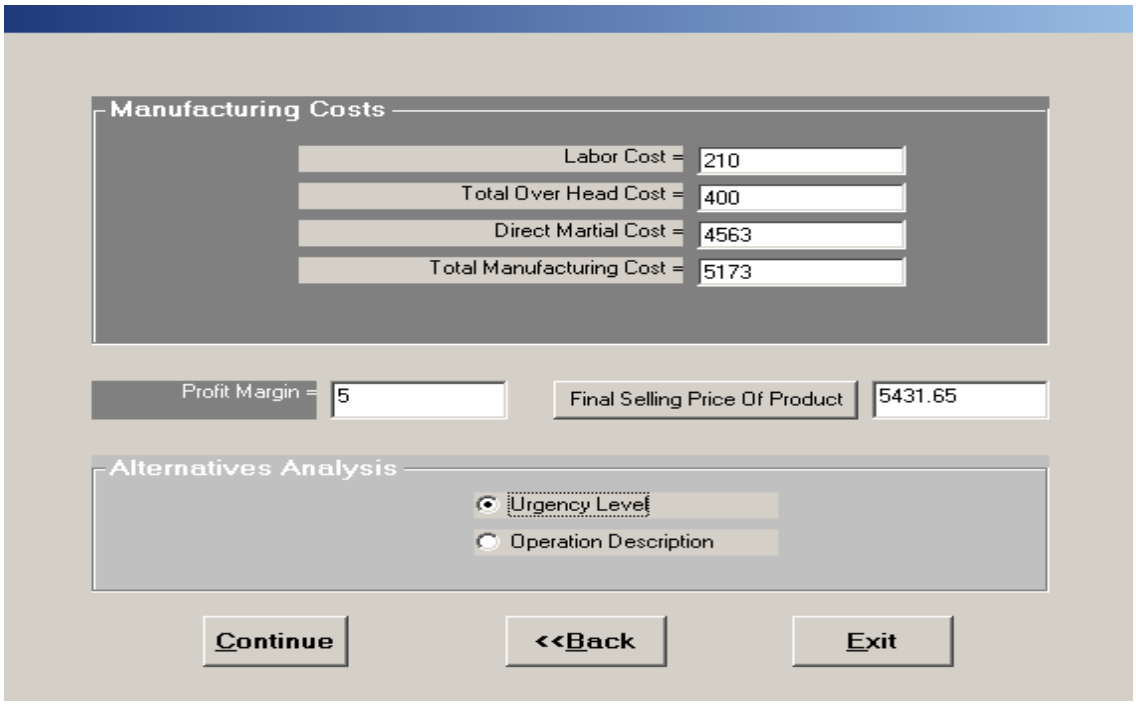


Figure 5. 11. Output form of selling price

Here the user can easily found the manufacturing costs of the products. However, to know the final selling price of the product the user should give the expected profit margin of the company. After doing so, he can find the final price by clicking the command button described as “final selling Price”.

There are two alternative ways that the user can evaluate solutions before making decisions. These are by changing the job urgency level or by changing the operation description (cost center). Any one of the two should be choose before clicking the **Continue** command.

For example, if the urgency level is selected and **Continue** is clicked the out put form as shown in fig-5.12 will appear on the screen.

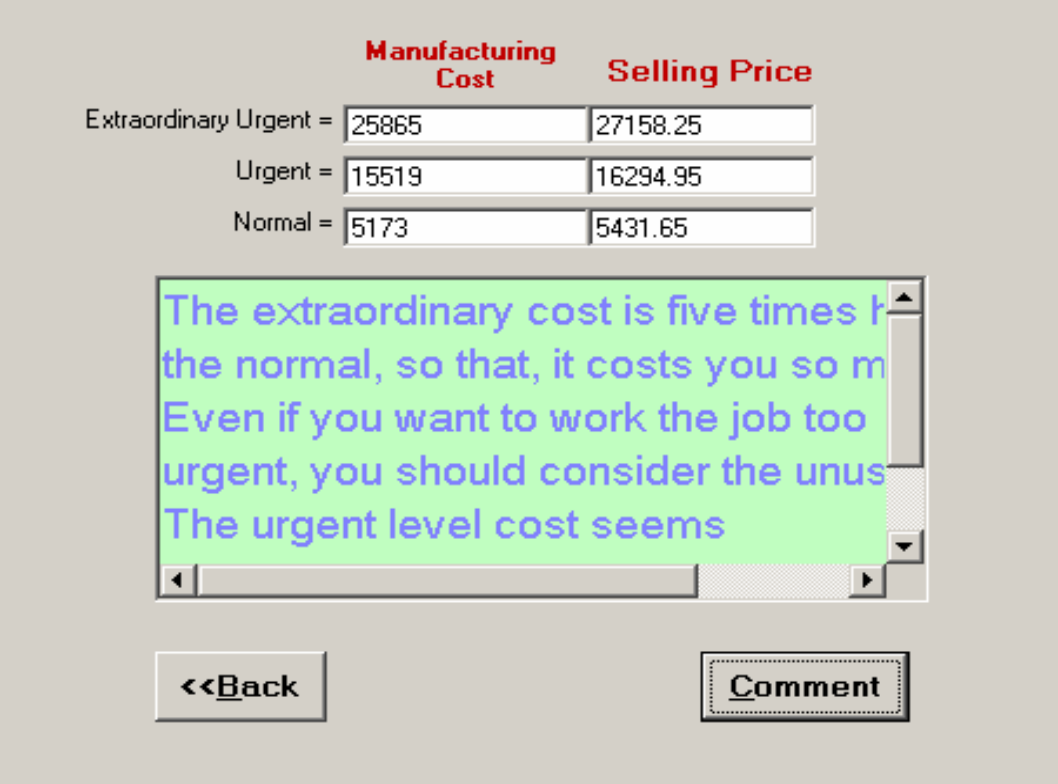


Figure 5. 12. Output form of analysis

5.4 Case-Two, Mobil

5.4.1 Programming of Decision-One

Mobil Lube Shops Operation System

This part of the program is developed based on the principles discussed on chapter-4 part 4.3.1. The flow chart in fig-5.13 shows how the computer program can operate as system. The programming codes are attached on appendix-IV.

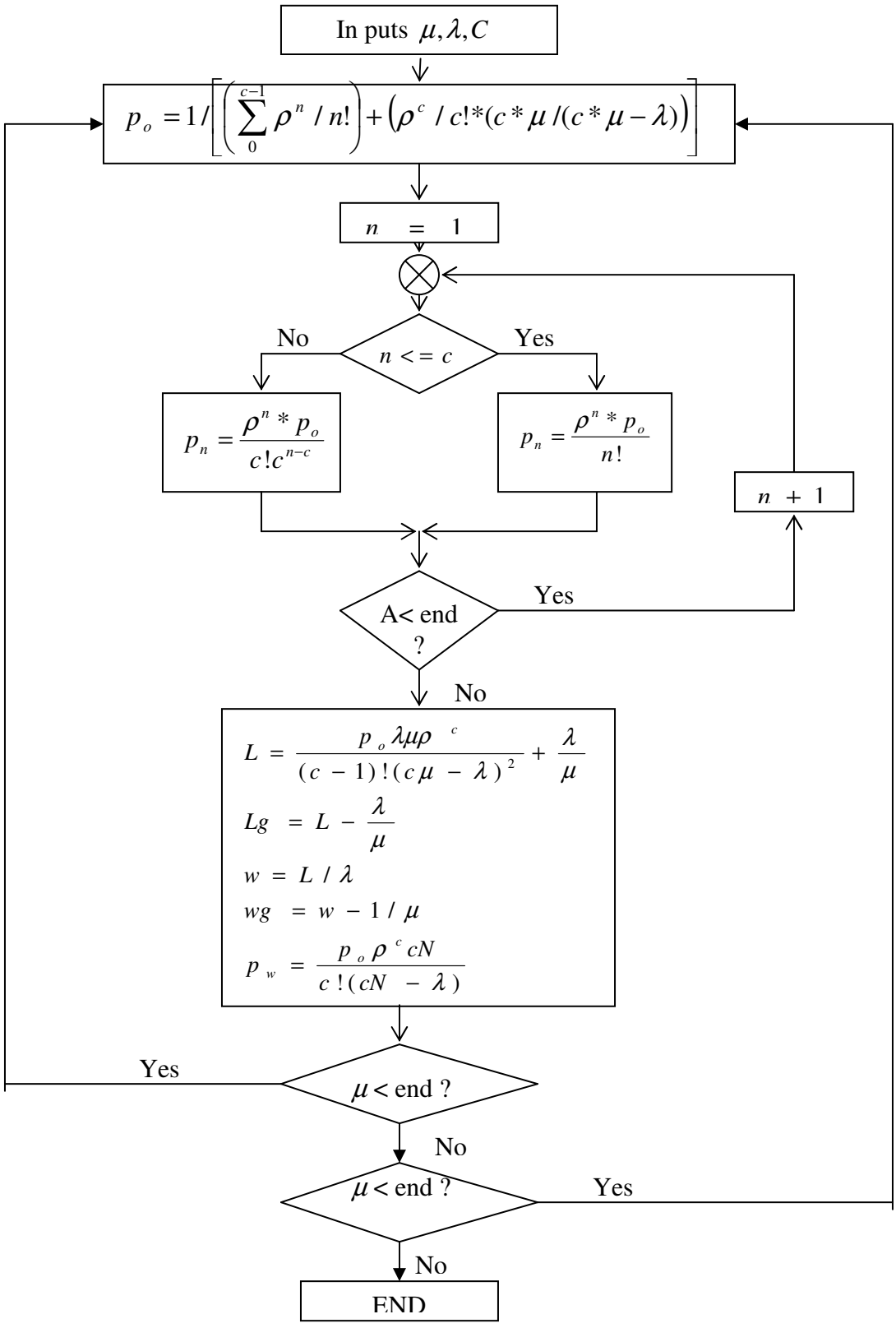


Figure 5. 13. Flow diagram of Queuing model

When the user wants to run this part of the program, the new input form will come on the screen. This input form has **Continue, Back** and **Close** command buttons.

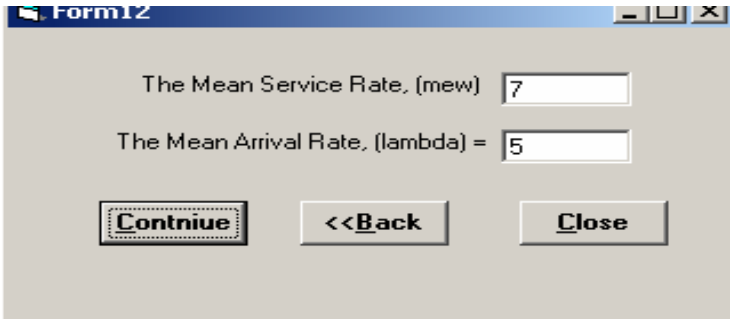


Figure 5. 14. Input form of Queuing program

The user can move back to the option chart form or end up the program by clicking the **Back** and **Exit** buttons respectively. Besides this by clicking the **Continue** button an output form clicking the Continue button an output form can generate that display different operational characteristics of the shop.

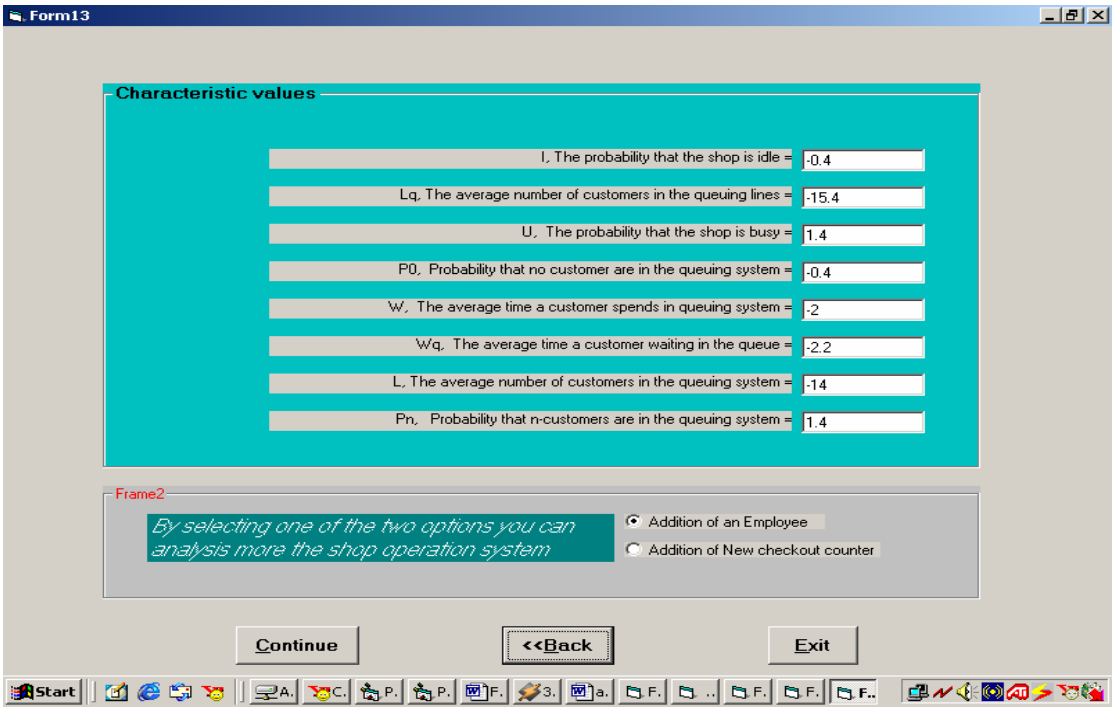


Figure 5. 15. Output form3 of queuing models

For additional information of the system the user have to select one of the two options available in the output form. These can help him to analysis the situation better. As clearly shown in the output form, the available options are adding a new cahier or shop assistance.

If the user selects one of these alternatives, for example adding shop assistance, another form (as shown in Fig-5.16) will come with **Back, Comment**, **Calculate** and **Exit** command buttons.

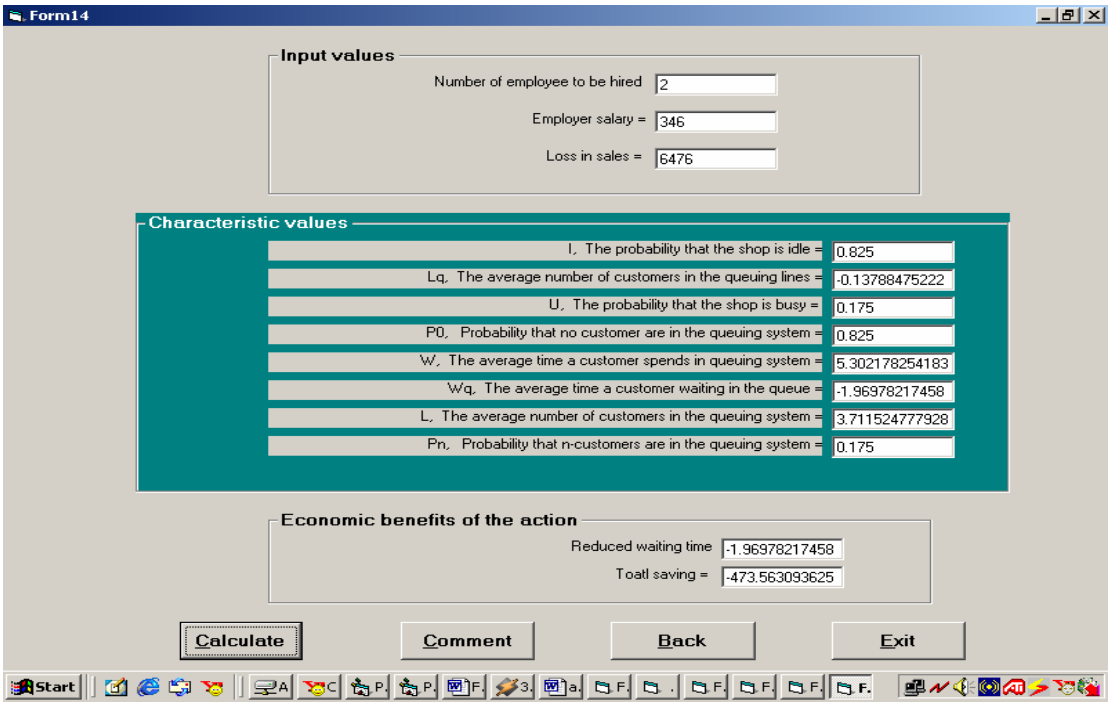


Figure 5. 16. Output form4 of alternative analysis

Here the user is expected to enter the input values before clicking the **Comment** as well as the **Calculate** buttons. Otherwise, a message box will come to remind him for the action done as shown in fig-5.17.

- If the **Calculat**e button is clicked after entering the necessary input values, the output will be displayed in that form immediate.
- If the **Comment** button is clicked the user can have the comment about the situation. Fig-5.18 is an example of the comments given for the ongoing situations.

Figure 5. 17. An example of message box

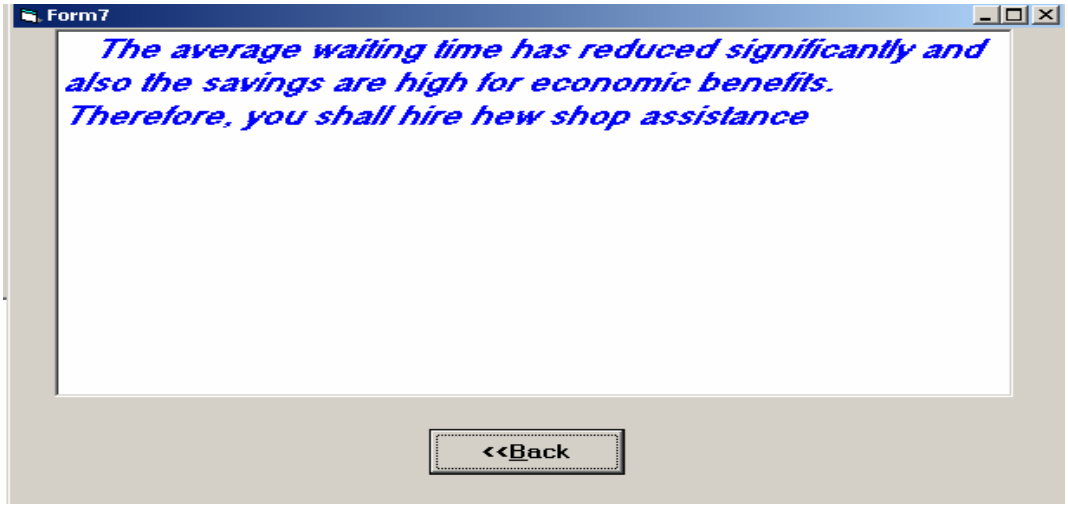


Figure 5. 18. An example of comment form

5.4.2 Programming of Decision-Two

Income After Tax (IAT)

This part of the program is developed based on the principles discussed on chapter-4 part 4.3.2. The flow chart in fig-5.19 shows how the program can operate in the system. The programming codes are attached on appendix-V.

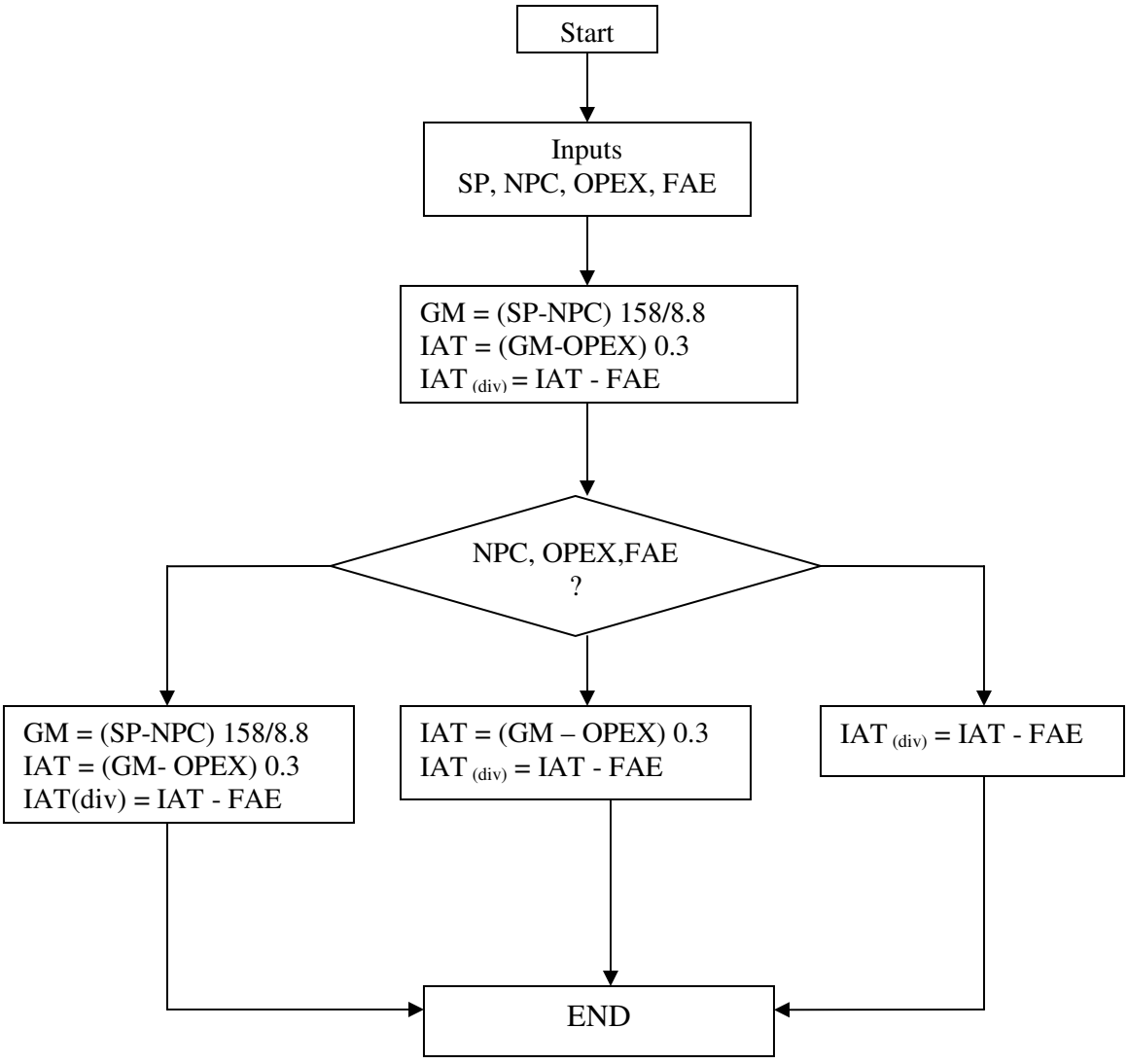


Figure 5. 19. Flow diagram of IAT model

The input form for this part of the program have **Calculate, Help** and **Back** buttons. The user should enter each of the four expected input values as shown in figure. Otherwise the message box will remind him for the validity of the data.

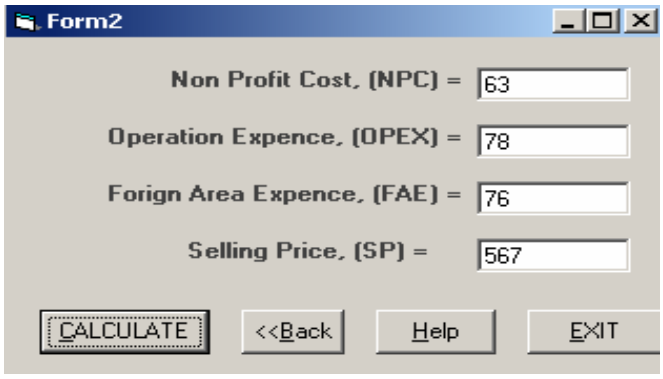


Figure 5. 20. Input form of IAT model

- If **Back** button is clicked the program will move to the option chart form.
- If **Help** button is clicked the user can have an immediate assistance.
- If **Calculate** button is clicked after entering the input values the results will be shown in the output form.

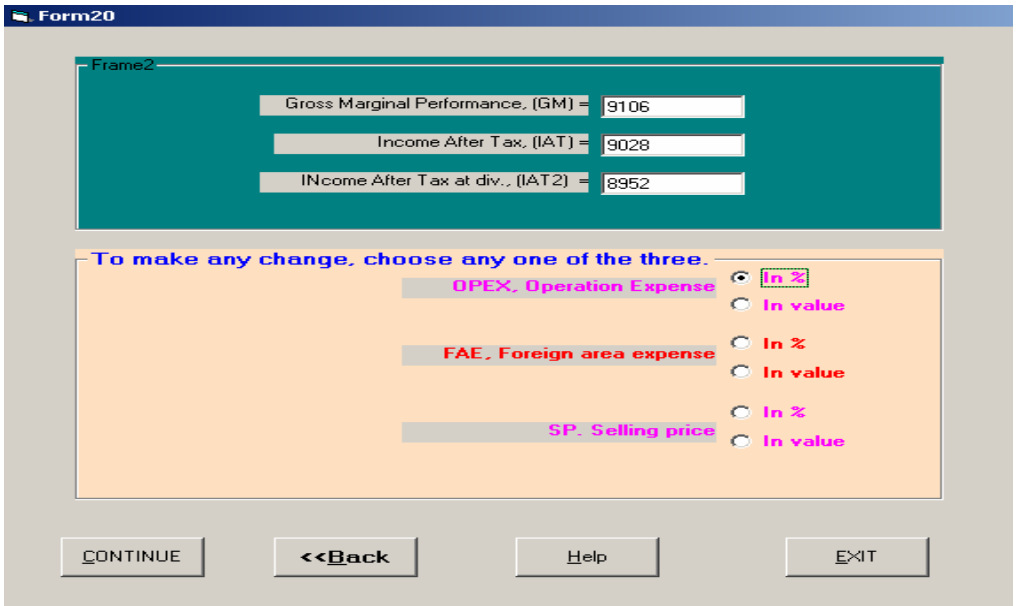


Figure 5. 21. Output form2 of IAT

Besides the output values, the user have a number of options to analysis the situation in alternative manner. That is, to see the changing effect of operation expense or other he can change in percent or in direct value form. For the proper operation of the system there are four command buttons.

If the user want to analysis the situation more by choosing one of the options and clicks the continue button the program will move to another new form. For example, if the OPEX in percent form is selected and continue button is clicked the form shown in fig-5.22, will come on the screen.

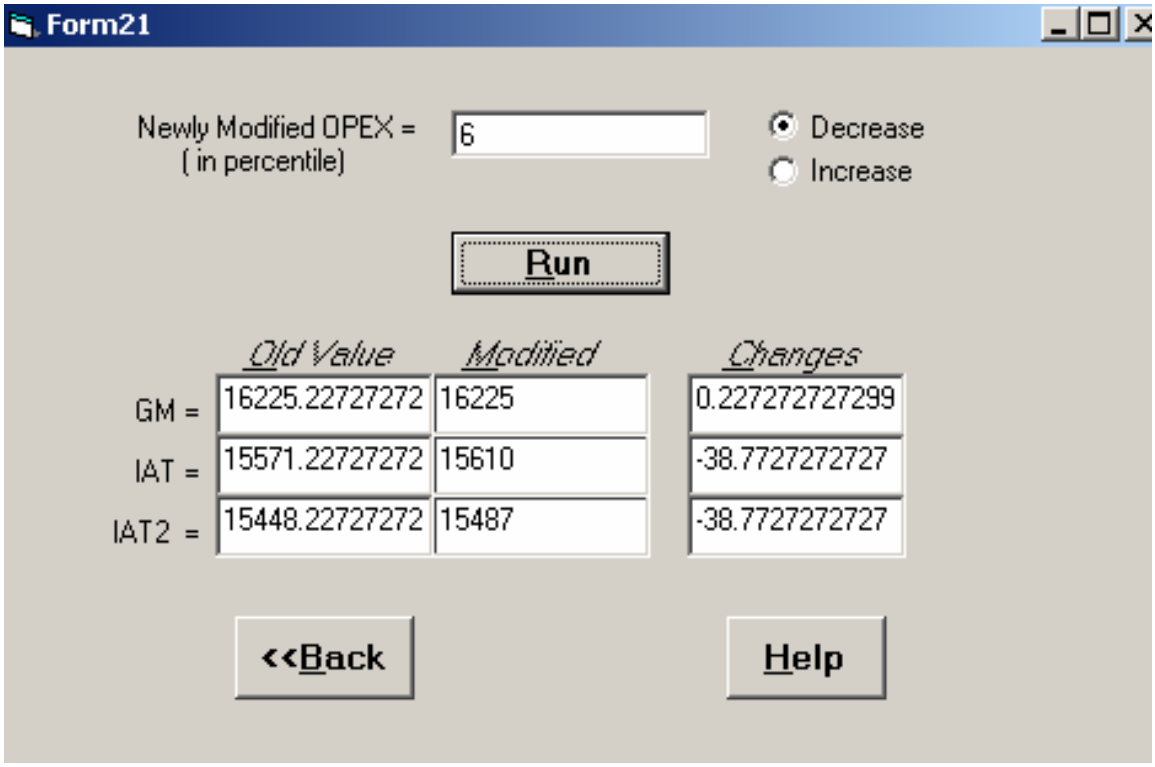


Figure 5. 22. Output form alternative analysis

CHAPTER-SIX

CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

Both ASPSC and Mobil Oil East Africa limited are confronting with a set of market problems. ASPSC, the biggest manufacturing enterprise in the nation, is running in its 34.6% of capacity due to its inability to sense the market, adapt and adopt the product mix to the ever changing situation. Similarly the service-giving corporation, Mobil Oil East Africa limited, has lower share of Ethiopian petroleum market due to greater competitors attack.

Even if they are wrestling with increased market competition, they are not arming themselves with sophisticated arsenals--systems that allow them to create better advantages. They cannot establish a better encompassing use of internal and external data to create a climate that foster an increase in the number of alternative solutions. For example, neither ASPSC nor Mobil have introduced Marketing Decision Support System (MDSS) in their working areas.

The MDSS supports and amplifies the skills of the mangers by eliminating data barriers to problem solving. It is systems meant to be an adjunct to the decision makers, to extend their capabilities but not to replace judgments. It includes a database, software system with models, data mining and other analytical tools and user interfaces.

MDSS is little more that that of MIS, which switched its focus form simple retrieval to analyzing and interpreting of the environment. MDSS, as type of DSS, is generally accredited to the Massachusetts Institute of Technology (MIT), USA.

The general objective of this thesis is to develop a marketing decision support system for ASPSC and Mobil. In addition to them, with slight modification it can be applied for other domestic enterprises as well.

Due to the time and other constraints, only four decision types are incorporated in this developed MDSS. These are:

- From ASPSC cases
    - Demand forecasting.
    - Selling price estimation.
- From Mobil cases
    - Lube shop management system.
    - Income After Tax (IAT) calculation.

Using appropriate separately treats each of the decision types modeling techniques. For example, the queuing model is used for the formulation of Mobil's lube shop operation management system. After all these analysis and formulations the computer program was developed by visual basic programming language and its database by an access programming languages.

The developed software has command buttons, options buttons and so on with multi windows on a screen. The intentions of doing all these are to increase the analyzing capability of the proposed MDSS.

This work can help the communities of ASPSC and Mobil to analysis their decisions better and to introduce themselves in the new ways of performing marketing activities. However, its size is too small to integrate all the marketing decision types they demanded. In addition to increasing the capability and capacity of this developed computer program, further researches in marketing areas should be forester.

6.2 Recommendations

The last but not the least part of this thesis work is to suggest what course of action as well as ASPSC and Mobil, as well as other domestic companies should take. The following are the main recommended points:

- Both companies should implement the developed MDSS.
- Both companies should take this work as a step towards take-off for further development of MDSS.
- Both companies should evaluate themselves and update their working system to the emerging technologies, materials, and new ways of marketing.
- Other enterprise across the nation should learn form ASPSC and Mobil research outputs, to perform marketing decision and related activities in simplified manner.
- When developing MDSS software, priority should be given to customize and adapt it to the given company's situations.
- Now and then, emphasis should be given to marketing and other decision support researches.

6.3 Future outlooks

1- Other decision areas of ASPSC and Mobil, which are not incorporated in the developed computer programming, should be covered.

2- The analytical capability of the developed computer programming can be further increased through future works.

3- Assessment across the domestic companies, about the development and implementation requirements of MDSS, can be done.

References

[1]. Ajay K. Kohl and Bernard J. Jaworski, "Market orientation: The construct, research propositions and managerial implication," ***Journal of marketing***, pp.1-18, April 1990.

[2]. Akaki Spare Parts and Hand Tools Share Company, ***"1994-1996 budget years strategic plan.***" Addis Ababa, N.P., 1993 E.C.

[3]. Akaki Spare Parts and Hand Tools Share Company, "***Manufacturing Procedure Manual***." Addis Ababa, N.P., December 1993.

[4]. Akaki Spare Parts and Hand Tools Share Company, "***Performance report for the budget year 2000/2001***." Addis Ababa, N.P., November 2001.

[5]. Akaki Spare Parts and Hand Tools Share Company, "***Performance report for the budget year 2001/2002***." Addis Ababa, N.P., September 2002.

[6]. Andrew C. Gross, Peter M. Bunting, and I. David Ford, ***"Business marketing***," Delhi, A.I.T.B.S. publisher & distributor, 1998.

[7]. Basic Metals and Engineering Industries Agency, "***Marketing information system***," Addis Ababa: N.P., N.d.

[8]. Belden Menkus, "Practical considerations in decision support system design," ***Journal of systems managements***, P.32-33, June-1983.

[9]. Bernard W.Taylor III, "***Introduction to Management Science***." 5th edition, USA: Printice-Hall.Inc., 1996.

[10]. Brenda Wierenga & Rerrit H. van Brunggen, "The integration of marketing problem-solving model and marketing management support systems," ***Journal of marketing*****,** Vol.40, P.17-28, July-1976.

[11]. Clyde W. Hollsopple, and Andrew B. Whinstone, "***Decision Support systems: A Knowledge-based approach*****,**" USA: West publishing Company, 1996.

[12]. Dipankar Chakravarti, Andrew Mitchell and Richard Stalin, "Judgment based marketing decision models: problem and possible solutions," ***Journal of marketing***, Vol. 45, P.13-33, February 1981.

[13]. Dr. John R. Page and Dr. H. Paul Hooper, "Basics of information system development," ***Journal of systems management***, Augest-1997.

[14]. Dr. R. G. Murdock and T. c. Fuller, "Subsystem cycles for MIS," ***Journal of systems management*****,** June-1979.

[15]. E. Jerome McCarthy, Stanley J. Sapporo and William D. Perreault, "***Basic marketing: A Global-managerial Approach***," USA, Von Hoffman press, 1994.

[16]. Fredrick E. Webster, Jr. "Top managements concerns about marketing: issues for the 1980's," ***Journal of marketing***, Vol.45, P.9-18, summer-1981.

[17]. G. Wagner, "Decision support systems: computerized mind support for executive problems**," *Managerial planning***, Sept-0ct, 1981.

[18]. H. A. Simon, "***The new science of management decisions***," New York: Hamper & Row, 1960.

[19]. H. Igor Ansoff, "Comment on Henry Mint berg's Rethinking Strategic Planning," ***Long Range Planning***, June 1994.

[20]. H. W. Goetsch, ***"Developing, Implementing and managing an effective marketing plan***," Chicago: American marketing association, Lincoln wood, IL: NTC business books, 1993.

[21]. Henley Assael, "C***onsumer Behaviors and marketing action***," Boston: Kent 1987.

[22]. H. K. Chan, " Decision support system for human resource management," ***Journal of System management,*** Vol.35, No.4, P.17-25, April 1984.

[23]. J. H. Donnelly, J. I. Gibson, and J. M. Ivancevich, " ***Fundamentals Of Management***," 9th ed. 195.

[24]. J. Paul Peter, James H. Donnelly and Lawrence X-grapey, "***A preface to making management***," Texas: Business publication, 1982.

[25]. Jack Z. Scissors, "What is a market?" ***Journal of marketing***, Vol.30, PP. 17-21, July-1966.

[26]. James A. O'Brien, "***Management information systems: Management information technology in the internet worked enterprises***," New Delhi: Golgotha Publications Pvt. Ltd, 2003.

[27]. Janinder N. D. Gupta and Thomas M .Harris, "Decision support systems for small business," ***Journal of system management***, February 1989, P.37-43.

[28]. John A. Howard and Jadish N. Sheath, "***The theory of buyer behavior***," New York: John Wiley, 1969.

[29]. Jon-Paul F. Anderson, "Marketing, strategic planning and the theory of the firm," ***Journal of marketing***, Vol.46, P.23, spring 1982.

[30]. Jour- Bert Rosen bloom, "Conflict and channel efficiency: some conceptual models for the decision maker," ***Journal of marketing***, Vol.37, PP.26-30, July 1973.

[31]. Keith J. Tuck well, *"**Marketing in action: Canadian**",* Canada: prentice hall Canada inc., 1994.

[32]. Leon Winner, "A Profit-oriented decision system," ***Journal of marketing***, Vol.30, P.38-44, January-1966.

[33]. Louis W. Stern and Adel I.El-ansay, "***Marketing channels***," New Jersey. Prentice hall, 1996.

[34]. Lutz Mutinous, mark Goode and Fiona Davides, *"**Quantitative analysis in marketing***," England: John Wiley & sons' ltd, 1998.

[35]. Michael E. Porter, "***Competitive Advantage***," New York: Free press, 1985.

[36]. Michael S. Scott-Morton and peter G. W. keen, "***Decision support system: An organizational perspective*****,**" Reading Mass., Addison-Wesley, 1978.

[37]. Michael S. Scott-Morton, "***Management decision systems: computer based support for decision making***," Harvard university: Cambridge Mass., 1971.

[38]. Nigel Percy, "***Market-led strategic change: transforming the process of going to market***," UK, Reed educational and professional publishing Ltd., 1997.

[39]. Paul Callaghan, *"**Business Advanced level GNVQ3"*** Britain: Bath press, 1994.

[40]. Paul E. Green, "Measurement and data analysis," ***Journal of marketing***, Vol.1, PP.15-17, January 1970.

[41]. Paul E. Green, Donald S. Tulle and Gerald Album, "***Research for marketing decisions*****,**" 5th edition, New Jersey: Prentice-Hall, Inc., 1988.

[42]. Peter D. Bennett, "***Dictionary of marketing terms***," Chicago: AMA, 1988.

[43]. Philip Kotler, "A generic Concept of Marketing," ***Journal of Marketing***, Vol.36, PP. 46-54, April-1972.

[44]. Philip Kotler, and Gray Armstrong, "***Principles Of marketing***," 9th edition, New Jersey: Prentice–hall Inc., 2001.

[45]. Phillip Kotler, *"**Marketing Management; Analysis, Planning and Control.**"* 9th edition, USA: Prentice hall intentional, 1999.

[46]. Richard H. Brine and James E. Stafford, "Marketing information system: a new dimension for marketing research," ***Journal of marketing,*** No.32, P.21, July 1968.

[47]. Richard L. Levin, David S. Rubin, Joel P. Stinson and Everett S. gardener, "***Quantitative approaches to management***," 8th Edith, Singapore: McGraw Hill Book, 1992.

[48]. Robert F. Dyer, and Ernest H. Forman, "***An analytic approach to marketing decisions***," New Jersey: Rentice hall, 1991.

[49]. Robert Schultheis, and Mary Summer, ***"Management information system: the manger's view***," 3rd edition, USA: Richard D. Irwin, inc., 1995.

[50]. Robin Wesley, "Strategic marketing: Betas, Boxes or Basics," ***Journal of marketing***, Vol.45, p.179, summer 1981.

[51]. Sitanus S. Mittra, "***Decision support system: Tools and techniques***," Canada: A Wiley-nescience publication, 1986.

[52]. Subhash Sharma & dale D. Achabal, "STEMCOM: An analytical model for marketing control," ***Journal of marketing***, Vol.46, P.104-105, Spring-1982.

[53]. Theodore Levite, "Marketing Myopia," ***The Harvard business review***, VOl.38, P.55, July-August, 1960.

[54]. Thomas V. Bonoma, ***"The marketing edge: marketing strategies work***", New York: Free press, 1985.

[55]. Victor P. Buell, *"**Hand book of modern Marketing***", USA: McGraw-Hall, Inc. 1986.

[56]. Vision consultancy Pvt. Ltd., "***Study on organizational structure, job analysis, job evaluation and salary scale, performance appraisal and incentive scheme of ASPSC***." Addis Ababa, N.P., 1991 E.C.

[57]. Von Neumann, and Morgenstern, ***"Theory of games and economic behaviors***," Princeton: Princeton university press, 1947.

[58]. W. Steven Perkins and ram C. Rave, "The role of experience in information use and decision making by marketing mangers," ***Journal of marketing research***, Vol.xxvll, P.1-10, February-1990.

[59]. William A. Cohen, "***The practice of marketing management: analysis, planning and implementation***," New York: Macmillan publishing company, 1978.

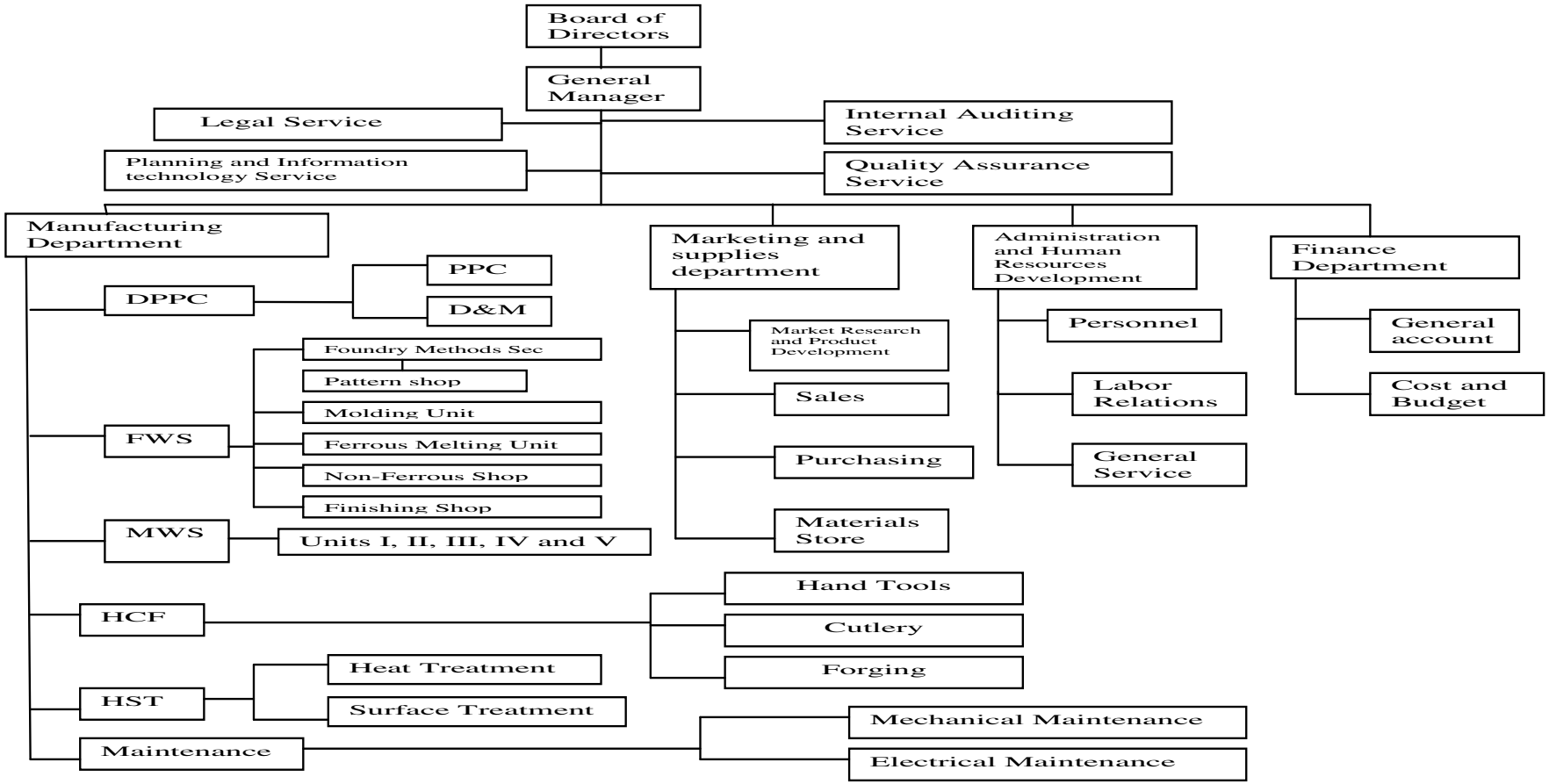
[60]. William F. O'Dell, Andrew C. Rappel and Robert H. Trent, "***Marketing decision-making: analytic framework and cases***," Ohio: southwestern publishing co. 1979.

[61]. William H. Newman, "shaping the master strategy of your firm," ***California management review***, pp.77-88, Spring 1967.

[62]. William M. Pride and O.C. Ferrell, "***Marketing: Concept and Strategies***," USA: Houghton Mifflin Company, 1993.

Appendixes

Appendix- I Organizational structure of ASPSC



Appendix- II The programming codes of demand forecasting

```
Private Sub cmdcontinue_Click()
   Dim D1 D2 D3 D4 D5  D6 D7 D8 D9D10 D11D12 As Integer
   Dim F1, F2, F3, F4, F5, F6, F7, F8, F9, F10, F11, F12 As Integer
   Dim First As Integer
   Dim second As Integer
   Dim third As Integer
   Dim fourth As Integer
   Dim year As Integer
   D1 = Val(txtD1)
   D2 = Val(txtD2)
   D3 = Val(txtD3)
   D4 = Val(txtD4)
   D5 = Val(txtD5)
   D6 = Val(txtD6)
   D7 = Val(txtD7)
   D8 = Val(txtD8)
   D9 = Val(txtD9)
   D10 = Val(txtD10)
   D11 = Val(txtD11)
   D12 = Val(txtD12)
If txtD1 = "" Then
  Response = MsgBox(" please enter the january sales value", vbCritical + vbOK, "Data validation")
  txtD1.SetFocus
  Form3.Show
End If
   F1 = D1
   F2 = (0.3 * D1) + (0.7 * F1)
   F3 = (0.3 * D2) + (0.7 * F2)
   F4 = (0.3 * D3) + (0.7 * F3)
   F5 = (0.3 * D4) + (0.7 * F4)
   F6 = (0.3 * D5) + (0.7 * F5)
   F7 = (0.3 * D6) + (0.7 * F6)
   F8 = (0.3 * D7) + (0.7 * F7)
   F9 = (0.3 * D8) + (0.7 * F8)
   F10 = (0.3 * D9) + (0.7 * F9)
```

```
F11 = (0.3 * D10) + (0.7 * F10)
F12 = (0.3 * D11) + (0.7 * F11)
 First = F1 + F2 + F3
second = F4 + F5 + F6
third = F7 + F8 + F9
fourth = F10 + F11 + F12

year = F1 + F2 + F3 + F4 + F5 + F6 + F7 + F8 + F9 + F10 + F11 + F12
If optmonth.Value = True Then
Form30.Show
Form30!txtnjan = F1
Form30!txtnfeb = F2
Form30!txtnmar = F3
Form30!txtnapr = F4
Form30!txtnmay = F5
Form30!txtnjun = F6
Form30!txtnjul = F7
Form30!txtnaug = F8
Form30!txtnsep = F9
Form30!txtnoct = F10
Form30!txtnnov = F11
Form30!txtndec = F12
   End If
If txtxx = "" Then
  Response = MsgBox(" You do not have enter the advertisement budget value, so it is assumed as zero!!!",
vbCritical + vbOK, "Data validation")
  txtxx.SetFocus
If txtxx = "" Then
  Response = MsgBox(" You do not have enter the advertisement budget value, so it is assumed as zero!!!",
vbCritical + vbOK, "Data validation")
  txtxx.SetFocus
  If Opt2.Value = True Then
Form31.Show
Form31!txtfirst = First
Form31!txtsecond = second
Form31!txtthird = third
Form31!txtfourth = fourth
Form31!txtyear = year
End If
```

End Sub

```
Private Sub cmdcontinue_Click()

Dim y As Double
Dim A As Double
Dim b As Double
Dim X As Double
Dim xx As Double
Dim yy As Double

X = Val(txtxx)
A = 3.2
b = 4.5

If txtxx = "" Then
  Response = MsgBox(" You do not have enter the advertisement budget value, so it is assumed as zero!!!",
vbCritical + vbOK, "Data validation")
  txtxx.SetFocus
End If
y = (b * X) + A
txtyy = y
End Sub
Private Sub Command1_Click()
 Form3.Show
End Sub
Private Sub cmd_Click()
 Form3.Show
 End Sub

Private Sub cmdcontinue_Click()
Dim y As Double
Dim A As Double
Dim b As Double
Dim X As Double
Dim xx As Double
Dim yy As Double
X = Val(txtxx)
A = 3.2
b = 4.5
If txtxx = "" Then
  Response = MsgBox(" You do not have enter the advertisement budget value, so it is assumed as zero!!!",
vbCritical + vbOK, "Data validation")
  txtxx.SetFocus
End If
```

Appendix- III The programming codes of selling price

```
Private Sub Command1_Click()

Dim S1, S2, S3, S4, S5, S6 As Double
Dim S7, S8, S9, S10, S11, S12 As Double
Dim S13, S14, S15, S16, S17, S18 As Double
Dim Tot As Integer
Dim DLC As Integer
Dim TOHC As Integer
Dim TMC As Integer

S1 = Val(txtsept)
S2 = Val(txtoctt)
S3 = Val(txtnovt)
S4 = Val(txtdect)
S5 = Val(txtjant)
S6 = Val(txtfebt)
S7 = Val(txtmart)
S8 = Val(txtaprt)
S9 = Val(txtmayt)
S10 = Val(txtjunt)
S11 = Val(txtjult)
S12 = Val(txtaugt)
S13 = Val(txtsepl)
S14 = Val(txtoct1)
S15 = Val(txtnov1)
S16 = Val(txtjan1)
S17 = Val(txtfeb1)
S18 = Val(txtmar1)
Tot = Val(txtapr1)

DLC = (S1 * 6.81) + (S2 * 8.04) + (S3 * 7.19) + (S4 * 9.01) + (S5 * 9.6) + (S6 * 12.42) + (S7 * 9.65) + (S8 *
12.42) + (S9 * 13.3) + (S10 * 13.73) + (S11 * 13.73) + (S12 * 13.73) + (S13 * 12.42) + (S14 * 6.88) + (S15 *
5.35) + (S16 * 0) + (S17 * 6.25) + (S18 * 6.51)

TOHC = (S1 * 2.25) + (S2 * 9.64) + (S3 * 7.69) + (S4 * 11.78) + (S5 * 12.69) + (S6 * 95.51) + (S7 * 11.98)
+ (S8 * 107.64) + (S9 * 86.54) + (S10 * 40.74) + (S11 * 40.74) + (S12 * 4.89) + (S13 * 22.45) + (S14 *
12.17) + (S15 * 16.61) + (S16 * 0) + (S17 * 4#) + (S18 * 23.92)

TMC = DLC + TOHC + Tot

Form40.Show
Form40!txtDLCc = DLC
Form40!txtTOHCc = TOHC
Form40!txtTotc = Val(txtapr1)
Form40!txtTMCc = TMC
End Sub
Private Sub Command1_Click()
txtsell = (txtTMCc * txtprom / 100) + txtTMCc

End Sub

Private Sub Command1_Click()
```

```
Dim S1, S2, S3, S4, S5, S6 As Double
Dim S7, S8, S9, S10, S11, S12 As Double
Dim S13, S14, S15, S16, S17, S18 As Double
Dim Tot As Integer
Dim DLC As Integer
Dim TOHC As Integer
Dim TMC As Integer


S1 = Val(txtsept)
S2 = Val(txtoctt)
S3 = Val(txtnovt)
S4 = Val(txtdect)
S5 = Val(txtjant)
S6 = Val(txtfebt)
S7 = Val(txtmart)
S8 = Val(txtaprt)
S9 = Val(txtmayt)
S10 = Val(txtjunt)
S11 = Val(txtjult)
S12 = Val(txtaugt)
S13 = Val(txtsepl)
S14 = Val(txtoct1)
S15 = Val(txtnov1)
S16 = Val(txtjan1)
S17 = Val(txtfeb1)
S18 = Val(txtmar1)
Tot = Val(txtapr1)

DLC = (S1 * 6.81) + (S2 * 8.04) + (S3 * 7.19) + (S4 * 9.01) + (S5 * 9.6) + (S6 * 12.42) + (S7 * 9.65) + (S8 *
12.42) + (S9 * 13.3) + (S10 * 13.73) + (S11 * 13.73) + (S12 * 13.73) + (S13 * 12.42) + (S14 * 6.88) + (S15 *
5.35) + (S16 * 0) + (S17 * 6.25) + (S18 * 6.51)

TOHC = (S1 * 2.25) + (S2 * 9.64) + (S3 * 7.69) + (S4 * 11.78) + (S5 * 12.69) + (S6 * 95.51) + (S7 * 11.98)
+ (S8 * 107.64) + (S9 * 86.54) + (S10 * 40.74) + (S11 * 40.74) + (S12 * 4.89) + (S13 * 22.45) + (S14 *
12.17) + (S15 * 16.61) + (S16 * 0) + (S17 * 4#) + (S18 * 23.92)

TMC = DLC + TOHC + Tot


Form40.Show
Form40!txtDLCc = DLC
Form40!txtTOHCc = TOHC
Form40!txtTotc = Val(txtapr1)
Form40!txtTMCc = TMC

End Sub
```

Appendix- IV The programming codes of Lube shop

```
If Option1.Value = True Then
Form3.Show
End If
If Opt4.Value = True Then
Form12.Show
End If
If Option2.Value = True Then
Form4.Show
End If
If Option3.Value = True Then
Form2.Show
End If
End Sub

Private Sub Command2_Click()
 Form10.Show
End Sub
'** Global variable decalration**'
Const step As Integer = 30
Public lambda As Double
Public mew As Double
Public C As Double
Public U As Double
Public A As Double
Public L As Double
Public Lq As Double
Public W As Single
Public Wq As Single
Public Pw As Double
Public Po As Double
Dim P(30) As Double
Public ratio As Double
'** **'
Private Function power(ByVal X, ByVal b) As Double
If X >= 0 Then
power = Exp(b * Log(X))
Exit Function
End If
End Function
'** **'
Private Function factorial(m As Double) As Double
Dim i As Double
factorial = 1
If m > 1 Then
For i = 2 To m
factorial = factorial * i
Next i
End If
End Function
'** **'
Private Sub cmdcontinue_Click()
```

```
Dim Response
Dim sum As Single
Dim n As Integer
     C = 1
  lambda = Val(txtArrRate)
    mew = Val(txtSerRate)
     txtW = W
     txtWq = Wq
     txtL = L
     txtLq = Lq
     txtI = A
     txtU = U
     txtPw = Pw
     txtPo = P(0)

If txtArrRate = "" Then
  Response = MsgBox("please enter avalid lambda value, [lambda > 0.0001]", vbExclamation + vbOKCancel,
"data validation")
  txtArrRate.SetFocus
End If
If txtSerRate = "" Then
  Response = MsgBox("please enter avalid mew value, [lambda > 0.0001]", vbExclamation + vbOKCancel,
"data validation")
  txtSerRate.SetFocus
End If

If C = 1 Then
  sum = 0
  For n = 0 To (C - 1)
  sum = sum + power((lambda / (C * mew)), n) / factorial(C)
  Next n
  P(0) = 1 / (sum + (power((lambda / (C * mew)), C) / factorial(C)) * ((C * mew) / ((C * mew) - lambda)))
  For n = 1 To step
  If n <= C Then
  P(n) = P(0) * (power((lambda / (C * mew)), n)) / factorial(C)
  ElseIf n > C Then
  P(n) = (P(0) * power((lambda / (C * mew)), n)) / (factorial(C) * power(C, n - C))
  End If
  Next n
  L = (P(0) * lambda * mew * power((lambda / (C * mew)), C)) / (factorial(C - 1) * power((C * mew) -
lambda, 2) + (lambda / (C * mew)))
  Lq = L - (lambda / mew)
  W = L / lambda
  Wq = W - (1 / mew)
  Pw = (P(0) * power((lambda / (C * mew)), C) * C * mew) / (factorial(C) * ((C * mew) - lambda))
  U = lambda / (C * mew)
  A = 1 - (lambda / (C * mew))
End If

Form13.Show
Form13!txtW = W
Form13!txtWq = Wq
Form13!txtL = L
Form13!txtLq = Lq
Form13!txtI = A
Form13!txtU = U
```

```
Form13!txtPo = P(0)
Form13!txtPw = Pw

End Sub

Private Sub cmdexit_Click()
  End

End Sub

Private Sub cmdcontinue_Click()

 If Opt1.Value = True Then
    Form14.Show
 End If

 If Opt2.Value = True Then
    Form15.Show
 End If

End Sub

'** **'
Private Sub Form_Load()
  txtW = W
  txtWq = Wq
  txtL = L
  txtLq = Lq
  txtI = A
  txtU = U
  txtPw = Pw
End Sub

Private Sub cmdexit_Click()
  End
End Sub

Private Sub cmdback_Click()
 Form11.Show
End Sub

'** Global variable decalration**'
Const step As Integer = 30
Public lambda As Double
Public mew2 As Double
Public C2 As Double
Public U As Double
Public A As Double
Public L As Double
Public Lq As Double
Public W As Double
Public Wq1 As Double
Public Pw As Double
Public Po As Double
Dim P(30) As Double
Public ratio As Double
```

```
'** **'
Private Function power(ByVal X, ByVal b) As Double
If X >= 0 Then
power = Exp(b * Log(X))
Exit Function
End If
End Function
'** **'
Private Function factorial(m As Double) As Double
Dim i As Double
factorial = 1
If m > 1 Then
For i = 2 To m
factorial = factorial * i
Next i
End If
End Function


Private Sub cmdexit_Click()
  End

End Sub

Private Sub cmdback_Click()
 Form10.Show

End Sub

'** **'
Private Sub Command1_Click()
Dim Response
Dim sum As Single
Dim n As Integer

        C2 = 1
    salary = Val(txtsal)
      loss = Val(txtloss)
      Wq2 = Val(Form13.txtWq)
      mew2 = 20 + 10 * (txtC2)
    lambda = Val(Form12.txtArrRate)

      txtW = W
      txtWq2 = Wq2
      txtL = L
      txtLq = Lq
      txtI = A
      txtU = U
      txtPw = Pw
      txtPo = P(0)
      txtTsum = Tsum
      txtredu = redu

If txtC2 = "" Then
  Response = MsgBox(" please enter number of sales men, [C>1]", vbExclamation + vbOKCancel, "Data
validation")
```

```
  txtNumServer.SetFocus
End If

If txtsal = "" Then
  Response = MsgBox("please enter avalid salary value ", vbExclamation + vbOKCancel, "data validation")
  txtArrRate.SetFocus
End If

If txtloss = "" Then
  Response = MsgBox("please enter avalid profit loss ", vbExclamation + vbOKCancel, "data validation")
  txtSerRate.SetFocus
End If



If C2 = 1 Then
  sum = 0
  For n = 0 To (C2 - 1)
  sum = sum + power((lambda / (C2 * mew2)), n) / factorial(C2)
  Next n
  P(0) = 1 / (sum + (power((lambda / (C2 * mew2)), C2) / factorial(C2)) * ((C2 * mew2) / ((C2 * mew2) -
lambda)))
  For n = 1 To step
  If n <= C2 Then
  P(n) = P(0) * (power((lambda / (C2 * mew2)), n)) / factorial(C2)
  ElseIf n > C2 Then
  P(n) = (P(0) * power((lambda / (C2 * mew2)), n)) / (factorial(C2) * power(C2, n - C2))
  End If
  Next n
  L = (P(0) * lambda * mew2 * power((lambda / (C2 * mew2)), C2)) / (factorial(C2 - 1) * power((C2 *
mew2) - lambda, 2) + (lambda / (C2 * mew2)))
  Lq = L - (lambda / mew2)
  W = L / lambda
  Wq2 = W - (1 / mew2)
  Pw = (P(0) * power((lambda / (C2 * mew2)), C2) * C2 * mew2) / (factorial(C2) * ((C2 * mew2) - lambda))
  U = lambda / (C2 * mew2)
  A = 1 - (lambda / (C2 * mew2))
  redu = Wq2 - Wq1
  Tsum = (redu * loss) - salary


End If

txtW = W
txtWq2 = Wq2
txtL = L
txtLq = Lq
txtI = A
txtU = U
```

Appendix- V The programming of IAT calculation

```
Private Sub cmdcalculate_Click()

Dim NPC As Integer
Dim OPEX As Integer
Dim IEA As Integer
Dim SP As Integer
Dim GM As Integer
Dim IAT As Integer
Dim IAT2 As Integer

  NPC = Val(txtNPC)
  OPEX = Val(txtOPEX)
  IEA = Val(txtIEA)
  SP = Val(txtSP)

If txtNPC = "" Then
  Response = MsgBox(" please enter the value of NPC ", vbExclamation + vbOKOnly, "Data validation")
  txtNPC.SetFocus
End If

If txtOPEX = "" Then
  Response = MsgBox(" please enter the value of OPEX (operation expence) ", vbExclamation + vbOKOnly,
"Data validation")
  txtOPEX.SetFocus
End If

If txtIEA = "" Then
  Response = MsgBox(" please enter the value of IEA ", vbExclamation + vbOKOnly, "Data validation")
  txtIEA.SetFocus
End If

If txtSP = "" Then
  Response = MsgBox(" please enter the value of SP ", vbExclamation + vbOKOnly, "Data validation")
  txtSP.SetFocus
End If

  GM = (SP - NPC) * (159 / 8.8)
  IAT = GM - OPEX
  IAT2 = IAT - IEA

  Form20.Show
  Form20!txtGM = GM
  Form20!txtIAT = IAT
  Form20!txtIAT2 = IAT2

  End Sub

Private Sub cmdexit_Click()
 End

End Sub

Private Sub Command1_Click()
```

```
 Form2.Show
End Sub

Private Sub cmdcontinue_Click()

If OptOPEX.Value = True Then
 Form21.Show

ElseIf Option1.Value = True Then
 Form21.Show

ElseIf OptIEA.Value = True Then
 Form22.Show

ElseIf Option2.Value = True Then
 Form22.Show

ElseIf Option3.Value = True Then
 Form23.Show

ElseIf OptSP.Value = True Then
 Form23.Show

 End If

End Sub


Private Sub Command1_Click()
Form20.Show

End Sub
Private Sub Command2_Click()

Dim NPC As Integer
Dim OPEX As Integer
Dim IEA As Integer
Dim SP As Integer
Dim GM As Integer
Dim IAT As Integer
Dim IAT2 As Integer

  NPC1 = Val(Form2.txtNPC)
  OPEX = Val(txtMOPEX1)
  OPEX2 = Val(Form2.txtOPEX)
  IEA1 = Val(Form2.txtIEA)
  SP1 = Val(Form2.txtSP)

If txtMOPEX1 = "" Then
  Response = MsgBox(" please enter the value of OPEX decreased or increased in percentile ",
vbExclamation + vbOKCancel, "Data validation")
  txtMOPEX1.SetFocus
End If

If Option1.Value = True Then
```

```
  GM = (SP1 - NPC1) * (159 / 8.8)
  IAT = GM - (OPEX2 - ((OPEX2 * OPEX) / 100))
  IAT2 = IAT - IEA1

  txtMGM = Val(Form20.txtGM)
  txtMIAT = Val(Form20.txtIAT)
  txtMIAT2 = Val(Form20.txtIAT2)


  txtMMGM = GM
  txtMMOPEX = OPEX
  txtMMIAT = IAT
  txtMMIAT2 = IAT2

  txtaaa = (txtMGM - GM)
  txtbbb = (txtMIAT - IAT)
  txtccc = (txtMIAT2 - IAT2)

End If


If Option2.Value = True Then

  GM = (SP1 - NPC1) * (159 / 8.8)
  IAT = GM - (OPEX2 + ((OPEX2 * OPEX) / 100))
  IAT2 = IAT - IEA1

  txtMGM = Val(Form20.txtGM)
  txtMIAT = Val(Form20.txtIAT)
  txtMIAT2 = Val(Form20.txtIAT2)

  txtMMGM = GM
  txtMMOPEX = OPEX
  txtMMIAT = IAT
  txtMMIAT2 = IAT2

  txtaaa = (txtMGM - GM)
  txtbbb = (txtMIAT - IAT)
  txtccc = (txtMIAT2 - IAT2)

End If


End Sub
Private Sub Command2_Click()

Dim NPC As Integer
Dim OPEX As Integer
Dim IEA As Integer
Dim SP As Integer
Dim GM As Integer
Dim IAT As Integer
Dim IAT2 As Integer

  NPC1 = Val(Form2.txtNPC)
  OPEX = Val(txtMOPEX1)
```

```
  OPEX2 = Val(Form2.txtOPEX)
  IEA1 = Val(Form2.txtIEA)
  SP1 = Val(Form2.txtSP)

If txtMOPEX1 = "" Then
  Response = MsgBox(" please enter the value of OPEX decreased or increased in percentile ",
vbExclamation + vbOKCancel, "Data validation")
  txtMOPEX1.SetFocus
End If

If Option1.Value = True Then

  GM = (SP1 - NPC1) * (159 / 8.8)
  IAT = GM - (OPEX2 - ((OPEX2 * OPEX) / 100))
  IAT2 = IAT - IEA1

  txtMGM = Val(Form20.txtGM)
  txtMIAT = Val(Form20.txtIAT)
  txtMIAT2 = Val(Form20.txtIAT2)


  txtMMGM = GM
  txtMMOPEX = OPEX
  txtMMIAT = IAT
  txtMMIAT2 = IAT2

  txtaaa = (txtMGM - GM)
  txtbbb = (txtMIAT - IAT)
  txtccc = (txtMIAT2 - IAT2)

End If


If Option2.Value = True Then

  GM = (SP1 - NPC1) * (159 / 8.8)
  IAT = GM - (OPEX2 + ((OPEX2 * OPEX) / 100))
  IAT2 = IAT - IEA1

  txtMGM = Val(Form20.txtGM)
  txtMIAT = Val(Form20.txtIAT)
  txtMIAT2 = Val(Form20.txtIAT2)

  txtMMGM = GM
  txtMMOPEX = OPEX
  txtMMIAT = IAT
  txtMMIAT2 = IAT2

  txtaaa = (txtMGM - GM)
  txtbbb = (txtMIAT - IAT)
  txtccc = (txtMIAT2 - IAT2)

End If


End Sub
```

Candidate's Declaration

I hereby declare that the work which is being presented in this thesis entitled **Marketing Decision Support System (MDSS): Case studies in Akaki Spare Parts and Hand Tools S. Co, and Mobil Oil East Africa Limited** is original work of my own, has not been presented for a degree of any other university and that all sources of material used for the thesis have been duly acknowledged.

_____ _____

Abiy Abebe Date

(Candidate)

This is to certify that the above declaration made by the candidate is correct to the best of my knowledge.

_____ _____

Dr. Ing. Daniel Kitaw Date

(Thesis Advisor)